

The Schools Water Project (SWAP): A Case Study of an Action Research and Community Problem Solving Approach to Curriculum Innovation

Danie Schreuder

Environmental Education Program (EEPUS)

Stellenbosch University

South Africa

Introduction

It seems ironic that the amazing breakthroughs and successes of scientific methods of enquiry of the past century that were supposed to enhance the quality of human life are currently looked on as being at the root of many of the pressing environmental and social problems of our time. Conventional approaches to science and technology that enabled humankind to manipulate and exploit natural resources led to a sense of authority and command which gave rise to a sometimes blind belief in '... the triumphs of natural science in seeking to develop the social understanding that would allow human beings successfully to harness the forces thus released to their own self-betterment' (Giddens 1982, p.69).

This extension of the apparent success of natural science as '... an ideology, a culturally produced and socially supported, unexamined way of seeing the world which shapes and guides social action' (Carr and Kemmis 1986, p.132) seemed very appropriate at the time. Inevitably, the trusted logical positivist and reductionist approaches permeated social sciences to such a degree that they dominated Western views on education for a long time. Popkewitz (1984, p.23) refers to the effect on education in which '...human engineers ... act upon educational affairs as though there are no difficulties or uncertainties; ...educators are to manipulate and control children as physical scientists manipulate objects of the physical world'.

Together with Western technology, these approaches to education have often been 'sold' to, and sometimes uncritically accepted by, so-called developing societies. Increasingly however, these approaches have shown grave weaknesses that cannot be dissociated from social and environmental degradation in Western societies, and probably in other societies where they have been applied. It seems that the most basic function of education, namely that of optimising human potential (McInnis 1984, p.21), has not been optimally achieved because of conventional positivist-behaviourist approaches to educational research and curriculum development.

Southern Africa has not escaped these effects. There are examples of a variety of grave socio-environmental ills within its boundaries. These are compounded by southern Africa's diversity of cultures and social structures. This failure of education is particularly noticeable in the

apparently ever widening gap between the formal curriculum and the real world (Smyth 1988, p.27). Understandably, increasing disillusionment is expressed by teachers of the life sciences as they realise the implications of this gap. The following quotation illustrates this: 'In the twenty years I have been teaching biology to secondary school pupils in the private schools of southern Africa, I have come to ask myself serious questions about the relevance of the kind of biology which I have to teach these young people...' (Watson 1990, p.16).

Environmental education is often defined as an *approach* aimed at 'changing attitudes', or 'making people aware', thereby falling into the same trap as many other educational ('reform?') programs which accept that students will react similarly if the 'recipe', and the 'instructions' of the program are strictly adhered to. A more contemporary view of environmental education is that it is a '*...sensitizing construct for curriculum reconstruction*' (O'Donoghue and McNaught 1991, p.396), where the *process of change* is the crucial issue and the sensitizing stimulus is directed by the social milieu. Teachers and pupils play a bigger role in curriculum innovation. Such an approach is conceptually much sounder, as reconstructive curriculum development seems to be the most urgent priority in the effort to make education relevant to the needs of society and the environment. The main purpose of a more contemporary approach to environmental education is to move towards *social change through the stimulation of a socially critical orientation towards the formal curriculum and education in general*. Such an orientation is based on the active participation of the teacher in developing curriculum material, critical evaluation, stimulation of critical dialogue, relevant encounters with the wide spectrum of environmental issues, and an informed commitment to positive change in society. Constructive support of the teacher by an action research team is of great importance.

The purpose of this paper is to describe a process where these principles are being applied in a local curriculum development initiative. A local river system is the focus of the project, the immediate objective being curriculum innovation to narrow the gap that exists between the formal curriculum and the real world. Ultimately the aim is to improve local social and environmental issues through a problem solving approach.

Selecting an action focus for curriculum development

In the past, curriculum change was often attempted by introducing research-based deterministic educational material designed by experts (the so-called RDDA-model [research, development, dissemination, adoption] - Wals *et al* 1992, p.23) which was used by the teacher in a predetermined way. This approach to curriculum innovation has a bad track record, as these models are often regarded with suspicion by those burdened with the task of implementing them. Similarly, handbooks are often produced by

'panels of experts', textbook companies and research institutions, predetermining curriculum content and 'enslaving' the teacher and pupil by giving them no responsibility for the development, implementation or evaluation of the curriculum. The detrimental effects on education in general of teachers blindly following textbooks have been mentioned as one of the major problem areas in education (Yager, 1982). In a new unified education system in South Africa, such unscientific and authoritarian approaches to curriculum innovation or the production of resource material might not be acceptable.

A further barrier to such efforts at curriculum innovation is a psychological one, namely the threat innovation poses to the identity of the teacher and the burden it imposes upon him. He identifies strongly with his subject knowledge and his professional skills and often it is on these that his professional self-respect is based. Most innovation efforts change both subject content and method. As innovators, teachers are asked to take on, initially at least, the burden of incompetence (Stenhouse 1975, p.169).

Personal involvement in the development of such 'packages' aimed at curriculum change to accommodate some of the principles of environmental education has led to disillusionment and frustration as they produced little more than cosmetic change to any philosophical perspective and/or teaching strategy of the teachers implementing the program, despite a nearly overwhelming interest in it. This is probably because of a positivist-behaviourist approach to curriculum innovation which '...has created the illusion of an 'objective reality' over which the individual has no control, and hence to a decline in the capacity of individuals to reflect on their own situations and change them through their own actions' (Carr and Kemmis 1986, p.130).

The Stellenbosch based Schools Water Project (SWAP) represents a different approach to curriculum innovation. This initiative was stimulated by a number of coincidences. Firstly, reports of action research projects described by O'Donoghue and MacNaught (1991), Wals, Beringer and Stapp (1990), Greenall Gough and Robottom (1993) and others seemed to offer new approaches with greater potential for addressing some of the serious shortcomings that characterised earlier efforts. Secondly, effective networking and support structures facilitated the local development and adaptation of GREEN fresh-water test kits that enable pupils to investigate the quality of streams and rivers and their catchments. Thirdly, the suitability of the Stellenbosch community characterised by vast socio-economic differences among the various communities; an historically important and badly degraded river system whose tributaries are easily accessible to all schools; and access to experts at the Stellenbosch University and in the local community seemed ideal for the launching of an action-based curriculum development initiative. Lastly, growing

concern about fruitless earlier efforts led to the conviction that the best way forward would probably be through a mutually supportive co-operative research project in which teachers and full-time research teams work together (Stenhouse 1975, p.159).

River and catchment fieldwork seemed to be a suitable action stimulus for curriculum development, as it involves a number of school disciplines and focuses on a relevant community issue. A relatively non-prescriptive approach to integrate the project into the various curricula is followed. The point is that the proposals made to the participants should not be regarded as an unqualified recommendation but rather as a provisional specification worth putting to the test of practice.

Extensive support to participants and monitoring of successes and failures, as well as regular workshops where participating teachers from different schools meet and exchange ideas on implementation and problem-solving is an important aspect of the project. In this way, teachers are prevented from possibly feeling incompetent. They are encouraged to play the role of researchers in order to improve the curriculum and make it more relevant to real community issues. On the basis of these inputs, a number of topics have been identified that are being produced as fact-sheets ('Focus on ...') to supplement the instruction booklets and laboratory manuals that go with the test kits. Continuous monitoring of community needs and involvement in problem solving offer ideal opportunities for action research. This in turn facilitates the narrowing of the gap between the community and the formal curriculum.

It must be stressed that the action stimulus - in this instance, the water and catchment investigation kits - serves to stimulate a process of development and innovation, while the development of the fieldwork exercise and accompanying resource material is regarded as a very useful by-product. No predetermined goals pertaining to the development of new resources, new perspectives, positive attitudes or behaviour are built into the process, but an interpretive stance focussed on experiential learning and social theory is taken (O'Donoghue and MacNaught 1991, p.399).

There are a number of reasons why the GREEN river monitoring program was selected as an action stimulus. Apart from the adaptability of the program, rivers can be regarded as an excellent focus for fieldwork as they are historically important in the establishment of a community. Particularly in smaller, more rural communities, rivers still play a major role in community life. Also, children like to spend time in and around rivers.

Rivers can be regarded as reflections of the communities they serve; the profile of the community, including basic needs, levels of awareness and concern and socio-economic development are reflected by the quality of the river. Rivers know no bounds as they flow, and can be regarded as natural links between different communities.

What is green?

One of the major responsibilities of education should be to '...give away the tools and skills of interpretation...' (Uzzell 1989, p.9). This includes the tools and skills of science developed for finding out about basic natural resources and their management. A world-wide network of interactive river studies, initiated and coordinated by GREEN (Global Rivers Environmental Education Network) at the University of Michigan's School of Natural Resources has been developed to enable pupils to identify some of the major causes of water pollution and degradation, and to assist them in investigating possible sources.

The procedure is based on a series of standardised and simplified tests that enable pupils to investigate a number of chemical, physical and biological properties of river water. Low-cost and recycled material is used to make up these test kits, and the results of nine tests, being sufficiently reliable, are used to calculate a water quality index based on the parameters of the American National Sanitation Foundation's standards (Monroe and Wals 1989, p.3). These tests are performed at different times throughout the year at different locations along the catchment and invariably lead to further, more wideranging investigations into catchment management to identify possible causes of water degradation.

Currently, ten secondary schools in the Stellenbosch area are involved in a multidisciplinary water study project. Biology, geography, physical science, history and other teachers have become involved to enrich pupils' understanding of the socio-environmental issues relating to water resources.

Various lecturers at the Education Faculty, and the Botany, Zoology and Chemistry Departments of Stellenbosch University are also involved in developing test and investigative procedures as well as resource materials. Some of these lecturers have incorporated various aspects of the SWAP program in their students' curricula. They work in groups on allocated sections of the river system, and their reports are made available to participating teachers. A project coordinator supervises the making up, dissemination, and replenishing of test kits, and provides teacher support in the form of training workshops and regular weekly visits to all participating schools. Test kits as well as all written material (instructions, worksheets, background information) are being developed and localised with the support and assistance of local water study programs in the Umgeni River catchment in Natal. Other identified needs of pupils and teachers such as specific written material are being met by producing, disseminating and workshopping pilot material which can be adapted to suit the needs of other school districts.

Teachers are requested to identify those pupils in their schools who have shown particular interest in the project as well as leadership qualities. These pupils are trained to make up test kits and in general test

procedures, and will, once they have successfully completed the training session, be issued with a lapel badge and a certificate that will qualify them as SWAP Pupil Coordinators. Some of these students have come forward with a proposal to take over the production, recycling and circulation of test kits on a sustainable basis. One of the largest, and longest established local educational publishers has also shown sufficient confidence in the project to develop it into a national curriculum enrichment initiative.

All information, such as research findings and new developments, is shared with numerous similar projects in other parts of Africa, Asia, Eastern and Western Europe, Latin and North America through the mother organisation (GREEN) in Ann Arbor, Michigan.

In a variety of communities the world over, this has directly or indirectly stimulated critical dialogue in the wider community, and in some cases led to positive action by addressing specific problem areas in the community itself. The Stellenbosch community appears to be no exception as early signs of spontaneous community involvement with the project are quite positive. The local town council become involved - not only financially - and the local newspaper and numerous business concerns have become partners in the project by providing materials, services and other forms of support. This is regarded as crucially important, as it could give the necessary impetus and support towards a sustainable curriculum development initiative. It is in this area that developments will be closely monitored in order to describe a socially directed curriculum development process that may be of use to other Western Cape communities.

How does the formal curriculum benefit?

One of the most serious weaknesses in modern formal curricula is the gap between formal education and the real world, between the classroom and real community needs. Curricula are static and often burdened by academic demands. This is a result of a conventional approach to education '... in which children are continually required to master and regurgitate information presented by their teachers...' (Dewey, 1938 as quoted by Howe 1992, p.244). It is further aggravated by a number of factors such as the positivist-behaviourist approach to curriculum development, the closed-shop approach characteristic of many educational decision-makers, an inappropriate educational ethos, a limited, reductionist view of the environment, unrealistic academic demands made on formal education and the inability to adapt to the ever changing needs of society.

An appropriate 'real life' focus together with appropriate, low-cost investigative tools have stimulated teachers to engage in a process of curriculum development involving planning, discussion, evaluation and ongoing redevelopment of a number of school curricula. Many of these projects have been a step in the direction of making curricula more

relevant and responsive to real community issues.

Locally, some aspects of this curriculum innovation can already be observed only a few months after launching SWAP (Stellenbosch Water Analysis Project). The most obvious of these are:

1. a socially critical approach to education develops, providing students and teachers with '...a map of existing culture and society and a map of what a better society might be like' (Greenall Gough and Robottom 1993, p.2);
2. the continuous development, the making available and the application of appropriate tools to find out about the environment;
3. hands-on practical encounters with the environment and society which leads to dialogue and discussion, the exchange of information and the design of possible problem-solving approaches;
4. a shift in the role of the teacher from being a disseminator of knowledge to becoming a supportive co-learner and creating opportunities for learning and change;
5. interdisciplinary cooperation that is much more conducive to the development of a holistic view of the environment and environmental/social issues;
6. opportunities for action research, ie. continuous critical reflection on curriculum development processes with a view to redesigning and improvement.

Apart from these benefits, it has been found that participating schools along the river catchments share ideas, information and experiences. This is achieved through a SWAP Action Committee on which all participating schools are represented. In a society deeply hurt by a separation of communities by political ideologies, this in itself is a worthwhile cause. This committee is also represented on a River Management Committee chaired by the Chief Town Engineer, and all the findings of the different schools are fed into a database of the Town Council.

The more conservative among the participating teachers are encouraged by others who have experimented with incorporating the water studies in the curricula. It is encouraging to note that once teachers have experienced the multiple benefits of the program, they themselves experiment with innovative ideas at ground level. This might stimulate a process whereby the teacher accepts ownership and develops sound, relevant curricula and resource material, and the pupil becomes an active partner in learning.

The diagram shows how these curricular changes and some of the social benefits that flow from them, could serve to bridge the gap between curriculum and community.

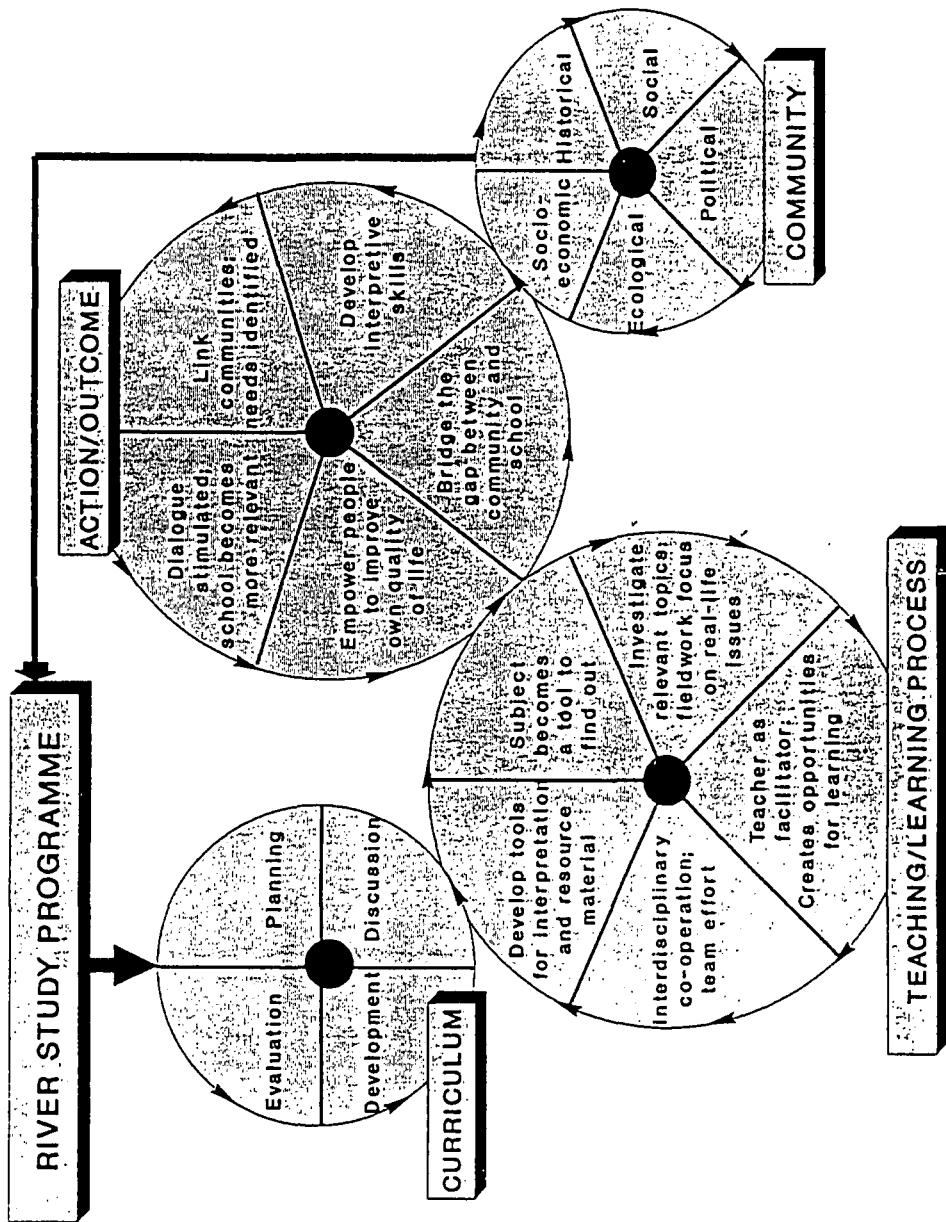


Figure 1: The 'SWAP Gearbox': Schematic representation of some curriculum changes and innovation, and changes in society stimulated by a river monitoring program.

Some social benefits of the river study projects

Convincing evidence of benefits that could bridge the gap between formal curricula and the community have been described. Some of these have already, after only nine months, been observed in the Stellenbosch community. These can be summarised as follows:

1. the development of a feeling of empowerment among both pupils and the wider community, which should be regarded as one of the principal functions of education;
2. the stimulation of critical and constructive dialogue and reflection, social negotiation and the organisation of positive action and involvement;
3. the development of an awareness of the real needs and problems encountered in a community, and of sensitivity for the needs of neighbouring communities;
4. the development of scientific investigative and interpretive skills, enabling pupils to obtain a better grasp of processes at work in society and in nature.

This does not mean that SWAP or any water study program holds instant solutions to educational and environmental ills; nor should it be assumed that the same results will be achieved in any community. The uniqueness of different educational contexts and community needs makes an universal recipe for success impractical and unrealistic, and demands appropriate approaches to curriculum development and education in general. But since GREEN programs focus on an extremely relevant and universal ecological and socio-economic issues incorporating basic human needs, these projects are remarkably adaptable. In southern Africa, very positive outcomes have been observed in situations as diverse as rural developing communities in the Umgeni catchment, and typical developed conditions such as the Western Cape urban areas in stimulating awareness, critical social dialogue and social change through formal education.

Although countless opportunities have developed where SWAP could extend to involve schools in other areas in the country, the belief that the success of SWAP lies in the fact that as a research initiative it must confine itself to a limited number of local schools. Interested school communities have free access to any research findings, as well as resource materials, but like the first ('input') gear in a gearbox being small to ensure optimal efficiency of the system, the research team should at all times be in touch with the maximum number of participants.

However, project coordinators have already been identified in neighbouring communities where excellent opportunities and infrastructures exist to implement similar developments. Students from the Education Faculty will workshop in these areas with participating teachers, and participants will be supported until such time as local structures are adequately self-supportive. After GREEN programs were introduced at a

recent Eastern African Environmental Network Congress in Kenya, two coordinators came forward. One has already attended local training workshops and support structures (Stellenbosch and Umgeni) to start similar but regionalised projects elsewhere in Africa.

Another exciting development is that SWAP has recently been linked to a high priority research project on the Cape clawless otter (*Aonyx capensis*). The coordinator of this project has produced suitable material that will be included in the SWAP worksheets for local schools, encouraging participating pupils to assist in finding and recording signs of these very rare animals in the local river system.

A comprehensive guide to the Cape riverine vegetation is also being developed in collaboration with the SWAP participants. A well-known botanist has embarked on this very ambitious project using pupils and students working in the catchment to check hundreds of plants on his list, and to report any as yet unidentified species.

SWAP has also recently being made a member of the Steering Committee of the National Water Research Commission. Thereby the educational potential of the project is being recognised in a predominantly scientific domain.

Conclusion

As some of the key elements of these projects are *community action, sharing, and learning through participation and a socially critical approach*, GREEN represents a promising stimulus that might bring about a revolution in both formal education and social change. These are the effects that many proponents of environmental education have endeavoured to attain - mostly with mixed success - for many years, as they attempted to actuate change in the formal curriculum through conceptual models and theories. In these approaches, '..."experts" determine the means to achieve some ends (that are often themselves not questioned), and these means are then translated into models and practices designed to achieve the ends...' (Howe 1992, p.246).

In the SWAP project, a socially critical approach to curriculum development is encouraged. It represents an effort to move away from the technicist, positivist view of curriculum reform, to a critical technicist, positivist view of curriculum reform, to a critical social process which is participatory and collaborative, and '...involves a form of educational research which is conducted by those involved in education themselves' (Carr and Kemmis 1986, p.156). It aims at involving teachers, students, parents and the wider community in the tasks of critical analysis of their own situations. In this way, it is hoped that the community might achieve a real awareness of the reality that shapes their lives, and of their capacity to transform that reality.

Development processes are closely monitored and participating teachers encouraged to constantly revise and critically reflect on identified needs and the methods which could prove effective in accomplishing curriculum innovation. Simultaneously, social involvement in the project is encouraged with the view of enhancing critical social awareness.

The strength of this approach to curriculum innovation lies in the fact that it becomes practice driven rather than theory driven. The teacher, pupils and the wider community form a close partnership that creates a better learning environment, and stimulates awareness and involvement in the community and the acceptance of the responsibility to improve the quality of life.

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