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Understanding science curriculum and research in rural Kwa-Zulu Natal

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2006-10-31T07:25:29Z
http://hdl.handle.net/10539/1508

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Chapter 1

INTRODUCTION

> *"Foremost among the challenges facing rural South Africa is the task of improving the quality of education. What is often overlooked, however, is the immense, untapped potential of rural communities to take the lead in shaping a better future for themselves."*
>
> (Mandela, 2005:vii, in HSRC, 2005)

Places

> *"There is a lovely road that runs from Ixopo into the hills. These hills are grass-covered and rolling, and they are lovely beyond any singing of it. … if there is no mist, you look down on one of the fairest valleys of Africa. About you there is grass and bracken and you can hear the forlorn crying of the titihoya, one of the birds of the veld. Below you is the valley of Umzimkulu, on its journey from the Drakensberg to the sea: and beyond and behind the river, great hill after great hill; and beyond and behind them, the mountains of Ingeli and East Griqualand."*
>
> (Paton, 1944:1)

In the sixty years since Alan Paton wrote these famous lines little has changed. At least I imagine so for I was not born yet. In 2005 there are farmers still ploughing by hand, children carrying water on their heads to the round mud huts with thatched roofs. No one has electricity or a phone-line - except the shop - and the schools next to the dirt road. The road weaves through SAPPI forests, past the schools and the Buddhist Retreat Centre in the Chibini area, and on for 15km to the lively one-street town of Ixopo, in Kwa-Zulu Natal, South Africa.

Figure 1.1 View of valley from Chibini



White Voortrekker farmers arrived in 1837 to ‘an empty land’ which is partly true - at least to a ‘broken land’ with people hiding and scratching an existence after the scourge of King Shaka’s 1820s wars. Then tribes moving south plundered everything in the way. It was an anarchical place of displaced refugees caught between two empires: Zulu in the north and British in the south.

In 1860s a London based company bought all the land but did nothing with it so people just carried on. In the 1880s the Natal Land and Colonization Company sold the land to white farmers who pushed the Blacks off. Displaced people become labour tenants - forced to work another's land. So the Blacks in the area have always been marginalized - since before apartheid, before the Whites arrived too. Political strife has doubly ravaged the area: in the struggle against apartheid, and in the civil wars between ANC[1] and IFP[2].

Marginalized people, even when power changes, are still on the outside. The old political hostility has been displaced to the margins – into crime – there is a feeling of betrayal and abandonment. People say the area lacks development because it is a Zulu IFP stronghold – therefore the ruling party deliberately withholds services. There is no clear evidence of this (especially as the province of Kwa-Zulu Natal is governed by IFP[3]) – but resentment persists. There is a simmering sense of the unfairness of the deep poverty after expectations of a better life since the country's change to democracy in 1994. There have been land claims in the area: all have been unsuccessful. There are conditions in South Africa more for rural conflagration than urban conflagration (Steinberg, 2003).

Difficulties with farming are also physical and include social factors, lack of infrastructure and climate change. This is exacerbated by loss of farming skills, and migration of labour to cities (Steinberg, 2003). Low returns from the land have led to "a general apathy towards farming" (Mubangizi, 2003:143). Farms are on tribal authority land so individuals need permission from the *Inkosi* to have use of a certain piece of land. The *Inkosi* is usually approached through the *Induna* (Headman).

The land itself is therefore deeply rooted to tradition. Place is not only physical. It is tied to feelings, identity, culture and survival. In the HSRC Report (2005:30) when asked to describe the meaning of 'rural', participants mentioned: "isolation, vulnerability, lack of opportunity, the need for self reliance, a sense of community and a commitment to traditional values". The report further points out that there are many local definitions for 'rural areas': *Emakhaya* is a remote, undeveloped area: this corresponds closely to the community in our project. This

[1] African National Congress
[2] Inkata Freedom Party
[3] IFP was the leading party in KZN at the time of the research. It has since changed to ANC leadership.

word may be used derogatively as rustic, but also implies ‘home’ and place of *amakosi* and *izinduna* (HSRC Report, 2005).

Two Schools

I present one early visit to the two schools in Chibini as recorded in my journal.

Visit to Lusiba Primary School and Sinevuso Secondary School
Journal entry 6th September 2002

“The hired Tazz, headlights on, slips and skids along the muddy dirt road. Even the goats and sheep are not wandering as usual, hiding somewhere from the bitter cold and relentless rain that covers the valleys and hills. The small mud huts with grass roofs - silent. Dense mist hides the isolated rectangle of the school.

Lusiba: The school grounds (like those in Soweto or Umlazi) are protected with a sturdy high fence and razor wire, big locked gates. Mine is the only car.

Mr Hadebe greets me warmly in the freezing cement classroom – the new fluorescent strip lights penetrate the gloom. Thirty five Grade 7 students – the senior class – (ranging in age between 13 and 17) tumble in and eight teachers sit quietly in a corner. Mr Hadebe introduces the teachers – only two were at the Research Project Community Indaba yesterday (he explains they needed to stay behind to run the school).

Mr Hadebe is jumping up and down along with the giggling children – (a fun way of getting warm)! “Up down. Down up. Up up UP, doWn No uP..!” Soon everyone is relaxed and warm and they break out into loud song: praying; greeting; and welcoming me. Children sit motionless and wide-eyed as I explain (in English) what the Sisonke Masihlangane Project is about. Mr Hadebe translates. No questions.

I invite teachers to brainstorm and discuss: “What are the experiences; strengths and talents of the children?” “What do the teachers think the children would like to learn?” – I leave it general – and don’t say “in science” as this might limit ideas too much. Lots of things can be turned towards science! “What questions do the teachers have for me?” They all work

enthusiastically and busily writing long lists – some stand as there are not enough chairs. They discuss mostly in Zulu. They want to know what influenced me to want to do this research. Do I think the community will benefit from this research?

I hand out large sheets of paper and crayons and ask the children to draw me a picture called “My Life” - then to write on the back one thing that they know and value – anything. Lastly, to write down any question they would like to know the answer to. They could do this in Zulu – many do.

They get to work straight away, quietly. Mr Hadebe facilitates, helps, smiles and encourages everyone. To conclude he arranges a democratic vote to elect a student to the Sisonke committee. This is done quickly and efficiently: the children seem used to this. The teachers don’t vote. Children nominate three candidates. They elect a girl.

Mr Hadebe then shows me some of the projects around the classroom. There are jam bottles of soil samples: group projects on studying soil types. Children’s posters, colourful and authentic with magazine cut-outs. Their own surveys that groups have done on nutrition and food types.

The session ends after 1½ hours with the most-welcome biscuits I brought. The boys present a traditional dance. Some use huge water containers for drums – a wonderful vibrant celebration. I feel very lucky to be here.

Mr Hadebe ends by showing me the neat gardens, and trees (each class is responsible for a tree; Mr Hadebe has two that he has to water personally). There is a beautiful vegetable garden: each class has its own section. I feel that this school is managing so well – will the research be able to build on this?

Figure 1.2 Lusiba pupils and Moyra



I drive a few hundred metres down the road to Sinuvuso – the Secondary School with Grades 8 -10.

Figure 1.3 Sinevuso Secondary School



Sinevuso: Mr Mkhize gives the impression of a busy man – behind his desk in the phoneless, computerless office. I see no other teachers. We go down to the big classroom. The desks are all lined in the front. Students from all grades stream in – about 65, (the total number at school today).

Mr Mkhize and I discuss my programme here. He seems a bit uneasy. The students need to go home because it is raining (it is 12 p.m.) I agree that a short meeting is best – just to say "Hello' so that they all know who I am. He seems slightly relieved and introduces me formally in English. I explain the project. He tells me there is no need to translate. When I pause, however, he tells the students something in English-Zulu about this being a project to see how the school is implementing OBE in Grades 8 and 9. At the end of my talk I mention the need for a student on the committee – Mr Mkhize does not look up from the report – so I suggest maybe a vote. Mr Mkhize then says that he has already nominated someone. He tells them his nomination (a Grade 10 boy) and asks if there are objections. 'They are free to make their own suggestions.' No-one responds. One girl then says that as this is OBE a Grade 10 student may not be appropriate. I find this a convenient place to say that this is not in essence an OBE project for Grades 8 and 9 but will involve the whole school - maybe a science student is most needed. With no further objections the boy is now on the committee. Mr Mkhize says sternly: "Can you say 'Thank you Miss Moyra'?, 'Thank you'. 'Good Afternoon Miss Moyra?", 'Good Afternoon.'" They all obediently chorus and then file quietly past to collect biscuits.
What are we in for?" (Journal 1, 2002)

The Project Summary

Sisonke Masihlangane: we are together - let's meet

This is a participative curriculum development project in two schools in Chibini, near Ixopo. I became interested in this community through links with a well established AIDS NGO, Woza Moya. It was clear that not only was health a priority for this community but education was contributing little to the development of students or the community. My research-intervention

project is part of a larger project: “Human Rights, Democracy, and Social Justice: Science and Mathematics Literacy in Disadvantaged Communities.” managed from the University of Durban-Westville[4].

The Rural Education research project has been running for about three years. The community hopes that science education will contribute to learning skills that will alleviate poverty. My aim, from the start, has been to define relevant science in (and with) this rural community, to explore indigenous science knowledge and link school learning with the community.

The community’s immediate concern is food security. This has led to a partnership with Heifer who has started a chicken-farming project with 20 farmers chosen by the community. (This group will expand as they ‘pass on the gift’ to other farmers.) Our research and curriculum intervention builds on integrating this enterprise with the school curriculum, while also developing understanding of science, education and community.

As the scope of the research expanded to include the wider community we struggled with complexity and competing agendas. Research moved into project management amidst all the difficulties of distance and ‘unstable’ environments. AIDS education and computers were brought in. The schools largely withdrew. Severe poverty means that children often go to school not having eaten or they stay away from school through not having clothes or because of obligations to household chores. It became clear that the educational aspect of the project would only have an impact if we could also address the immediate stresses of poverty.

We worked with all sectors of the community over the three year period collaborating on data creation through workshops, interviews, student assignments, and school visits. We discussed visions, concerns and findings, celebrating learning in a 10 day science intervention that ended in a community Science Festival. Feedback and interviews continued into the following year, as did the development of the farming project.

[4] Now: University of Kwa-Zulu Natal

People

Education is *for people*. Participative research is inquiry *with people*. It is therefore fitting to include descriptions and acknowledgements not only of places but people.

Of South African's 45 million people, 18% have had no schooling; 16% have some primary education and 6% have completed primary school (Census, 2001). The average number of years of education in tribal rural areas is 3.4 years (CDE[5], 2004). Life expectancy for South African children born in 2002 is 49 years. One quarter of under-5s (in the period 1995-2002) suffer from stunted growth (UNICEF, 2004). The negative side of these statistics hits most strongly in rural areas. In Chibini subsistence farming enables the largely unemployed community to eke out an existence with some help from child grants, casual labour and pensions. In spite of poverty and ill health community spirit and cultural practices endure. There is a strong sense of identity in the homogenous society where everyone is Zulu-speaking with an African/Christian worldview. This research is particularly indebted to the openness and vision of strong leadership within the community. The following people contributed to this research project:

Inkosi Ndlovu is the Chief of the Ifafa region. I have appreciated her wisdom, kindness and support. Here she is performing a 'chicken dance' with the grade 1 class at the science festival: definitely one of the most charming performances I have ever seen!

[5] Centre for Development and Enterprise

Figure 1.4 Inkosi Ndlovu and the Class 1 ‘Chicken dance’



Induna Chiya is the head Induna in the area. He helped in summoning people to our initial meetings.

Induna Ngcobo has provided consistent guidance and commitment to the project and been a quiet and humble pillar of strength to all our efforts. This is the story he told us:

The Induna’s forefathers had a farm in Mtakama but the White people took it and they were forced to come and live in Chibini. He was born here and will die here. Everyday he takes the cows to graze. It is also his responsibility to solve the community’s social problems, to know the community’s needs and liaise between the community and the king.

Figure 1.5 Induna Ngcobo (front left) and elders at a community meeting



The *Isangoma*, (Traditional healer) as well as elders, parents, farmers and other community members have been generous in their openness and willingness to participate.

Students are all Zulu-speaking youth from the Chibini area: the youth are the heart of the project.

Figure 1.6 Students during the science festival week



Prof. Cliff Malcolm is the project leader of the wider Human Rights and Democracy Project, my co-supervisor, and has been thoroughly involved in every step of the project. Cliff brought with him later in the project a team of researchers: Dr TT Bhengu who played a significant role in our science festival and in interviewing participants, Lavine Kowlas, Busi Goba, and Prof Bill Kyle from St Louis in the USA, and his 10 year-old son Sean who took part in the science festival.

Figure 1.7 Cliff Malcolm and Ms Mbhele at a community meeting



Figure 1.8 TT Bhengu, Sihle Mchunu and Sean Kyle



Sihle Mchunu and Nomfundo Ndlovu joined us as community researchers. Nomfundo for just a couple of months and Sihle for more than half the project. Sihle has gone on to University in Durban where he is now in his second year of a teaching degree.

The Woza Moya, team: Sue Heddon, Jane Nxasana, Benedicta Ndlovu and TC Ngcobo who are on the management team of the AIDS NGO and who became involved in the project and partnership with Heifer.

The Mbumba committee drew up a constitution and guided the chicken farming project: Mr Nkandi, Mr Miya, Ms Khetiwe Ndlovu, Ms Mbhele, Ms T.C. Ngcobo, Ms Benedicta Ndlovu, Moyra Keane; Ms Loretta van Schalkwyk; Mr. Radebe; Mr B. Mkhize; Mr Elliot Ngubane; Mr Ngobo; Mrs Bhengu.

The Heifer team: Gavin McGregor, Edward Mfakadolo and Mike Menge, from the farming NGO provided training, resources, chickens and on-going support including the connection with funders, Rohm and Haas.

Principals: Mr Mkhize and Mr Hadebe were generous in opening their schools and staffrooms to us. They translated between English and Zulu at public meetings and voiced their public support of the project. The teachers at both schools, especially Ms Mbhele of Sinevuso, contributed in many ways from cooking for functions, participating in workshops and having us in their classrooms.

Mr Elliot Ngubane, from the Department of Agriculture and Mr Khuboni from the Department of Education who both were involved in community meetings and provided support and guidance. Mr Ngubane served on the Mbumba committee.

Leonard Mthembu, a neighbouring school principal, was a consistent friend who was always ready to drive the long distance to come to my aid over some problem. His warmth and ease was a great comfort.

Background

South African context

> *"No valid consideration of the school curriculum can be made without consideration of a child's view of causal relationships and no analysis of causal relationships in African children can be made without consideration of the nature of (their) spiritual beliefs."* (Hawes, 1979:13)

It is remarkable how important questions are rediscovered. South Africa has reached a point of real transformation in many areas and especially in education. The questions on curriculum that Hawes was asking during his work in the 60s and 70s in Africa, we are still asking. He framed these questions while South Africa was going through the transition from colonialism to a new South African republic, at a time when the government had no interest in improving education for Black students. Perhaps we are only now in a position to properly address these issues around the dilemma students face in the dissonance between traditional world-views and life styles, and school science. The recurring questions that were evident and in need of attention decades ago can no longer be ignored.

South African education is at a stage in policy development supported for the first time by a liberal and democratic constitution, where such questions can be considered seriously. In this study I explore how far we can pursue them in a paradigm of participative research: Allsop from his position in DFID[1], discusses Community Empowerment Transforming Education and points out that: "we seem to know little about how far it is possible to go in engaging community organizations in low-income countries in the necessary reshaping of basic schools…" (Allsop, 2000:227). An important aspect of this study is the exploration and documentation of the actual research process.

[1] UK Department for International Development

Current Education Policy

> *"Throughout the world, countries are grappling with three broad sets of policy objectives: international competitiveness for their enterprises, social equity for all members of their societies, and sustainability of their interactions with the natural environment." (IDRC 1995:7)*

Science education policy needs to be in line with these broader policies, outlined in the International Development Research Centre. South Africa does indeed have education policies that are consonant with these principles. However, in science education critique, interpretation and implementation need urgent addressing.

The formation of science education policy in South Africa is in a vulnerable stage (Jansen, 1999a; 1999b). It is vulnerable to expedient, pragmatic and historical forces in the face of lack of resources, implementation capacity and general understanding of the policy (Chisholm, et al, 2000). Even in view of the revision of Curriculum 2005[2], the attempts at teacher training and the development of curriculum materials, it is not clear exactly *how* the aims of the science curriculum are to be met. There is little known about the complex status of actual curriculum in rural schools (GDE, 2002). ('Curriculum' here would include all aspects of what students learn in and out of school.) There is even less known about a curriculum that would address the needs and aspirations of students and communities in rural areas while still fulfilling the ideals of equitable standards and opportunities for higher education and job market access. Then there is the complicating and alarming aspect of the HIV/AIDS pandemic. Planners and teachers have yet to understand how this will affect everyday teaching. With infection rates in Kwa-Zulu Natal as high as 30%, teachers can scarcely afford to assume a 'business as usual' approach (Malcolm, 2002).

Considering what should be taught in school raises the question of the Nature of Science. A number of investigations have shown that teachers have a restricted and positivist notion of

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[2] Curriculum 2005 (C2005) embodies the vision for General Education in post apartheid South Africa. (**Strategic Plan**: Statement of Policy and Commitment by the Minister of Education): 2002-2004 (pdf document.)

the Nature of Science (Singh, 1998; Chakane, 2001; Linneman & Lynch, 2001). Some studies indicate that a blending of Western and Indigenous science would be desirable (Brown & Miller, 2001; Gado & Verma, 2001). There is wide debate at many levels with a strong focus of aligning C2005 with the new constitution based on human rights, equity, multiculturalism and empowerment. It is not clear what this might mean for science curriculum development. As Hawes (1979) pointed out in the 70s, it is less disturbing to concern ourselves about whether a curriculum is working than whether it is appropriate.

Education policy for general education and training (GET) in South Africa expects that science education should be 'relevant' – to the nation and to individuals and communities. It provides for this in two ways: it defines a broad set of outcomes that are to be relevant to national life, and sets these outcomes into a framework of learner-centred education, to require local interpretation.

> *"Educational and management processes must therefore put the children first, recognising and building on their knowledge and experience, and responding to their needs." (White Paper, Department of Education, 1995)*

Thus the concept of learner-centred education has a pedagogic aspect (building on learner's knowledge and experience), and an outcomes aspect (responding to learner's educational goals). These two aspects are reiterated in the Revised National Curriculum Statement which calls for participatory outcomes and assessment standards as well as learner-centred and activity-based education (Department of Education, 2002). Of particular relevance to this study is the priority in the previous minister of education's "call to action" that "Schools must become centres of community life" (Asmal, 1999:10).

In both aspects, the policy exhorts curriculum designers and teachers to take into account local contexts, cultures and knowledges. Further, the prescribed content is to constitute 70% of the school programme, with teachers to develop the remaining 30% according to local needs, consistent with the broad outcomes (Department of Education, 2002).

Defining Curriculum

Battista and Clements (2000:738) define curriculum as "a detailed instructional blueprint for guiding students' acquisition of certain culturally valued concepts, procedures, intellectual dispositions, and ways of reasoning." This is somewhat different from the notion I had in mind for exploring curriculum in a rural community. I would be doubtful about an 'instructional blueprint' as this excludes degrees of flexibility, as well as putting emphasis on 'instruction'. This definition also omits mention of values, goals, methodologies and purposes; individual needs and talents etc. I take all of these to be important in conceptualising 'curriculum'. Campbell and Lubben (2004) in their study on student understanding of HIV/AIDS in Southern Africa advocate teaching for 'behavioural change' and 'knowledge-for-action curriculum'. This emphasis is imperative in the current health crisis context. Campbell and Lubben also adopt Hodson's (2003) curriculum components which include one relevant to our social justice framework: 'Engaging in socio-political action'. In this study I continue to use the term 'curriculum' broadly (with the connotations of 'negotiated-participative curriculum for action') but also as a concept requiring definition through the research process.

There are also various qualifications of the term curriculum such as: intended curriculum, implemented curriculum, received curriculum, hidden curriculum etc. Such foci are not the main concern here. If there were to be a qualifier it would be the 'community-designed' curriculum or 'negotiated' curriculum, which is conceiving it at a broader level than the cognitive or pedagogic categories and using the term more loosely.

At this point in curriculum reform in South Africa, the Delors Report (1996) to UNESCO (cited in Hallak, 2000) is helpful. It proposed a number of educational aims: learning to be, learning to know, learning to do, and learning to live together. These correspond closely with Wenger's four learning components of identity, meaning, practice, and community (Wenger, 1998). This more fundamental approach to learning provides a background of wider aims than improving science performance in national examinations. Throughout this study I have tried to hold open possibilities for this broader view of curriculum.

Injunctions of previous research

> *"How can we speak about a child's best interests being of paramount importance, as the Bill of Rights does, when we cannot even agree about what is in a child's best interests in the first place?"* (Asmal, 2002:5)

The need for qualitative data within classrooms and schools is a priority identified by Riley et al. (2000), in the World Bank report on rural schools. They also identify the following knowledge gaps in relation to relevance of learning in schools:

- "Expanding the concept of school to the broader learning environment
- Defining the goals for learning for children in rural communities
- Meeting community expectations for value of learning
- The link between the curriculum and employment
- The balance between national curriculum guidelines/local needs/responsive to students needs" (Riley et al. 2000:8).

The report further emphasises the need for greater links between health and education programmes especially in response to the HIV/AIDS crisis. It is clear that discovering the child's best interests will be influenced by the impact of HIV/AIDS.

The Centre for Development and Enterprise (CDE) Research Report 13 (2004:26) concludes that one strategy for improving mathematics and science education is to "carefully assess the strengths, 'virtues' of the system as well as the weaknesses…". This study has worked from this perspective – which is also the injunction in the quote by Mandela at the beginning of this chapter. The CDE further points out that the maths and science education system is extremely heterogeneous – thus undifferentiated strategies will not work. For this reason the focus of a particular case study is valuable. The CDE report, however, focusses primarily on improving science and maths matric (Grade 12) performance, which is not my interest here. Such an approach is based on the assumption that the current system is the most beneficial, but focussing on matric pass rates can lead to artificially engineered 'improvements' as discussed in such critiques as "The absurd drama of matric" (Macfarlane, 2004).

The need for research into science education in rural communities is clear. The recent HSRC

Report (2005) 'Emerging Voices' provides valuable quantitative data on schools and infrastructure as well as devoting considerable space to the voices of participants. Although many of my findings have resonances with this study, I have focussed on science education and curriculum innovation in a longer-term case study in which philosophical world-views emerge strongly and lead to themes beyond descriptions of schools, classrooms and management practices.

Purpose of the Research

Science Education Rationale

> *"Every culture, every nation can build a science that fits its own particular needs.*" (Feyerabend, 1991, quoted in Irzik 1998:163).

In spite of these research recommendations since the 1970s and the change in education policy in the mid nineties, rural schools are still teaching much the same things as before - in the same ways. There is not simply a rift between rural and urban, between rich and poor, and between Western worldview and African, but between the school and the community.

The global consensus of the Rio Charter in 1995 provides motivation for the aims of this study in addressing some of these inequities. The charter focuses on:

- "The problems of poverty
- The need for equity
- The imperatives of sustainability
- The need to promote the participation of traditionally disadvantaged groups and to empower those groups to bring about sustainable forms o f development
- The need for developing countries to develop their own Science and Technology capacities..." (IDRC 1995:11)

These are very different principles from those of the 1960s 'republic of science' where, according to Polanyi (1962 in IDRC 1995:17) "scientific activity should be governed by

scientists' intellectual interests…". Such scientists, almost by definition, would be a small elite group.

Decades later the science and technology report on the South African scientific organisation, the CSIR, claims it is:

> *"…least well equipped to deal with problems of disadvantaged communities. It has no experience in conducting research whose specific goals have emerged from long processes of consultation and discussion with disadvantaged people."* (IDRC 1995:26)

Science research and science education are being challenged here: can they contribute to addressing global and national priorities of redress? Can they lead to improving life in rural communities?

Methodology Rationale

It is critical at this stage of education policy development to have information from those who have in the past been excluded and who still tend to be marginalized (Hallak, 2000; and Watson, 2000). Without wider and more in-depth consultation and investigation we run the risk of losing valuable traditional knowledge and also of establishing a policy and curriculum that exclude the interests, goals and traditions of a wide sector of our population (Odora Hoppers, 2002). Through a sense of ownership and self-determination, the real obstacles facing under-resourced schools stand a chance of being overcome.

The transformation of curriculum needs to draw on the social and environmental contexts of students. The 'World Conference of Education for All' proposed including socio-cultural aspects of science and technology in the curriculum (Cleghorn & Kakkar, 2001). Calabrese-Barton and Tobin (2002) claim that the school needs to be embedded in the community and that it is not enough for parents to be involved in the school. These directives supported the approach of starting the research in the community through community *indabas* (meetings).

Brock-Utne's (2002) extensive analyses of education in Africa have led her to suggest in "Whose Education for all?" that indigenous learning systems need to be studied, revived and

included in the curriculum in order to avoid the recolonization of the African mind. The idea of 'learning systems' extends beyond instances of science use in African communities to include ways of learning, epistemologies, educational structures and goals, as well as language use. This wider perspective requires fuller and prolonged involvement in the community. It also means that a wide range of demographic, social, and philosophical data is relevant to understanding how science education can make an authentic contribution.

In South Africa there is pressure to improve achievement in mathematics and science education, especially when media reflects outrage after the publication of poor matriculation results or after the dismal performance of students reported in the TIMSS[6] report (Howie, 2001). This distracts from the question of what we really want for our children. We are again focusing on whether a curriculum is working rather than whether it is appropriate or perhaps, even worse, believing the assessment even though its validity is questionable.

Reporting rationale

As with any discourse, my purpose here is not merely to enunciate information, but to influence and offer new insights. I have included my own perspectives along with those of other participants. Participation, changing team members (in the community and among the researchers) and adoption of different roles makes the choice of 'person' or 'voice' difficult. I switch from the use of first person to third person depending on the context. This leads to some unevenness of tone but is unavoidable as some ideas, actions and experiences were mine only and at other times other participants were involved.

The participative process has led to unpredictable changes of direction and unanticipated themes. I have therefore included part of the literature reviews and emerging frameworks in Part 2 in the 'findings'. I have, for example, discussed the ethics in detail as a finding. In the reporting I have fictionalised some names but not others. I discuss such dilemmas in the ethics theme.

[6] Third International Mathematics and Science Study, (Human Science Research Council).

Human rights, democracy and social justice

We approached the research through a broad framework of human rights, democracy and social justice. Each of these concepts is complex, open to diverse and often contradictory interpretations. For example, human rights can be considered from perspectives of the individual or the country; they can be aspired to but impossible to achieve due to lack of resources. Democracy was a basis of participatory process which included gender awareness and foregrounding voices of children, but is not addressed specifically as a concept. Social justice promotes equity in education yet it is clear that equity cannot mean uniform content and process, because such uniformity will not lead to the same benefits in different contexts. Our proposed curriculum needed to find a path between national opportunities and best quality while incorporating local knowledge, interests and cultures. We took as our starting point the rights of a rural community to express its own needs, participate in its own ways, and, through participation, offer its ways of negotiating tensions between local and universal, rural and urban, African and Western. We saw it as our responsibility to carry the research findings to wider audiences.

Policy motivation

Discovering the science educational interests of rural communities may support a number of strategies that are identified in the Manifesto on Values, Education and Democracy (DOE, 2001:7). These are listed – with my comments relating to this research:

1. Ensuring equal access to education. (i.e. including education that equips for life circumstance).

   Comment: Going beyond notions of access to education 'that equips them for their life circumstances', there is substantial evidence (discussed in the literature review) that Western science is alienating for non-western students. By access, it is necessary to include epistemological access and structures and procedures that will improve access in rural areas.

2. Learning about the rich diversity of cultures, beliefs and world-views within which the unity of South Africa is manifested.

Comment: Locally designed curricula need to include access and exposure to wider learning opportunities. The converse is that documented local science knowledge and worldviews can be used in urban schools to enrich science education with African perspectives. There is very little of this currently available beyond examples of indigenous technology.

3. Making Arts and Culture part of the curriculum.

   Comment: Traditional African cultural practices such as dance, art and story can be used to communicate science learning.

4. Nurturing a culture of communication and participation in school.

   Comment: Through an emphasis of democratic and participatory pedagogy communication is fostered.

5. Making multilingualism happen.

   Comment: Multilingualism needs to be promoted as a strength, a resource, within classrooms – this includes improvement of English language skills as well as appreciation and use of local languages.

Research Aims

I sought, in this study, to work collaboratively with students, educators and community members to discover the interests and educational purposes of African students and their community in two rural schools. The focus was on understanding and documenting how scientific thinking and knowledge can contribute to improving well-being in the community. This included an exploration of the traditional knowledge within the community. All these aspects of purpose, interest and knowledge were drawn together to serve as input into curriculum policy and design. The intention was for interested participants in the study to draw on the data collected, and, as a team, to design a curriculum unit to be trialled in the school. This intention, through the research process was diverted into taking the curriculum out of the school.

Although the main contribution of the study is towards curriculum development, other aspects or 'pillars' identified for the improvement of Science Mathematics and Technology Education, are affected. These include human resource development, and science, mathematics and technological literacy (Kahn, 2000). In taking seriously a student's interests, needs and learning context, the goal of creating a "confident and independent" learner who has the "ability to participate in society as a critical and active citizen" (DOE, 2001a) is more realistic.

Creating and sharing information has been one of the goals of this participative research project, as well as building efficacy for all participants – a recommendation of a number of researchers: e.g. Cornwall & Jewkes, (1995); de Vos, (1998); Terre Blanche & Durrheim, (2002).

The Problem of Research Questions

Everyone knows how it is: you can always go back and change your research questions after you find that the ones you started with did not work out! Then in the revised and edited report it looks like it all turned out pretty much neatly. So in the original research proposal I had research questions focussing on students' and community's interests and educational purposes as well as appropriate research methodology. These were variously criticised by colleagues as being too broad and unfocussed. On the other hand the questions presented another problem of limiting the possibility of participation. Was I to approach the community saying: 'I have these questions and you may want to participate in answering them'? Is it more appropriate to start out framing the questions collaboratively? Furthermore, my research was to be part of a larger project where research questions were enunciated somewhat differently with more focus on local and national tensions, scientific literacy and assessment, within the framework and for the promotion of social justice.

At every early meeting community members asked me what I meant by 'science'. I faced the tautological dilemma of saying we needed to define this ourselves! When I started by explaining changes in education policy, some community members implied that they did not care much for ANC policy. Again I had to vacillate. Teachers who taught other subject areas asked if they would be left out.

When I asked “What is relevant learning for students?” the answer was “We are hungry.” The response seemed oblique. At first I thought the answer not quite relevant – then I suspected that it was the question that was not relevant. It later became clear that the answer was frank and to the point: poverty is devastating and everywhere, with the range of physical, social and psychological stresses that attend it. ‘Relevant’ science education needs to respond to all these things.

The word relevance (like science) is also problematic: Relevant to whom? To what? For what purpose? In what context? With what priority? Further – the word ‘relevance’ does not even have a translation in Zulu! These are some of the dilemmas that the research was propelled into from the start. An alternative was to talk about the possible consequences of the research rather than clear and preset questions, and hence to envision proposed outcomes.

Proposed outcomes

I present here part of the explanation of the research as it was proposed to the community at the first public Indaba (meeting) on the 5th September 2002. I explained aspects of the education policy, C2005 – as well as the proposed research methodology – and invited participation and comments.

Some of the possible outcomes listed were:

- Community voice to impact on policy regarding science education
- Using the curriculum opportunity to develop locally relevant innovation
- Teacher / community / researcher growth and learning
- Practical support, skill development of participants and community members
- Preserving/ documenting local knowledge (Report 1, C30a)

The community then named the project: ”Sisonke Masihlangane” (We are together, let’s meet). This was perhaps the first project outcome.

The notion of participation is central to the project. It has a number of dimensions: collaboration within and across research teams, within each community (including the schools), and with other relevant groups such as NGOs. Participation is in itself one of the proposed outcomes.

The research thus produces insights and answers to questions that arise though the process. These may be grouped into understandings of:

1. How science curriculum contributes to the educational purposes and well-being of a rural community. (See Part 2A)
2. Research processes in rural education. (See Part 2B)

These two purposes are not distinct in the sense of ‘Aim’ and then ‘Method’. Process and participation are central to both. Also the approach to both is consistent with the theoretical frameworks (discussed in Chapter 2). I do however, present ‘findings’ on both in two separate sections: Part 2A: Relevant Science Findings, and Part 2B: Methodological Findings.