Multi-Paradigmatic Transformative Research as/for Teacher Education: An Integral Perspective

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ABSTRACT

How can science education research constitute an empowering form of professional development that generates essential higher-order skills for personally tackling the global eco-cultural crises of the 21st Century? In this chapter we argue that graduate research schools need to provide a range of epistemologies for novice researchers to engage in transformative learning about their own professional practices. Epistemological pluralism involves multiple research paradigms – interpretivism, criticalism, postmodernism. We outline the characteristics of these relatively new paradigms, consider how their methods can be combined, and illustrate how one such hybrid research method - critical auto|ethnography - has been employed by transformative culture studies researchers. We conclude by proposing an integral perspective which is inclusive of all research paradigms.

KEYWORDS:
inquiry·learning·research methods·social justice·teacher education

There's a crack in everything. That's how the light gets in.

Suddenly, or so it seems, we find ourselves in an age of great uncertainty; a new dark age, perhaps? The world is wracked by crises of unparalleled proportions, forcing us to rethink the fundamentals of our lives. Financial, climatic, health, resource and security crises are acting in concert to rob us with frightening speed of our confidence in the taken-as-natural primacy of our historic (Western) worldview. We are being forced to question our habituated ways of improving the material quality of our lives. Thanks to increasing public alarm it has dawned on us that for centuries our commitment to modernity, especially the seemingly unassailable drivers of science and technology, has

fuelled unsustainable global exploitation. Prominent organizations such as UNESCO are lamenting the collapse of cultural, linguistic and biological diversity (Skutnabb-Kangas et al. 2003). The world's leading climatologists are warning that chronic pollution of planetary eco-systems, especially atmospheric carbon emissions, has created chronic damage to the planet's biosphere (Stern 2006). We are rapidly running out of time to curb our carbon footprint.

Reflecting on how science education can contribute to resolving the problem of our survival on this planet we are inspired by Leonard Cohen's poetic notion in the epigram to this chapter, preferring to view this moment in human history optimistically as an unparalleled challenge and opportunity. We share Nobel Peace Prize nominee Ervin Laszlo's view that in order to avoid worldwide breakdown of social systems a macroshift is needed in the way we understand, respond to and reshape social reality. It is time to go beyond a narrow materialistic scientific view of reality and embrace a multidimensional worldview of multiple interconnected realities in order to create "a global civilization that possess the will and the vision to achieve solidarity and translate it into international and intercultural coexistence and cooperation" (Laszlo 2008 p. 37). We understand that going beyond involves a transformation of consciousness to higher levels of awareness and understanding of self and other and of the complex interconnectedness of all things. And so we advocate engaging science educators, especially those undertaking graduate research studies, in what Jack Mezirow (1991) calls 'transformative learning':

> experiencing a deep, structural shift in the basic premises of thought, feelings, and actions. It is a shift of consciousness that dramatically and permanently alters our way of being in the world. Such a shift involves our understanding of ourselves and our self-locations; our relationships with other humans and with the natural world; our understanding of relations of power in interlocking structures of class, race, and gender; our body-awareness; our visions of alternative approaches to living; our sense of possibilities for social justice and peace and personal joy. (Morrell and O'Connor 2002, p.xvii)

How can graduate research students engage in transformative learning when to do so involves making their own (and others') subjectivities a key focus of their inquiries? Transformative research involves a process of examining critically our personal and professional values and beliefs, exploring how our lifeworlds have been governed (perhaps distorted) by largely invisible socio-cultural norms, appreciate our own complicity in enculturating uncritically our students into similar lifeworlds, creatively reconceptualising our own professionalism, and committing to transform science education policy, curricula and/or pedagogical practices within our own institutions. How can research as transformative learning be represented in a doctoral dissertation and be legitimated as scholarly knowledge production?

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Our purpose in this chapter is to address these questions. In doing so we draw on over 25 years of development in the field of qualitative social science research by pioneering scholars such as Norman Denzin, Yvonna Lincoln and Egon Guba whose scholarly work is well represented in the Sage Handbook of Qualitative Research (Denzin and Lincoln 2005) and the international journal, Qualitative Inquiry (http://qix.sagepub.com/). We start by considering the limitations of the traditional single paradigm approach to educational research dominated throughout the twentieth century by hegemonic positivism and its derivative postpositivism. By the term 'paradigm' we mean a specific scholarly framework for conceptualising, investigating and communicating about the world; and, like Thomas Kuhn (1970), we recognise the incommensurability (but not incompatibility) of paradigms due to their contrasting ontologies (what is the nature of reality?), epistemologies (what type of justifiable knowledge can be generated) and methods of investigation (how can we generate justifiable knowledge).

We outline three research paradigms relatively new to science education – interpretivism, criticalism, postmodernism – and we consider the unique contribution that each is making to transformative research. In particular, we highlight the role of *new logics* for making new sense of personal experience of a complex and emerging world and *new genres* with which to investigate and communicate heartfelt concerns about the human condition. Drawing on recent graduate research in the field of cultural studies of science education we illustrate how multi-paradigmatic transformative research can be enacted. In closing, we adopt a perspective drawn from integral philosophy and generate a meta-theory about the compatibility of multiple research paradigms, justifying the transformative researcher drawing on all paradigms, including postpositivism.

Throughout the chapter we exemplify our arguments with reference to the nascent field of the cultural studies of science and mathematics education where graduate research students are exploring critically, reflectively and creatively their own cultural situatedness, excavating and re-honoring their indigenous cultural capital, generating authoritative voices with which to re-author their professional worldviews, and developing personal professional philosophies with which to generate seeds of liberation in the hearts and minds of their own students, many of whom are future teachers of science.
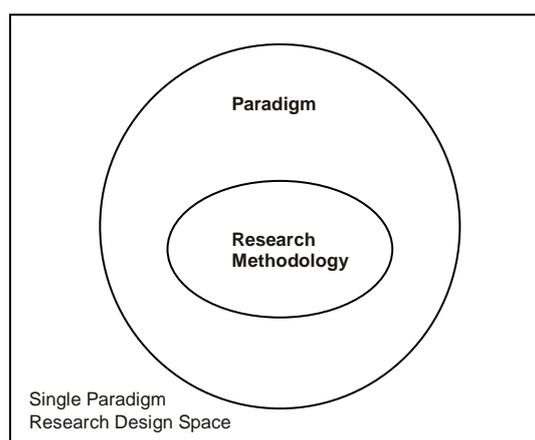
SINGLE PARADIGM RESEARCH

Established for centuries as the standard bearer of the scientific materialist worldview, the positivist research paradigm has been, over the past 30 years, the subject of intense critique by philosophers of science and critical pedagogues (Kincheloe and Tobin 2009). Nevertheless, for historic reasons explained by Donald Schön (1983) and notwithstanding the rise in popularity of 'qualitative' research, positivism remains the dominant research paradigm in the social sciences,

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albeit in a 'softer' form called postpositivism. Jerry Willis (2007) gives an excellent account of all major research paradigms, describing postpositivism as directing a search for universal laws by employing an objectivist epistemology, a highly controlled, theory-testing methodology (or 'methodolatry'), and privileging academic research practice over the professional practices it purports to serve.

Our view of this research paradigm is mixed (Luitel et al. 2009). On the one hand, for reasons that we explain later in this chapter, we believe that it offers valuable methods for science education researchers. However, we are highly critical of its hegemonic stranglehold of graduate school research agendas inasmuch as it provides restrictive ways of thinking and writing that are not conducive to transformative learning.

The classical hypothetico-deductive logic of the postpositivist research paradigm comprises three powerful but restrictive logics, namely, propositional, deductive and analytical. Propositional logic entails reductionism that is exclusive of the ambivalence and uncertainties enshrined in our everyday realities, thereby ruthlessly reducing the notion of educational research to technical procedures. Whilst using deductive logic it is almost impossible to think outside of pre-existing laws and to deduce new truths. A narrowly conceived analytical logic promotes dualistic thinking, which can create unhelpful antagonisms between opposing attributes. Furthermore, positivism requires these logics to be expressed via the standard scientific genre of impersonal representation characterised by a neutral, passive, decontextualised and distanced authorial voice. Although there is much to value in the standard logics and genre of the postpositivist paradigm, it is important to realise their limitations in accounting for and representing complex, nonlinear, emergent and imaginative aspects of the thinking and actions of a transformative researcher.

Within a single paradigm research design space framed by postpositivism the task of the graduate research student is relatively straightforward: to 'fill in the blanks' of a standard methodological template, ensuring that validity and reliability are the key regulators. In such restrictive scholarly conditions novice researchers, like the proverbial Chinese fish, may remain largely unaware of the epistemological 'water' in which they are immersed. Thus, when new research methods are encountered, especially in the absence of epistemological awareness, they are subordinated by the postpositivist paradigm under the seemingly inclusive label of 'mixed methods' research.

Single Paradigm Research Design Space

But our criticism is not directed at the single paradigm model of research *per se*, rather we are concerned primarily with its restrictive nature, especially when it perpetuates uncritically and unimaginatively the prevailing tradition of

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postpositivism as the normative research paradigm. The problem is twofold. First, postpositivism privileges research that suppresses the subjectivity of the researcher, thereby failing to provide scholarly conditions for professional development as/for transformative learning, resulting in research serving largely to reproduce the prevailing research paradigm of postpositivism: an endless cycle of academia perpetuating its own existence. Second, the hegemony of postpositivism reproduces a narrow materialist scientific view of reality which reinforces the importance of learning uncritically *a priori* objective facts solely within a restrictive Western modern worldview, to the exclusion of developing higher-order scientific literacy skills (Hodson 2008) with which to scrutinise the historical scope, philosophical boundary conditions and sociological limitations of this worldview.

We believe that professional development of science teachers, especially via graduate research studies, should enable them to develop personally the transformative learning skills that they now are being called upon to develop in their own students, whether in school science or in college science teacher preparation courses. A pedagogy of transformative learning aims to raise students' critical awareness of the historic impact of science (and technology) on society, enabling them to develop ethical decision-making skills and a sense of personal agency for committing to make a difference, and fostering their empathic appreciation of alternative (ecological) knowledge systems embedded in other cultures (Settelmaier 2009). These transformative learning skills constitute essential components of the higher consciousness called for by Laszlo (2008) for combating the chronic crises threatening the planet's eco-cultural systems.

MULTIPLE RESEARCH PARADIGMS

Critique of single paradigm postpositivist research was precipitated by proponents of new research paradigms, two of which (interpretivism, criticalism) have become reasonably well-established in science education, whilst the third (postmodernism) is a relative newcomer still trying to establish a foothold.

Paradigm of Interpretivism

The interpretive research paradigm began to shape the thinking of science education researchers in the 1980s (Gallagher 1991). This paradigm is concerned primarily with generating context-based understanding of people's thoughts, beliefs, values and associated social actions. Its social constructivist epistemology foregrounds the researcher's unfolding subjectivity in shaping the process of the inquiry, especially the act of interpretation of the other's meaning perspective. Hallmarks of this paradigm are social constructivist standards of trustworthiness and authenticity (Lincoln and Guba 2005). Trustworthiness standards of credibility, dependability, confirmability and transferability are 'parallel to' the positivist standards of validity and reliability.

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Authenticity standards regulate the educative relationship between the researcher and his/her co-participants (or stakeholders) and include aspects of empowerment characteristic of the critical paradigm.

Interpretive researchers embrace an open-ended research design process that allows emergent research questions, emergent modes of inquiry and emergent reporting structure. The parallels with complexity scientists investigating emergent realities is quite striking (Horn 2008), leading us to speculate that interpretivist research might actually be scientific, in a post-Newtonian sense! The role of theory is quite different, no longer being entirely a priori, or situated at the front end of the inquiry. Theorising arises throughout the inquiry, the broader significance of which is supported by ongoing literature reviewing. Thus the challenge for the research advisor is to find a way of resolving the perplexity of graduate research students indoctrinated into a postpositivist ideology as their entrenched objectivist epistemologies are challenged by this alien paradigm.

Culture studies of science education researchers employ interpretive research, especially ethnographic fieldwork methods, to understand the culturally situated nature of participants' beliefs and how they shape and are shaped by their normative social practices. For example, interpretive research has revealed how the everyday practices and communal artefacts of a Nepalese village community, living within a largely non-Western worldview, have ethno-mathematics embodied informally and intuitively within them. This cultural knowledge was used to design mathematics curriculum materials for local schools to foster two-way border crossing between Nepali and Western worldviews (Kathmandu University 2008).

Paradigm of Criticalism

Science education researchers began to embrace the critical paradigm in the 1990s as a source of social values and transformative action (Kincheloe 2008). Central to this paradigm are concerns with social justice, bio-cultural diversity and sustainable eco-systems. Critical researchers employ ideology critique to understand how power imbalances serve as key sources of social injustice within normative social structures, especially how they give rise to and reproduce habituated behaviours of social groups (such as science curriculum writers, science teacher educators).

Critical researchers aspire to going beyond interpretive understanding of the social world to adopt an interventionst role and redress, for example, racial discrimination and climate change through advocacy and other forms of active engagement. One of these is a form of dialogical writing designed to engage the reader in reflecting critically on his or her own complicity in uncritically reproducing normative social values and practices; for educators, Max van Manen (1991) called this engaging the reader in pedagogical thoughtfulness.

Critical researchers strive to generate a professional praxis, that is, a practice aimed at social restructuring, at making a difference by, for example, working with

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socially and economically disadvantaged communities to foster their heightened social conscience, to develop their intellectual prowess, to enable them to envisage a brighter future for their children, to empower them to unify around a heartfelt commitment, to project an articulate critical voice, and to hone strategic political skills in order to gain recognition and additional resources with which to transform their community and, ultimately, the broader society.

Critical science teacher-researchers use critical reflexivity (or critical self-reflective inquiry) as a self-study tool to help decolonize their own professional practices of hegemonic ideologies that serve asymmetric social interests; ideologies such as unabashed scientism and culturally decontextualised (or 'pure') mathematics which, in industrially developing countries, can serve as vectors of neo-colonialism. Critical teacher-researchers aspire to help create emancipatory learning environments in which all students develop a critical conscience and civic mindedness. These advanced habits of mind enable students to engage in ethical decision-making about the impact on society of developments in science and technology, such as conflicting climate change policies, genetically modified food, human tissue transplantation, and euthanasia. Many graduates of emancipatory learning environments will become teachers of socially responsible science curricula.

Paradigm of Postmodernism

The postmodern paradigm is a recent arrival from the arts - critical literary studies, art and architecture, media studies – and has begun to exert an influence on science education researchers during the past decade (Taylor and Wallace 2007). Postmodernism elicits both fear and favor via its basic principle: "be suspicious of all grand narratives" ("including the grand narrative of postmodernism", respond its critics, not without irony). Forged in the fires of literary criticism, postmodernism (including poststructuralism, which metaphorically equates social life with text) has us constantly cocking an eyebrow, doubting the status of all universal knowledge claims - our own and others' - about the factual and moral truths of our empirical and ideational worlds, reminding us that every rational truth claim rests on a particular form of reason and is represented via a particular means of expression, none of which can rightfully claim primacy over others.

On the one hand, conservative science educators fear the 'slippery slopes' of a deconstructive postmodernism which, by asserting a strong moral relativism, diminishes the long-established universalism of the Western modern worldview. On the other hand, critical science educators, especially culture studies researchers, are embracing a constructive form of postmodernism with its central principle of pluralism. The power of constructive postmodernism lies in its opening the door into the multi-hued world of arts-based research (Eisner 2008), providing the transformative researcher access to powerful new logics with which to make new sense of and to act upon their personal experience of a complex and emerging world, and new genres with which to investigate

and communicate their heartfelt concerns about the human condition (Luitel and Taylor 2007).

There are many new research logics, here we focus briefly on four. Firstly, dialectical logic allows the transformative researcher to hold contradictions together in creative tension so that, for example, *research as objective probing* (i.e., culture-free, disembodied) and *research as creative subjective envisioning* (i.e., culture-laden, embodied, emergent) can be given equal consideration without one denying the legitimacy of the other, just as the concept of light does not make sense without the concept of darkness (Luitel et al. 2009). In this chapter we signify a dialectical relationship by use of the '|' symbol.

Dialectical logic is often found in the company of metaphorical logic, which promotes open and embodied inquiry for exploring multiple facets of knowledge and knowing (Lakoff and Johnson 1999). Metaphorical logic enables the transformative researcher to engage in multi-schema envisioning, using elastic correspondence between conflicting schemas, in order to capture the complexity of a phenomenon. For example, an inquiry into transformative science teaching might explore the teacher's enactment of contrasting images such as *science as a body of knowledge*, *science as a process of inquiry* and *science as critical literacy* (Willison and Taylor 2006).

Narrative logic promotes thinking grounded in everyday lifeworlds (David 2006). Storied thinking enables transformative researchers to contextualise their knowledge claims within their personal, professional and cultural contexts (Clandinin and Connelly 1998). Narrative logic cultivates a diachronic vision, a means for conceiving the research process as a chronological evolution of emerging events, research foci and ideas. Diachronic vision helps make events intelligible in relation to what has transpired in the process of inquiry. Poetic logic enables the transformative researcher to experience nonreal, envisioned, and atypical reality, thereby reaching beyond the horizon of his/her conscious awareness towards the ineffable. Poetic logic can be useful for introducing nonlinearity, silence, emergence, melody and meter, thus contributing to a holistic understanding of the world (Leggo 2004).

Amongst a plethora of new research genres we mention five. The first is narrative genres, which are used to speak from a lived storied perspective bringing contexts, events and people to the textual space, thereby depicting richly the complexity of human experience. Many cultures bring forth storytelling traditions as a means of knowledge generation, depiction and transmission. Transformative researchers can use their natal cultures as a referent for structuring narratives to communicate research outcomes with their primary audience, articulating a dilemma, a moral tale, or a personal-professional story that paints an holistic sense of being and becoming (Cumming 2007).

Poetic genres help represent aesthetic-imaginative aspects of our knowledge claims through meter, rhythm, rhyme and playfulness (Christie 1979). Knowledge embedded in poetic genres evokes emotional, aesthetic, spiritual and interpretive responses. More so, a poetic genre is useful in transformative research to generate
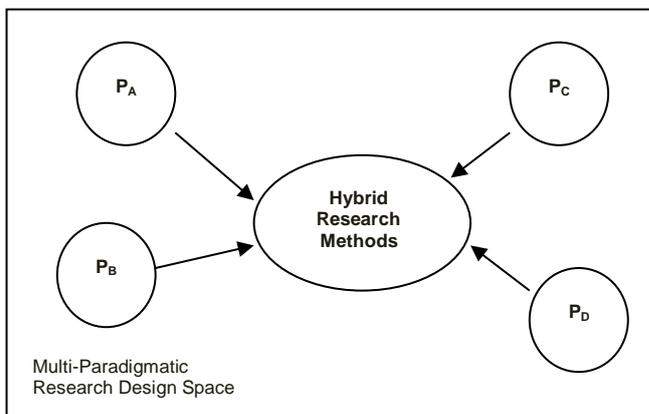
multiple, interactive and imaginative views of reality which help researchers to cultivate multi-perspectival envisioning of the issues under study (Glesne 1997). Within Eastern wisdom traditions there is a millennia-old truism that poetic eyes can reach further than the sun's rays.

Performative genres such as plays or multi-voiced dialogue are designed to be acted out in professional contexts to stimulate transformative learning amongst an audience. A hallmark of performative research texts is that they are dialogic, embracing openness and uncertainties, thereby providing an interactive space for the audience. Transformative researchers construct performative texts in the form of ethnodramas and ethnotheatre as means of generating resistance against repressive hegemonies (Saldaña 2005).

Non-linguistic genres - photographs, paintings, cartoons, collage, creative models - can represent knowledge claims otherwise unaccounted for by linguistic genres (Sullivan 2008). Transformative researchers use photographs and paintings to represent particulars, peculiarities and extraordinariness otherwise neglected in the mediative process of linguistic textuality. Cultivation of visual imagination can bring clarity to the articulation of knowledge claims, and can be achieved by juxtaposing linguistic and non-linguistic genres to foster pedagogical thoughtfulness in the reader/viewer (van Manen 1991).

MULTI-PARADIGMATIC RESEARCH

Thus, a new era of "paradigmatic and methodological pluralism" (Paul and Marfo 2001) has emerged to create the necessary scholarly conditions for transformative research to flourish. Transformative research draws on the alternative research paradigms outlined above, particularly their new logics and genres, to conduct inquiries that are as much transformative of the researcher as they are of the participating other and of the social system in which self and other are embedded. Transformative research is a multi-paradigmatic approach as and for professional development of science educators: as a means of becoming change agents who wish to transform the policies, structures and processes of the teaching and learning of science, and for the purpose of ensuring that science (and technology) contribute to sustainable development, particularly of eco-cultural systems worldwide.

Multi-Paradigmatic
Research Design Space

In the single paradigm research design space considered earlier postpositivism constitutes an ontological and epistemological framework within which students design their research methodologies. Methods of data collection (or data generation) introduced from

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beyond the borders of this framework are assimilated within this onto-epistemic space in accordance with the restrictive logics and genre of the postpositivist paradigm.

However, in the multi-paradigmatic research design space, it is essential to preserve the espistemic integrity of research methods drawn from various paradigms, and thus the pluralistic concept of referent (Tobin and Tippins 1993) replaces the restrictive concept of framework. The diagram represents a multi-paradigmatic research design space in which multiple paradigms (P_A, P_B, P_C ...) serve as referential systems of knowledge production. The transformative researcher draws upon these paradigms, weaving together a hybridity of research methods with which to address complex research problems associated with the demands of their professional practice. Of primary importance is the need to ensure that appropriate standards of legitimation (i.e., quality standards or epistemic warrants) are used to regulate and justify different types of knowledge produced by the inquiry.

Hybrid Research Methods

Culture studies researchers are currently working within multi-paradigmatic research design spaces, drawing on interpretive, critical and postmodern paradigms to create powerful hybrid research methods such as *critical auto|ethnographic inquiry*.

In critical auto|ethnographic inquiry, the autobiographical 'self' is set in dialectical tension against the ethnographic 'other', the researcher investigating critically his or her own cultural situatedness from the unique standpoint of both a cultural insider and border crosser, excavating the way in which his or her professional identity has been shaped (distorted) historically by hegemonic cultural, social, political and economic imperatives (Taylor and Settelmaier 2003). The autobiographical impulse directs excavation of the researcher's multiple lifeworlds (sic) by means of a variety of logics – metaphoric, dialectical, narrative – and seeks expression in a variety of genres – ethnodrama, poetry, imagery, dialogue, screenplay. Science and mathematics educators have reported successful critical and soulful auto|ethnographic studies of their own professional practices (Pereira et al. 2005).

In its many nuanced forms (evocative, soulful, critical), auto|ethnography has emerged as an exemplar of a hybrid research method for transformative research. Critical auto|ethnography enables culture studies researchers to explore their culturally embedded identities, to excavate and portray multi-hued accounts of their lived experiences, to generate critical reflexivity with which to deconstruct the hegemonic grip of their cultural history, to envisage with optimism, passion and commitment a culturally diverse and inclusive world, and to engage their readers in moments of pedagogical thoughtfulness.

Doctoral research completed by Mozambican science educators Emilia Afonso (2007) and Alberto Cupane (2008) combined postcolonial theorising and critical auto| ethnographic methods to develop professional philosophies of culturally inclusive teaching for Mozambique. As they examined their hybrid cultural identities (in colonial

and postcolonial times) they generated auto|biographical memoirs, poems, stories, performance texts and images with which to explore and represent: (i) their lived experience as tribal indigenes who had since childhood crossed cultural borders into various hybrid spaces, especially the colonial space of Portuguese language and customs, (ii) the mixed outcomes of their earlier professional struggles to render science education culturally diverse and inclusive, and (iii) their vision as culture workers intent on transforming the professional practices of future generations of Mozambican school science teachers (Afonso and Taylor 2009). Thus, multi-paradigmatic research empowered Emilia and Cupane to transform their professional practices in accordance with a shared vision of creating culturally inclusive school science classroom environments wherein tribal children throughout Mozambique can harness their cultural capital, especially their indigenous knowledge systems, and develop hybrid cultural identities with which to reconcile the tension involved in belonging simultaneously to pre-modern, modern and post-modern worlds.
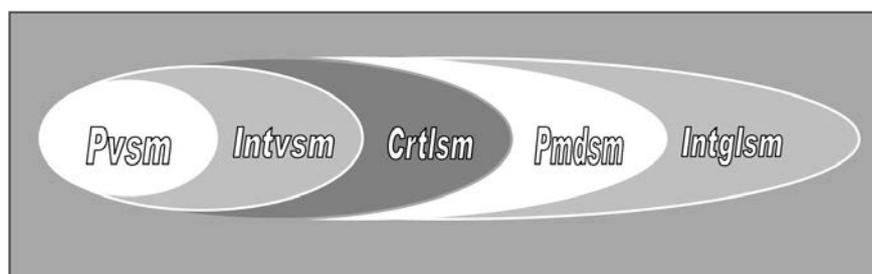
AN INTEGRAL PERSPECTIVE

Thus far, our account of transformative educational research as drawing on multiple paradigms (interpretivist, criticalist, postmodernist) has all but excluded positive consideration of the positivist paradigm. In rejecting its hegemony and being critical of its restrictive methods, however, we do not intend to reject this paradigm because we recognise that it has great value for particular purposes. We turn to integral philosophy for an inclusive meta-theory of multi-paradigmatic educational research, utilising some of the new logics of the postmodern paradigm and its central principle of pluralism. In the process we propose an integral paradigm, which, we believe, is currently emerging from the postmodern paradigm, offering as yet largely unrealised ways of knowing for science educators to help address the global crises of the 21st Century.

Integral philosophy – 'integral' meaning to integrate, to bring together, to join, to link, to embrace – can be regarded as a holistic philosophical referent characterised by the notion that it is not the individual mind that is celebrated but integral connectivity (Gergen and Gergen 2000). In the West, there is a common belief that if two opposites cannot be united, we try to either control or eliminate the oppositional pole of the bifurcation. An alternative strategy to this antagonistic Cartesian dualism is integration through dialectical logic: we attempt to transform both poles of a contradictory set of metaphors into a higher set of understandings where a higher level of synthesis is yet another departure point of further dialectic seeking (Slattery 1995). Integral philosophy uses dialectics to integrate dialectical systems by realising that all elements are interrelated and are reflections of the same underlying unity. Applied to research, the dialectics of integralism allow for paradigmatic pluralism and for unity-in-diversity (Pallas 2001).

A key contribution of integral philosophy is that it helps us to understand the multiple research paradigms of the social sciences not as independent entities vying for

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legitimacy by pitting themselves against each other but as integral parts of a developing hierarchical system, each part (paradigm) building on its predecessor and giving rise to the next part (paradigm), and so on. What is distinctive about this system is the interdependence of the paradigms, best understood as the ongoing emergence of part-whole relationships in which each successive paradigm both transcends and includes its predecessor. It was the integral philosopher Ken Wilber (2000) who developed this theory of paradigm development. He drew on Arthur Koestler's (1976) view of naturally occurring hierarchies (called 'holarchies') in which each part (or 'holon') is itself whole and simultaneosly a part of some other whole. The following diagram illustrates a holarchy of paradigms, with each paradigm emerging from (and including) earlier paradigms (from left to right) thereby creating a multi-paradigmatic system of knowledge production for social science research. This open-ended developmental process is driven by ongoing critical reflexive awareness of the inherent limitation of each paradigm to resolve significant social issues, leading temporarily to a state of chaos (a Kuhnian revolution) out of which emerges a more highly organized (or transformed) pattern of consciousness (i.e., a new paradigm) which can defuse earlier problems but which itself has inherent limitations, and so on.

The integral perspective, embodied in the integral paradigm, not only recognises the interconnectedness of multiple paradigms but also the 'moments of truth' in each of these distinctive knowledge production modes - each paradigm produces valuable knowledge - and accordingly it rejects attempts to privilege any single paradigmatic way of knowing. Thus, from an integral perspective, each way of knowing offers important but different and thus partial truths about the world, and all ways of knowing are equally legitimate and important. An integral perspective is not syncretism, where we would try to blend and homogenise differences into a whole. Pluralism respects differences residing across the variety of traditions without reconciling or integrating them. Unity-in-diversity and epistemological pluralism as proposed by an integral philosophy suggest that we have to learn to live with the ambiguity of difference which is a "…courageous practice, and engagement with the fact of diversity in our world" (Simmer-Brown 1994 p. 101). And isn't this what Laszlo (2008) is calling for when he asks us to embrace a multidimensional worldview of multiple interconnected realities in order to develop a synergistic global civilization capable of cooperating to solve the planet's eco-cultural crises?

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CAUTIONARY NOTE

There is, however, a crucially important challenge for the transformative educational researcher who embraces the integral paradigm and attempts to integrate positivist research methods into the hybrid mix of methods drawn from other paradigms. History warns us that the long-established hegemony of the postpositivist paradigm lurks not out there somewhere (such as in research methods text books) but within the subconscious mind of most of us, for that is the legacy of our earlier science education, and that it will likely re-emerge to seize the methodology of the unwary researcher. Graduate research students are a primary target for postpositivism's subtle reassertion of its right to reify social reality and objectify understanding. Usually the first sign is loss of authorial voice and sudden certainty about foretelling the long-term outcome of the inquiry. The antidote is for the transformative researcher to keep in touch with all of the epistemologies underpinning the inquiry (perhaps making wall charts of them). Criticalism will alert us to maintain a critical reflexive awareness of the power and scope of postpositivism's epistemological ideology, and to keep monitoring whose political interests are being served by the unfolding inquiry. Interpretivism will alert us to ensure that there is plenty of room for emergence of new research questions, new methods and new theorising, especially progressive development of our own subjectivity, and to keep making the familiar strange. But it is not only data collection and analysis methods of postpositivism that are a problem in this regard, its hypothetico-deductive logic and impersonal genre are especially worrying because they exert a subtly powerfully hold on our thinking. And thus we need also to remain mindful of the type of logic we are employing and to consciously allow plenty of space for exercising alternative logics and for allowing the constant process of writing narratively (and poetically, etc) to actually constitute our unfolding inquiry (Richardson 2000). And once we have established these important habits of mind we can safely and profitably make use of the unique research tools that postpositivism has to offer. In this way incommensurable paradigms can become compatible and co-exist peacefully (Watkins 1970).

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