

Science and Mathematics Education Development in Namibia after Independence: The INSTANT Project

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Abstract

The In-service training and assistance for Namibian teachers (INSTANT) project was established after the independence of Namibia with the aim to guide the educational reforms in science and mathematics in secondary education. The paper provides an overview of the project's activities and reflects on the sustainability of project activities. It starts with a reflection on the political and educational context in Namibia after independence and the consequences for the design of the project. It introduces the areas in which the project has been active during the time it was operating: curriculum development and teacher development. Although sustainability was one of the main concerns of the project, the Ministry of Basic Education and Culture (MBEC) seemed less interested in sustainability of project achievements than in solving its immediate and urgent problems. The position of the project within the MBEC rather than the University of Namibia and the kind of activities to which the project was asked to contribute are raised as issues hampering sustainability. In spite of these problems, several long lasting effects can be reported as a result of the project's activities. These include a trained cadre of science and mathematics education leaders, physical science textbooks and a better understanding by teachers of what is meant by learner-centred education.

Political context

In 1994, accompanied by much international publicity, South Africa held its first truly democratic elections. However, a few years earlier, in 1990, and also widely publicised, a similar transition had already taken place in an adjacent territory (to the north and west of South Africa) - as what was at one time known as South-West Africa gained independence after a long and often bitter struggle. Thus, on the 21st March, 1990, Africa's last colony, Namibia became independent, after over one hundred years of colonial rule - first under Imperial Germany and then under apartheid South Africa. Although from 1966 onwards, the UN was legally responsible for the administration of Namibia, in reality the illegal occupier (South Africa) held *de facto* power and true freedom only came with independence.

Notwithstanding that modern South Africa was never colonised, there are many

similarities in the transition processes undertaken by both countries. Both suffered the divisive and inequitable policies and practices of apartheid and both chose to adopt policies of reconciliation when justice finally prevailed and the new orders were introduced.

In the case of Namibia, SWAPO (the South-West Africa People's Organisation), which had led the struggle for independence, was duly elected to power with a significant majority. Under President Sam Nujoma, it has remained the ruling party ever since.

Namibian society entered independence characterised by a rigid social structure and a highly skewed pattern in income between white and black - estimated at the time to be somewhere between 1:10 and 1:20. The disparities between white affluence and black poverty were striking. Figures quoted at the time suggested that in the urban areas 86% of black income earners were earning substantially below subsistence level, while in the rural areas in the northern part of the country this figure was estimated at 99%. The war of independence greatly exacerbated the miserable conditions experienced by most black citizens of shanty housing, poor sanitation, ill health and malnutrition.

Perhaps the biggest challenge facing the new democratic government of the time was that popular expectations, following independence, of an early improvement in material living standards were running very high. No matter how much it was committed to reform and equity, the new government faced a wide range of formidable problems. This paper focuses on the specific challenge with respect to education and in particular mathematics and science education - subject areas that had been seriously neglected amongst the black population prior to independence.

Education context

Given the all-pervasive nature of the apartheid system, the educational context at independence was entirely entwined within the political context. Inadequate educational provision prior to independence had led to a massive backlog of needs to be attended to - as evidenced by the 60% illiteracy amongst the adult population. Within the formal sector, two immediate problems faced were the shortage of classroom space and the inadequate level of training of the existing teaching staff. In what was a most wasteful system, education was managed through no fewer than eleven separate, independent, educational administrations reflecting the different ethnic groupings across the country.

Counter to all tenets of good management and good education, not only were these different educational authorities discouraged from communicating with each other, such communication was actually forbidden. In the process of setting up the INSTANT Project, the future team leader visited the offices of one of the eleven authorities (National Education) during the course of late 1990. That is, after independence but before the new Ministry of Education, Culture, Youth and Sports had been properly established. In the offices of the educational authority visited, a number of appointments were set up for meetings and school visits. However, facilitating a school visit in a different authority was not possible because of the legacy of apartheid. The visitor could request such a school visit from the particular

authority concerned, but one authority could not phone the other in order to facilitate this process.

In education the same battles occurred between the traditional, conservative forces on the one hand and the progressive ones on the other, that wanted to break with the past and use the momentum created by the political events at and after the gaining of independence, to renew the whole education system. Reflecting on the first years of educational development after independence, the Minister of Education at the time indicated that external project staff were used as a buffer between the traditional forces in the country and his ministry in order to push innovations through (Angula & Grant Lewis 1997).

Teacher education in pre-independence Namibia was underdeveloped for the country as a whole. The white population group was well catered for, the post-graduate diploma (Higher Education Diploma, HED) being the main trajectory to qualification. For the black population, there were teacher colleges, which focused mostly on the content of senior secondary school, rather than on pedagogy, thus providing a second chance route to a successful completion of senior secondary school. As a result, the majority of teachers were not adequately trained, or not trained at all, at the time the country gained independence (Cohen 1994). Poor teacher preparation obviously had its impact on students' progress. In addition, under the Apartheid system students from the non-white population groups did not normally take science and mathematics classes beyond junior secondary education. It was not until 1992 that the first students in Katima Mulilo sat for the Higher Grade examination at the end of grade 12 and failed (Cohen 1994).

This vicious cycle of poor teacher preparation and poor student achievement had resulted in a fairly desolate state of science and mathematics education, which required breaking after independence. This state of education had major implications for the design of the project. The project was set up to guide the process of educational reform and curriculum change primarily to achieve a change in teaching methodology, but needed to do so against a background of a largely unqualified teaching force. Statistics from 1988 on teacher qualifications (Cohen 1994) show that 70-90 % of teachers were unqualified (99% of white teachers were qualified).

The International Conference on Teacher Education for Namibia in Lusaka, Zambia, was held just before Independence under the auspices of the United Nations Institute for Namibia. A number of research papers were presented at the conference and the deliberations were seminal in the development of the subsequent structure of the education system, particularly of teacher education programs. Of particular significance was the proposal of the working group on the curriculum that science and mathematics should be compulsory for all up to grade 9 (subsequently changed to grade 10) and that teacher education programs should reflect this change.

INSTANT Project

The INSTANT project (IN Service Training and Assistance for Namibian Teachers)

operated in Namibia from 1991 to 1997. After an initial start-up phase of just over a year, the project operated another phase from 1992 to 1997. The project was staffed by a substantial number of foreign experts working together with local experts on the development of science and mathematics in the country. Vrije Universiteit Amsterdam (VUA) was the primary implementing agency, assisted in the second phase by the British Council (BC).

Design of the project

Initial negotiations between the Ministry of Basic Education and Culture, European Union (EU) as the funding agent of the project and the project implementers (VUA) concerning the project design resulted in a very short project proposal of about four pages. The proposal listed pointers as to what the project intended to do in the area of science and mathematics education but also stated that the project design would develop as the political and educational contexts evolved. This seemed quite revolutionary at the time, but these days project designs often have an inception period to allow for proper negotiations between the project partners to make sure that the project is based on local realities (not on the implementers' perceptions of these) and on a shared vision.

The overall design of the project focused on the improvement of science and mathematics education in the country. More specifically, the project focused on assisting the MBEC with the design and implementation of the new science and mathematics curriculum in secondary education. During the initial phase of the project, the focus was also on Life Science, a new subject in junior secondary curriculum developed during the years in the Loudima¹. In addition, the project also focused on upper primary education (natural science and health education). However, the latter two components of the project were in the more definite design taken on board by the Life Science Project, a Danish funded sister project.

The project was acutely aware of the many aspects playing a role in the development of science and mathematics (van den Akker 2003). Notably, it put its priority emphasis on the interacting areas of curriculum development and teacher development. However, the high profile position of the project in the country in the area of science and mathematics opened it up to a large number of requests from the ministry and other institutions on an almost continuous basis. Requests for help with solving urgent problems and other activities (such as textbook production, assistance with the development of the new structures for curriculum reform and membership of numerous committees set up to guide the education reform generally) could not always be ignored.

¹ The SWAPO camp in the Congo which housed many Namibian refugees and where SWAPO had developed many of the educational models to be put in place once Namibia had gained independence from South Africa.

Project activities

Curriculum development

In curriculum, the project focused on the *intended* curriculum by way of involvement of its staff in the development of the science and mathematics subject curricula (syllabi), both for secondary and upper primary education. These activities were organised by the National Institute for Educational Development (NIED). Subject curricula were developed by subject panels, similar to other countries in the southern African region. These panels typically consist of subject advisors in the MBEC, experienced teachers and external advisors to the MBEC, and in the case of physical science, mathematics and natural science and health education, of staff from the INSTANT project. Much time was devoted to the development of textbooks for physical science with one staff member acting as the editor in a team of writers, mainly experienced teachers. A further major activity was the development of teacher support materials for the subjects of physical science, mathematics and biology. Furthermore, much effort was put in the acquisition of science equipment. Through additional sources (among which was the Namibian Petrofund, an industrial fund established by the government and funded by the petroleum exploration companies as part of their exploration licence), science kits were purchased from South Africa. The Indian Government had sent lots of equipment to Namibia some of which was suitable for use at schools. Sorting out the equipment and packaging it in sets to schools was a major job. MBEC called in the project to help.

Teacher development

This major component of the project operated at different levels. Initially, the project mainly targeted teachers in the schools directly through workshops. Once experienced and suitable teachers were identified to work along with project staff as facilitators and as regional spearheads of in-service education activities, the project gradually started to work towards a cascade model for the delivery of its programs. However, soon the realisation came that the number of local teachers who could be involved in such a cascade was very limited. This put severe strain on the sustainability of the cascade. The project therefore devised a plan to have senior teachers released from their duties at school and work alongside project staff, a small number at a time, but on a continuous basis so that many could be trained during the project period. This involved complicated negotiation with MBEC which dragged on for several years, but which eventually resulted in a total of 17 teachers being seconded to the project. This happened during the last three months of the project. Needless to say that this affected the regular running of the project in a major way, at a time that preparation for the closure of the project should have been well underway. All 17 seconded teachers (who became known as *secondees*) were accommodated in the open-floor office of the project usually occupied by about 9 staff (including secretarial staff). An initial full-time program was offered to them consisting of the following elements: computer skills training, teacher collaboration skills (classroom observation and providing feedback and peer coaching), involvement in a

small research project at or around their own schools and planning and executing a national workshop at upper-primary level.

Sustainability of project results

Sustainability of project results received major attention during the period the project was active. Perhaps less so at the beginning of the project when it was still trying to establish itself in the ever-changing educational landscape in Namibia, but soon it became the overriding issue in the project's activities. However, the project did not always find MBEC on its side. The Ministry in the early days after independence had numerous specific problems of its own, solutions for which were often *ad hoc* and made in haste. In the area of science and mathematics, the INSTANT project was often asked to step in to assist MBEC finding solution to these problems².

A major flaw in the project design was that it relied crucially on the quality of its facilitators who were neither paid for the work nor given a reduction in their own teaching load. Further, neither the work they did, nor the workshops they, and their colleagues attended, were recognised in either salary notches or promotions. While teachers were, in the heady days following independence, often prepared to work beyond the normal call of duty for no reward, after a number of years this issue came to the fore as a significant impediment to the progress of the project.

Another problem observed and connected to the above was that the MBEC became entirely dependent on the project for all science and mathematics education matters. Phone calls to the MBEC on science and mathematics education were usually referred to the project. The MBEC saw the project as its science and mathematics department, an uncomfortable situation in view of the fact that the project was mostly operated by external advisors who one day would pack their suitcases and go home.

One specific issue already highlighted above was the training of the secondees. Permission required from the MBEC took over two years to arrive. This may serve as an example of the difference in urgency between MBEC and the project when it came to sustainability.

A negative impact of the project that is still evident is that it was physically established within government rather than attached to either the University of Namibia or a college, a more natural locus for a teacher education program. The latter arrangement was put forward to the MBEC in the early days of the project, but this request was not accepted by the MBEC. As a result, not only did the expatriate staff have no counterparts but there is a strong argument that the training institutions, particularly the department of science and mathematics education at the University, were actually weakened by being left outside

² Providing assistance to MBEC to solve the numerous ad-hoc problems became known at the project as the *Fire Brigade* mode of operation. Whenever a request was received to attend to a fire, the project would move in to help and extinguish it. Although appreciated by the MBEC it often distracted from achieving the main project objectives.

mainstream training and curriculum development. This was especially so for the training in later years related to the introduction of the IGCSE curriculum with its specific requirements on content and assessment.

Capacity building for the system

The secondee training is seen as one of the most successful contributions to a sustainable infrastructure for teacher development by far. Although right at the end of the project period, the impact of this training can be seen if one looks at the post-project period.

On the one hand, many of the secondees were involved in the teacher development activities of MBEC, but gradually these activities have faded over time as donor funds dried up. At present, no systematic structure for in-service education is available to science and mathematics teachers. On the other hand, many of the facilitators moved into positions of leadership, as heads of department and headmasters at schools, subject advisors, and subject coordinators at the MBEC. The present director of education for the Khomas region was one of the first INSTANT trained facilitators and many of INSTANT's secondees now occupy key positions as advisory staff or administrators in the ministry, in the examinations directorate and in the colleges of education. Although many of these positions are not immediately directly related to the work INSTANT trained them for, the former facilitators have been selected on the basis of the skills they acquired during their time at INSTANT, and which they are able to use in their new positions.

Curriculum development - textbooks and teacher support materials

In the early independence years, the new curriculum was taught using old textbooks. INSTANT facilitated the development and trained the authors of new locally produced physical science textbooks for grades 8 to 10 (Curry et al. 1994). These textbooks shaped the curriculum in the early independence years and continue to do so.

In addition, much effort was put into the development of exemplary teacher support materials, which provided teachers with detailed lesson plans and suggestions on how to put the suggested curriculum changes into practice in the classroom. The development of these materials in a cyclic approach of design and formative evaluation has resulted in robust set of materials with proven practicality and effectiveness in the class (Ottevanger 2001). These materials embedded in in-service education scenarios proved to be very effective in the professional development of teachers³. Although very popular with teachers at the time, very few of these teacher materials remain the schools in the present day Namibia. Teachers may have taken them with them when they left school, and, as they were not replaced by the MBEC they have disappeared gradually from the schools.

Besides, the materials and resources necessary to execute the curriculum in the classroom, many other curriculum components require attention for the successful

³ Many similar teacher education projects in the Southern Africa regions have subsequently used similar approaches incorporating exemplary teacher support materials.

implementation of the (operational) curriculum in the class. Van den Akker (2003) identified 10 curriculum components. These include: rationale, aims and objectives, content, learning activities, teacher role, materials and resources, grouping, location, time and assessment. These components need to be coherently addressed before one might expect successful implementation in the classroom. In its attempt to guide the implementation of the new curriculum, the project has, over time, attended to most of these, and although the assessment component may perhaps have been under-emphasised, one of the secondees has now been chief examiner for grade 10 and 12 physical science and another manages the science examinations.

Teacher education

Despite the major efforts of the project in the area of teacher education, it must be concluded that the results are quite limited and restricted to the small number of people that have taken maximum advantage of the project's professional development program. However, what the project had perhaps not sufficiently realised was the fact that many of the schools and teachers in Namibia at the time of the project operated at the lower stages of development as defined by Beeby (1966) and elaborated by de Feiter et al. (1995). As a result, the effectiveness of some of the professional development activities may have been wasted on them, whereas it must have been extremely useful for others. The awareness that differentiated training schemes and 'treatment' would have been more useful crystallised out over time. The recent proposal for a Zone of Feasible Innovation as defined by Rogan and Grayson (2003) speaks to this issue.

Although direct evidence of the effectiveness of the project is not evident, there is much that can be seen within the system that, although somewhat intangible, is nevertheless significant. There is, for example, a fairly clear understanding of what constitutes learner centred education in the sciences (less so in mathematics) and why it is important, even if there is little evidence of its widespread practice. This means that subsequent activities reinforce, rather than actively create, the paradigm shift.

At the end of the project period, the project suggested to the MBEC a formal upgrading program for inadequately prepared teachers to replace the many teacher development activities that took place under INSTANT (MBEC 1996). With some delay, this program was indeed designed and executed, this time, appropriately at the University of Namibia. As part of a study on the status of science, mathematics and ICT education in sub-Saharan Africa, this program for senior secondary teachers was identified as a promising example in the development of science and mathematics education, and in particular as a generic model for upgrading of under-qualified teachers (Leyendecker 2004). And the program still flourishes under its own momentum after the end of the project support.

Subject coordinating committee at MBEC

Another area of priority for further development that the INSTANT project suggested in its final recommendations to the MBEC (INSTANT 1998) was the establishment of a

subject coordinating unit in the MBEC to coordinate all science and mathematics activities in the country. With some delays, this department has indeed been set up, and INSTANT trained teachers are running it. There is evidence, however, that the members of this unit are increasingly being diverted from their primary work into more general administration, and the fact that the unit does not have its own vehicle has seriously curtailed its essential outreach activities.

Teacher development, curriculum development, and school development

The relation of teacher development, curriculum development and school development as a basis for successful implementation of educational reforms is by now well established. Largely for reasons of manpower, the project did not pay much attention to development of schools and departments in schools. The focus was mostly on the individual teacher, even though cooperation existed between them, not at school level, but at workshops and cluster meetings. This may have hampered the success of implementation. At the time of the project, however, these essential structures were only beginning to be developed and institutional support for them would have been premature. It is an unfortunate characteristic of project design, imposed by its funders, that it is short term. Effective educational change, however, is a long term process and there can be little doubt that much of the impact of the project has now been lost simply because subsequent developments, such as the formal establishment of a teacher support structure via school clusters (initiated, in fact, by the project), did not have the manpower or resources to capitalise on the work initiated by INSTANT and its sister projects in Life Science and English.

Conclusions

When looking back at the operations of the INSTANT Project during the early part of the last decade, it is important to realise the unsettled political and educational situation prevailing immediately after independence. This situation resulted in an ad-hoc type of project execution as well as in numerous requests from the MBEC to carry out activities outside the mandate of the project, distracting it from its main activities. In ideal circumstances the project would have used a much more careful design, more piloting with smaller target groups in certain regions of the country, more attention to school development, more coherence between the different components of the project, and some degree of integration with pre-service programs. However, needless to say that under the prevailing political circumstances immediately after independence, piloting in one region and not in others was out of the question.

Sustainability of project activities was high on the priority list of the project, but it was not an issue for the Ministry which preferred to use the available expertise in the project to solve its immediate problems in an ad-hoc manner. In spite of this it must be concluded that the INSTANT project has made some notable contributions to the Namibian science and mathematics teaching force. It has built capacity for science and mathematics education in

persons who today can be found in crucial positions in the system, as curriculum developers, as teacher trainers, as subject advisors, as headmasters, and as MBEC officials. It has established a paradigm for science teaching and learning for others to build on. The phases (i.e. secondary) that were addressed by INSTANT are notably stronger than the primary phase and the effective pass rate (C and above) in IGCSE physical science remains one of the highest (though still low by international standards) and is a benchmark for other subjects to emulate.

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