



Pergamon

International Journal of Educational Development 21 (2001) 447–461

International Journal of  
EDUCATIONAL  
DEVELOPMENT

www.elsevier.com/locate/ijedudev

*Rocky Horror Show*

## Educating scientists in context: a Namibian case study

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### Abstract

Education and science have both been hailed as keys to development and 'progress' in the 20th century, which implies that science education in particular will open doors to such outcomes. However, the internationalisation of scientific work and the transnational science and technology industry may ensure that few benefits are experienced by a poor country. The innovative approaches of one institution in the education of scientists in Namibia is examined. It shows the possibilities of context-based science education to produce scientists capable of practical problem-solving, and the value of scientific partnership-building for sustainable development. This raises issues about the broader conceptual framework linking education, science and development. © 2001 Elsevier Science Ltd. All rights reserved.

**Keywords:** Science and development; Fieldwork training; Science education; Education in Namibia; Desert Ecological Research Unit of Namibia

### 1. Introduction

In recent years the argument for a key role for education in development has faltered a little. High levels of educational participation, especially at the post-compulsory level, have been associated with high levels of GNP, but what is the nature of the relationship? Is it more than a correlation? Is there a further issue which accounts both for high levels of education and of GNP? What other factors should be considered, for example, youth employment, levels of investment in scientific research and development, whether R&D is undertaken nationally or imported? Is it more than an economic equation, and if so, what other variables need to be considered? And there is also a sustained cri-

tique of the ways in which western education has been imposed on non-western cultures and socialisation processes, the suppression of indigenous knowledge, and the implications of transferring a western model into another social, cultural and epistemological system, whether through aid at home or sending students abroad (see e.g. Altbach, 1971; Carnoy, 1974; Simkin, 1982; Burns, 1984; Crossley, 1984; Garrett, 1984; Jones, 1987, 1991; Watson, 1994; Farrell, 1997; but see also Golding and Harris, 1997).

Nevertheless, the debate about education and 'social progress' (e.g. Haddad et al., 1990) continues. There are three critical strands to this debate at present. The first looks at the role of education in democratic transformation, with a focus on countries emerging from authoritarian rule (e.g. Mitter, 1993; Beck, 1998). The second is concerned with the impact of globalisation on society and its sub-systems, especially a system that is

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basically a recipient of 'advice' 'expertise' and 'information' (e.g. McNeely, 1995; Taylor et al., 1997). The third, linked, strand deals with theorising the continued impact of colonialism on contemporary problems, including educational ones (Tikly, 1998). The first strand places education at the active interface of change, whereas the second and third are more concerned with examining wider effects on education. They nevertheless imply that education has an important role in society, but problematise the influences on it which may subvert or distort that role. The ways in which these strands interact in a national context are examined here for Namibia.

Namibia is a small, extremely dry country. Major issues for its national development stem from the need to raise educational levels, and from the many challenges of a rising population in a country limited by water and land quality. This paper examines one institution, the Desert Research Foundation of Namibia (DRFN), which began as an ecological research institute and now incorporates educational and training projects. This paper reviews the educational work of this Foundation against the backdrop of the search for sustainable development in Namibia. It focuses in particular on the provision of fieldwork and context-based experiences in tertiary science education, and on the orientation of students to work for sustainable development. The case study is then used to reflect on the education–science–development nexus.

## 2. Background

Namibia is the driest country south of the Sahara, with 97% of its area classified as arid or semi-arid (Zeidler, 1996). The Namib Desert stretches along the entire coast, and up to 80–120 km inland, and the Kalahari Desert lies to the east. Seventy percent of the indigenous Namibian population lives by subsistence agriculture, and over 60% are in the less dry northern regions (18% of the land surface). Water conservation and resource management which deals with the threat of desertification, degradation, overstocking and inappropriate land use are challenges which must be met to enable

the country to continue to support even its present population of 1 600 000.

It is in this context that any discussion of development must take place, assuming as fundamental that development is not synonymous with economic growth. The particular colonial history of Namibia (e.g. Hishongwa, 1988, 1992; Ministry of Education and Culture, Namibia (MEC), 1993) and the recency of its demise, adds another dimension to any national agenda for development, the government's perceived urgent need to orient its services to the whole community, but in particular to

...those interests that have little economic leverage in the market. That is especially important where those who are the most successful in the market become increasingly influential in setting its rules. (MEC, 1993: 16.)

Thus, there is a fourfold developmental challenge: political, socio-economic, cultural and environmental, with the potential for tensions to emerge between the concern for equity and human rights, and the management of a fragile environment.

The political challenge stems from the past, a sub-stratum which is particularly pertinent given the recency of Namibian independence from the repressive South African rule. The desire for equity places a heavy burden on a government wishing to maintain credibility with those who brought it to power after a long battle for self-determination. The government not only has to deal with the problems of underdevelopment, neglect and abuse of people and environment, but to do so demonstrably and transparently.

The socio-economic situation is both part of that challenge, and one of the constraining factors. Careful planning and new resources, both monetary and human, are required in order to shift the economy and its support systems from an orientation to South African white interests to those of the people at large. In turn, the wider context includes the Southern Africa Development Community (SADC) and ultimately the international one. To introduce effective change with equity will require new resources and ideas. Engagement with

outside agencies in this process, especially multi-lateral agencies, is potentially precarious not just for the fulfilment of the ideological aspirations of the government and people, but economically as well. Put baldly, how can a small arid country, rich in mineral resources, fulfil the people's expectations for services, living standards and basic human rights in a globalised world economy?

Equity also resonates as a cultural issue. There are over ten tribal groups, and a white population of 96 000 (Hishongwa, 1992: 5). Suppression and subservience were dominant motifs under German (1884–1915) and South African (1915–1989) rule. In 1958 the South African Bantu Education Act was extended to Namibia. The Act virtually precluded non-white Namibians from all but basic education, and that in the Afrikaans language, an internal lingua franca which limits access to outside sources and ideas. The 'old' is still present, not just in the continuity of people despite political change, but in the widespread use of the Afrikaans language, although English is now the main official language. Language, and the conscious and unconscious cultural as well as individual ideas and symbols from the colonial period will take time to transform. There has been an influx of Namibians who were refugees for up to 20 years, who have obtained an education abroad, and there was also support for the freedom fight within the country. There is thus a 'culture of freedom' on which to build, but also enmities to resolve and harness for national development efforts.

Ecological challenges as well as socio-economic and political ones impinge on and interact with cultural ones. As the lessons of other primary producing countries continue to demonstrate, the environment can be a catastrophic casualty in the race for economic gain (e.g. Griffiths and Robin, 1997). The mostly dry Namibian ecosystems are particularly vulnerable to over use. Both degradation and irreversible desertification are real threats (Seely, 1991: 11). Development with justice, within such environmental limits, is an additional challenge for planners and for the research and education which would ideally underpin it.

Sustainable development in Namibia is imperative. To attain it, the population will need to become involved in development processes which

do not threaten their ultimate wellbeing. However, ecological sustainability may not be perceived by the people as in their immediate interests. The country has barely completed a major political and economic transition. Can the government afford to provide visible signs of improvement for the human condition, in tandem with sound, future-oriented ecological and economic policies? This paper examines one aspect of this complex problematic, the training of scientists, and focuses on the work of one research institute in that process. Through examining the issues raised in the case study, the role of education, especially science education, in sustainable development, is highlighted and some key aspects identified.

## 3. A key role for education?

Access to formal schooling was severely limited in Namibia before its independence. It is hardly surprising therefore that education is perceived as potentially important to obtain national social and political as well as economic objectives. The Namibian government has embraced education as one of the cornerstones in the national development strategy, in rhetoric that is reminiscent of the heyday of hope for education as a transformative institution. Given the history of discrimination and neglect of any infrastructure for Africans in Namibia, the major priorities of the present government in the sphere of education are equity (the extension of education as a human right for all), implementation of lifelong learning strategies, and learner-centred education. These ideas are encapsulated in the Ministry for Education (MEC) Brief Towards Education for All: A development brief for education, culture and training (MEC, 1993). The second paragraph of this states:

Education for all is an important goal, guaranteed in the Constitution and central to the national development strategy. (MEC, 1993: 2)

Thus, extension of education is seen not only as a constitutional and ideological issue, but also a development one. As the Brief continues:

Expanding access to education increases productivity and economic growth. Education has come to be understood as an investment in human capital. Extending and improving education promotes development. (MEC, 1993: 2)

There are multiple demands on the educational budget. The tertiary sector is proceeding modestly, with one university (the University of Namibia: UNAM) and a multi-site Polytechnic (Otaala, 1998). The former has a restricted range of undergraduate programmes, and limited post-graduate opportunities, and the latter has a strong vocational emphasis. There is some reliance on education abroad at the tertiary level, especially the post-graduate, which allows Namibia to concentrate on perceived priorities but will create pressures to open up other areas. Government bursaries are essential for most students in the upper levels, which is a form of control of access. New approaches are required, including distance education and different patterns of study programme to accommodate working mature age students.

A large effort is required to balance these issues against overall development needs. There is tacit acknowledgment that education has a role in the creation and dissemination of the knowledge necessary to continue to achieve development with sustainability (MEC, 1993: 2). To orient education to the creation and transmission of knowledge for sustainable development is a significant challenge. However, given the small pre-independence base, there is an opportunity to build a system based on bottom-up knowledge development for sustainability, to create

...an ecologically literate and ecologically competent citizenry who understand global issues, but who also know how to live well in their places. (Orr, 1992: 1)

The literature on sustainable development is largely euro-centric in nature (Kunzmann and Dericioglu, 1985; Orr, 1992). Namibia faces a large challenge to establish sustainable development policies and to engage the education system not only in transmission of relevant knowledge but the creation of sound indigenous approaches.

#### 4. Science education and sustainable development

Science is one area where education can address sustainable development issues. However, science itself can be considered problematic as a tool of development because it is potentially a vector for global penetration. Scientific knowledge, which is promoted as value free and at least culturally neutral, has been 'exposed' as a social construct and a carrier, as well as a legitimator, of a powerful, dominant and hegemonic culture [see especially the feminist critiques by Fox Keller (1985) and Harding (1986)]. If science has a social basis it can be placed beside local knowledge as tools for development. But what does such recognition imply, especially for the content of educational programmes? In the field of ecology, moves away from its euro-centric base have led to new directions, but also to some muddled ideas about the relative worth of 'traditional' and 'modern' (introduced) practices. This is probably one of those pendulum swings between the 'ecological colonialism' of frontier settlers who denigrated the lands they conquered (Griffiths, 1997: 3) and the uncritical promotion of the traditional as superior. Some resolution of these positions is emerging through the notion of 'coadaptation' which recognises that humans change the environment in ways that may be more, or less, harmful and which may promote evolution (Flannery, 1994: 15). It may be some time before such a resolution reaches the classroom, but a more reflexive practice in science education is a step forward. The present case study looks at this at a practical level.

Schleicher (1989) is concerned with the pre-conditions for provoking more widespread reflexive science education. He argues for an interdependent relationship between environmental politics, public awareness and education and suggests that ecological awareness, rather than mere environmental education, is the appropriate path to pursue. In this way the human, socio-political and economic effects on the environment as well as the biological interactions and outcomes are brought into the debate, and form the necessary content for education to bring about change in human behaviour and in social policies towards the environment.

Thus, the type and scope of environmental education, and not just its inclusion, is critical.

There is need for a greater range of human understanding of and practices towards the environment in educational content and practice. One aspect of this which is drawn out in the present case study, is the development of local research competency and knowledge creation. Done in partnership with other researchers and communities, this will enable appropriate knowledge transfer and adaptation (see also Carnoy, 1974; Hetland, 1984; Crossley, 1990; Low, 1994).

The foregoing suggests that there are, in particular, pedagogical and epistemological issues in the development of environmental/ecological education. What are the possibilities for this in a small, newly independent country with multiple demands on public sector resources? It is not the intention here to argue for detailed content in science education in Namibia: readers are referred to two particularly interesting articles which deal with these questions in African contexts (Krieger, 1988; September, 1990). What will be considered is a concrete example of how a particular problem in the provision of education can be turned to the development of knowledge and practical skills for environmental sustainability.

It is argued here that hands-on work in science education is particularly important for the development of skills and capabilities to translate theoretical knowledge into active work (see e.g. Harrison, 1987; Cross and Price, 1992). However fieldwork is becoming a costly luxury even in western undergraduate programmes. In Namibia, it is not built into science courses at university level. Most students come from villages, where the stringencies of peasant existence construct the environment in short-term, pragmatic ways. Books alone will not enable them to learn to 'read' the environment in different ways. It may be knowledge imperialism to suggest that traditional attitudes to the land and the biota are potentially destructive. However, the environmental actions that may be necessary in the face of rapid population growth and the ever-present threat of desertification call for an urgent meeting between traditional and scientific knowledge.

Such a meeting needs deliberate fostering for

young scientists in Namibia. The next sections of this paper present a case study of such work by the Desert Ecological Research Unit of Namibia (DERUN, formerly DERU). As a basic research institute, it collected, *inter alia*, long-term ecological data. These data can now be used for understanding and dealing with environmental change at a practical level, as well as providing a knowledge base for education about the issues.

#### 5. The Desert Ecological Research Unit of Namibia, Gobabeb: a history of partnerships

DERU was established at Gobabeb in 1965 as a research unit of the Transvaal Museum (Zeidler, 1996). It is located at the conjunction of three major eco-systems: the gravel plains of the northern desert, the southern sand sea and the bed of the ephemeral oasis, the Kuiseb River. It is within the Namib-Naukluft National Park, 115 km from the nearest town, Walvis Bay, and over 300 km from Windhoek, the national capital.

The core staff at Gobabeb has always been small (10 or below) but is regularly augmented by visiting scientists, and by local and international students and volunteers. Its programmes are collaborative scientifically, and rely on diverse funding sources.

The Desert Research Foundation of Namibia (DRFN) was established in 1990 as an independent, non-governmental organisation (NGO). DERUN is one of its branches. DRFN collaborates with UNAM, the Polytechnic of Namibia, the Ministry of Environment and Tourism, Department of Water Affairs, the National Museum of Namibia and the Ministry of Higher Education, Vocational Training, Science and Technology. While major funding has come from overseas governmental aid programmes (SIDA in Sweden, the German BMZ and USAID), DRFN and DERUN operate on a very tight and sometimes uncertain budget.

In 1998 a Joint Venture Agreement was signed between the Ministry for Environment and Tourism (MET) and the DRFN, which enables it to secure long-term project funding. The first venture is the building of a small SADC Regional Research and Training Institute at Gobabeb, which will pro-

vide additional working and living accommodation. Alternative technology will be incorporated in the design and building of these additions, in order to demonstrate the practicability (and especially in the case of water use, the necessity) of such technology.

Before looking in detail at the contribution of DRFN and DERUN to scientific education, its method of working through internal and external partnerships will be outlined. It is argued that these partnerships are an important aspect both of the applied research and educational function, as well as the ongoing credibility and long term sustainability of both the DRFN and DERUN. As a small-scale institution, they also show how a path can be cut through the aid-influence nexus through the involvement of local partners in major decision making and implementation.

### 5.1. Scientific partnerships

Scientific partnerships have been fundamental to the mission and programme of DERUN from its inception. The Unit is dedicated to understanding the unique environment of the Namib, as an intrinsic scientific interest, and as a place where human and natural activity may combine for survival or for disaster.

Since the DRFN was formed as an NGO, there has been greater emphasis on applied research, though pure research is still 'the engine' of its work (JRH, personal communication, July 1998). DERUN's programme is funding-dependent, which gives rise to interesting symbiotic relationships. Since the research community in Namibia is still small, there is a need for international partnerships (Henschel, 1996), but to maintain facilities to attract such partners, there is need for infrastructural support, currently provided by the Ministry for Environment and Tourism. The laboratories and library largely rely on donors, while providing a service to visiting scientists and students. Joint projects are emerging, especially in two key areas, fog harvesting and land management.

International volunteers are regularly involved with the DRFN, some of whom are undertaking fieldwork for overseas qualifications. Formal agreements are now in place with overseas insti-

tutions for regular volunteer placements (JRH, personal communication, July 1997). There is a more overt training element for local volunteers, and a number go on to employment contracts with the DRFN, each having had a chance to 'take a look' at the potential of the other.

### 5.2. Partnerships for teaching and learning

Collaboration takes place for the supervision of post-graduate students from abroad, facilitated when students' supervisors have themselves undertaken research with DERUN, which establishes a chain of involvements. Some overseas post-graduates develop a strong commitment to Namibia and the DRFN, evidenced in their research topics and ongoing links after they return home. Some international graduate students first came to DERUN as volunteers, so there are several entry points involving both research and practical action. So far there is little reverse traffic (and mostly with South African universities) though some Namibian students who have worked with DERUN have gone on to partners abroad for further study.

Teaching materials development for all levels of education, including teacher preparation, has been undertaken by DRFN, a direct product of their research (Sguazzin, 1995, 1996). The executive director, Dr Mary Seely, has been particularly active in producing a number of accessible and action-oriented publications about the environment.

The training component of DERUN is now given "more focused attention" (Seely, 1996: 3), and will be discussed in the next section.

### 5.3. Advocacy

Advocacy is a form of partnership-building practised by DRFN and DERUN staff. It involves network building amongst overseas scientists and donors, alerting them of the issues and challenges in the Namibian environment, and amongst government and other agencies in Namibia. Staff also provide advice and policy input at the national level and Mary Seely is a member of the National Planning Commission, which guides national development. The DRFN is a major partner in the

Namibian Program to Combat Desertification (NAPCOD), which is significantly funded by the German Corporation for Technical Cooperation, GTZ. Other forms of advocacy are discussed in Burns (1999).

### 5.4. Partnerships with local communities

Partnerships with local communities have become important to the work of DRFN and DERUN. At DERUN, the Mission Statement notes that it is "a resource centre for arid-lands studies that conducts and facilitates appropriate, participatory, and applied, short and long-term research and training". Namibians are active participants in research, teaching and learning, and advocacy. Additionally, recent projects involve co-operation with the local Topnaar communities living in 12 semi-permanent settlements along the nearby Kuiseb River. One project brought together local people and a Nama-speaking group from the Richtersveld in South Africa, both facing similar challenges as residents in what are now national parks. While there has been earlier research on local community issues (e.g. Van den Eynden et al., 1992), partnership and participation have become aims in research planning more strongly since independence.

Only one Topnaar person has been employed so far at DERUN as more than a manual worker. Current projects to harvest water from the heavy seasonal fogs, to assess local water needs and sources, and on intermediate technology, attempt to involve local people. During 1997 and 1998 a Nama-speaking assistant with community development qualifications was employed to facilitate local participation. This is a slow process which must overcome the barriers built by the neglect and racial separation of the old South West Africa Administration. Developing community partnerships is a long-term process. New projects emphasise applied research and aim to empower people to use local indicators of change in their ecosystem and adapt land use patterns to prevent degradation (JZ, personal communication, July 1998). The short-term nature of most employment at DERUN interrupts partnership-building, while most university, especially qualification-oriented, research takes

scant account of the nature of communication and trust building.

The next step, involving dialogue with local people about their perspectives on the issues, is beginning to emerge. Concern by the older people with perceived lower harvests of an important food source and cash crop, the *!nara* melon, is being investigated as a DERUN project, starting with assessment of local knowledge and beliefs. Discussion by the present researcher with indigenous staff in July 1998 showed that they wanted to become involved with the community. Their concerns varied from a desire to bring about change based on their (largely 'scientific') insights to a willingness to sit down and start with local people's assessment of the situation.

## 6. Education for sustainable development: DERUN initiatives

DERUN is involved in science education in a major way through the research process. All research which involves junior team members ideally has a teaching-learning component, and DERUN's deployment of local staff on research projects and ongoing monitoring makes this explicit. They also run a practicum and a summer programme for UNAM students, and offer an extended placement for Polytechnic Environmental Management course students.

School groups may spend a day at DERUN where they can sample the Namib environment, see scientists at work and be shown the environmentally friendly technologies in use in the running of the station. The senior research assistant, who first came to Gobabeb as a volunteer in 1994, is firmly convinced of the role of school visits in bridging the textbook-active knowledge gap for children. "Children don't get an opportunity to know their own country...If you demonstrate [something to them before their eyes], then they learn it in the head and also feel it" (VM, personal communication, July 1998). Annual open weekends bring in a wider public. However, some staff feel there should be more effort to involve the local community on these or other occasions.

Two aspects of the work at Gobabeb are

inherently oriented to education for sustainable development, and involve partnerships in the process. The first is the field research training programme, and the second is the research training built into the institute's employment strategies.

Field research training is conducted through three major activities. The first are short field courses (up to one week's duration) conducted for UNAM and the Polytechnic. The emphasis in these courses is on problematising knowledge, and translating questions into researchable projects, preferably with practical application. For example, one course for third year ecology students was oriented around a paper on the Sustainable Biosphere Initiative. Students read this, then chose one of the questions it suggested, and engaged in the "tough task" (Kaune, 1993: 13) of translating the question into a small research project, to be answered using the local environment. With a flash flood in the Kuiseb River on the third day of the course, students abandoned individual projects to jointly examine the flood debris at intervals along the riverbed. Very little is known about the dynamics of arid region river systems, and the students were able to investigate nutrient supplies in the debris, and estimate its volume and deposition pattern. They were encouraged to question further, looking at the implications of dam building and livestock introduction for such a fragile river ecosystem. The on-the-ground understanding that students can acquire through such an experience is a vital link between research and action. Without the partnership with DERUN, this experience would not be possible. The courses are supported by outside partnerships, in this case through the provision of a minibus for the UNAM Zoology Department by SIDA and NORAD.

In 1998, the first group of five Polytech students commenced a 4 month practicum at DRFN. This is part of compulsory experience for the Diploma of Environmental Management, and the students are required to design and carry out a supervised research project. DRFN provides both the supervision and the opportunity, through work within its programmes, for students to see other scientists at work. They also have access to the visiting scientists, as well as the library at Gobabeb, the best collection in Southern Africa on arid regions. This

opportunity to participate not only in a project but a scientific culture is one of the strengths of the DRFN, especially at the field station at Gobabeb, as indicated in VM's testimony, above.

The second activity is an annual Summer Research Programme which began in 1992. It aims to bridge some of the gaps between the collection of research on the Namibian environment, which has largely been done by non-Namibians, and the mainly textbook studies at university by potential Namibian researchers. Students are led through all phases of a research project and present their results at a final weekend event attended by community and political visitors. They also prepare posters for further dissemination of their findings. There is an emphasis on skill training for the field, and on analysis of results including computing skills. There are six to ten participants in the 8 week courses. Financial support by SIDA has, *inter alia*, enabled purchase of computers which give participants hands-on experience and extend Gobabeb's resources for others, too. The research is not limited to the Namib area: an annual theme is selected so that individual projects feed into an overall focus.

The summer courses are based on pedagogically sound principles for active learning and communication. They draw on the resources of knowledge, accumulated data, library and personnel of DERUN. For urban students, projects involving farm studies are a new experience, and for all it is a first exposure to fieldwork. Such experiences are another aspect of translating theory into practice. One participant wrote:

...the course not only exposed us to an unfamiliar view of Namibia's physical and social environment as well as lifestyles, but clearly demonstrated the inter-linkages of seemingly divergent factors that are at play on the environmental scene...I have no doubt in my mind that each and every one of us left Gobabeb with a better understanding of the causes, processes and consequences of desertification in Namibia. (Nghitila, 1996: 10)

Another said:

I have been exposed to different research methods. I have an idea now how to write up research reports and to present them clearly. My only concern is how we convey this message to local populations, to let people understand the varying conditions and the contribution of their actions to land degradation. (Botellé and Kowalski, 1996: 11)

Foreign post-graduates and volunteers at DERUN are also exposed to the realities of the Namibian environment and society, and to hands-on applied research, which has a potential multiplier effect. During my first field visit in 1997, for example, the three overseas volunteers were considering post-graduate work in Africa, and two overseas post-graduate students were doing applied work not only of direct relevance to Namibia but with potential to "spread the message" through international scientific communities (Zeidler, 1994).

Employment of Namibians is part of the capacity-building mission of DRFN. A number of summer course participants have volunteered to work there after graduation, where they are assisted to develop further research skills and experience. They may be helped to apply for appropriate post-graduate courses abroad (Henschel, 1996). Such mentoring is important, given that there are no post-graduate science opportunities in Namibia at present. It may also encourage Namibians who study abroad to undertake relevant applied projects, returning to Gobabeb for supervised fieldwork. During late 1997-1998 the post-graduates provided tutoring for three of the assistants undertaking their matriculation studies by distance education. The senior research assistant matriculated in June 1998, and considers that the general atmosphere at Gobabeb was helpful for his studies. One of the post-graduates, herself a Namibian resident, said she extended her knowledge and confidence through being a tutor.

DERUN 'talent spots' through the volunteer system. It takes on high school students in their later stages, assists them with their studies, and those who demonstrate interest and initiative are placed in paid positions in projects. The interaction between the growing interest and understanding of

a former volunteer through the opportunities of employment at DERUN is shown in the following conversation:

VM: When I was small, I wanted to be an electrician or mechanic. The research part here was very new. Now I'm more interested in climate change in general. It involves a lot of subjects.

RB: Do you enjoy doing research?

VM: It's changed a bit. '95 was my first experience, and it was fun going out. There were things I knew from childhood but just kicked out of the way. Here I've developed a new relationship with the insects, and the more I do, the more I like them. At the end, if you come to love them, you like not just to collect for someone else, but you want to go to the whole stage, to learn that.

RB: What are the stages?

VM: Doing fieldwork, analysis, giving recommendations and writing an article.

Learning by doing has been so effective for this young man, that he is the sole local researcher for one international project, having overcome a challenge by the grantors who wanted to restrict "capacity building" to post-graduate students (JRH, personal communication, July 1997). In the first half of 1998 he presented the results of one project at a regional meeting in Harare, and in July 1998 attended the first international conference on fog in Canada, again presenting the results of his work.

When interviewed in 1998, he had a clear vision of the role of DERUN in innovative post-school education for mature-age students. He would like to continue the research with the fog project, as his interests have crystallised around climate research. Ideally, this would involve "being in charge of that

project, and going to a professor and classes for 3–4 months each year". This suggests a new model for university undergraduate programmes, partially exemplified in the Polytechnic model of 2 years 'in school' followed by an extended practicum. VM's approach would allow students to continue their income-earning activities, but would require both flexible employment for on-campus time, and enough places conducting research to provide relevant employment.

Three out of five Namibian research assistants in 1997 spontaneously attested during interviews to their interest in learning about the environment from a new perspective, and how to study it in order to assist people to use it better. A year later, one of those assistants is developing a chicken-raising project he would like to implement with the local people. In the 12 months he felt he had learnt "how to communicate" with the people and begin the process of how to "convince people to change" (IK, personal communication, July 1998).

## 7. The DERUN research culture

DERUN provides an additional benefit this is rarely mentioned in the literature on science education, namely a scientifically-enhanced cultural environment. This stems in part from its geographical remoteness and until 1997, its lack of modern communication facilities. Its excellent specialised library and regular scientific visitors enhance resources for its central tasks. Gobabeb is a community, and science is its *raison d'être*. This permeates the day-to-day life of all. Project business is the main concern of weekly staff meetings, and there is an unwritten expectation that all those on site will be present at morning tea each day, where work needs and issues are discussed informally. Regular Brain Storming Evenings are used to discuss project results and talk with visitors.

The community fosters a learning environment that supports individuals and their education as scientists. Research assistants, students and long-term volunteers live in 'The Slums', an area where there are small individually-occupied caravans, and communal kitchen and bathroom facilities. The longest resident of 'The Slums', an overseas PhD

student, exercises informal leadership and sets the pace for basic routines and an atmosphere of caring and concern for members. She attributes a crucial role in morale-building to one of the indigenous residents, who has worked there in several capacities (JZ, personal communication, July 1998).

In addition to general community life and work, there are shared tasks which require knowledge about other projects and work at Gobabeb. Weather observations are made thrice daily (Gobabeb is a first order weather station) and transmitted to Windhoek. This is the responsibility of one person, but others assist or substitute during his absence. Others are similarly involved in the regular pit-trap clearance and specimen identification, and the conduct of detailed station tours for visitors.

As noted earlier, informal assistance is offered by community members to those undertaking formal studies, and at least one person showed interest in offering to tutor local Topnaar workers' children (VM, personal communication, July 1998). Efforts are made to organise communal recreation. However, it is easy for residents to work after hours and to consult others about their work, plan field trips and help each other. A largely self-contained community such as Gobabeb promotes self-reliant problem solving, and my observations suggest that most people there are multi-skilled and keen to learn from each other (cf. an Antarctic scientific station: Chipman, 1978; Law, 1983).

The site itself also promotes practical learning and problem solving. All those interviewed said that the low-distraction environment enhanced learning, especially through interaction. And the location in the Namib Desert is a constant reminder of the reality of extreme aridity, while the stark beauty of the desert was named by some as an inspiration for their work. The multiple advantages of the isolated Gobabeb site have been recognised in the decision to locate the new Research and Training Institute out there.

## 8. Discussion and conclusions

Since the DRFN mandate has broadened in the 1990s, it has become a major player in the struggle

for ecological sustainability in Namibia. With applied research and education added on to its activities, it is a site of significance in the Namibian context, where institution building is still a significant task for government. In such a situation, a small NGO with 30 years' experience in the country and with strong international links, can exert a considerable influence not only on the training of researchers and the conduct of research, but through the dissemination of information, internal and external networking, and input to policy.

It has been presented in detail here because it is both an example of innovative approaches to science education for development, and also raises issues about that relationship. These will be considered *seriatim*.

### 8.1. Science education for development

As a research institute, DERUN is able to focus on context-based research training. The location and the human environment foster socialisation into a scientific culture which views science as a tool for practical problem solving. Location, resources and pedagogy are combined to provide fieldwork experience for senior science and land management students which exposes them to practical problem-solving. Through DERUN's and DRFN's wider partnerships, students are also introduced to a larger scientific community, including participation in cross-national comparative projects.

Detailed examination of the approaches, as presented here, show how ecological problem-solving education can be developed within science. Since the ecological problems are a core ingredient in Namibia's future development, education for development is thus advanced. So far, the testimony of participants suggests that the programmes described here are effective tools for learning about how to do science to answer practical problems. Before suggesting it as a model for wider adoption, research on the learning processes as well as the content of the learning about scientific research would be fruitful in order to evaluate this type of fieldwork from a pedagogical as well as an epistemological perspective. Follow-up of former participants would also be valuable to assess how the

knowledge gained at Gobabeb has been used in subsequent employment. A case can also be made for evaluating the role of volunteers, and the exchanges that take place between visitors and locals at all levels (e.g. Hansen, 1995; Lessor et al., 1997).

Overall, DERUN shows how science education can be oriented to development in a concrete situation, bringing science to bear on a critical aspect of sustainable development in Namibia through innovative research and training. As an NGO with international connections, it has been able to fill a gap which formal education has left. Its independence is also a weakness, since the Foundation has to struggle to secure its own sustainability, and Henschel (1996) has demonstrated that subsidisation is a strategy which impoverishes local resources and increases the dependency of local consumers. Nor is DERUN able to influence directly the wider educational policy and practice context from which it draws its participants. This is less serious in a small country like Namibia, where key players can interact relatively easily, and where the educational system is still being established. However, it reinforces King's (1986) concerns about both the direction of benefits in collaborative work, and the value of exemplary projects.

A final consideration in assessing the role of DERUN as a provider of exemplary approaches to education for sustainable development is that neither science nor development have themselves been problematised. The conduct of local projects, the input of local knowledge, and attempts to implement change which inevitably runs up against the development goals and impediments of the wider society, will go some way to encouraging such a critical consideration. The final section reflects on these issues in the wider context of education and development debates.

### 8.2. Science, education and development: theoretical reflections

The case study shows how an NGO can be an innovative provider of educational experiences that foster the adaptation of scientific knowledge to local development needs. However, science can no

longer be regarded as a monolithic concept. Nor is the prevailing educational paradigm unquestioned (Aviram, 1996). Several components for a new education paradigm that incorporates development issues can be discerned in the case study.

The first arises from the way the NGO has increasingly engaged with the local community, working towards participation and the inclusion of local knowledge for development. This is an implicit attempt to resolve complex identity issues that have been taken up by educators in three major theoretical directions: post-modernism largely in the 'first' world, post-colonialism in 'third' world contexts, and multi/interculturalism in both. All three are essentially cultural critiques which also try to theorise difference and inequality.

When applied to education, post-colonialism in particular suggests a framework for examining contemporary problems, though it is weak in economic critique (Tikly, 1998) and can be a new form of identity-polarisation (Fox, 1998), which reduces its potential usefulness in building a new educational paradigm. It does offer a methodology for evolving a cultural foundation for both education and development, exemplified explicitly in the case study in the participatory approach to development projects, and implicitly in the learning that participants undergo in the implementation of a project.

Postcolonialism also can be the basis for an approach to the difficult environment and development debate as it applies to 'third' world countries. Critics of the conceptualisation of environment and development in the third world (Kunzmann and Dericioglu, 1985), and especially the report of the World Commission on Environment and Development (1987) suggest that it makes an uneasy compromise between a notion of *environmental* sustainability that placates radicals, especially environmentalists, and one of sustainable *development* which placates "businessmen and bankers" (Orr, 1992: 23). These problems are reflected in the contents and processes of education about/for sustainable development, including the extent to which education enables a radical critique of current national and international approaches (Trainer, 1990; Huckle, 1991; Mische, 1992; Hickling-Hudson, 1994). Post-colonialism alone will not resolve this, though it focuses attention on the plurality of

knowledges. It can be linked to other critiques, especially of the international political economy, to re-orient curriculum, pedagogy and the development of reflective sustainable projects and practices.

The case study shows that science and local knowledges can be harnessed in applied scientific research and research training. Practice rather than theory indicates the necessity for community involvement at each stage for sustainable outcomes from development projects (e.g. Krieger, 1988; Low, 1994; Mogome-Ntsatsi and Adeola, 1995; Ruddell, 1995). This implies a dialogue between knowledges (e.g. Swift, 1992). A second element for a new educational paradigm will admit the community and its concerns as a partner, rather than an optional extra. This calls for radical change in discussions of educational goals, organisation and outcomes.

So far this paper has not problematised development, though this is implied once post-colonialism is introduced into the attempts to link education and development. Theorising development seems to have reached a stalemate (e.g. Apter, 1987; Hoogvelt, 1990). Modernisation continues as a dominant discourse, and development as a "hosting metaphor containing crucial connecting assumptions between growth and democracy" (Apter, 1987: 7). The advocates of such delineation of development, and its critics have been polarised. The theory-building process seems to be divorced from practice, *vide* the failure to take account of the negative consequences of 'first world' development, and 'development science' is backed by, if not subsumed within, 'development ideology'. Post-modern and post-structuralist critiques of western development thought have made little impact on it. Meanwhile, present realities suggest that the global marketplace and global communications are now key actors in development. This changes the task of education for development, the direction of that change depending on the view taken of both the problems of globalisation and the alternatives to it (e.g. Taylor et al., 1997). Local capacity building is one solution, though it is suggested that this cannot be divorced from a view of the larger context and the means to think critically about it. Several decades ago Paulo Freire (1974)

introduced a question-posing method to stimulate this process of critique. An NGO is in a stronger position to promote such an approach than a government education system.

'Partnership' and 'capacity building' are current buzzwords for developers and may dangerously divorce the discussion from the larger context. Aldick (1992) suggests a world systems approach may be needed in educational theorising to link the experiences of 'third' world countries with 'mainstream' educational thought. Contemporary concerns with globalisation, the second strand identified here in education and development discussions, suggest a context for bringing the global framework of world systems theory to critical reflection on the local effects of globalisation. Such reflection needs to look beyond the state as a major system component.

A case has been made here that education can play a role in development, but that knowledge and development are problematic concepts, as recent theories indicate. The third strand in educational thought, concern with democracy, takes the debate further towards a new formulation of the relationship between education and development. While traceable to Dewey (Mitter, 1993), the current debate about education and democracy, encompasses both the role of education in creating a culture to support political transformation, and the democratisation of social institutions including education (Beck, 1998). Beck argues that democratisation is a significant part of the development process, especially when oriented to the second meaning, but needs to be removed from a euro-centric interpretation of democracy in order to become an instrument of individual and social emancipation. In the case study, DERUN can be seen to have made the first tentative moves towards a more democratic society through its internal organisation and community projects, although the gains are so far small and fragile. It is also linked to government goals for greater equity in society through its training and work for local empowerment. Its central concern with development within a particular context is an attempt to attain democracy, which fits with the overall developmental aims of the government. Critique is relatively weakly represented in the institute. It does,

however, introduce the second element for a new educational paradigm in its attempt to deal with national and local development issues in its approach as well as its programmes.

Is 'education for development' an outdated concept in a post-modern world that has criticised every aspect of the two concepts? The case study suggests that a small NGO primarily-dedicated to science-based research can establish educational programmes which bring together local and international understandings, work with local communities to improve their livelihood and protect the land for future generations, and train young people for practical problem-solving. This, surely, is a form of education for development that contains within it the seeds of a democratic transformation, based in a praxis that suggests new theoretical directions for education and development.

## Acknowledgements

The research for this paper took place within a project funded by the Australian Research Council. Permission for the fieldwork at Gobabeb was obtained from the Ministry of Environment and Tourism, and the DRFN. The assistance and encouragement of the following people is warmly acknowledged: Robin Thomson and Dr Jennifer Jarvis (University of Cape Town); Dr Mary Seely and Margaret Paisley (DRFN, Windhoek), Helen and Hartmut Kolb (Windhoek), Dr Joh Henschel (Director of Resources and Research, DERUN, Gobabeb) and the Gobabebians resident during July 1997 and 1998. Kim McLeod provided helpful assistance with locating background literature.

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