CHAPTER 6

AN APPROACH FOR IMPLEMENTING TECHNOLOGY

6.1   INTRODUCTION

The findings in chapter 5 identified gaps and challenges in implementing Technology in the senior phase (Grades 7-9) schools. Some of the challenges include lack of resources, inadequate educator training and lack of conceptual knowledge in Technology education. Chapter 6 presents a proposed implementation approach. It lays out a proposal for an approach that will assist the Department of Education in the North West Province to build permanent capacity to plan, deliver and manage quality education in Technology in the senior phase (Grades 7-9) of the General education and Training Band.

6.2   JUSTIFICATION OF THE IMPLEMENTATION APPROACH

Chinn and Kramer (2004:268) define an approach as *"creative and rigorous structuring of ideas that project a tentative, purposeful and systematic view of phenomena"*. According to McEwen (2006:26), an approach is defined as *"a systematic explanation of an event in which constructs and concepts are identified and relationships are proposed and predictions made"*. The author goes on to argue that many approaches include a schematic drawing depicting the overall structure of or interactivity of the components. In other words, an approach is a set of statements or advices that help to explain or guide an action.

McEwen (2006:29) defines a model as *"a graphic or symbolic representation of phenomena that objectify and present certain perspectives or points of view about nature or function or both* while Hestenes (1998:1) sees a model as *"human construct to help us better understand real world systems"*. A model replicates reality with various degrees of precision. An approach comprises of concepts that are observed in experience and deriving a set of interpretative principles that will guide action for the better. An approach

would therefore be assessed by looking at its clarity, adequacy and importance. A model has an information input, information processor and an output of expected results. In this study an approach was used because it can influence practice in the following ways (McEwen, 2006:29). It can:

- Identify certain standards for education practice;
- Identify settings or conditions within which education practice should occur;
- Identify distinctive education processes to be used and technologies to be used including parameters for client assessment, labels for client problems, a strategy for planning, a typology for intervention, and criteria for evaluation of intervention outcomes;
- Direct the delivery of education services; and
- Direct Quality Assurance programmes.

The implementation of technology education is dependent on a number of factors, including but not limited to the following:

- Profile of Technology educators;
- Attitudes of educators towards Technology;
- Available resources to deliver the curriculum to defined standards;
- Educator training; and
- The attitudes and concepts of learners towards Technology.

All the above factors need to be converted into an approach that would assist policymakers to ensure that implementation becomes successful at all levels of the General Education and Training (GET) Band. In the Further Education and Training (FET) Band, there are four areas of specialization in Technology. These are Mechanical, Electrical, Civil Technologies and Engineering Graphics and Design is compulsory for any of the fields of specialization. These subjects were implemented as from January 2006.

According to the Technology 2005 Project (1996:4), one of the first projects launched by the Heads of Education Departments in 1994 was the Technology 2005 Project with the brief outlined below:

- Establish a Technology education forum;
- Gain support for Technology as a learning area;
- Develop a South African relevant understanding of Technology;
- Structure pre-service and in-service training; and
- Develop a strategic plan for implementation.

In April 1996, the four-member Technology 2005 National Task Team was appointed and the provinces received grants to appoint full time staff for the three-year duration of the project. By May 1996, Technology 2005 had developed a draft curriculum framework for Technology and in July 1996, Curriculum 2005 was announced with Technology as a distinct learning area (Mouton, Tapp, Luthuli & Rogan, 1998:8).

6.2.1 Technology as part of C2005

In the foundation phase there were three learning programmes with Technology forming part of Life Skills. A pilot programme was run by the North West Education Department in the third term of 1997 and training of Grade 1 educators followed in the fourth term. Full implementation for Grade 1 was set for January 1998. In the intermediate phase there were five learning programmes and Technology was combined with Natural Sciences. Training for Grade 4 was conducted in 2000 with full implementation in January 2001 (DoE, 1997:35).

In the senior phase there were eight learning areas and Technology was a programme on its own. The subject advisors and curriculum developers were trained in March 1999 by the National Department of Education, followed by provincial workshops where the trainers were trained. The training of Grade 7 was set for January 2000 and for Grade 8 in 2001 (DoE, 2005:2).

6.2.2 The Revised National Curriculum Statements

After the review of C2005, the RNCS was introduced in the General Education and Training Band. In the foundation phase it was implemented in 2004 and in 2005 it was implemented in the intermediate phase. In the senior phase implementation is done grade by grade with grades 7 implementing Technology in 2006. As from January 2007 it has been implemented in grade 8. The final year of introducing Technology in the senior phase is 2008 (DoE, 2005:9).

The National Department of Education realises that it does not have the resources to implement Technology on a large scale and thus needs to build partnerships with all role players to assist with educator training in this new learning area. The following points are summaries of what the researcher regards as important for successful implementation of Technology:

- South Africa accepts that Technology is an essential learning area and will benefit all learners;

- Technology implementation should be sustained in all South African schools;

- Competent training, in line with South African Education policy, must be delivered by all training institutions;

- Training expertise should be shared to achieve the common goal of competently trained educators; and

- Ultimately, all educators delivering Technology in South African schools should be appropriately trained and qualified (PROTEC, 2006:15).

The proposed implementation approach in figure 6.1 emanates from findings of the study. The approach seeks to improve the department's capacity to deliver quality Technology education in grades 7-9, in a sustainable way, to all provincial schools.
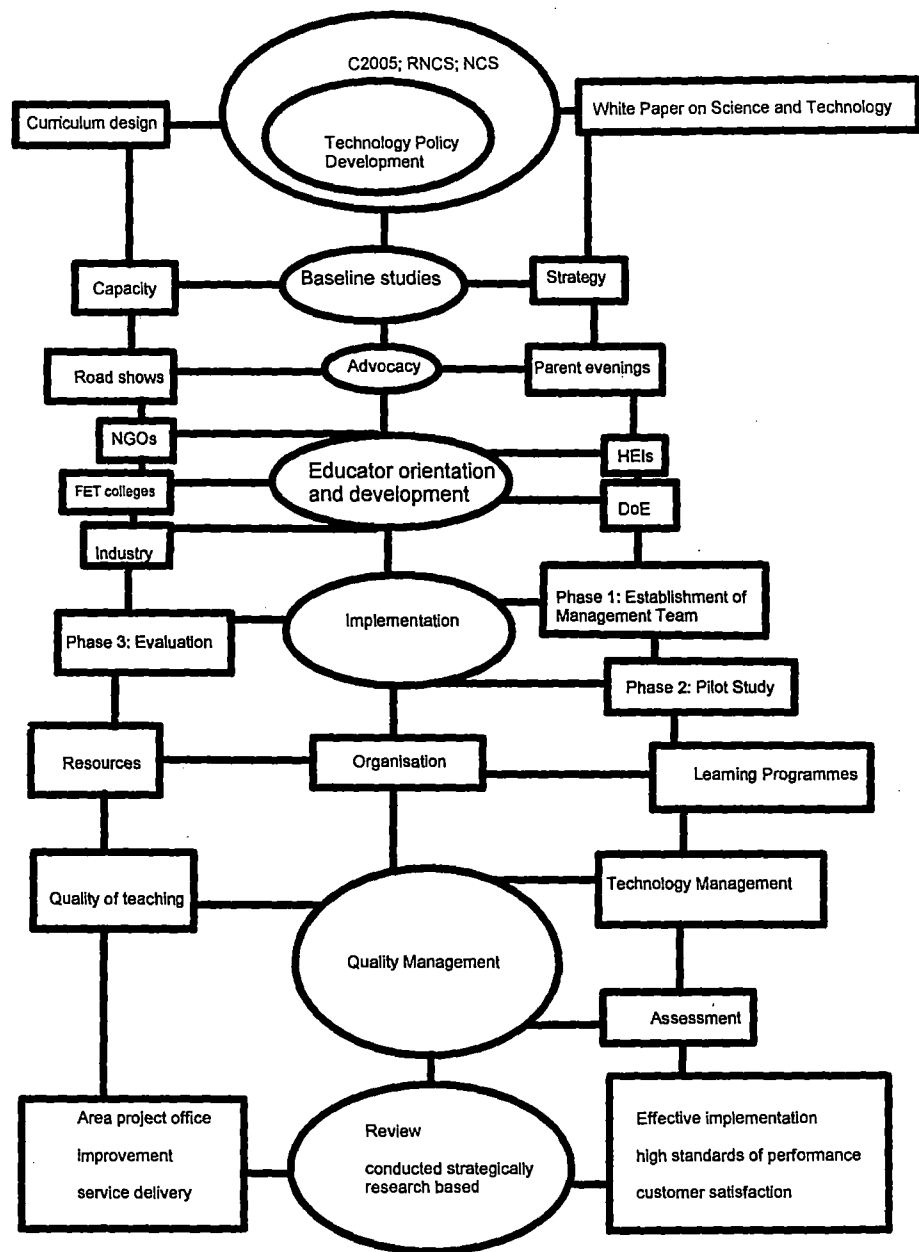
Figure 6.1: Technology education implementation approach

6.3   DESCRIPTION OF THE APPROACH

6.3.1   Technology policy development

The development of a Technology policy should start at the National Department of Education. A dedicated team dealing with Technology issues should be established to liaise with the provinces. It is imperative that government supports the initiatives from universities and other higher education institutions by setting conditions that are conducive for the implementation of Technology in schools. Curriculum design is a dynamic process and keeps on changing from time to time. In this regard, the policy team will ensure that the policies are aligned to meet the demands of the curriculum changes. Curriculum design should take care of the diverse needs of the South African society (Stevens, 2002:1).

The policy and white paper on Science and Technology should be utilized to feed on the curriculum needs of the school as well as those of the country. These have a bearing on the infrastructure and the resources. The Technology education policy makers should be linked strongly with the Department of Science and Technology to ensure that their needs are catered for in the policy. International bench marking should be conducted so as to learn what other countries are doing. The white paper on science and technology proposes partnership with a variety of stakeholders including the Department of Education in matters pertaining to research and development (DACST, 1998: 20).

6.3.2   Baseline studies/audit

It is very crucial that before any large scale study is ventured a pilot study be conducted or an audit in order to determine the needs of the people. Baseline assessment is used to determine what people already know and have in their possession. This study will help in establishing the state of readiness of all stakeholders. An audit related to crucial things in the implementation of Technology should be administered. These include educators, learners, subject advisors, curriculum developers and parents of learners. The study will

also assess the capacity of the various stakeholders to implement Technology. An audit should also be conducted in terms of human, material and physical resources in order to establish the existing capacity (Polaris Marketing Research, 2007:2). These audits will then be used to develop a strategy for implementation. A strategy is a plan that has been informed by the strengths, weaknesses, opportunities, needs and threats (Wikipedia, 2007 (a):1-2). It will sustain all the strengths and opportunities and come up with ways of addressing the threats and weaknesses in order to turn them into strong points.

6.3.3 Advocacy

An advocacy campaign should be conducted using various modes like workshops, road shows, newspapers, talk shows, and radio and television presentations as well as parent evenings (The Ford Foundation, 2007:1). In workshops, presentations are made and participants are offered the opportunity to ask questions related to implementation. The road shows may include distribution of pamphlets to the community and display of artifacts. The talk shows would involve inviting experts to make presentations and demonstrations on Technology. This process will ensure that the learning area is well marketed especially within the parents' community who according to research alluded to in chapter 5, have negative attitudes towards Technology (interview with experts paragraph 5.6.3.7 bullet number four). If they do not allow their children to do Technology there is no way that the schools can have sufficient learners. We need to win the parents in particular. The radio and television presentations could be made during the education slots and listeners or viewers could be requested to comment on the presentations. In the parent evenings, parents are invited to come and view learners' work including the projects and learners' interest in technological careers. The literature review has indicated the potential of Technology to improve the quality of peoples' lives. Ironically, the disadvantaged populations in general and women in particular, especially those in rural areas, do not have access to information about these technologies (DACST, 1998:69).

6.3.4   Educator orientation and training

The advocacy should be followed by educator orientation and training programme. This should be done to selected schools as a pilot. Various stakeholders should be involved in the training of educators. The subject specialists should be involved in the initial training on generic Outcomes-Based Education issues. These should form part of the short courses that are organized by the Department of Education. This will also include the methodology and content regarding the learning area as well as support in schools. This will ensure that the trends in Technology which are dictated by the policy are promulgated and implemented. It was discussed in the literature review that the implementation of Technology as learning area in many countries has been undermined by the shortage of resources, educators and inadequate support (DACST, 1998:68). It is hoped that educator training would help alleviate the said problem. The Department of Education pledges to support initiatives towards the training of Mathematics, Science and Technology educators (DoE, 2001 (a):6).

Another stakeholder in the training of educators should be the Higher Education Institutions (HEIs) (Wikipedia, 2007 (b):1-5). Data obtained from the educator questionnaires revealed that most educators are not having an accredited qualification in Technology (Table 5.1, page 125). At the Advanced Certificate level they should deal specifically with the content and methodology of the learning area. This will ensure that educators get accreditation for the learning area they teach. Senior degrees will cater for advanced research in the learning area. All accredited teacher training in South Africa fall within the competency HEIs especially universities. The Department of Education should collaborate with universities to form a strong partnership regarding teacher training.

The FET colleges (Wikipedia, 2007 (c):1-3) have a place in the training as well. They have well equipped resource centers for conducting practical work. Arrangements could be made with relevant authorities to place educators for a certain period in these institutions to allow them to acquire the required practical skills. Technology educators

could also enroll for the National Certificate Vocational as part of the enrichment programme.

A strong partnership needs to be established between schools and industry (Siegel, 2006:35). Industries normally invest money into schools by sponsoring learners' fees and donating equipment required to teach Technology. They also gain from the partnership by having learners joining industries after completing their studies. Industry also helps with the training of staff members. This could also allow for educator placements in industry. Industry needs to be encouraged by producing the kind of student that can be absorbed by these industries. The Department of Science and Technology (DACST, 1998:24) acknowledges that industries are fundamental to the financing and implementation of innovation in society.

Service providers (Non-governmental organizations) are very crucial to help the department with specialized training and support. Some of the NGOs receive financial backing from foreign countries with interest in Technology Education (Sun Microsystems, 1999:3-9). These stakeholders could play a variety of roles in the implementation of Technology such as policy making, research and development, trainers and providers of infrastructure among others (DACST, 1998:25). The Department of Education does not have sufficient capacity to train and support all its schools. Various service providers should be appointed to train educators and service schools. The providers offer expert advice in the implementation of Technology and sponsor some of the ventures.

6.3.5 Implementation Plan

The implementation of Technology should involve the following activities, in phases as described:

Phase 1: Establishment of the management team

All structures required for implementation, training and support should be put in place. It may involve the following activities:

- This phase may take six months. A management team should be created for implementation. Service providers should be appointed and the memorandum of agreement, business plan and budgets as well as timeframes should be approved and contracts concluded;

- Provincial, regional and area project officials should be appointed. Initial training of the officials should begin. These officials should be deployed as supervised trainers for educators in schools;

- Initial training and pilot study should be provided to lead schools in senior phase schools;

- A development plan should be created to oversee and review a complete Technology curriculum for use in grades 7-9. The team should include provincial officers, educators and service providers;

- The implementation will be the responsibility of the North West Provincial Department of education. It will also chair the management committee. They will work in partnership with major funders. The Department may also co-opt the involvement of other stakeholders, such as industry, other development agencies and community bodies;

- The department should identify education service providers and other educational institutions to provide specialist services as needed. These will be accountable to the department and will be represented on the management team. The department will decide on the process for the selection of service providers, based on its

needs, on the track record of such agencies in previous similar activities and on the capacity for such agencies to build capacity within the province;

- To the extent that departmental officials are selected for involvement, the department may wish to consider ways of ensuring that the skills developed are committed to the province for a minimum period of time. This may require participating officials to commit to minimum periods of service, to undertake additional educational responsibilities (within reason) and to participate in training (Wikepedia, 2007 (d):1-2; Christian educators, 2007:1-2).

Phase 2: Pilot study

After the establishment of the management team at provincial head office, and the creation of structures at the regional and area project office levels, the second phase could comprise of the following activities:

- This phase may take up to three years. After initial training of the programme in lead schools, the regional and area project officials will begin an extended training programme for educators in all schools offering grades 7-9, under the auspices of the department and service providers;

- Curriculum development will begin. This will include the development of a full grade 7-9 Technology curriculum relevant to the North West Province;

- New curriculum modules will be delivered to schools. These will be developed, piloted and then extended to all schools after lead educators have been trained;

- Simultaneously the province, regional and area project offices will be engaged in a training programme that also involves them in developing, adapting and implementing improved management and support systems. These will be aligned with national and provincial policy development in Technology, as they occur;

- Once all regional and area project office officials and lead educators are trained, they will cascade the new materials and systems into their regions and area project offices and the schools; and

- Initial evaluation will occur and be fed back to the various stakeholders for reaction and adaptation (Texas Education, 2007:1-5).

Phase 3: Evaluation

Evaluation should be carried out by the service provider accredited in evaluation and monitoring. This phase could involve the following activities:

- A full evaluation of the implementation will be completed and tabled. This phase may take six months.
- A review of human resource performance and lessons learned will be completed and policy recommendations tabled; and
- The project partners will begin on extensive review and planning for the extension of the new system and procedure to other schools in the province (Texas Education, 2007:1-5).

Scale of implementation

The scale of implementation will be a considerable one. Based on a participation level of about 100 learners per school, each school will add 100 learners each year until a maximum annual participation reaches 300 learners. The cumulative year on year total is 220 000 learners in 733 senior phase schools, although this is unlikely. Based on an average educator participation rate of three educators for Technology per school, the total number of educators would be 2199. This too is probably unrealistic. At first estimation the numbers involved may be as high as those given in the Table 6.1.

Departmental officials	40
Educators	2199
Learners	220 000

Table 6.1: Estimation of the scale of implementation of Technology in the senior phase

6.3.6 Quality management

The ultimate goal of quality management is to enable the school to offer viable quality programmes that satisfy the needs of customers, namely learners. The schools should evaluate their own Technology departments. According to Wikipedia Quality management is a method for ensuring that all the activities necessary to design, develop and implement a product or service are effective and efficient with respect to the system and its performance (Wikepedia, 2007 (d):1). Benchmarking is one of the key operations of quality management. In this regard comparison with other organizations in order to gain the performance of our organization should be conducted (Anonymous, 2007 (a):1).

This process of quality management should be conducted by the Technology learning area heads and they could look into the following aspects:

Learning Programme, Work schedule and Lesson Plan

Educators are expected to plan their lessons (short, medium and long term). Aspects relevant to planning could look into the following issues and attempt to answer the posed questions.

- The acceptability of the learning programme, work schedule and lesson plans in terms of the learning outcomes and assessment standards. Learning Area heads need to verify if these reflect the structures of the areas of knowledge and activity from which they draw.

- Are they sequenced to optimize learning and to match the ability and interests of learners?

- Are they broken down into units of appropriate length, each with a clear purpose, which is explained to learners?

- Is there an appropriate balance of activity and expository teaching, between negotiated and imposed work?

- Does expensive equipment lie idle whilst learners pursue learning activities, which might be more profitably done through homework?

- Does each unit of work have a basis in skills, concepts and attitudes?

- Where necessary, have teaching methods been adapted to accelerate skills development so that learners are given sufficient time to explore concepts, to engage in problem solving and to apply skills (Boughey, 2006:1-18).

Quality of teaching and learning

The quality of teaching and learning are the most important focus areas in the school. The learning area heads need to check the following:

- Are teaching strategies varied enough to match the wide range of activities?

- Is there a distinctive creative and productive atmosphere in the classrooms at all times?

- What contributes to and detracts from the maintenance/ creation of such an atmosphere?

- Is there quality of motivation and discipline appropriate to practical activity rooms?

- Is staff enthusiastically engaged? Do they expose learners to their own creative work?

- Are learners exposed to outside representatives of the "culture" of capability from the adult world of the home, arts, design and industry?

- Is there an attempt to overcome sex stereotyping and to cover for multi-ethnic and mixed ability groups?

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- How is staff made aware of their own successes and failures in teaching, and pointed towards improvement?
- Is there an effective use of educational technology? (Boughey, 2006:1-18).

Learner Assessment

Assessment of learners is one of the crucial factors regarding the implementation of technology as alluded to in chapter two (paragraph 2.11). It is important that these assessments are done in line with the relevant policies to report about the performance of learners. The head of department may use the following questions as criteria for quality assuring learner assessment:

- Are you clear about assessing products and artifacts as evidence of learner achievement/ development, rather than as simple ends in themselves?
- Do you assess all major areas of creative endeavour or do you focus only on the most easily assessable areas?
- How aware are you of recent developments in the assessment of creative work?
- Do you use a full range of assessment methods, including objective tests, multiple choice items, conventional written examinations, practical tests, course work assessment, interviewing learners among others? How far do your assessment methods reflect the distinctive nature of capability?
- Are your systems practical, reliable and valid?
- How far do you use learner self-assessment?
- Do you attempt to produce positive profits of achievement for all learners?
- To what use do you put the information when gathered? Do you use information to modify your teaching methods? (Wikepedia, 2007 (e):1-7).

Use of resources

Resources are scarce and there is a need to take care of the few that are available. The type of approach in implementing Technology would normally dictate the type of equipment that is required (Elmer & Goodhew, 1996:2; Anonymous, 2007 (b):1-3). The learning area head will need to look at the following pertaining to resources:

- To what extent are furniture, equipment and machinery arranged to promote efficient use?
- How efficient is learner access to equipment?
- How watertight is your security for equipment and tools?
- How far are rooms safe to use?
- What systematic routines do you have to ensure maintenance of safe conditions and to rectify problems as they occur?
- What training has staff had in Health and Safety?
- How do you ensure that staff and learners are always aware of "Health and Safety" in their work.
- Is the system of stock control thorough and practical?
- How accurate and up to date are departmental accounts?
- Is the department always reasonably prepared for a visit from Health and Safety Officers?
- Is stock control structured into learning experiences of learners?
- How effective are in-school systems of equipment maintenance?
- How effective is your method of obtaining specialist outside contractor maintenance service?
- What steps do you take to ensure that your department receives an adequate share of school funds?
- How successful are you in obtaining materials and money from other sources?
- Does your technology department work co-operatively within the school's annual timetabling cycle?

- Do learners have sufficient time in your department? Are group sizes small enough for safe practical work?

- Is there a regular system for the display of learner's projects, staff work and exhibits from out of school? To what extent are these linked into the formal curriculum?

- How far do you make use of the community and the outside world through visits and work in galleries, museums, factories, studios, etc? Do you integrate such experiences into schemes of work?

- How far do you tap industry and commerce for help with technical problems, materials, and work experiences?

Technology management

The learning area head will need to look into personnel management and development issues. He/she will have to establish if there are relevant policies to make the technology department functional. The following questions could be used as criteria to check the effectiveness of such policies:

- Do roles of responsibility within the department adequately match the work to be done?

- How effectively are roles carried out? What methods are in operation to monitor role performance?

- Is there a policy to regularly review roles with a view to change and enrich experience? Would "role rotation" be feasible?

- Is there adequate senior staff support for all staff? Do you regularly canvass the views of junior staff on this issue?

- Do you systematically attempt to analyse INSET needs, linked to the needs of the department and to the needs of your staff for personal development?

- Are there adequate and systematic methods of looking after probationary teachers, student teachers, technical and support staff?

- Do you contribute effectively to the general middle management of your school, making both general and specialist contributions, and advocating the case of Technology Education? (Wikepedia, 2007 (f):1-2).

Organisation

The organization of the department had to do with communication and control as a management function throughout the department and ensuring that resolutions are being implemented. The criterion against which this is judged is guided by the following questions:

- Is the departmental decision making compatible with the annual decision making calendar of the school?
- Do you delegate making it to the lowest level at which it can be done effectively- to the point of expected delivery?
- Is communication clear and effective? Are meetings conducted in a business-like and purposeful manner?
- Do you monitor the implementation of decisions and ensure that those with power use it responsibly?
- Is there a clear system of learner's referral and counseling, and does this match the whole school system?
- Does responsible staff keep their "fingers on the pulse" by regular checking of the work of learners?
- Is routine administration and control of information on registers, mark books, learners' profiles, reports, storage of examination results etc effective? (Wikipedia, 2007 (g):2).

Internal evaluation should be conducted at the level of the school because schools are held accountable for their performance. This means that the school improvements are the responsibility of schools rather than of the Department of Education. This implies that schools have to identify the areas that need development and draw a comprehensive plan

on how they could improve on those areas (DoE, 2001(e):5). A copy of the improvement plan should be submitted to the Area Project office for support.

External evaluation should then be conducted to verify the school's own evaluation. According to the National Education Policy Act, Act 27 of 1996 subsection 3 (4), the Minister shall be responsible for:

> *"... planning, provision, financing, staffing, co-ordination, management, governance, programmes, monitoring, evaluation and well being of the education system...Section 8 of the same Policy elaborates specifically on the responsibility of the Minister with regards to monitoring and evaluation".* Sub-section 8 (10) states that:

> *"The Minister shall direct that the standards of education provision, delivery and performance throughout the republic be monitored and evaluated by the Department annually or at other specified intervals with the object of assessing progress in complying with the provisions of the Constitution and with National Education Policy".*

Audits at learning site level are designed to monitor where the school is at that point in time, its strengths, and areas for development and recommendations for improvement (DoE, 2001(c):12). This process includes observing educators in the classrooms, interviewing school management, educators, learners and parents (DoE 2001 (b):3). More data is gathered by scrutinizing various school policies and records. The National Policy guides this process on Whole-school Evaluation, Guidelines and Criteria, Instruments for School-Self Evaluation and the Education Labour Relation Council (ELRC) Collective Agreement No. 8 of August 2003 (DoE 2003 (a): 5).

In terms of Systemic Evaluation (DoE 2001(d): 4) data is gathered using Learner Assessment Tasks and Contextual Questionnaires that are administered to learners, educators, parents, principals and district officials. The instruments used are developed at a national level and are benchmarked against international standards.

Looking at the following criteria could assist in conducting self assessment (DoE 2001(e):12).

- Standards reached by learners in public examinations;
- Standards reached by learners in work seen;
- The progress made by learners in lessons over a period of time;
- The attitudes of learners and educators to their studies and their behaviour in lessons;
- The quality of teaching and learning;
- The effectiveness of leadership and management in the learning area;
- The breadth and balance of the curriculum offered in the learning area and the quality of associated planning;
- Assessment practice; and
- Any other important feature of the learning area.

The reports are then shared among the school, area project offices and the external quality assurance verifiers to establish a common understanding and an agreed course of action. On the basis of the internal and external evaluation reports, the school will develop a learning area improvement plan. The subject advisors will guide and support the school in developing and implementing the plan and intervention strategies. It is very crucial that they have diversified skills and professional competencies that can handle both curricula and extra-curricular challenges. The area project office must be able to monitor the implementation of the plans, provide the necessary support and promote a culture of continuous improvement.

6.3.7 Review

From time to time the implementation should be reviewed to check if everything is on track. This should be informed by research in the classroom as well as external evaluation. The reasonable interval at which this could be done is once in five years. At

this stage a fresh approach will be followed based on the improvement suggestions and the latest trends in the learning area (Khumalo, 2004:184).

6.4   SUMMARY

The proposed implementation approach that has been developed emanated from the findings and challenges identified in chapter 5. Critical issues were identified and these included training, resources, advocacy and quality management. Since the inception of the new education system after the first democratic elections a number of policies have been developed. A lot of criticism, however, has been leveled at the lack of monitoring and evaluation of the implementation of these policies (EFA, 2006(a):20; EFA, 2006(b):2). The Quality Assurance Chief Directorate, therefore, has a responsibility to ensure that national and provincial education policies are complied with.

In compliance with the policy there is a need for a system that will monitor and evaluate the education provision to ensure quality service delivery. Quality Assurance involves the establishment of processes to improve, monitor, evaluate and report publicly on the performance against predetermined goals and agreed outcomes (DoE, 2001(c):12).

The monitoring and evaluation strategies used in Quality Assurance are different from the inspections of the past, which focused on monitoring for quality checks. Those inspections served as policing mechanisms to entrench apartheid education policy, and had very little to do with assuring quality of education provision. The monitoring and evaluation mechanisms used in Quality Assurance, relate to a new democratic order, which involve approaches that are characterized by partnerships, collaboration, openness and transparency (DoE, 2001(e):5).