

## DELUSIONS OF PROGRESS: A Case For Reconceptualising Environmental Education

Malcolm Plant

### ABSTRACT

The great modern project that was bent on using technology to improve the human condition through the control of nature has not worked out as its earlier proponents once promised. By assuming that economic growth and technological progress are ways to a cleaner environment and social equality, humanity has created unprecedented social and environmental problems. The more we exercise power over nature, the less predictable and resilient nature has become. The more wealth we produce, the wider the economic gap between rich and poor. But few would argue that ecological damage is, primarily, the fault of technology:

it is first and foremost a crisis of mind which makes it a crisis for those institutions which purport to improve minds. This is a crisis of education ... (Orr, 1994).

Broadly responding to the theme of this conference, this paper critically examines the 'crisis of education'. I begin by reflecting on my own limited experience of teaching in Africa, not to claim any legitimacy for speaking on behalf of (South) Africa but in an attempt to unmask my own (past?) naive complicity in the 'crisis of education'. A brief analysis of 'progress' and the dynamics of 'globalisation' serves to illustrate the complexity, uncertainty and change in modern society which necessitate a continual and reflexive testing of new paradigms for environmental education. One such paradigm is a socially critical pedagogy which is inherently interdisciplinary and which is advanced as a transformative learning process promoting teachers' own well-being. I then propose, tentatively, a way of locating this paradigm within a more general theory that draws on recent understanding of the dynamics of complexity and disorder and reveals the world as sensitive, fragile and unpredictable. This is the theory of chaos, a core concept of which is the notion of an 'attractor' that may be used as a metaphor for establishing a new benchmark of confidence for environmental educators to counter the dominant metaphor of progress, the Laplacian dream of discovering the deterministic rules that enable us to predict and control the future. The issues raised in this paper are of interest to the author's research and teaching, a distance learning MA in Environmental Education through Action Enquiry at Nottingham Trent University, UK, with Roger Firth.

... the idea of great progress is a delusion, along with the idea that the truth will ultimately be known. (Wittgenstein, 1980)

Progress might have been alright once, but it's gone on too long. (Ogden Nash, quoted by Provine, 1988)

### OUT OF AFRICA

I have a lasting memory of teaching in East African secondary schools early in my career. I had been recruited along with many others from Europe and North America to help the newly independent African countries take advantage of educational 'expertise' from the 'developed' world, presumably to speed their 'progress' towards the sort of society from which their

overseas teachers came. It was a time of great hope both for the taught and for their teachers, so why should I look back on those years with such mixed feelings? My job was to teach science and I did, confidently and blindly, unaware that the path to 'progress' might not be left in the safe hands of science and its application through technology. My African and Asian students were demanding yet compliant, eager to learn yet uncritical of the content of their learning. And, of course,

I was complicit in this delusion, confident in my attachment to and support of existing systems of domination and secure in my belief that I commanded an authority of experience and knowledge that allowed me to control its transmission between contexts and roles. Now, looking back on those years, I am acutely aware of time wasted, of an opportunity lost, but, in those days, I had neither the critical instinct I have now, nor the benefit of hindsight! My concerns about this experience are several: that students and I were deluded by the promise that a better future depended on investing in a form of science and technology unsuited to their needs; that the knowledge I commanded was guaranteed by the authority of my role; how, as the all-knowing teacher, my authoritative position had prevented me from encouraging the voices of my students and making the 'border crossings' that might have led to a transformation of our roles. It took me some time to realise how naive I had been and how little my teaching had contributed to serving local interests, to how my attention was,

occupied with the relations of authority which secure professional, political, and pedagogical status through the strategy of speaking in a particular time from a particular space (Giroux, 1994).

In my 'privileged' position (a white, European 'ex-colonial' teacher), I surely adopted the role identified by Hook (1994) as the dominant paradigm of "White patriarchal supremacy", one which students had little opportunity or will to challenge - it was what they and their political leaders agreed to. And when I had the opportunity to teach in extra-mural, rural settings away from the demands of the school curriculum, I ignored the wishes of the villagers to relate my knowledge and skills to their local needs - simply because I was not prepared for it politically, emotionally or pedagogically. My education had championed an infatuation with the notion that theory takes precedence over practice.

Are present day curricula better able to engage students with the urgent realities of the 1990's than they were 20 or 30 years ago? I doubt it. Despite the major upheavals in national curricula witnessed in developed countries in recent years, our education programmes continue to bypass the intellectual issues and moral imperatives needed for taking responsibility for the Earth. Where does education foster the passion and ingenuity to match that shown by previous generations in obeying the command to take dominion over the planet? Take away computers and the new information technologies and, as Orr (1994) notes, "programmes and the curriculum of the 1990's [in the United States of America] look a great deal like that of the 1950's". This is no less true of the United Kingdom's 'back to basics' National Curriculum, which was brought into being by a continuous stream of government legislation and policy recommendations during the 1980's. Driven by a dogmatic belief in free market economics and based on a technical view of rationality which gives credence to a reproductive form of education, it was imposed on schools and education in a starkly pure ideological form (Firth, 1995; Maguire & Ball, 1994). As Hooks writes:

The objectification of the teacher within bourgeois educational structures seemed to denigrate notions of wholeness and uphold the idea of a mind/body split, one that promotes and supports compartmentalisation. Professors who embrace the challenge of self-actualisation will be better able to create pedagogical practices that engage students, providing them with ways of knowing that enhance their capacity to live fully and deeply (Hooks, 1994).

The misguided notion of a discipline-based core curriculum largely unrelated to major concerns of the day is used to sustain the educational *status quo*, but with greater efficiency than ever before. As Braden (1995) explains,

the notion of a core curriculum reinforced by the naming and departmentalising of subject areas ... leaves the student and teacher in a position from which border crossings between disciplines, contexts and roles is almost impossible.

Some of the assumptions underpinning such curricula are that:

- knowledge is everywhere uniform so that abstract knowledge is more valuable than practical, local or indigenous knowledge; and, paradoxically,
- educational practice can take place without educational theory;
- the teacher is all-knowing and the student an object of knowledge and history;
- education's main purpose is to serve the growth economy;
- new technology is better than older technology;
- personal progress hinges on a successful exploitation of the consumer society.

During my teaching in East Africa, I had, unwittingly, been party to these assumptions. That experience, and much more since then, has caused me to question the relation between teacher and learner and what constitutes legitimate knowledge transactions. What are the delusions that sustain the foundational assumptions of the curricula that I taught then, and are still being taught today? How can teachers liberate the voices of their students so that the teacher becomes learner and student becomes teacher? Why has the greater part of humanity decided that the planet's future rests on furthering a growth economy, on putting our faith in machines, on genetic engineering, on 'nanotechnologies', on continued degradation of the global commons? In what democratic settings have we been able to debate any 'rights' to use the Earth as we please? And is there, in these times of social tumult and environmental havoc, a metaphor that can give us confidence and purpose as environmental educators?

These are questions for the whole of humanity, but in an African context, they need to be addressed against the backdrop of post-colonial developments. Maathai (1995) notes that,

since independence, many African states have hardly enjoyed internal peace and security because the post-colonial leaders digressed from their initial vision and became dictatorial and oppressive.

Thus, during my stay in East Africa, the euphoria generated by the end of colonialism was fading and freedom and independence were gradually replaced by a culture of fear and silence. People became ostracised by leaders who implemented oppressive systems of governance that flourished under the geo-political rivalry of the superpowers during the Cold War. The current surge of interest in democratic governance and for more freedom, is being encouraged by some African leaders in a desperate move to hold onto power. In these political circumstances, the environment is often neglected despite government statements at national and international levels. Africa has a fragile environment and experiences frequent droughts and insufficient rains. Where is the responsible leadership to put into place the planning that will help to reduce famine and re-generate the environment? In Kenya, The Green Belt Movement plays its part in promoting the democratisation process in that country and of re-empowering its citizens to challenge their leaders to live up to their responsibilities (Maathai, 1995). The mental and cultural decolonising of the African mind is not an easy matter and South Africa knows only too well how African unity has eluded the post colonial generation of Africa. But, in South Africa, power sharing has replaced the political culture of 'winner takes all' and offers an interesting alternative to the political arrangements elsewhere in Africa.

The point of this rather introspective introduction, related to an African setting, is

to bring into focus the paradox of progress which I have been witness to: an idea that, on the one hand, beguiles us into thinking that the path to a better future lies in continued economic growth sustained by educational programmes that see students as members of the workforce; and, on the other hand, that works against social equity, development needs and a safer, cleaner and ecologically richer natural environment.

### ECONOMIC PROGRESS

No single idea has been more important than, ... the idea of progress in Western civilisation for nearly three thousand years (Nisbet, 1980).

The Enlightenment ideal of pursuing rational objectivity and truth gave rise to the idea of progress and of industrial modernity which,

permanently gave the owners of capital, the business middle class, the right of permanent innovation, something that appeared completely inconceivable, even blasphemous, to earlier periods, now comes to be taken for granted ... it comes the law of modernity (Beck, 1994:26).

Yet, as Mansfield (1991) notes: "The goal of economic growth is a relatively new one; most past societies have had economies that were unprogressive."

In Victorian times, economic progress was intertwined with ideas of individual perfectability through competition, a notion that was transferred to the biological world:

... as natural selection works solely by and for the good of each being, all corporeal and mental endowments will tend to progress towards perfection (Darwin, 1872).

The Darwinian idea of 'survival of the fittest' was to be reflected in the economic world where,

'progress' became a tool for justifying the free market, for colonial domination

and exploitation of non-western 'primitive' societies, and for the manipulation and exploitation of our natural and biological environment (Wimsatt & Schank, 1988:231-74).

However, Goldsmith (1992) reminds us that our capacity to exhaust natural resources is not in the nature of biological evolution since, during evolution, biological systems become increasingly self-sufficient by perfecting their recycling mechanisms, a prime example of which is tropical rainforests. Economic activity puts this process in reverse; the waste products of one process, rather than serving as raw material for the next, are simply released into the environment in the cheapest way possible. Our inability to make the causal connection between such actions and their environmental consequences means we cannot see the parts in relation to the whole (Bohm, 1987) and remain oblivious of the essential interconnectedness of the world around us.

In spite of a growing unease with the destructive social and environmental effects of economic progress, Western culture remains wedded to progress, to a belief that more growth will result in a cleaner environment, a stable population level, and social and economic equality. Moreover, progress is fundamental to pedagogical thought:

In recent years, in Western Europe and North America we have seen how education has emphasised quantity of practice as a means of school improvement. School reform is reduced to such remedies as increased homework, or more stringent certification requirements as evidence of teaching competence. Reports of change or activity regardless of their nature and depth are considered testimonials of progress (Popkewitz, 1991:35).

Underpinning these ideas of educational progress is the defining of education's purpose as the preparation of the student for

a useful role in society through individual discipline and self-government.

What, then, ought to be the criteria for progress? Is it morphological complexity which stresses the importance of traditional cultures and values to counter what Polanyi (1957) described as "the relentless march of the market"? Is it an ability to maintain genetic diversity, not only of humanity's own genetic pool but of the rest of the natural creation? Stephens (1967) suggests that grimly utilitarian cultures tend not to survive very long, collapsing in the face of some novel threat, but that cultures which cultivate the decorative and playful tend to find, somewhere in that cloud, the resources to meet most challenges.

#### GLOBALISING TENDENCIES

Globalisation is generally seen in terms of the spread of the telecommunications industry, multinational enterprises, global financial markets, and global pollution. These tendencies are seen by some writers (Hern, 1990; Heyneman, 1984) as evidence that humans are becoming more genetically and culturally uniform with increasing reliance on a reduced range of crops and an acceptance of particular, typically Western, lifestyles which threaten to engulf us with monotony and dullness; "a massive trend towards natural, social and technological uniformity" (Feyerabend, 1987:3). For Giddens (1991) the universalising tendencies of industrial growth are seen in the spread beyond nation boundaries of radioactivity from the Chernobyl reactor, an example of what Giddens calls 'the globalisation of unintended consequences' which would also include acid rain, global warming and ozone depletion. Another globalising tendency to which Giddens refers is 'time-space distancing' by which he means, for example, how the spread of global communication networks contributes to social relationships becoming stretched across great distances, time and space taking on a universal social dimension whose reality is independent of any individual

social location. Associated with time-space distancing are 'disembedding' mechanisms where, for example, expert systems such as computer-based applications of chaos theory give guarantees about what to expect in a wide range of actual contexts. Lash and Urry (1994) see global processes as having two crucial characteristics. First, they are autonomous from mere inter-state relationships, eg. the decreasing number of languages of communication; and, second, these global processes are not dominant in the sense characteristic of industrial modernity but are controlled by the dominant consumer 'class' rather than amongst the whole society. Thus instead of a significant trend towards global uniformity, it is more likely that a number of processes are producing the globalisation of culture. Featherstone argues that,

there may be emerging sets of 'third cultures' which themselves are conduits for all sorts of cultural flows which cannot be merely understood as the product of bilateral exchanges between nation states (Featherstone, 1990:1).

Waters (1995), drawing on Arnason (1990) and Hall (1992b), sees globalisation as a differentiating as well as a homogenising process, "it pluralises the world by recognising the value of cultural niches and local abilities" (Waters, 1995:136). And to Robertson (1992) "globalisation refers both to the compression of the world and to the intensification of the consciousness of the world as a whole," by which he means that there has been both an increase in global interdependence and an awareness of that interdependence. The latter has given rise to what Robertson calls a 'search for fundamentals' where people yearn to make cross-cultural connections that recognise this interdependence, eg. in the worldwide indigenisation of a variety of social practices move towards indigenous communal medicine is encouraged by the World Health Organization. During the last twenty years, contemporary movements promoting the rights and identities of 'native peoples' have been formed, involving contact between

Australian Aborigines and Canadian Akwesasne Indians, and between a wide variety of Indian communities across and beyond the western hemisphere. Indeed, there is now a widely based World Council of Indigenous Peoples, while the United Nations Centre of Human Rights has been involved in drafting a declaration of rights for indigenous peoples. As Robertson points out:

these movements involve a recognition that the promotion of the global is only possible on an increasingly global basis, thus casting doubt on the wisdom and accuracy of the 'think globally, act locally' maxim. *Acting* (and thinking) globally is increasingly necessary in order to make the very notion of locality viable. Locality is, to put it simply, globally institutionalised (Robertson, 1992).

One of the consequences of globalisation is the increasing realisation that global and other systems are inherently disorderly and full of incipient danger that may be triggered by minor events. Indeed, in recent times there has been a profound shift in our vision of the universe ... from the simple, stable, eternal one of Newtonian modernism to the complex, chaotic, finite one of postmodernism" [a movement which represents] "a radical revision of the world and human consciousness" [and which has in turn] "radical implications for education and curriculum (Doll, 1989:243. Quoted in Green & Bigum, 1993).

Schon, too, has written about the social and educational implications of a paradigm shift away from Newtonian thinking:

professional knowledge is mismatched to the changing character of the situations of practice - the complexity, uncertainty, instability, uniqueness and value conflicts which are increasingly perceived as central to the world of professional practice (Schon, 1983:14).

## CHAOS AND COMPLEXITY

The science of chaos (Becker & Dorfler, 1989; Gleick, 1987; Hall, 1992a; Stewart, 1989) owes much of its development to the use of computers in the rapid and repetitive calculations needed in modelling non-linear systems. The notion of non-linearity is crucial to the understanding chaos theory for it, "overturns the deterministic classical view to reinterpret the universe as being constituted by forces of disorder, diversity, instability and non-linearity" (Best, 1991:194).

The application of the theory of chaos to non-linear systems coincided with a significant intellectual shift in the social sciences which involved a break away from universalising, totalising perspectives toward local, fractured systems and modes of analysis (Hayles, 1990). By the 1980's, the new information technologies and communication technologies had not only contributed to a view of the world as a complex system, interconnected by a complex array of feedback loops, but the complex systems that had emerged were unstable, fragile, even weather-like. In Kammanga's terms:

these new insights alert us to the possibility of a sensitive and fragile world, necessarily changing the way we think about it and (ought to) treat it (1990:58).

Chaotic systems are not merely random and unstructured. Complex systems which are apparently chaotic are able to undergo spontaneous self-organisation. Moreover they are adaptive in that they do not just passively respond to events; they are able to bring order and chaos into a special kind of balance. Complex systems such as society are often seen to be on the 'edge of chaos' but this should be seen constructively. The edge of chaos is the constantly shifting battle zone between stagnation and anarchy, the one place where a complex system can be

spontaneous, adaptive and alive (Waldrop, 1994). Self-organising systems take chaos from the surrounding environment and pull it into a dynamic, ordered pattern. In the case of the conscious mind, the brain takes the plethora of information that bombards it every moment and draws it into a pattern - if this is cultural information, into a 'world view', or a lifestyle.

The implications of the science of chaos for the study of the curriculum is already a subject of academic papers (eg. Green & Bigum, 1993; Macpherson, 1995) although we should be cautious about its relevance for constructing paradigms of environmental education, largely, as Best (1991:218) observes, because of "the problems of applying scientific metaphors towards a study of society". How can we justify the use of a 'science' to explore new ways of thinking about environmental education when that science is identified with a cluster of concepts including 'truth', 'progress' and 'reason'? However, in order to respond to the dynamic, open-ended complexity of social and environmental issues which are implicated in the environmental crisis, and to the open textuality of Nature itself, Best (1991) argues for a new paradigm "based on principles of indeterminacy, chaos and evolution".

## RISK SOCIETY

A sociological version of chaos theory can be found in Beck's concept (1992) of a 'risk society' which has three core dynamics (Bronner, 1995:70):

the individualization of politics; the 'reflexive' urge towards modernisation; and, perhaps most importantly, the new ecological threats to the environment.

For example, global danger can be exacerbated rapidly by the hazardous side-effects of global pollution from a single nuclear melt down or an oil spill. Beck's reference to 'reflexive modernisation' means that, in a risk society, people are more inclined to increasing self-reflection about

their experience of modernity. Reflexive modernisation responds to the realisation that,

on the global level ... modernity has become an experiment ... it is not an experiment in the laboratory sense, because we do not govern the outcomes within fixed parameters - it is more like a dangerous adventure, in which each of us has to participate whether we like it or not (Giddens, 1994:59).

Reflexive modernisation recognises that, the current risks are a direct consequence of industrialisation and are implicit and unavoidable within it, they are not the risks of unintended adventure (Waters, 1995).

The globalisation of high risk industries "by their nature ... endanger all forms of life on this planet" (Beck, 1992:22, *italics* deleted). We live in an age of risk which equates progress with the exploitation of non-renewable resources, where social reflexivity is characterised by a persistent striving to be informed by flows of information and analysis, eg. about risk, which subjects social activity to continual revision. Beck's notion of a 'risk society' acknowledges that it is not possible to reclaim traditional ways to help rescue the environment from the damaging side-effects of industrialisation. Instead, these concepts draw our attention to the need to reflect on modernity, its ideals and the ways in which we attempt to realise them (Beck, 1992). Indeed, new social movements are becoming increasingly reflexive in questioning the risks arising from technology, political power and expert systems, risks that are with us now and in the future. And since the goals of environmental education arise from the recognition of these risks, educators need to reconceptualise these goals, continually and reflexively, if they are to transcend the conventional wisdom of scientists and educators or the "purely practical" insights of simplistically defined practitioners or communities" (Janse van Rensburg, 1994) in

an on-going search for ways of responding to the environmental crisis.

### ATTRACTORS

I want to argue that the theoretical development of environmental education is characterised by a number of 'attractors' (a concept borrowed from chaos theory) or channels along which its educational processes run their course - for a time, at least - punctuated by periods of randomised chaos. We may recognise that, from the complex and seemingly chaotic dynamics of social and ecological systems, an attractor emerges from time-to-time and dominates the way we think. In the main, such an attractor attempts to answer the same fundamental questions about environmental education. Here are six of them (after Macpherson, 1995):

1. Who needs environmental education?
2. What does an environmental education curriculum look like?
3. Who should design such a curriculum?
4. Who should deliver such a curriculum, and how should they be selected and prepared?
5. How does this curriculum become adopted collectively?
6. How can you tell when environmental education is working?

Whilst each attractor would provide an internally consistent set of answers to the six questions, it must contain the seeds of its own demise. The attractors turn out to be myths! Macpherson (1995) believes that, "curricular attractors are legitimised more by ideology than epistemology and spread more by diffusion than by deliberate acts."

Let us identify three of these attractors for environmental education and examine how they might begin to answer the above questions.

#### The Empirical-Analytic Attractor

"[M]ost environmental education has tended to privilege modernist scientific discourses

which claim to have access to the way things are" (Gough, 1994). For example, education's response to global warming is justified with reference to extrapolations about the composition of greenhouse gases based on empirical-analytic research evidence. The perceived need to understand objective data before responding appropriately to the greenhouse issue reflects what Harding (1986) calls "the longing for 'one true story' that has been the psychic motor for Western science". This attractor assumes an environmental education curriculum better suited to those who are scientifically and technologically literate, one that is teacher-proof and designed by experts, delivered by journeymen, adopted nationally, and assessed by testing knowledge and understanding about the physical causes of environmental concerns. This attractor still sustains much of what passes for environmental education at all levels.

#### The Socially Critical Attractor

This attractor draws attention to the necessary bond between theory and practice if we are to understand both the nature of our contemporary ecological predicament, and the means by which we can collectively transform our roles within it. In *Teaching to Transgress*, Hooks (1994) argues for such a transformative learning process, one which is inherently interdisciplinary and which can never be abstracted from the political project of transgressing the realities of domination. In order to teach in a way that de-centres authority and creates self-empowering conditions, teachers must also develop a political awareness of their own location in history and society, and a sound understanding of the relationship between power, ideology, knowledge, difference and identity.

Hooks' pedagogy owes much to the critical work of Paulo Freire (1987) in seeing education as *praxis* - a form of practice in which the "discernment of some 'good' which constitutes its end is inseparable from



a discernment of its mode of expression" (Carr, 1995). In pedagogical terms this means that there is a dialectical unity between theory and practice, between reflection and action in a movement towards self-actualisation. Hooks' insistence on self-actualisation, or what Zeichner (1993) calls 'personal renewal', requires teachers and their students to engage collaboratively in order to cross cultural borders, listen to each other and share power - a process reflected well in the methodology of 'action research'. Thus the socially critical attractor is intended to reach into everyone's lives by empowering them to throw off their oppressors. It reflects a curriculum which is 'subversive' in advocating a democratic transformation of society in the interests of the environment. It is designed by its practitioners, combining theory and practice in a never-ending process of self-reflection and action - a 'do-it-yourself' attractor; and its adoption by a larger community is via a sharing of insights between teacher and learner.

### The Deep-Ecology Attractor

This attractor appeals to those people who believe in the total interrelatedness and intermingling of all components of ecosystems and the biosphere; a belief in ecological equality, the complexity of ecological systems and in the maintenance of biological diversity; "a deep-seated respect, or even veneration, for ways and forms of life" (Naess, 1989). The followers of this attractor might comprise those close to the heart of the animal rights movement, Gaianists, some ecofeminists and direct action groups such as Earth First!, who would advocate that practising deep ecology is the only lifestyle that works for the long-term health of the Earth. They would claim that everyone needs this form of education as a personal philosophy; its curriculum is ecological, radical, and holistic; and the evidence of it working occurs when human communities become integrated parts of the larger biotic community, living in harmony with it.

### The Socially Critical Attractor in Action

In 1994, an MA in Environmental Education Through Action Enquiry was launched in the Faculty of Education at The Nottingham Trent University. Its 'curriculum' is based on the socially critical attractor (Huckle, 1991; Robottom, 1989). It was designed by Roger Firth and Malcolm Plant, both concerned to involve students and their tutors in a transformative approach to professional practice which embraces the curriculum as *praxis* and Hooks' and Freire's notion of self-actualisation. This means that its participants behave as 'reflective practitioners' who Schon (1993) argues require "collaboration with clients (individuals, groups, communities) in identifying, clarifying and resolving their problems", via a process of *action research* (eg. Altrichter *et al.*, 1993; Elliott, 1991; McNiff, 1988). The extent to which action research empowers participants and researchers to consider their responsibilities and initiate changes in order to 'educate for the environment' is being evaluated as an on-going process throughout the MA.

### CONCLUSION

Environmental education is an inherently complex field of study, drawing on diverse political, sociological, philosophical, pedagogical and environmentalist strands in an attempt to give meaning to the ecological crisis in terms which are holistic and interdisciplinary, and responsive to profound social and environmental change. However, the academic world largely conforms to a methodological rigour that promotes and defends compartmentalisation, denigrating the notion of wholeness and disempowering students from valuing the complexities of their surroundings by illustrating the connections between what is taught and the diverse interconnectedness of reality. Moreover, students are encouraged to see knowledge as absolute, to be passed on by experts skilled in ways of knowing yet incapable or unwilling to allow their

students to challenge the legitimacy of this knowledge. As Kincheloe (1993) writes:

The ideal modernist educator becomes the detached practitioner, an independent operator who rises above the values of 'special interests'. The detached practitioner occupies a secure position immune from critique - he or she has, after all, employed the correct methodology in reaching his or her position.

This is the 'crisis of mind' of which Orr (1994) speaks.

In this paper I have drawn on a critique of progress in order to emphasise the importance of drawing on new theories that relentlessly work to help us understand both the nature of our contemporary environmental crisis and the means by which environmental educators can collectively and collaboratively engage in an attempt to transform their practice. The social and ecological complexities of environmental issues, which increasingly have a global dimension, need appropriate theories to understand them. A theory which may be of crucial significance in this venture is that of chaos. Predicated on complexity it brings together the postmodern virtues of situatedness, praxis, embodiment, process and sustainability and offers environmental education a way of transcending the fantasy of progress, of knowability and certainty, of predictability that permeates much of the current response to the environmental crisis.

It is not that the science of chaos might be a 'better' way of developing an understanding of the crisis, but it could allow us to see the order in the apparent disorder that pervades our present perception of environmental problems (Green & Bigum, 1993). The recognition that environmental education provides a field of action for testing a complex approach to reality has recently gained some attention (eg. Elliott, 1994). Such action means going beyond the concepts and images derived from the

scientific disciplines in order to examine the complex social and ecological complexities which underpin them. Globalisation and the emergence of the risk society is a clear indication of the current complexities to which we should respond as environmental educators. Chaos theory challenges the likelihood of ever being able to manage social progress and individual perfectability in an instrumental way. But it does offer a metaphor, the attractor, which triggers constructive ways of reconceptualising environmental education in changing times. Currently, environmental education is being swept along by the socially critical attractor which is based on critical pedagogy often mediated through an action research methodology. Though a socially critical pedagogy has been discussed for some years (eg. Freire & Shor, 1987; Giroux, 1989; Kemmis, 1986; Shor, 1980), evidence is still scarce of how it can empower students to participate in the democratic transformation of society in the interests of the environment (for an example of how it *can*, see Gough & Robottom, 1993). Evidence for that bond between theory and practice, which Hooks (1994) so strongly advocates, is still needed in environmental education.

But in the light of globalisation and the emergence of the risk society, we should be on the look out for alternative attractors that may emerge from chaotic events being witnessed around the world. In conclusion I propose a fourth attractor, one that accepts that 'uncertainty' is only sensible, old certainties having passed into history.

### The Reflexive Modernisation Attractor

This attractor is paradoxical insofar that its critique of modernity rests on an embrace of its most radical possibilities. It has little use for anti-technological prejudices and ecological luddites, yet it builds on the Enlightenment project; it deals with the radical implications of scientific progress on the environment, but ignores matters of scientific methodology (Bronner, 1995). It offers a self-critical sociology which is

unambivalent in one respect: it is committed to contest all forms of theoretical and practical authoritarianism in the name of an always unfulfilled set of possibilities for individual happiness and a new 'global' dialogue. Its champion is Ulrich Beck (1992, 1994, 1995) who formulated the concept of a 'risk society' in which the latent risk content of any action serves as a stimulus for progress. For Beck, critique is the source of progress, and his concept of the risk society is less a construct than a formulation seeking to show how other, more traditional paradigms can neither keep pace with technology nor comprehend it. Modernisation ever more surely manifests a 'reflexive' character which uses the simultaneous fragmentation and globalisation of the risk society as a point of departure for any new theory of politics and social movements. With this attractor, there is no 'end' for modernity and nothing beyond it. The past is no longer demarcated from the present in some form of binary opposition; it is instead an on-going referent for the new.

Is this attractor the basis for a new theory of environmental education? It has affinities with the socially critical attractor, but whereas the latter challenges the old political hegemonies of 'left' and 'right', benefit or cost, bourgeois or proletarian, the reflexive modernisation attractor seeks not to confront the present but, rather, how the present is giving rise to a new future. And it is emancipatory in the sense that modernity makes it possible, according to Beck (1992), for people to create their own biographies. Certainly, environmental educators need to further a global dialogue about the globalisation of ecological risk and to explore its implications for a reconceptualisation of environmental education based on an acceptance of uncertainty and complexity.

The first step in our criticism of customary concepts and customary

reactions is to step outside the circle and invent a new conceptual system ... that suspends, or clashes with the most carefully established observational results, confounds the most plausible theoretical principles ... (Feyerabend, 1980)

## REFERENCES

- Altrichter, H., Posch, P. & Somekh, B. 1993. *Teachers Investigate Their Work: An Introduction to the Methods of Action Research*, Routledge, London.
- Arnason, J. 1990. Nationalism, Globalisation and Modernity. In Featherstone, M. (Ed.). *Global Culture*, 207-36. Sage, London.
- Atkinson, S. 1994. Rethinking the principles and practice of action research: The tensions of the teacher-researcher. *Educational Action Research International Journal*, 2(3), 383-402.
- Beck, U. 1992. *Risk Society, Towards a New Modernity*. Polity Press, London.
- Beck, U. 1994. The reinvention of politics: Towards a theory of reflexive modernisation. Beck, U., Giddens, A. & Lash, S. *Reflexive Modernisation*, Polity Press, London.
- Beck, U. 1995. *Ecological Politics in an Age of Risk*, Polity Press, London.
- Becker, K. H. & Dorfler, M. 1989. *Dynamical Systems and Fractals: Computer graphics experiments in pascal*. Cambridge University Press, New York.
- Best, S. 1991. Chaos and entropy: Metaphors in postmodern science and social theory. *Science as Culture*, 2(2,1), 188-226.
- Bohm, D. 1987. *Wholeness and the Implicate Order*. Ark.
- Braden, S. 1995. Critical pedagogy and video as a tool for development. *The Development Education Journal*, Issue 3.
- Bronner, S. E. 1995. Ecology, politics, and risk: The social theory of Ulrich Beck. *Capitalism, Nature, Socialism*, April.

- Carr, 1995. *For Education: Towards Critical Educational Inquiry*. Open University Press, Buckingham.
- Darwin, C. 1872. *The Origin of the Species*. 6th edition. John Murray, London.
- Doll, W. E. 1989. Foundations for a post-modern curriculum. *Journal of Curriculum Studies*, 21(3), 243-53.
- Elliott, J. 1991. A model of professionalism and its implications for teacher education. *British Journal of Educational Research*, 17(4).
- Elliott, J. 1994. *The Dynamic Curriculum: A Child of ENSI*. Unpublished paper
- Featherstone, M. 1990. *Consumer Culture and Postmodernism*. Sage, London.
- Feyerabend, P. 1987. *Farewell to Reason*. Verso.
- Feyerabend, P. 1980. *Against Method*. 68. Verso.
- Firth, R. 1995. Postmodernity, rationality and teaching environmental education. *International Research in Geography and Environmental Education (IRGEE)*, 4(2).
- Freire, P. & Shor, I. 1987. *A Pedagogy for Liberation : Dialogues for Transforming Education*. Macmillan, Basingstoke.
- Giddens, A. 1991. *Modernity and Self-Identity*. Polity, Cambridge.
- Giddens, A. 1994. Living in post-traditional society. In Beck, U., Giddens, A. & Lash, S. *Reflexive Modernisation*. Polity Press, Cambridge.
- Giroux, H. A. 1989. *Schooling for Democracy: Critical Pedagogy in the Modern Age*. Routledge, London.
- Giroux, H. A. 1994. *Disturbing Pleasure*. Routledge, London.
- Gleick, J. 1987. *Chaos: Making a New Science*. Cardinal, London.
- Gough, A. G. & Robottom, I. 1993. Towards a socially critical environmental education: Water qualities in a coastal school. *Journal of Curriculum Studies*, 25(4), 301-316.
- Gough, N. 1994. Playing at catastrophe: Ecopolitical education after poststructuralism. *Education Theory Now*, 44(2), 189-210.
- Green, B. & Bigum, C. 1993. Governing chaos: Postmodern science, information technology and educational administration. *Educational Philosophy and Theory*, 25(2).
- Harding, S. 1986. *The Science Question in Feminism*. Cornell University Press, Ithaca, New York.
- Hall, N. 1992a. *The New Scientist Guide to Chaos*. Penguin, Harmondsworth.
- Hall, S. 1992b. The question of cultural identity. In Hall, S., Held, D. & McGrew, T. (Eds). *Modernity and its Futures*. Polity, Cambridge.
- Hayles, K.N. 1990. *Chaos Bound: Orderly Disorder in Contemporary Literature and Science*. Cornell University Press, Ithaca, New York.
- Hern, W. 1990. Why are there so many of us? Description and diagnosis of a planetary ecopathological process. *Population and Environment*, 12, Fall, 9-39.
- Heyneman, D. 1984. *Journal of Parasitology*, 70(1), 6.
- Hooks, B. 1994. *Teaching to Transgress: Education as the Practice of Freedom*. Routledge, New York.
- Huckle, J. 1991. Education for sustainability: Assessing pathways to the future. *Australian Journal of Environmental Education*, 7, 43-62.
- Hurrell, A. 1995. A crisis of ecological viability? Global environmental change and the nation state. In Dunn, J. (Ed.). *Contemporary Crisis of the Nation State*. Blackwell, Oxford UK & Cambridge, United States.
- Janse van Rensburg, E. 1994. Research priorities for environmental education in southern Africa: Preliminary report. *Southern Africa Journal of Environmental Education*, (14), 3-9.
- Kamminga, H. 1990. What is this thing called chaos? *New Left Review*, (181), May/June, 49-59.

- Kemmis, S. 1996. Mapping Utopia: Towards a socially critical curriculum. *Interaction*, 14(5), 11-30.
- Kincheloe, J.L. 1993. *Towards a Critical Politics of Teacher Thinking: Mapping the Postmodern*. Bergin and Garvey.
- Lakin, L. 1995. A possible solution. *Education in Science*, (163), June.
- Lash, S. & Urry, J. 1994. *Economies of Signs and Space*. Sage, London.
- Maathai, W. 1995. Bottlenecks of development. *Resurgence*, (169).
- Mansfield, E. 1991. *Microeconomics*. WW Norton, New York.
- Macpherson, E.D. 1995. Chaos in the Curriculum. *Journal of Curriculum Studies*, 27(3), 263-279.
- Maguire, M. & Ball, S.J. 1994. Discourses of educational reform in the UK and the USA and the work of teachers. *British Journal of In-Service Education*, 20(1), 5-16.
- McNiff, J. 1988. *Action Research: Principles and Practice*. Routledge, London.
- Naess, A. 1989 *Ecology, Community and Lifestyle*. Cambridge University Press, New York.
- Nisbet, R. 1980. *History of the Idea of Progress*. Basic Books, New York.
- Norgaard, R.B. 1994. *Development Betrayed: The End of Progress and a Coevolutionary Revisioning of the Future*. Routledge, London.
- Orr, D.W. 1994. *The Greening of Education*. Schumacher Lecture, Bristol, England.
- Polanyi, K. 1957. *The Great Transformation*. Beacon Press, Boston.
- Popkewitz, T.S. 1991. *A Political Sociology of Educational Reform*. Teachers College Press, New York.
- Robertson, R. 1992. *Globalization: Social Theory and Global Culture*. Sage Publications, London.
- Robottom, I. 1989. Social critique or social control: Some problems for evaluation in environmental education. *Journal of Research in Science Teaching*, 26(5), 435-443.
- Schon, D. 1983. *The Reflective Practitioner*. Temple Smith, London.
- Shor, I. 1980. *Critical Teaching for Everyday Life*. South End Press, Boston.
- Stephens, J.M. 1967. *The Process of Schooling: A Psychological Examination*. Holt, Reinhart and Winston, New York.
- Stewart, I. 1989. *Does God Play Dice? The Mathematics of Chaos*. Blackwell, Oxford.
- Waldrop, M.M. 1994. *Complexity: The Emerging Science at the Edge of Order and Chaos*. Penguin Books.
- Waters, M. 1995. *Globalization*. Routledge, London and New York.
- Wimsatt, W. & Schank, J. 1988. Two constraints on the evolution of complex adaptations and the means of their avoidance. In Nitecki, M. (Ed.). *Evolutionary Progress*. University of Chicago Press, Chicago.
- Wittgenstein, L. 1980. *Culture and Value*. Blackwell, Oxford.
- Zeichner, K.M. 1993. Action research: Personal renewal and social reconstruction. *Educational Action Research*, 1(2), 191-219.