

**A Case Study of the Constraints to the Effective Teaching of Technology in
Grade 7 Experienced by Schools of a District in KwaZulu-Natal.**

by

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Submitted in partial fulfilment (37%) of the academic
requirements for the degree of
Master of Education (Science Education) in the
School of Science, Mathematics & Technology Education
University of KwaZulu-Natal

August 2006

ABSTRACT

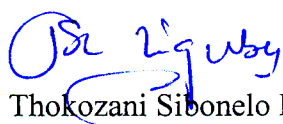
This study concerned itself with the constraints experienced to the effective teaching of Technology in Grade 7 by schools of a district in KwaZulu-Natal. The study arose out of personal; experiences of managing staff who had a responsibility to teach Technology in my school. It was assumed that by highlighting some of the problems encountered by schools in the teaching of this new learning area, future teaching and learning might improve. The main research question was: What constraints are experienced by Grade 7 teachers to effective teaching of Technology? A number of specific research questions were generated which focused on the main issues of the research. These were: Are there relevant physical resources available for the teaching of Technology in schools?; Do teachers possess the required skills to teach Technology?; Are teachers' understandings of the Technology Learning Area similar to official department policy?; What attitudes do teachers have towards the new Technology Learning Area? Approaching from a realist perspective, a descriptive case study was used to gather both qualitative and quantitative data. Schools offering Technology in Grade 7 in a school district of 94 schools were supplied with questionnaires for the principal and technology teachers to complete and return. These questionnaires were followed by classroom observations and teacher interviews in carefully selected schools. Data were coded, captured, analyzed and interpreted. Arising from the data analysis a number of findings were presented. The main findings were: In most cases, schools in the district do not have the specific resources required for the teaching of Technology in Grade 7. While most had general physical school infrastructure this was not always in a good condition. Teachers do not have many of the skills or competencies required to teach Technology. The majority of teachers who had been assigned to teach Technology had not received sufficient training. Where some training had taken place, the majority found it not very useful. Teachers have a common

understanding about what Technology as a discipline is but differ on what should be emphasized in technology education at school. Teachers had a positive attitude to the introduction of the Technology Learning Area in the curriculum but suggest that it be combined with Natural Science Learning Area at the senior phase. Arising from these findings two main recommendations were made involving the allocation of resources to rural schools in which it was felt that the Department of Education should take primary responsibility and the continuing professional development of technology teachers in which two complementary models were suggested. Further research was suggested in the area of separate or integrated science and technology learning areas and on the long term impact of the teaching of Technology on technological literacy and its impact on the economy.

PREFACE

The work described in this thesis was carried out in the School of Science, Mathematics and Technology Education, University of KwaZulu-Natal, from August 2002 to October 2005 under the supervision of Prof. Paul Hobden (Supervisor).

This study represents original work by the author and has not otherwise been submitted in any form for any degree or diploma to any tertiary institution. Where use has been made of the work of others, it is duly acknowledged in the text.



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August 2006

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ACKNOWLEDGEMENT

I wish to thank the National Research Foundation who helped fund this research study by providing me with a student bursary.

DEDICATION

This dissertation is dedicated to my late father Alfred, my mother Nellie, my wife Cebisile and my children Nokusho and Nokwanda.

CHAPTER 1

INTRODUCTION

1.1 Background

The 1994 election is a milestone in the history of South Africa. It marked the beginning of many reforms and innovations destined to bring about changes in the lives of many South Africans. In the field of education, prior to 1994, a number of separate education departments existed for different racial groups. For example, the Education Department of the House of Delegates for Indians, the Education Department of the House of Assembly for Whites, KwaZulu Department of Education and Culture for the Zulus, etc. The principles upheld by the Government that took over, e.g. 'Equal education for all', dictated that the different education departments be fused into one. It was then decided that a new curriculum for a new South Africa be introduced. The result was the introduction of Curriculum 2005 embodying Outcomes Based Education (OBE) (Department of Education, 1997a). It would have its first phase of implementation in 1998. The task teams set up in the post election period came up with eight learning areas with Curriculum 2005 as an umbrella curriculum. Among the eight learning areas was Technology. In the intermediate phase (Grade 4 to 6) it is integrated into the Natural Sciences Learning Area but was a separate learning area in the senior phase (Grade 7-9). The purpose of this study was to investigate the constraints to the effective teaching of Technology in Grade 7.

1.2 New Curriculum

For the greater percentage of South African schools, Technology is a totally new learning area. The only form of technology education which took place prior to 1994 was "Design and Technology", enjoyed by advantaged schools within some educational departments such as the ex-Natal Education Department (Kahn & Volmink, 1997). Technology as a learning area is new to policy makers, staff within education support structures such as superintendents of education and subject advisors, principals of schools and more significantly to teachers who are implementers of the curriculum.

The new technology curriculum requires a number of new skills and content not familiar to teachers. For example, the first of the seven specific outcomes expected of learners is:

Understand and apply technological processes to solve problems and to satisfy needs and wants (Department of Education, 1997b). These processes involve identification and explanation of needs and wants, consideration of possible and relevant solutions, making an informed choice, developing a design, realization of solutions according to design, evaluation of realized solution and recording and communicating the process. Similarly the second specific outcome requires the application of technological knowledge and skills to be ethical and responsible. Evidence of achievement should show the acquisition of knowledge and skills in respect of safety (e.g. first aid), information (accessing various types of data), materials (sources, types, properties, etc.) and energy (sources, types, transformation, etc.) in systems and control (e.g. levers, pulleys, cams, etc.), processing (e.g. problem solving with food and with textiles), structures (everything made in technology) and communication (to be integrated throughout in technology) (Department of Education, 1997b).

According to Mouton, Tapp, Luthuli & Rogan (1999), technology in life is about using knowledge, skills and resources to solve problems. This solving of problems should be in response to satisfying needs and wants. According to Mouton et al. the pedagogy of teaching Technology should thus ideally be:

- activity based;
- integrating thinking and action within the context of technological problem solving;
- involving learners in decision-making, being able to justify choices made and self-evaluation;
- involving collaborative and individual work and;
- linking schoolwork with technological activities in the wider community.

The preceding methodology envisaged for technology education means that:

- The learners themselves must be involved in activities during their learning (learner centred). That is, the learners should be able to work on their own, or, in groups or pairs.
- Learners must actively “do” something, be it designing, making, explaining, demonstrating, dramatizing, etc.
- Learners must be able to justify decisions and choices that they decide on. They should also be able to analyze and evaluate their work and that of their peers critically.
- The activities and tasks that the learners engage in should be in context and must be meaningful.

Successful implementation of a new curriculum demands a number of interdependent innovations. These according to Jansen (1997) can be outlined as follows:

- Trained and retrained teachers.
- Retrained educational managers and principals to secure the implementation as required.
- Parental support and involvement.
- New forms of learning resources (textbooks and other aids).
- Opportunities for teacher dialogue and exchange as they co-learn in the process of implementation.

It was reported that the introduction of Technology had problems from the onset due to a low level of technological literacy, especially among teachers (Marsh & Shaw, 2001). Teachers were not used to operating in this envisaged way which required high levels of technological literacy. Some of the problems influencing the implementation of technology education are general problems applicable to the whole of Curriculum 2005 e.g. resources, new teaching methods etc. An additional barrier to implementation as reported by an early investigation into C2005 implementation was that “the content and conceptual boundaries are not yet as neatly drawn as they are in more established school subjects, so that their distinctiveness from other learning areas is not easily apparent to teachers” (Chisholm, Volmink, Malan, Ndhlovu, Mahomed, Lubisi, Ngozi & Mphahlele, 2000, p. 46). While the Chisholm Report felt that the best way to deal with the problems was to recommend that Technology be subsumed into the Science and Life Orientation Learning Areas, this was not accepted by the Education Department and in the end it remained with the status of a separate learning area in the senior phase.

Throughout this study when reference is made to the new curriculum, it is to the original Curriculum 2005 (Department of Education, 1997a) which had been implemented at the time of the study. Subsequent to this research study, a revised version began to be implemented in schools (Department of Education, 2002) as a consequence of the recommendations of the Chisholm report.

1.3 Personal experience

As a headmaster of a primary school, which includes intermediate grades (Grade 4 to 6) and the first year of senior phase (Grade 7), I have witnessed problems in the implementation of

Technology. These problems seemed to me to emanate from the fact that technology education was new in South African schools, teachers lacked the necessary competence to teach the subject and there was a general shortage of resources.

In my experience, teachers do not know exactly what they are supposed to be practising in their classrooms in order to claim to be teaching Technology in the best possible way. Even internationally there is no consensus on what counts as knowledge in technology education or what is best practice from an implementation perspective (Kahn & Volmink, 1997; Rasinen, 2003). This problem, in the South African context, is further compounded by the fact that Technology has to be taught following an outcomes based education approach (OBE) wherein teachers are expected to plan activities aimed at achieving predetermined specific and critical outcomes specified in the official documents (Department of Education, 1997a; 1997b; 1997c). Given that this approach is new, it can be seen that teachers are learning Technology and at the same time dealing with OBE. It is the teacher's responsibility to develop appropriate instructional strategies to address different student needs and bring enthusiasm through a variety of teaching approaches to the classroom. This should be done to ensure sound learning for every student. In my opinion this multiple task is very difficult if it is not accompanied by training and on-going support.

This was borne out in my experience in my own school where my teachers were having difficulty organizing activity based learning sessions as required by the new curriculum. For example, one day in my school I was doing routine class visits and had to observe a technology lesson in progress. The teacher had planned to let the learners construct crankshafts and show their operation. The instructions for the task indicated that each learner needed to have scissors, some old cartons, a wire and some lids of bottles for wheels in order to be able to perform the task. What I noticed was that very few learners had the material to do the constructions. It looked as if the teacher had envisaged the problem because she had brought with her a handful of scissors and a few old cartons of corn flakes to help the learners. The scissors had to move from one learner to the other. Most of the learners could not finish the construction in the stipulated time and some failed even to start. The time was soon over for this a one hour technology lesson. Learners were given a chance to complete their constructions at home. I tried to figure out which of the three kinds of tasks i.e. capability tasks, resource tasks or case study tasks, learners were being engaged in, but I could not. The teacher herself could not explain except to say that she was teaching what she had been taught

while training at college for her diploma. What she was doing fell under technological systems in the curriculum. The following day I asked the teacher about what had happened about the crankshaft systems. She showed me what she had collected but pointed out that not all learners had managed to submit. On probing further about the reason why, I learned that some learners just did not have all the material to do the constructions even at their homes. Each construction was cart-like with a crankshaft making a carton figure shaped like a person to move up and down as the cart moved forwards or backwards. These were kept in the staff room (a converted classroom of size approximately 9m x 7m) in one of the corners. In my opinion the overall learning experience was not good for many of the learners and I considered the lesson to be very unsuccessful.

On reflection as to why I considered the lesson unsuccessful I felt that the availability of resources directly influenced the teaching and learning of Technology. In addition, it came to my mind that over and above resources, the skills with which the teacher was equipped played an important role in the teaching of Technology, and also other learning areas. There was great disparity among schools in South Africa. For example, a few schools previously well supported by the apartheid government and referred to as Model C schools had the additional opportunity to supplement their funds from their relatively affluent local communities with high school fees while the greater majority of rural schools with little historical support and where parents had struggled to put up buildings, had to resource their schools out of the little wages they earned and even had to pay in some cases some additional teachers salaries. Most of the latter mentioned schools are still lacking infrastructure for general teaching and learning. The question arose as to whether local schools were in a similar situation as far as the implementation of the new technology curriculum went and what other constraints there might be to the effective teaching of Technology.

1.4 Research Approach

The above situation in my school motivated me to look carefully at the current state of affairs in schools with a few to making a contribution to the improvement of technology education which I saw as a valuable learning area for our rural schools. It was my contention that technology education was not operating effectively and that this was due to a number of constraints such as:

- availability of appropriate resources and their storage.

- qualifications that technology teachers have.
- involvement of these teachers in technology professional development programmes.
- competences related to skills required in the teaching of and learning of Technology.
- teacher understanding of Technology as a learning area.
- attitudes which teachers have with regard to technology education.

Consequently, the study set out to address the following key research question: What constraints are experienced by Grade 7 teachers in teaching Technology? A number of specific research questions were generated which focused on the main issues of the research.

Specific question 1: Are there relevant physical resources available for the teaching of Technology in schools?

Specific question 2: Do teachers possess the required skills to teach Technology?

Specific question 3: Are teachers' understandings of Technology similar to official department policy?

Specific question 4: What attitudes do teachers have towards the new Technology Learning Area?

This study focuses particularly on technology teaching in Grade 7. It is an investigation about constraints to the effective teaching of Grade 7 Technology in schools of a particular district in the province of KwaZulu-Natal. KwaZulu-Natal is divided into regions. Each region is subdivided into districts with lesser numbers of schools. I chose this particular district because it is my workplace and therefore I had access to the district office, principals of schools and schools themselves. Grade 7 is the first level of the senior phase (Grade 7 to 9) where Technology is taught as a separate learning area.

In this study a pragmatic, mixed method approach to research (Johnson & Onwuegbuzie, 2004) was considered to be consistent with the purpose of the research and was adopted. It was felt that the most suitable way of approaching the research questions was to do empirical research in the form of a descriptive case study. It allows for the detailed description and analysis of the nature of existing conditions, the availability of relevant resources, and in particular teacher capabilities to handle Technology. Multiple sources of evidence producing both qualitative and quantitative data were used. Data was gathered through completion of questionnaires by respondents (Grade 7 technology teachers), supplemented by interviews and classroom observations at specific schools.

After collecting all data, their analysis and interpretation allowed the researcher to answer the research questions. In this study, the descriptive research approach has been used rather than an evaluative or theoretical approach as the study was seeking to find out the processes that were ongoing. Descriptive research, as described by Best (as cited in Cohen, Manion & Morrison, 2000) is concerned with conditions or relationships that exist; practices that prevail; beliefs, point of views, or attitudes that are held; processes that are going on; effects that are being felt; or trends that are developing. Thus, all these aspects seem to match with the issues being investigated in this study.

1.5 Value of study

Having witnessed problems in the implementation process pertaining to teacher preparation and provision of resources, I have recognized the need to investigate the area so as to:

- Improve the implementation of the Technology in my own school and assist others to do the same.
- Determine the mismatch between the level of resources required and resources available.
- Inform those responsible for implementation about the knowledge, skills, values, and attitudes that teachers possess with respect to the Technology Learning Area.

The district in which the study was conducted comprises of urban (mostly former Model C schools), semi-urban, rural and deep rural schools (HSRC, 2005). Urban schools are mostly located in towns or in cities. Semi-urban schools are located in the suburbs surrounding towns or cities. They are usually found in areas settled by black communities sometimes referred to as black townships. Rural schools are far from towns or cities and usually serve poor black communities. Although distant they are accessible. Deep rural schools are the furthest away from towns or cities and are usually not easily accessible because of bad dirt roads and sometimes full rivers without bridges. A large number of possible categories of schools, classified according to location, are therefore represented. As a consequence, the results and findings of the research should be applicable to other districts and regions within KwaZulu-Natal and some lessons can be learned from them.

The study is considered essential especially for a country like South Africa, which is in the stage of development, trying to find its place in the global world. Technology education has the support of the Reconstruction and Development Programme (RDP) with its focus on

human resource development. The explicit assumption by the current ANC led government is that the economy of this country rests upon sound science and technology policies, allowing access to programmes of education and training in scientific and technical fields at all levels (Kahn & Volmink, 1997). According to Pavlova (2005) “technology education was seen as a means for developing knowledge, skills, attitudes and values which allow students to maximize their flexibility and adaptability to their future employment, mainly, and to other aspects of life as well” (p. 3). For me the long-term goal of the study is to improve the teaching of Technology and through this increase technological literacy and consequently boost the country’s economy.

1.6 Conclusion

In conclusion, the South African Department of Education took a big step by introducing Technology in schools. However, the raising of the ground for those disadvantaged by previous departments of education for this giant leap was necessary to enhance a smooth implementation. Whilst teachers have to learn to cope with an outcomes based approach, they have at the same time to learn processes of technology so as to be able to teach confidently and thus effectively. I have personally witnessed what I consider to be problems in my own school with regards to implementation of the learning area. They relate to a lack of appropriate resources, minimal teacher skills, understanding of Technology and attitudes towards it. The purpose of the study was thus to investigate this existing situation in order to determine the constraints to effective teaching and illuminate some of the shortcomings of the implementation of the new technology curriculum.

In the following chapter I review literature on issues pertaining to technology education. In Chapter 3 is an outline of the design of the study and a motivation for the selection of the particular methods used to gather data to address my main research question. In Chapter 4, I present my results and analysis accompanied by discussion and in Chapter 5 after summarising I have given some suggestions for future actions and possible areas for future research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This review begins by looking at definitions of technology and technology education. To do so it is firstly emphasized that Technology is a new learning area not only in South Africa but in many other countries as well. It is assumed that the newness of Technology as a learning area has an impact on its implementation. Secondly, it is further argued that different definitions of technology and technology education have led to different ideas about the content and implementation process of Technology as a school learning area. Thirdly, whether to separate or combine the science and technology learning areas is a debatable issue with some countries like Canada combining science and technology as one learning area (Ontario Ministry of Education, 1998) and others opting for separate learning areas. This discussion is followed by a rationale for introducing technology to the general school curriculum with a view that this will throw some light on how best the introduction can be done. The organization of the South African curriculum and the theory behind implementation of new curricula are also discussed. The context is explained given that the implementation process of new curricula differs from one country to the other depending on the social, economic and political situation of that country. This is done to shed some light on understanding the way in which technology education has been or should have been introduced in South Africa to minimize constraints to its effective teaching. In the last two sections the resources required for technology are discussed with a focus on professional development programmes for teachers and provision of physical resources.

2.2 Defining technology and technology education

2.2.1 Technology as a new curriculum

Technology is a new learning area in the South African curriculum and was introduced after the first democratic elections that took place in 1994. It began to be taught in Grade 7 in the year 2000 alongside the other seven learning areas. One notices that South Africa is not an

exception because literature reveals that even globally Technology is new. For example, in Israel, technology was only introduced as a junior high school subject in 1994 (Reddy, 1998). In New Zealand the mandate to start technology education as one of the learning areas was given in 1999 (Jones & Moreland, 2004). It has been claimed (Donnelly, 1992) that Britain is a world leader in the field of technology education, as opposed to other countries in which earlier technical curriculum were started but these were either vocational or merely applied science. In contrast in Britain some form of technology began to take shape in the early 1970s. It is claimed that by the late 1970s a new subject, Craft, Design & Technology (CDT) could be identified in many secondary schools which was the precursor of the modern technology curriculum. Some countries like USA and Holland introduced technology as an add-on to science curriculum not as a separate discipline (Donnelly, 1992).

The ongoing research in many countries as to exactly what technology education should constitute indicates that the field of technology education is ill-defined and has yet to be properly understood. In her review report on the implementation of technology education in a few countries Reddy (1998) cites a number of studies such as ; the Treagust and Rennie report on an evaluation of the approaches and programmes implemented in six technology schools in Australia; the study by Chinien, Oaks and Boutin in Canada to indicate the need for technology education in school curriculum; and an international survey carried out by UNESCO in Africa in the mid-1980s to indicate the importance of technology courses to promote children's interest for technical work and careers, to mention a few. She concludes her review by finding that it is a difficult matter as implementing technology into the school curriculum is not only an issue of curriculum development but also an issue of curriculum innovation in a system. In addition Rasinen (2003) in a comparison of six countries found that they were all at different stages of developing their technology education programs.

“Departure points for curriculum planning, the planning process, and the structure of the curriculum differ from one country to another. For these reasons, a single model cannot be applied to each country” (p. 31).

2.2.2 Definitions

It would appear that there is a worldwide common understanding of the term technology in relation to general life but there are different understandings and viewpoints about what counts as technology education particularly in terms of the content to be taught and the

approaches to be followed. From the literature it is apparent that technology as a school learning area (hereafter referred to as Technology) is still ill-defined hence the many different approaches in different countries. The most recent South African curriculum documents defines technology as “the use of knowledge, skills and resources to meet people’s needs and wants by developing practical solutions to problems while considering social and environmental factors” (Department of Education, 2002, p. 37). The Ontario Ministry of Education and Training in Canada defines technology as “both a form of knowledge that uses concepts and skills from other disciplines (including science) and the application of this knowledge to meet an identified need or solve specific problems using materials, energy and tools (including computers)” (1998, p. 3). Jones and Moreland (2002) with reference to the New Zealand technology curriculum interpret technological activities as responses to the identification of some human need or opportunity in which arriving at a solution requires management of time, resources and people. Despite obvious differences in expression these definitions have in common three key points, viz., (a) the use of knowledge, skills and resources, (b) solution of problems and (c) satisfaction of human needs and wants.

In contrast there are many different approaches to teaching the technology learning area which can be investigated in different ways. Pavlova (2005) considers the task of comparing the approaches in different countries as not simple but rather requiring analysis which could take place at different levels such as just comparing curriculum documents to comparison of ideologies underlying the curricula. In this limited review comparisons are restricted to broad approaches. For example Kahn and Volmink (1997) in their analysis provide us with a range of approaches to technology curricula, these being:

- A craft-oriented approach in which students are taught to use tools and materials to make pre-designed objects as is the trend in several Western European countries.
- A production-oriented approach where those skills related to mass production, its control and organization are emphasized, as is the trend in several Eastern European countries.
- A ‘high-tech’ approach where modern technology is emphasized as preparation for work in the 21st century such as in the case of Germany and France.
- An applied science approach used in countries like Denmark where technology is taught mainly within the context of science.
- An STS approach followed in an increasing number of countries, in particular Greece and Canada, where the emphasis is placed on the relationship between science,

technology and society and which sees technological innovation as a driving force for social change.

Kahn and Volmink (1997) further claim that some countries adopt a unique approach from the above approaches to technology curricula, while others incorporate two or more of the approaches at the same time in their curricula frameworks. The point being made is that there appears to be no international consensus as to what counts as technology education. “Technology is the most complex, dynamic and, perhaps, significant of present day curricula”, argues Donnelly (1992, p. 123).

2.2.3 Separate or integrated into science

Whether to have technology in the curriculum as a discipline or learning area all by itself or to incorporate it under the science curriculum is a debatable issue. Technology has been introduced in the South African curriculum whilst this issue has not been resolved among educationists internationally or locally. Benne and Birnbaum (as cited in Gardner, 1994) noted that advocates of a separate science and technology education distinguish between the two fields by focusing upon the differing functions and outcomes; the aim of the scientist being to produce knowledge and that of the technologist to transform knowledge into techniques and artefacts for which there is human demand. Medway (1989) looks at technology as “marked by different purposes, different processes, a different relation to established knowledge and a particular relation to its specific contexts of activity” (p. 6). He asserts that the difference in purposes of science and technology accounts for the difference in processes of the two fields.

On the other hand are advocates of a combined science and technology. Gardner (1994) claims that to some people science-and-technology represents a single concept embracing anything to do with understanding and manipulating aspects of the world. He suggests three possible positions of the relationship between science and technology. Firstly, the *technology as applied science* view, which claims that technological capability grows out of scientific knowledge. Medway is opposed to this position, “Technology cannot simply be the application of science because science does not always supply knowledge in a form which is applicable” (1989, p. 9). He continues; “Technologists do indeed consult formal scientific and other knowledge; reference works are an indispensable tool, but these do not constitute their main source in designing, modifying, fault-finding and evaluating artefacts and systems”. De Vries (2006) is of the same opinion that it is not only the use of scientific knowledge that

informs technological developments but there are other types of knowledge. “The science – technology relationship is more complicated than popular ‘technology as applied science’ idea suggests” (De Vries, 2006, p. 3). Secondly, is the *materialistic* view claiming that technology precedes science, i.e. experience with tools, instruments and other artefacts is necessary for conceptual development. Thirdly, is the *interactionist* view, which considers technology and science as a two-way interaction informing each other in mutually beneficial ways.

Lewin (2000) contends that the early technological innovation occurred before the development of what is now recognized as science. He further claims that, “Later generations of innovation, which resulted in comparative advantages in production, began to acquire the character of designed solutions to well specified problems explored using the intellectual and empirical tools for enquiry associated with science” (2000, p. 2). However, Gardner (1994) asserts that none of the above three positions provides an account of science and technology relationships which holds true for all cases over all historical periods. He therefore claims that each has implications for the content and sequencing of science and technology curricula. For example, the Ontario Curriculum, Grades 1 to 8 (Ontario Ministry of Education and Training, 1998) regards both science and technology as ‘a way of knowing’ and a process of exploration and experimentation. As a result The Ontario Ministry of Education opts for a combined science and technology curriculum and suggests the use of activities that combine the acquisition of knowledge with both inquiry and design process in a concrete, practical context. South Africa has chosen the opposite view, which separates the science and technology learning areas. The view of science and technology thus adopted is the *dermacationist* view, which looks at the two fields as independent, with differing goals, methods and outcomes (Gardner, 1994). Issues like this one persist since technology curricula are new in most of the world countries.

Positioning technology education in the existing traditional curriculum is thus an issue to be handled with caution and its position is likely to undergo change as our understandings change and as different groups hold influence in departments of education responsible for curricula.

2.3 Rationale for inclusion of Technology in Curriculum 2005

According to Taylor and Richards (1985a), “social changes, political revolutions, economic transformations, advances in knowledge and re-evaluations of the past are some of the factors which serve to reshape curricula” (p. 16). As far as the rationale behind the introduction and implementation of new curricula including technology education in South Africa is concerned, it had both economic and political agendas. Medway (1989) claims that three main pressures have led to a new worldwide estimation of the importance of technology education: economic, social and educational with economic being the most powerful. Many of the countries having shown a desire to include technology in the school curriculum have among other justifications, the instrumental ones of promoting economic competitiveness (Kahn & Volmink, 1997). In South Africa, particularly, Ankiewicz (1995) sees the subject “as having a role to play in the social and economic transformation of the country” (as cited in Prime, 2001, p. 16). The inclusion of Technology is seen as a key to economic development and, in countries like South Africa, as part of a cure for economic decline. In the words of Kahn and Volmink, “To introduce technology into schooling, has found a warm reception with the ANC-led government with its own quest for rapid economic growth, and a preparedness to believe that a technology subject in schools will have a strong effect upon future productivity and innovation”, (p. 19).

In South Africa, the curriculum known as Curriculum 2005 because of its terms of implementation, which includes Technology Learning Area, is underpinned by the principles of OBE. OBE changes the focus of teaching and learning. The emphasis is not on covering a given quantity of work, but learning programmes are designed to enable learners to achieve certain specific outcomes. In South Africa, particularly, in the initial document on Curriculum 2005; (Lifelong Learning for the 21st Century) issued by the Department of Education, the following curriculum drivers surface: Firstly, Curriculum 2005 came about to redress past imbalances caused by apartheid – “All South Africans want a prosperous, democratic country, free of discrimination...” (Department of Education, 1997c, p. 2). This is in agreement with Jansen’s observation (1999) that, “In the wake of South Africa’s first non-racial elections in 1994, the new Minister of Education launched a national process which would purge the apartheid curriculum of its most offensive racial content and outdated, inaccurate subject matter” (p. 57). Secondly, advocates of Curriculum 2005 claim that the new curriculum will help boost the economy of the country and thus eliminate unemployment – “Soon all South

Africans will be active, creative, critical thinkers living productive and fulfilling lives. These are the types of citizens who will lead South Africa to great heights” (Department of Education, 1997c, p. 3). Socially, “citizens need to understand technology so as to be able to predict the likely effects of the introduction of system or process, appreciate the restrictions on what particular technologies may achieve and identify problems for which technology might provide solutions” (Medway, 1989, p. 2). Thirdly, Curriculum 2005 is seen as a solution to deeply entrenched pedagogical problems i.e. passive learners to become active learners, rote learning to be replaced by critical thinking, reasoning, reflection and action (Department of Education, 1997c). Unfortunately, the organization and position of South African Technology curriculum is questionable as shown in the following sections.

The danger of the technology curriculum being driven by economic and political factors rather than a philosophical framework is that it “leaves the curriculum development and implementation process open to being shaped by political ideology, by the historical antecedents of the technology curriculum, and by organizational factors such as availability of resources” (Prime, 2001, p. 13). The implication is that each country has its unique approach to formulation of a new curriculum and thus its implementation. This is possibly what happened in South Africa.

2.4 Organization of South African Technology Curriculum

The organization of the technology curriculum within the larger curriculum has in many senses taken the middle ground as far as integration into science is concerned. Technology education is integrated in the intermediate phase (i.e. Grade 4 to 6) into the Natural Science learning area but in Grade 7 (i.e. first grade of the senior phase) it is separated into two distinct learning areas of Technology and Natural Science (Department of Education, 1997b). This is similar to many other countries. When comparing different approaches (Rasinen, 2003) found that in general technology education in the primary school is integrated with science while in the junior and senior secondary schools it is more likely to be taught by specialized teachers. “However, integration among different subjects and the surrounding society seems to be emphasized universally at least in theory” (p. 46). The Curriculum 2005 policy also emphasizes the importance of integrating technology with other learning areas as this is seen as very important implementation strategy. For example in New Zealand over

60% of teachers reported integrating technology with other learning areas as a strategy to implement effectively (Jones, Harlow & Cowie, 2004).

In the curriculum for Technology critical and specific outcomes are listed with the content being organised under general themes; Systems and Control, Structures, Processing and Communication. Unlike some curricula such as the Ontario Curriculum topics are not specified. The onus is upon teachers to decide and develop learning activities to achieve the critical and specific outcomes. According to Mouton et al. (1999) three key types of tasks are employed by technology to achieve teaching, viz.,

Capability tasks – The open ended tasks that require the integration and application of knowledge and skills to address technological problems, needs and wants.

Resource tasks – The short structured tasks that are aimed at developing specific knowledge and skills. Learners are afforded an opportunity to engage in designing and problem solving.

Case study tasks – These tasks are commonly known as market research or surveys. They are used at the introduction stage of a project to set the scene. They should ideally provide an opportunity to examine the social, ethical and environmental issues related to the development of technology and its applications.

It is the responsibility of the teacher to plan and implement similar task in everyday teaching and learning. In contrast to traditional curricula there is no list of content topics that have to be covered.

There are seven critical outcomes, which are very broad and are for the whole phase (Senior Phase i.e. Grade 7 to 9). They are as follows:

- communicate effectively using visual, mathematical and or written presentation;
- identify and solve problems by using creative and critical thinking;
- organize and manage themselves and their activities responsible and effectively;
- work effectively with others in a group;
- collect/analyse, organize and critically evaluate information;
- use science and technology effectively and critically, showing responsibility towards the environment and health of others; and
- understand that the world is a set of related systems. This means that problem-solving contexts do not exist in isolation.

(Department of Education, 1997a)

The critical outcomes are accompanied by specific outcomes, specific to each learning area. For Technology there are seven specific outcomes namely:

- understand and apply the technological process to solve problems and satisfy needs and wants;
- apply a range of technological knowledge and skills ethically and responsibly;
- access, process and use data for technological process;
- select and evaluate products and systems;
- demonstrate an understanding of how different societies create and adapt technological solutions to particular problems;
- demonstrate an understanding of the impact of technology; and
- demonstrate an understanding of how technology might reflect different biases, and create responsible and ethical strategies to address them.

(Department of Education, 1997b)

For each specific outcome assessment criteria, range statements and performance indicators are outlined. Assessment criteria being statements of the sort of evidence that teachers need to look for in order to decide whether a specific outcome or aspect thereof has been achieved, range statements; indicators of the scope, depth and parameters of the achievement, and performance indicators; the more detailed information about what learners should know and be able to do in order to show achievement. For most teachers there is very little perceived difference between assessment criteria and performance indicators. Maybe it is for this reason that the Department of Education decided to come up with the concept of Expected Levels of Performance (ELPs). These seem to wrap up all of the above. It is claimed that the ELPs function educationally to define: the performance required, the level of performance, the scope or parameters of the performance or the evidence required and how much.

Following the preceding description it can be seen that the requirements of Curriculum 2005 include teaching and learning driven by goals (outcomes) specifying the skills, values, knowledge and attitudes to be developed by learners. The attainment of these outcomes depends on the efficient use of specific strategies. The most prominent ones are activity-based, learner-centred lessons in which learners must be allowed to work at their own pace, the use of group work and the use of continuous assessment practices which are an integral part of the teaching and learning process (Pillay & Sanders, 2002). The transformation

demands that people must change from their old practices to new ones that will accommodate the requirements of the new curriculum. The change process is not an easy one but fraught with complexities both theoretical and practical.

2.5 Curriculum implementation

To implement a new curriculum some important steps need to be taken into consideration. There are many different models or frameworks used to understand curriculum implementation. One way to understand the introduction of Technology as a new curriculum is to use the 'objectives' model of curriculum development or design. This model represented in Figure 2.1, the proponent of which is Ralph Tyler, an American curriculum theorist (Taylor & Richards, 1985b) identifies four stages of curriculum construction and implementation, viz., (a) selecting and defining objectives, (b) selecting and creating learning experiences, (c) organizing learning experiences and (d) curriculum evaluation.

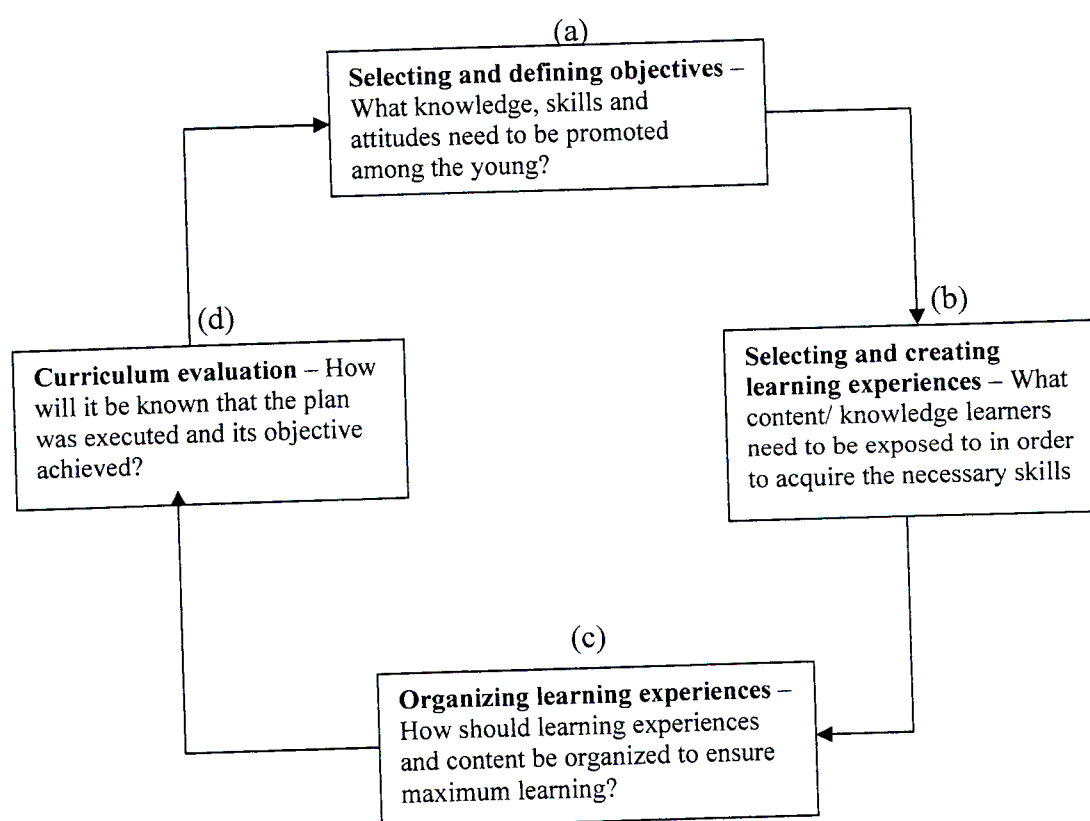


Figure 2.1 Tyler's Curriculum Model

Taylor and Richards (1985b) have elaborated on these four stages. The first clarifies what it is hoped that the curriculum will achieve. Statement of goals referred to as objectives need to be specific i.e. they need to indicate both the kind of behaviour to be developed in the learner and the area of content in which the behaviour is to be applied. In the second stage learning experiences to be offered to children in the light of objectives are selected. In the third stage these experiences are organized to reinforce one another and to produce a cumulative effect. Vakalisa (1994) emphasizes the importance of organizing learning experiences to which learners will be exposed i.e. in an integrated manner to present reality holistically and coherently. They must be arranged in a meaningful sequence that promotes understanding. In the last stage evaluation takes place, which is an examination of the extent to which the objectives are realized in practice thereby indicating the effectiveness of the curriculum. It should be noted that Tyler's model is cyclic.

According to Khumalo (2006) teachers' involvement in the development of a technology curriculum policy is of utmost importance as they are the implementers of the curriculum. In the process of the technology curriculum development and implementation one would expect adherence to the four steps mentioned above or a similar documented process. For example the introduction of the curriculum in New Zealand went through a number of identified steps (Jones, Harlow & Cowie, 2004). A draft curriculum statement was trialed in schools during 1994. A year after i.e. in 1995 a final statement was released followed by full implementation in five years time i.e. in 1999. In 2001 the curriculum review started and it "provided an opportunity for teachers who had been involved in implementing technology in the New Zealand curriculum to share their experiences" (p.4). The period between 1992 (the year in which Technology education policy was first developed) and 1999 (the year in which Technology was firstly implemented) was used for sustained research and development focus to inform the structure of the curriculum, national implementation and classroom practice (Jones & Moreland, 2002). Teachers were involved at many points along the process. According to Hargreaves (cited in Barnes, 2005, p. 7) researchers have found that in the implementation of systemic educational reforms, the attitude of the classroom teacher is crucial in determining the success or failure of innovative curriculum such as Technology.

Unfortunately it appears that in the general implementation of Curriculum 2005 all the steps mentioned in Tyler's model have not been properly taken care of. Chisholm et al., (2000) found that the implementation process "was not always carefully thought through, properly

piloted or resourced and enormous stresses and strains were consequently place on already over-burdened principals and teachers in widely-divergent educational contexts” (p. 4).

2.6 Teaching Practice

The South African curriculum is organized in a way which poses demands on teachers used to a more traditional way of teaching. There are many challenges facing teachers before they can be considered as effective in the outcomes-based style of teaching. Khumalo (2006) notes one challenge as expectation of teachers to denounce teaching practices they are comfortable with whilst at the same time to promote technological literacy. He notes the other challenge as expectation of teachers “to transform learners from passive recipients of technological literacy to active participants in the technological process” (p. 56). Traditionally, teachers are generally used to being the most active members in the classrooms whilst learners are kept passive and mere recipients of information. This according to the Department of Education (1997a) is referred to as active teaching and passive learning as opposed to critical thinking, reasoning, reflection and action on the part of learners. Teachers have for some years in the past used syllabi with content broken down into subjects as opposed to integrated knowledge with learning relevant and connected to real life situations. Assessment has been based on exams instead of continuous. This means that learning has been seen as the responsibility of the teacher, and it depended on the motivation and personality of the teacher. According to the new approach, learners should be encouraged to take responsibility for their learning and must be motivated by constant feedback and affirmation of their worth (Department of Education, 1997a)

According to Jones and Moreland (2004), learning is more effective if the teacher structures information, taking into account the prior knowledge of the learner, monitors learning and provides effective feedback. De Swardt, Ankwicz and Engelbrecht (2006) compare the new approach to learning with two important theories of learning i.e. the constructivist approach and the behaviourist approach. Constructivist approach claims “to be meaningful learning in the sense that it is the active creation of knowledge structures (for example concepts, rules, hypotheses, associations) from personal experience” (p. 5). On the other hand, behaviourist approach to learning among other things, “involves memorization of important information, development of motor skills and understanding of concepts and relationships” (p. 5). The new

approach emphasize the role of the teacher as facilitator of learning which implies less of the behaviourist approach and more of the constructivist approach. Technology teachers have to understand and practise the new approach in order to be considered as effective in their teaching. When focussing on technology education Jones and Moreland (2004) claim that to be effective as a technology teacher one needs to develop three dimensions of knowledge, i.e. (1) knowledge about technology, (2) knowledge in technology and (3) general technological pedagogical knowledge. The importance of the new approaches is emphasised by Ankiewicz, Adam, De Swart, and Gross (2001) who state that if we want to develop the problem solving and critical thinking skills that the new curriculum has the potential to develop then “This makes the call for innovative teaching approaches to technology education a significant one” (p. 190).

2.7 Professional Development of Teachers

Properly planned professional development of teachers is imperative for successful and effective curriculum implementation. Khumalo (2006) states that readiness for teaching technology means more than just advocacy campaigns and information. “It requires mental as well as professional readiness and preparedness because of the paradigm shift that was essentially the purpose of implementing Technology” (p. 60). According to Barnes (2005) “without teacher development there is no curriculum development” (p. 7). The introduction of new curricula creates pressure for schools to align their programmes with those of reform policies. The teacher is crucial for any effective teaching-learning process and thus appropriate training facilities should be put in place in that country (Fabiano, 1995). The point is emphasized by Haney and Lumpe (1995) who contend that teachers are social agents and possess beliefs regarding professional practice and their beliefs may impact their actions. The classroom teacher is the focus of restructuring more so because he or she is the actual implementer of the curriculum. Tobin, Davis, Shaw and Jakubowski (1991) claim that with respect to each practice that is changed the teacher becomes a novice. HEDCOM identified several skills to be developed by prospective technology teachers (Department of Education, 1996b). They may be domain specific or generic and are broadly defined as follows:

- Versatility and discipline in management and organization of various Technology Education–related resources around and within lessons.

- Flexibility within a range of methodologies that allow the teacher to be at home with group and individual classroom contact.
- Practical understanding of the role of teacher as an educator and a facilitator. This as opposed to traditional approaches means that the teacher does not link professional status to always informing learners but allows opportunities to have learners informing each other and locating and utilizing information or skills resources.
- Practical understanding of why and how to link or relate theory with practical, and recognize the relationship between Technology Education and the world of work.
- Evaluation and continuous assessment skills which are not limited to traditional pen and paper testing only.
- Ability to teach problem solving strategies, designing skills, knowledge and understanding related to the field, communication skills, various information skills, planning skills and safety measures.

HEDCOM condensed the above list into four major categories viz., communication skill, methodology skill, classroom management skill and assessment skill (Department of Education, 1996b). Under each skill are several competences, for example, clear articulation of what is taught under the first skill, facilitating learner centred practices under the second, maintenance of good discipline under the third and assessing continuously under the fourth skill (p. 8-12). In order to determine if a teacher is competent to teach technology their competence in each of these skills could be determined. These form the basis for one of the questionnaires used in the study.

The Department of Education (1998a) in its Norms and Standards for Educators has noted that the key educator problem has been identified as one of poor quality, implying that the provision of good education in-service is vital. Professional development programmes should be planned so that they yield the desired goals. The chance of widespread implementation of exciting reforms is minimal without carefully planned professional development programmes. Taylor (1999) through conducting of a survey of some evaluation studies of South African teacher in-service programmes has noted the prevalence of a number of methodological shortcomings. He singles out as the most prominent the heavy reliance on self-report (perspectival) data and a tendency to accept without question that in-service has been successful because of a number of interested participants.

Haney and Lumpe (1995) claim that professional development standards include ideas such as building on teachers' experiences, ongoing reflection and feedback, exposure to resources, support of teachers, learning about how teaching takes place in the classroom and collaborative goal setting and programme development. They regard teachers as critical components in education reform and therefore crucial in the design of professional development programmes. Their point is in line with Clarke's ten key principles for professional development programmes (1994) summarized as follows:

- Address issues of concern and interest recognized by the teachers themselves.
- Involve groups of teachers rather than individuals from a number of schools.
- Recognize and address impediments to teachers' growth at individual, school and district levels.
- Use teachers as participants in classroom activities or students in real situations to model desired classroom practices.
- Emphasize a conscious commitment on the part of the teacher.
- Recognize that changes in teacher' beliefs about teaching and learning are derived largely from classroom practice.
- Provide opportunities for reflection and feedback.
- Recognize the fact that change is gradual, difficult and often a painful process.
- Encourage participants to set further goals for their professional growth.

There is a further outcry that for in-service programmes to be effective, they should inform pre-service training i.e. they should feed their findings into pre-service training in order to cut cycles of weaknesses in teaching and learning (Fabiano, 1995). Adherence to principles mentioned above can enhance organization of professional development programmes that are so crucial to effective implementation of new curricula.

Fortunately effective programmes do exist but unfortunately their impact is minimal on the overall system. Marsh and Shaw (2001) at Rhodes University evaluated the Further Diploma in Technology Education (FDE-Technology) professional development programme for teachers which was delivered through collaboration with ORT-STEP Institute. That is, the Organization for Educational Resources and Technology Training – Science and Technology Project. ORT-South Africa offered a helping hand as early as 1993. The diploma had been established to contribute towards alleviating the scarcity of technological literacy in Eastern Cape Province. The same programme was established at the University of KwaZulu-Natal

through a non-governmental organization called CASME (Centre for the Advancement of Science and Mathematics Education). Note that the diplomas referred to are in-service programmes offered part time to teachers for a period of two years or more. The programme in the Eastern Cape was evaluated and found to have a positive impact on the teachers' practices. Evaluations were done in two ways: (1) teacher appraisals and (2) site visits. Teachers seemed to meet guidelines provided by South Africa's Committee on Teacher Education (COTEP) these being proficiency in the roles of, monitor of learning, interpreter and design of learning programmes and materials, leader, administrator and manager, scholar, researcher and lifelong learner, development facilitator and learning area specialist. However, the small numbers of teachers who have been registered in the past recent years as compared to the number of schools requiring technology teachers is an indication of the minimal impact the programmes have on teacher professional development.

Informed by previous problems, recent models of continuing professional teacher development (CPTD) for technology teachers used by RAUTEC (Engelbrecht, Ankiewicz & De Swardt, 2006) are reported to be showing success. These are the school based and the school focussed models in which training interventions are carried out by higher education institutions funded by trade and industry partners. According to them they "were successful in providing training to educators that addressed their needs and problems, equipping them with conceptual knowledge with regard to the technological themes, procedural knowledge with regard to applying the technological process, and new insight into the instructional methodology of technology" (p. 20). The point is that while previous INSET models have not always shown the success we expected there are newer models based on sound research which are showing promise.

2.8 Resources

For effective teaching to take place resources relevant to the learning area are indispensable. Jones and Moreland (2004) contend that physical resources are intimately involved as "Technology is essentially an activity that involves not just the social context, but also the physical context, with thinking being associated with and structured by the objects and tools of action" (p. 122). There is common agreement in the literature that many factors could be constraints to the effective teaching of technology. These factors vary across education

systems and individual schools and include the numbers, abilities and attitudes of qualified teachers, the availability of printed materials, tools and equipment, and the nature of physical accommodation (Fabiano, 1995; Medway, 1989; Walstra, 2004). In particular for technology education the availability of consumable materials is vital since many activities involve hands on work and are practical in nature. These factors which could constrain the teaching of technology are discussed hereunder with particular reference to the South African context.

2.8.1 Human resource

The crucial position that the teacher occupies in the teaching and learning process has been highlighted in the preceding section. The number of teachers available to teach in a learning area is a critical factor, which determines the teacher/pupil ratio, which in turn indicates the degree to which students are afforded individual attention. Fabiano (1995) asserts that more teachers should be trained in order to reduce the teacher/pupil ratio, which could result in an improved quality of education by creating an environment in which teacher-pupil interaction is meaningful. The requirement of a reduction in the teacher/pupil ratio is of significant importance given that technology learning often requires practicals where the teacher should interact effectively with individual or small groups of pupils (Fabiano, 1995). However, the promotion of the quantity of teachers only at the expense of quality is at variance with the production of quality education. Teacher abilities and attitudes should be taken into consideration. Curriculum 2005 looks at teachers as facilitators of learning, assessors of learning to help learners improve, providers of support, nurturers and guides to learning (Department of Education, 1997a). The point driven at is that just increasing the number of teachers made available for the teaching of Technology is not enough unless these teachers are equipped with the requisite learning area content and skills of delivery.

Professional development of teachers in Curriculum 2005 has been catered for through the Education Policy Reserve Fund, a conditional grant made available to the Department of Education by the Department of Finance, to tackle systemic problems in education (KwaZulu-Natal Department of Education and Culture, 1999). The project began in the financial year 1998/1999. Besides professional development of teachers in Curriculum 2005, the project caters for other transformational initiatives like education management development, school governance, financial management, physical resource packages etc. Leveraging of resources and skills to gain maximum value are stated goals of the project. Teacher preparation and development to implement Curriculum 2005 would according to Chisholm et al. (2000) take

three phases; orientation, training and in-school support. Chisholm et al., (2000) made profound revelations about shortcomings and flaws of the implementation such as:

- Cascade model using trainers of poor quality.
- Shortage of resources to implement training back at schools.
- Redeployment policies affecting teacher morale.
- Very short periods of time allocated to workshops.
- Lack of ongoing support and development of teachers on site.

Overall the critical component of developing the human resources for the implementation of technology education was not done with much success.

2.8.2 Printed teaching and learning materials

Fabiano (1995) asserts that technology curricula used in African schools have either been adopted or adapted from curricula used in Europe. In cases where a curriculum has been adopted, the textbooks and other learning guides have been adopted too. In cases where a curriculum has been adapted, new textbooks and other learning guides have had to be written. However, in both cases provision of textbooks, teacher guides and other reference materials has not been easy. Fabiano attributes this state of affairs to a number of factors; quality of teachers in the schools, overloading which leaves very little time for creativity, lack of active science associations, lack of moral support by ministries of education and insufficient funds available to schools to buy books.

The South African Government has in its national and provincial levels of government undertaken to honour the state's duty, in terms of the South African Schools Act, Act 84 of 1996, to progressively provide resources to safeguard the right to education of all South Africans (Department of Education, 1998b). Seeing that educational needs are always greater than the budgetary provision for education, the South African Schools Act imposes a responsibility on school governing bodies to do their utmost to improve the quality of education in their schools by raising additional resources to supplement those, which the state provides from the public funds. The onus is upon the learners' parents to decide what additional revenue the school needs for educational purposes, and how that revenue is to be raised, including whether or not fees are to be charged. However, it is obvious that those schools in poor areas disadvantaged by past funding policies will continue to be poorly resourced for technology education as they are unable to raise the funds from surrounding

communities. The extent to which these proposals meet with the equitable provision of resources in all schools is thus suspect.

2.8.3 Laboratory space, equipment and consumable material

Many of the concepts and principles in science and technology education are better understood through observation during a lesson or practical work by pupils (Fabiano, 1995). Certain minimum floor space, quantities of equipment and other consumables are needed for one school to do demonstrations or learner experiments effectively. Walstra (2004) came up with a table of equipment required for the teaching and learning of Technology as specified in the current curriculum by a group of 24 learners. For each item the number required in an ideal situation i.e. if cost is not a problem, the number necessary for implementing most activities, the number needed and the number suggested for small group-work in a classroom (about 6 learners) is provided. It is obvious from the list that the majority of items are not standard items that would be found in rural schools. They will need to be specially obtained for the purposes of teaching technology. Unfortunately schools are not provided with similar lists indicating what will be provided by the department and what they need to obtain. Though the state takes it upon itself to provide sufficient school places for every child in the compulsory attendance bracket i.e. Grade 1 to 9 (Department of Education, 1998b), it does not particularize provision of laboratory space to all schools. Finance for equipment and consumables, is available to schools through Norms and Standards for School Funding as for teaching and learning materials in the preceding paragraph. Much as laboratory space, equipment and consumables are needed in the teaching and learning of technology, there appears to be more emphasis on investing heavily on teacher training workshops so that teachers can be trained to use available resources effectively. Naidoo and Lewin (1997) warn that improvement of teacher performance should take first priority to expanding access to resources. However, training to use resources which do not exist and are unlikely to be freely available is problematic. It is clear that a balance between the two should be sought.

2.8.4 Funds

One would notice that in discussing all the other resources it became impossible not to allude to the financial resource since it impacts upon all others. If we accept that education is an investment for the country it is correct to say that before any fruits can be reaped, the state must invest in education generally and in technology education in particular. Fabiano (1995) warns that excessive funding of education may not necessarily produce the best results out of

an education system. This calls for proper and informed decisions on the part of education planners as to what percentages of the financial resources will be suitable for professional development programmes of teachers, printed and learning materials, equipment and consumables and provision of laboratory space.

2.9 Summary and current focus

Due to the fact that technology education is new in many countries and that different opinions exist about what should be entailed in technology education, different countries approach technology curricula in different ways. South Africa has opted for separate technology learning area in the senior phases within Curriculum 2005. There is a tendency to emphasize the importance of technology education in a developing country like South Africa instead of taking more consideration of preparedness to implement. The organization of the curriculum itself puts a burden on the teachers more especially those used to a traditional way of teaching to plan activities suitable for learners to attain specific outcomes (learning programmes). Curriculum development requires that certain steps be followed to ensure proper curriculum implementation. Intensive retraining of teachers is a necessary factor contributing to successful and effective curriculum implementation. Professional development programmes for teachers should be carefully planned to yield required results. Provision of resources, be they human or physical, are imperative for successful curriculum implementation.

The foregoing review highlights that there are many factors that can influence the teaching of technology as a new learning area within our curriculum. In particular it was seen that resources in the form of human and physical could be major constraints to the effective teaching of Technology and this forms the focus of the study. Consequently, looking at current practice in schools among others we need to know whether; enough resources have been provided to enable implementation; how and to what extent teachers have been prepared as implementers of the curriculum; teachers' attitudes to technology education and the place it should have in the new curriculum.

This particular study has much in common with a study by Mouton et al. (1999). The main difference is that the study carried out here deals with schools functioning generally under normal conditions whereas Mouton et al. (1999) targeted schools that were involved in a

specific Technology 2005 Project. It was a pilot project prior to the countrywide implementation of Technology. Although originally the project was to be trialled in all the nine provinces of South Africa, the teacher training aspect of the project was only completed in Gauteng, KwaZulu-Natal and Western Cape. An implementation evaluation study was therefore carried on these three provinces. Specific schools had been supplied with some instructional materials and physical resources for the technology curriculum. The study therefore looked at teacher attitudes towards instructional materials and resources. Aspects such as appropriateness to grade level, appropriateness of language, appropriateness of format, appropriateness of scope and appropriateness of sequence were incorporated. As for resources, questions of insufficiency only arose in the context of large class sizes. Teachers involved in the project were afforded training through either OrtStep or Provincial Task Teams (PTT's) allowing all to start teaching with similar technology training. In the present study not all teachers have received training nor have schools received equipment and materials. It looks specifically at the implementation of the new technology learning area in a group of normal government schools in more detail with emphasis on the constraints to effective teaching of Technology.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The study set out to address the following key question: What constraints are experienced by Grade 7 teachers to the effective teaching of Technology? In the process of operationalizing this general research question (Cohen, Manion & Morrison, 2000, p. 75), a number of specific research questions were generated. These questions focus on the main issues that constitute the key aim of the research and lend themselves to being investigated in concrete terms.

Specific question 1: Are there relevant physical resources available for the teaching of Technology in schools?

Specific question 2: Do teachers possess the required skills to teach Technology?

Specific question 3: Are teachers' understandings of the Technology Learning Area similar to official department policy?

Specific question 4: What attitudes do teachers have towards the new Technology Learning Area?

The study was approached within a post-positivist/realist paradigm. Realism as a philosophical paradigm recognizes the differences between perceptions and reality, and the need for researchers to interact with the participants to understand their perceptions, and so try to reach a partial understanding of the reality itself (Krauss, 2005). Within a realism framework both qualitative and quantitative methodologies are seen as appropriate. In this study a pragmatic, mixed method approach to research (Johnson & Onwuegbuzie, 2004) was consistent with the purpose of the research and was adopted. This means that the combination of methods and instruments that worked best for answering the research questions was used leading to the collection and analysis of both qualitative and quantitative data.

The above questions dealt with the description of the current situation in the teaching of Technology. There are a number of research methodologies used by educational researchers depending on what is required to answer their research questions. For example two approaches are historical research involving systematic and objective location, evaluation and synthesis of evidence in order to know conclusions about past events, and correlational research where the researcher attempts to establish the inter-relationships among variables

(Beard, 2001). Given the above research questions which focus on describing and evaluating existing conditions in schools, a descriptive case study methodology (Yin, 2003) was chosen as the most appropriate for answering the research questions.

Bassey (1999) writes that an educational case study is an empirical enquiry which is “conducted within a localized boundary of space and time (i.e. a singularity); into interesting aspects of an educational activity” (p. 62). He also sets out a number of descriptors of educational case study such as, “sufficient data must be collected for the researcher to be able to explore significant features of the case and to create plausible interpretations of what is found” (p. 62). It is felt that this study has sufficient characteristics in common with Bassey’s descriptors that it can be described as a case study. This study fits under the group of case studies, referred to as picture drawing by Bassey and a descriptive case study by Yin (2003), involving a descriptive account and drawing together of the results of the exploration and analysis of the case. It is set out to both describe and interpret what is happening with respect to the teaching of Technology in a particular school district so that others may make value judgements about the worthwhileness of the case description provided. The expected endpoint is that others, such as policy makers or subject advisers will use these findings to decide whether or not to try to induce change in this and similar situations.

The sections that follow indicate how the case involved in the research was chosen, the methods of data collection utilized, description of research instruments, the data corpus (Gallagher & Tobin, 1991) and how the data were analyzed.

3.2 The case

According to Merriam (1988) the unit of analysis or the case can be a number of things such as an individual, a programme or an institution. Merriam indicates that the case is “what the researcher wants to be able to say something about at the end” (p. 44). In this study, the case is defined as the schools teaching Grade 7 Technology in a district. At the start of the study, the Technology Grade 7 teachers in a particular district were targeted. The district can be described as a semi-rural district (HSRC, 2005) with the vast majority of schools being defined as rural however with some schools close to urban centres and one or two close to a large town. It is difficult to determine the representativeness of the district. However, personal experience has shown that there are many similar constituted districts in the KwaZulu-Natal

educational department. This district was one of several districts comprising a broader educational Region. It consisted of 94 primary schools offering the Technology Learning Area in Grade 7. The district was chosen for two major reasons. Firstly, because it is where I detected some schools (mine included) showing some form of shortcomings in the implementation and teaching of Technology. Secondly, it is my workplace and therefore I had easier access to the district office and the schools themselves. During the period between August 2002 and August 2003 while still collecting data, KwaZulu-Natal Department of Education underwent restructuring. Regional and district boundaries were demarcated anew. This resulted in districts becoming broader such that they in turn were subdivided into circuits. What used to be district offices became circuit offices that managed a fewer number of schools. The district in which the study was started, was renamed to a circuit of 64 primary schools all offering tuition in the Technology Learning Area. These schools were all in the original district which remained the focus of the study. The balance of the schools were allocated to another circuit and were no longer considered. This change had little effect on the study except to change the total number of schools in the case and change the terminology from district to circuit.

3.3 Instruments of data collection

In order to obtain the descriptive data required, a survey questionnaire was used of all the teachers from the schools which were part of the defined case i.e. those in the district teaching Technology in Grade 7, followed up with selected interviews with students and teachers and also some classroom observations of technology lessons. Consequently, three instruments of data collection were used viz., questionnaires, classroom observations and interviews, which are described in detail below.

3.3.1 Questionnaires

The first instruments of data collection were questionnaires, which had the advantage that information would be collected from a large number of teachers in one fell swoop (Munn & Drever, 1990). A questionnaire survey allowed data to be gathered at a particular point in time allowing for the nature of existing conditions for teaching Technology to be described. One potential problem recognized was that I knew most of the teachers and they knew me and as a result they might be less likely to be frank with me if I was interviewing them. It was hoped

that the use of questionnaires might encourage greater honesty, though it could happen that dishonesty and falsification might not be discovered (Cohen et al., 2000). One other advantage of using questionnaires was that they were economical (Cohen et al., 2000) as they would save in terms of time and money. Overall it was decided that the provision of information anonymously via questionnaire was the only option given the resources available for the study. Through this method of data collection, a large number of schools (94 altogether) could be potentially reached, given the time I had at my disposal. A large coverage of population could be realized with little time and cost (Bless & Higson-Smith, 2000).

I began my field research in the beginning of August 2002. In order to save time, I started by adopting research instruments that had already been extensively used by Mouton et al. (1999) in an implementation evaluation study. I used two questionnaires one called "Form A: Teacher Profile Questionnaire" (appendix 1) and the other called "Form B: School Profile questionnaire" (appendix 2). The former form sought to find out about age, gender and home language of the teacher. It required the teacher to furnish his or her pre-service and in-service Technology training and general experience in teaching the subject. The latter form was meant to elicit information regards learner population of schools and condition of physical resources classified as classroom facilities, administrative facilities, educational facilities, recreational facilities and infrastructure.

The problem of there being no opportunity of negotiating of meaning of any questions found ambiguous by the respondent (Munn & Drever, 1990), was minimized by piloting the questionnaires with a teacher in my own school and three other Grade 7 technology teachers in the neighbourhood. This was done to refine the contents, wording, and length of questions to make them appropriate for Grade 7 technology teachers and remove any potential ambiguity. The teachers filled in the questionnaires and returned them. They indicated that they needed only a few minor explanations here and there. For example, one did not understand the meaning of INSET and PRESET. These were explained and I decided to write these explanations in brackets in the questionnaires. Otherwise the teachers reported that they completed the questions with ease and consequently no major changes were required to the questionnaires.

Initially all schools were furnished with Form A and Form B for Grade 7 technology teachers to complete. Each school in this district had a pigeonhole located in the district office. Any

information to be passed to schools or any other material supposed to reach schools, is put in these pigeon holes for collection by principals of schools. I negotiated with the District Manager to allow me access to these pigeonholes. I put Form A and Form B in the pigeonhole of each school offering Technology Learning Area. The covering letter requested principals of schools to return completed questionnaires to the receptionist at the office on or before the last day of August 2002. It also contained a statement assuring respondents of the confidentiality of names in the questionnaires and that they would only be used for identification purposes and not for publication.

Initially out of the 94 schools furnished with questionnaires, only 20 responded. On probing further by writing letters to the principals of schools concerned and extending the date to the 15th of September, I got nine more. As a result, schools returned 29 questionnaires. This low return was expected as Bless & Higson-Smith (2000) points to a couple of disadvantages of mailing questionnaires, one being a low rate of returns. They attribute a low rate of returns to a number of factors like respondents not receiving the questionnaires because of some reasons, such as poor mail service, lack of interest, etc. Some of these reasons could be the cause of the low rate in this study. However, I did receive replies from 31% which is a percentage within the parameters of 20 to 40% of questionnaires that are usually returned according to Bless & Higson-Smith.

On scrutinizing the above forms in relation to my research questions, it became clear to me that they either contained questions eliciting extra information not related to my research questions or did not give information that I now realized after completing my literature review would be required to answer my research questions. Taylor and Vinjevold (1999a) assert that, "The first and most obvious requirement of any research instrument is that it must fit the purpose of the research: it must elicit the information required to illuminate the research question." (p. 91). The two studies, Mouton's et al. (1999) and current study though related in the sense that both sought to elicit information about teaching and learning of Technology, differed in many factors particularly in the data collection techniques. The questionnaires did not elicit information about resources specifically used in Technology lessons, and the storage and use of these. These had been catered for in the Teacher Interview Schedule (Form C, appendix 3) and the Classroom Observation Schedule (Form D, appendix 4). While all teachers in his study were observed thus obtaining this information only a few selected teachers in the current study would be observed. Thus information about technology teaching

and resources would be missed from all those not observed. In addition, Mouton's questionnaire instruments obtained information on the school learner population and even the recreational facilities which I considered irrelevant to answering my research questions. Also the questionnaire did not specifically ask about possible constraints or ask for detail about teacher skills. I therefore decided to construct new questionnaires more relevant to my research questions to augment the original instruments.

The outcome was the production of five new forms; Forms 1A, 1B, 2, 3 and 4. Form 1A is a questionnaire on physical resources utilized in a technology class (appendix 5), Form 1B is a questionnaire on professional development of technology teachers (appendix 6), Form 2 is a skills competence checklist (appendix 7), Form 3 is about Technology learning area understanding (appendix 8) and Form 4 is a questionnaire on attitudes (appendix 9). Form 1A, Form 3 and Form 4 contained open-ended questions. The questions afforded teachers an opportunity to give reasons for their choices. The questionnaires reached teachers in the same fashion as the initial batch. This was done in August 2003 to the 64 schools now allocated to the circuit. Out of these schools 20 responded which was a similar response rate to the initial questionnaire.

3.3.2 Classroom observations

To ensure the validity of data collected, triangulation became imperative. This is the use of two or more methods of data collection in the study of some aspect of human behavior (Cohen et al., 2000). The questionnaire survey of the teachers was followed by classroom observations of Grade 7 technology lessons in carefully selected schools. How these schools were selected is explained in the next paragraph. The main reason for doing classroom observations is best captured in the following quotation by Taylor and Vinjevoid:

Classroom observations can provide an enormously rich source of data about general conditions in schools, teaching methods, the quality of learning taking place, the use of equipment and materials, and the relationship between the forms of teaching and learning behaviours and their outcomes. (1999a, p. 91)

I planned to visit selected schools based on their general physical resource situations which I thought would be one of the major constraints to implementing the curriculum. I completed a preliminary analysis of physical resources as contained in form B for each school. I classified schools in three broad categories based on my analysis of resources as indicated in the

questionnaires, my personal experience in my own school and on the analysis of the curriculum documents. These categories were:

1. Schools with very few resources available for the teaching of Technology.
2. Schools with a satisfactory number of resources available for the teaching of Technology.
3. Schools with adequate resources available for the teaching of Technology.

From each of the above categories I randomly chose one teacher from each of three schools for classroom observations and conduction of interviews. Choosing three schools from each category meant that I would travel to nine schools both beforehand to make arrangements and again on the actual day of observations. This was the limit of my resources but I felt these visits would provide sufficient information to aid my analysis.

I negotiated with principals of schools and their technology teachers before the actual observations were performed. This was an attempt to obtain genuinely informed consent which according to Erickson (1998) reduces the risk of social harm as dignity is affirmed and agency respected of those who will be involved in the study. We set the dates and time of visits. Teachers were also informed that after observation they were going to be interviewed on some issues related to their understanding and attitudes towards the Technology Learning Area. I was a non participant observation and recorded events as observed by the outsider (Bless & Higson-Smith, 2000). During each visit, I completed Form D, the Classroom Observation Schedule (appendix 4) as I observed the lesson in progress. Each of the nine teachers that were observed in class was individually interviewed for plus or minus 30 minutes.

3.3.3 Interviews

Interviews have an advantage over postal questionnaires because of greater flexibility and ability to extract more detailed information from respondents. In addition, the interviewee gets a chance to find out more about the interview itself and can get explanations to some questions concerning misunderstandings experienced (Cohen et al., 2000). After observation of each lesson as mentioned above I sat with the teacher and asked questions as they appear in Form C, the Teacher Interview Schedule (appendix 3). I used a structured interview with the questions prepared beforehand informed by the responses to the survey questionnaire. A schedule of questions both short and direct (Cohen et al., 2000) was prepared with a space below each question to record the interviewee's response. Responses were recorded by taking

notes verbatim while the interview was taking place. It was not easy to write as fast as the interviewee was talking, but I wrote key points. Unfortunately respondents did not want to be audio taped. Later I summarized the response to each question posed. The type of data collected in relation to research questions is summarised in table 3.1

Table 3.1 Relationship between research questions and type of data collected

Instrument	Question 1 Are relevant physical resources available?	Question 2 Do teachers possess the required skills to teach Technology?	Question 3 Are teachers' understanding of Technology Learning Area similar to official departmental policy?	Question 4 What attitudes do Teachers have towards Technology Education?
Questionnaires version 1	School profiles 29 schools &	Teacher profiles 29 schools		
Questionnaires version 2	20 schools	20 schools	20 schools	20 schools
Classroom Observations	9 lessons of about 1 hour each	9 lessons 1 hour each	9 lessons 1 hour each	9 lessons 1 hour each
Interviews	9 teachers for 30 min each	9 teachers for 30 min each	9 teachers for 30 min each	9 teachers for 30 min each

3.4 Analysis of data

The information collected through Form B (School Profile Questionnaire) was captured and summarized in a spreadsheet allowing me to visually compare schools with regards to the availability and condition of physical resources. This enabled me to categorize schools in relation to four groups of facilities viz., classroom facilities, administrative facilities, educational facilities and infrastructure. The same method of summarizing data with a spreadsheet was used to compare teachers with regard to their ages, gender, home language, qualifications, training in technology education and their experience in years. This information was collected through the use of form A (Teacher Profile Questionnaire). The spreadsheets produced descriptive data summaries presented as tables in the next chapter.

I analyzed interview data and open-ended questionnaire data from the second set of questionnaires in a similar manner to that outlined by Hobden and Lewy (1992). I read all first responses one at a time from each interview schedule or returned questionnaire and then all the next responses again one at a time. I coded and grouped responses that had the same idea. This process was both deductive based on expected categories mentioned in the literature and inductive in response to new categories that arose from the data. The last stage was to create a qualitative summary of the ideas and formulation of evaluative statements which formed the basis of my assertions (Gallagher & Tobin, 1991) which were the answers to my research questions.

CHAPTER 4

RESULTS, ANALYSIS AND DISCUSSION

In the previous chapter the specific research questions were stated, the approach to answering the questions was justified and the various data collection tools were described. In this chapter the findings of the study are reported under four general headings or themes which are linked to the four specific research questions that this study was attempting to answer namely physical resources, teacher professional development, teacher understanding of technology education, and teacher attitudes towards implementation of Technology as a learning area. Under each theme an assertion is made to address one of the research questions (Gallagher & Tobin, 1991) and backed by evidence from data collected from the questionnaires, classroom observations and interviews.

4.1 Physical resources

ASSERTION 1: In most cases, schools do not have the specific resources required for the teaching of Technology in Grade 7. While most had general physical school infrastructure this was not always in a good condition.

Physical resources were classified into two very broad categories i.e. general physical resources in the school for teaching and learning as a whole and resources specifically employed for effective teaching of Technology. The general resources category was further classified into classroom facilities, administrative facilities, educational facilities and infrastructure. It was assumed that these facilities indirectly influence any teaching and learning in a school and consequently would influence the teaching of technology. The specific resources for technology teaching refers to resources used in a technology class (Walstra, 2004) such as tools (screwdrivers, hacksaws, knives, etc.), equipment (G-clamps, gears, pulleys, etc.) and materials (plastic, wood, paper, etc.). For each item under subgroups of the general resources teachers had to indicate whether they are available or not and if available, to indicate the condition of resource. The result of the analysis is presented in Table 4.1.

Table 4.1 Availability and condition of general learning and teaching resources

Facility	No of schools with facility	%	Condition of facility					
			Poor		Fair		Good	
			No. of schools	%	No. of schools	%	No. of schools	%
Classrooms	29	100	8	28	10	34	11	38
Desks	29	100	10	34	11	38	8	28
Writing boards	29	100	10	34	7	24	12	41
Display area	8	28	2	25	2	25	4	50
Teacher's table	23	79	6	26	9	39	8	35
Teacher's chair	26	90	7	27	9	35	10	38
Cupboard	10	34	4	40	2	20	4	40
Textbooks	29	100	11	38	8	28	10	34
Stationery	29	100	11	38	8	28	10	34
Writing aids	29	100	11	38	8	28	10	34
Science corner	6	21	1	17	3	50	2	33
Electricity	7	24	0	0	0	0	7	100

Looking at the schools as a whole it appears that while some particular resources for teaching and learning were not available, most of the others were present but not always in a good condition. From this table it can be seen that in general the schools had adequate desks, writing boards, textbooks, stationery and other writing aids although according to respondents some of these resources were not in a good condition. Only a third of the schools had cupboards, which implied a shortage of storage facilities identified earlier as essential for storage of technology related resources. Dedicated display areas and science corners were rare which should be used to display learners' technology projects. The reason could be that there was not enough room in the classrooms to provide such facilities given large numbers of desks because of large classes. When teachers were asked in a subsequent questionnaire about the storage of products from Technology lessons, 13 teachers claimed to store them in classrooms either in the corner in boxes or in cupboards. One teacher claimed to keep them in the office and another in the staff room. Five claimed that they have no space for technology

products and thus dispose of them immediately as one teacher stated, “We display them a short while in the classroom for evaluation and give them back to the learners to keep at their homes because we do not have enough space at school”. The implication is that both resources for making artefacts and finished technology products had a limited space for storage due to shortage of storage facilities. This should be of concern as it is recognized as a constraint to teaching Technology. Mouton (1999) reported that the teachers in his study indicated that when they left technology resources in their classrooms because they did not have dedicated storage for tools etc. that some of them went missing (p. 40).

The basic infrastructure facilities linked to the teaching and learning of Technology researched were classrooms and electricity. All the 29 schools (100%) claimed to have adequate classrooms for the teaching of Technology. Of these, 38% are reported to be in good condition, 35% fair and 28% poor. The implication is that all Technology learners have accommodation though some of the classrooms may be dilapidated. What was significant was that only seven (24%) of the 29 schools had electricity. Therefore many of the schools were not in a position to make use of electrical appliances often used in technology teaching (Walstra, 2004) except for those that might have had generators. It could be for this reason that other educational facilities like computers, VCRs, TVs and radio, overhead projectors and photocopiers indirectly linked to the teaching and learning of Technology are scarce as Table 4.2 shows. Only five schools had an OHP and only seven had duplication facilities something needed to supply groups or individuals with learning materials unless the schools were supplied with texts and sets of materials which was not the case in this district.

Table 4.2 Availability and condition of educational facilities indirectly linked to the teaching of Technology

Facility	No. of Schools with facility (n=29)		Condition of Facility					
			Poor		Fair		Good	
	No.	%	No. of schools	%	No. of Schools	%	No. of Schools	%
Computers	2	7	0	0	1	50	1	50
VCR, TV, Radio	6	21	2	33	0	0	4	67
OHP	5	17	1	20	1	20	3	60
Photocopier	7	24	0	0	4	57	3	43

The general poor condition of physical resources in some schools, reported by teachers in the questionnaires, was confirmed through observation during school visits. The conditions varied drastically between the nine schools visited. In the worst school the Technology classroom (used for other learning areas as well) had either missing or cracked windowpanes. Given that there was no fence around the school this was most likely due to vandalism. With broken windows there was no control of ventilation in the classroom and I suspected that the learners suffer from cold during winter periods. The position of windows i.e. being on the ground floor and level with the ground, appeared to contribute to a lack of concentration by learners. When I observed a lesson in this class they could not resist the temptation to look outside these windows as they were frequently disturbed by outside movement. The walls had old paint and were scratched. There were 49 learners present on the day and three were absent. Their desks (double desks combined) were arranged such that they sat in groups but the desks were inclined so they did not form a good combined working surface. It was difficult to move them around and there was limited space for the teacher to move through. The standard size classroom was too small to accommodate 49 learners sitting at desks and there was no electricity. In short the entire situation was very un conducive to effective Technology teaching and learning.

By comparison the best school was a former Model C school. The school had electricity and reasonable high net wire fencing. There were no signs of vandalism. The technology classroom was on the second floor of a double storey building. There were small windows at a higher position on the wall and these were either opened or closed to regulate ventilation. This configuration seemed to enhance concentration because learners could not look out of the windows. Though light came in through windows, extra lights were provided. It had well-painted walls with oil paint. Learners sat on chairs, two per flat table. The classroom was large enough to allow freedom of movement in the class. There were 38 learners altogether. The physical environment was in my opinion much more suitable for effective teaching and learning of Technology.

When I questioned teachers during their interviews about the specific resources required for teaching Technology they had strong feelings about the availability of resources used. Six of the teachers who were interviewed raised serious concerns about their shortage as the following statements indicate: “We don’t have adequate teaching resources, in fact we have

books only, and then we improvise”; “We are short. Lack of resources makes the teaching of this learning area a major problem”; “We do not have any resources at this school. It would help greatly if we had our own physical resources such as gears, pulleys, cranks, etc”. Two teachers stated that they had some of the required resources for teaching of technology. “I do have some of the resources although they are not enough”; “ I think the school is trying its level best to provide us with resources such as glue, pair of scissors and charts”. Only one of the nine schools visited claimed to have enough resources as the teacher responded, “Yes, we do have resources. We do have books and kits supplied by the ex department as early as 1988”. This was most probably one of very few schools supplied with resources to teach a subject called Design and Technology in the 1980s but subsequently stopped when the new curriculum was introduced.

Further information about availability and storage of resources for Technology and products was obtained from the second set of questionnaires to which 20 schools responded (Appendix 5). Teachers were asked to rate their schools as poor, fair or good at providing resources needed in a Technology class. Teachers were also asked to rate the availability of waste material in the immediate school vicinity that could be used to teach Technology. This was asked as teachers in the Mouton study had indicated that this might be a solution to a lack of resources i.e. use easily available waste materials (Mouton, 1999, p. 40). Nine teachers indicated that their schools had poor provision of Technology resources, ten claimed to have a fair provision of resources by their schools and only one claimed that his school was very good at providing the resources. These results were very similar to those found in the interviews.

About availability of waste material, seven teachers indicated poor availability; eleven indicated fair and two indicated good availability. The eleven teachers claiming a fair availability of waste material attributed the shortage to the location of their schools as indicated by the following statements: “The school is situated in a very disadvantaged area, rural, far away from town. Even if children have to research; it’s hard for them”; “We mostly get natural resources like grass, wood, soil, etc. It is very difficult to get processed resources like tins, newspapers, cardboards, etc. whereas these are the most useful resources”. Only a small number of schools claimed to get some waste material like cardboard, wires, old newspapers, old magazines cans, posters, planks, etc. from their immediate vicinity. Teachers said they had found these materials useful in designing and making products. This adds

support to the comments made by teachers in the Mouton study who indicated that waste materials were a good resource. However, it also indicates that where waste materials are not available this is a constraint to effective teaching.

According to Walstra (2004) technology teaching will succeed only if among other things facilities and equipment needs are considered. Mouton et al. (1999) made similar findings that there existed school-specific obstacles to effective teaching such as the need for appropriate space for Technology, money for resources, and secure and accessible storage facilities. Despite being supplied with equipment and other resources in this Technology project, teachers still felt constrained in their teaching because resources were not delivered on time and were sometimes inappropriate for the projects being done and they did not have storage facilities. Further a submission by Sol Plaatjie Primary School to Chisholm et al. (2000), asserts that historically disadvantaged schools do not have resources like paper, photocopying facilities and other technologies of teaching to implement Curriculum 2005 effectively and in particular Technology as well. Given what has been reported in this study about the resources available it is obvious that many if not most of the schools constituting this case study found the lack of both general resources for teaching and learning and specific resources for technology teaching a severe constraint to the effective teaching of Technology.

4.2 Teacher professional development

ASSERTION 2: Teachers do not have many of the skills or competencies required to teach Technology. The majority of teachers who had been assigned to teach Technology had not received sufficient training. Where some training had taken place, the majority found it not very useful.

In providing evidence for the above assertion I have started by outlining the teachers' profile, following with a description of their involvement in professional development programmes and of their reported skills of teaching Technology.

4.2.1 Teachers' profile

Of the 29 teachers who responded to questionnaires 19 were males and 10 were females. Fifteen had their home language as IsiZulu and five were English first language speakers with

nine not indicating a language choice. The majority appeared to be mid career with their ages ranging from 26 years to 49 years. The majority (19) fell in the age range 30 to 39 while four were younger and six were older with no teacher over 50. Only a small proportion of the teachers could be considered professionally qualified to teach Technology. For example, only 20% (6) teachers even had qualifications involving Technology. One teacher had a welding certificate, a second had NTC 3 and a third had a University of South Africa certificate. The other three teachers possessed a Senior Primary Teachers Diploma in Technology (SPTD – Tech). The rest i.e. 23 teachers, had no Technology qualification of any description. The teachers' experience in teaching Technology ranged from one to four years but their general school teaching experience ranged from two to 26 years. While the majority only taught one grade there were many who were teaching a number of grades. There were 17 teachers who taught Grade 7 only whilst 12 taught Technology in other grades as well i.e. Grades 4, 5 and 6. Those teachers who taught Technology in other grades as well were in general those who were more qualified in Technology.

There were very few teachers who had undergone pre-service training in Technology. Those who had were the young teachers whose ages ranged from 26 to 29 years. The rest of the teachers were older and had had some time as teachers in other subjects. Similar findings have been made in a study by Makgato, Khumalo & Mafisa (2006) in schools in the Gauteng province. Educators held the opinion that they were not ready at the time of Technology implementation and had minimal or no qualifications in Technology. “Educators with Mathematics, Science and Home Economics backgrounds were assigned to teach Technology” (p. 91). The fact that so few teachers were trained as Technology teachers is an obvious constraint to the effective teaching of technology in this district.

4.2.2 In-service Professional Development Programmes

Only six teachers had some experience of in-service training in Technology. Three of these teachers had been involved in workshops that dealt with materials development, two had been involved in a workshop of designing technological products and one had been involved in-service professional development programme called Itlatloga Project dealing with Mathematics, Science and Technology, organized by a non-governmental organization. Twenty-three teachers had only been involved in departmentally organized general workshops in Outcomes Based Education lasting for periods not exceeding one week. These workshops involved skills development, materials development, assessment, planning, timetabling and

organization of learning activities and only a few having a bearing on Technology. When teachers were questioned about the usefulness of these workshops 14% found them helpful, 21% found them moderately helpful and 57% found them not very helpful. (Some teachers did not respond.) This is an indication that something needs to be done to make in-service programmes more helpful. Most teachers attributed the unfruitfulness of workshops to a lack of matching the activities to the resources available in their schools. "It was useless to design and make bridges when we do not have the same material to do likewise in our schools". Some found discrepancies between activities in workshops and what they actually teach in their schools. "Most activities were not relevant to what I teach". A few felt the time allocated to the training was far too short: "Time was just not enough". However, one teacher who had been involved in the Itlatloga Project claimed to have been exposed to a very useful professional development programme. She boasted that the Mathematics, Science and Technology programme had helped her a lot "because it demonstrated the link between the three" and taught her "how to use more of the waste as resources for Technology".

Teachers made some recommendations that more departmental workshops be run e.g. "Professional development programmes in Technology is still a must for most teachers as this is a newly introduced learning area". Some teachers recommended an extension of time allocated to workshops, e.g. "two weeks to one month so that they are more useful". Others recommended that professional development programmes be done more frequently "at least once in a quarter". This recommendation was similar to that made by teachers in the Mouton study (1999) where over 60% of teachers wanted more INSET as they considered it as "absolutely essential and lesser amounts of training would not be acceptable" (p. 54).

From submissions to Chisholm et al. (2000), it surfaced that although new learning areas like Technology had been introduced to teachers in workshops, there was no attempt to adequately train teachers in the knowledge and skills aspects of the new learning areas. Teachers had just been orientated to the general curriculum, instead of being developed in their skills specific to their learning area. This is in contrast to implementation strategies in other countries such as New Zealand from which many of our outcomes based curriculum ideas originate, the teachers in the current study report little professional support. According to Jones, Harlow and Cowie (2004) over 75% of New Zealand technology teachers were given training in Technology skills. In addition they received a regular newsletter with ideas for implementation and "Know How" materials and tapes (p. 110). Unfortunately in the current

study this was not the case, with there being reported a lack of initial training, INSET and follow-up professional support for the teaching of technology which was obviously a constraint in this district's schools.

4.2.3 Teacher Skills

During my observations in schools I observed nine lessons in progress which gave an indication of the type of skills that technology teacher's were able to display in their classrooms. It is accepted that they might have other skills but not display them due to constraints. The following is one lesson in which many of the skills were displayed and can be considered an example of effective technology teaching.

There were 33 learners in the class on the day it was observed. The teacher came for his technology lesson carrying a carton. In it he had six sets of resources. Each set consisted of a square sheet of soft wood, a ruler, a pencil, a hand drill, a tenor saw, a G clamp, two dowels, panel glue, iron file and a compass. The sheets of soft wood were of different sizes. The teacher divided learners into six groups with three groups each having five members and the other three groups each having six members. Each group was allocated to a table. He instructed learners to produce two sets of wheels. He hinted that they were to employ their mathematical knowledge to accomplish the task perfectly. The sheet of soft wood was to be used as efficiently as possible i.e. with very little of it to be thrown away. The criteria by which the finished product would be judged were that: (a) the wheels should move without wobbling. (b) They should all be of the same size. (c) They should move in a straight line when given a push. Learners set to do the task enthusiastically. They discussed in their groups how they were to approach the task. There seemed to be pandemonium as they argued about which instrument to use at different times. The teacher moved around monitoring the progress. As time went on some groups looked quieter as they settled on an agreed procedure. They divided duties among themselves in the groups. Some did the cutting of smaller squares, some the filing of excess wood to make circular wheels, some the drilling and some the fitting of dowels. The teacher guided those who seemed totally stuck. All groups finished the task but at different times. On assessing the products all met the preset criteria. The learners, with the guidance of the teacher, were able to generate the procedure they had followed which looked as follows:

- Mark four equal squares on a soft piece of wood with a pencil and a ruler,

- For each square draw diagonals to get the centre of each square (i.e. where diagonals cross).
- Using a compass mark four circles with radii from centre to edge of each square.
- Hold the square sheet of wood by a G clamp on a table.
- Cut the four squares.
- Fasten the smaller squares one by one and file off the corners to form circular wheels,
- While each wheel is fastened drill the centre.
- Fit the wheels onto the dowels and glue on.

I considered this to be one of those lessons that were very successful. It was characterized by learner-centredness; learners employing their previous knowledge and being active whilst the teacher merely acted as a facilitator of learning.

I also observed some lessons that were poorly organized lacking many of the skills on the side of the teacher. The following is an example of one such lesson. In this case there were 38 learners in this class. The teacher came to class and told learners to take out their Technology textbooks. He ordered them to open a certain page of the textbook on which there was a drawing of the water supply system. He started explaining the use of each facility from the storage dam to the time when water reached houses, schools, clinics etc. The explanation took most of the Technology lesson while the learners were passive and merely listening to the teacher. He then told them to redraw the diagram in their exercise books. The lesson was typically teacher-centred and from the observers viewpoint looked uninteresting.

In trying to assess the skills teachers had, the following framework discussed in chapter two was used. Four broad skills of teaching Technology have been previously identified in report of HEDCOM being communication skill, methodology skill, classroom management skill and assessment skill (Department of Education, 1996b). The committee further specifies specific competences under each skill. In order to obtain further information about the competencies, teachers were afforded an opportunity to rate their competences under each skill. They had to rate themselves as competent, not sure or incompetent. These were included in the second set of questionnaires. From the table 4.3 it can be seen that many teachers feel that they are quite competent in overall communication as shown by the fact that in all competencies the majority indicated that they felt competent. Overall 63% (76 of 120) of all responses

expressed a feeling of competence with only 11% of responses indicating incompetence at a skill.

Table 4.3 Number of teachers and their rating in each competence under communication skill

Competence		Number of teachers (n=20)			
		Incompetent	Not sure	Competent	
CO1	Language medium command	1	6	13	
CO2	Clear articulation of what is taught	1	3	16	
CO3	Framing unambiguous questions	1	9	10	
CO4	Use of non-judgemental language	4	3	13	
CO5	Generate and facilitate discussion	1	6	13	
CO6	Use of other forms of communication	5	4	11	
Total responses		120 (6x20)	13	31	76

Table 4.4 Number of teachers and their rating in each competence under Methodology skill

Competence		Number of teachers (n=20)			
		Incompetent	Not sure	Competent	
ME1	Facilitating learner centred practices	2	13	5	
ME2	Timing individuals, pairs or groups usage	3	6	11	
ME3	Allowing reflection & critical choices	2	16	2	
ME4	Demand of different thinking skills	6	12	2	
ME5	Development of problem-solving skills	4	6	10	
ME6	Encourage learners' responsibility for their learning	1	5	14	
ME7	Efficient use of resources	1	5	14	
ME8	Evaluation of teaching & learning	4	13	3	
ME9	Integrating problem-solving with practical activities	2	12	6	
Total responses		180 (20 x 9)	25	88	67

When it comes to competencies involving methodology (Table 4.4) the situation changes. Though teachers feel confident that they have some of the required skills like, timing, developing problem-solving skills, encouragement of learners' responsibility for their learning and efficient use of resources, they doubt themselves about other skills. For example, the majority are not sure about their ability to facilitate learner centred practices, allowance of reflection and critical choices, evaluation of teaching and learning and integrating problem-solving with practical activities. On the whole teachers are more doubtful about their competences in methodology with only 37% (67) of all responses indicating a feeling of competence.

Table 4.5 shows that many teachers are quite comfortable with skills dealing with managing their classrooms with 67% (78) of all responses indicating competence. However the low expressed competence in the individual skill of cultivation of technology skills (CL5) and apparent lack of ability to sustain interest and motivation (CL6) has to be a cause for concern.

Table 4.5 Number of teachers and their rating in each competence under Classroom management skill

Competence		Number of teachers (n=20)		
		Incompetent	Not sure	Competent
CL1	Maintenance of good discipline	0	2	18
CL2	Effective class management	5	3	12
CL3	Facilitator, monitor & information resource person	0	3	17
CL4	Organiser of learning environment	2	4	14
CL5	Cultivation of Technology skills	6	6	8
CL6	Sustenance of interest & motivation	2	9	9
Total responses 120 (6 x 20)		15	27	78

When the skills of assessment are considered the results are uneven with some indicating competence others incompetence and others evenly spread between the categories. For example a large number of teachers understand the difference between norm-referenced assessment and criterion-referenced assessment and feel competent with continuous

assessment (Table 4.6). The numerous OBE workshops and policy documents emphasised continuous assessment. Given that this is not specific to Technology but throughout the new curriculum this reported competence is as expected. What is interesting is that only eight teachers understand the principles of assessment indicating that in some cases they act but are not sure of the principles underlying their actions.

Table 4.6 Number of teachers and their rating in each competence under Assessment skill.

Competence		Number of teachers rating (n=20)		
		Incompetent	Not sure	Competent
AS1	Understanding principles of assessment	4	8	8
AS2	Differentiation between norm & criterion-referenced assessment	0	2	18
AS3	Assessment of individual's assessment	4	7	9
AS4	Systematic recording of learner progress	5	8	7
AS5	Giving feedback to enhance learning	5	4	11
AS6	Use of assessment as diagnosis	2	11	7
AS7	Assessing continuously	2	6	12
Total responses 140 (7 x 20)		22	46	72

Overall only about 50% (72) of the responses dealing with assessment indicated competence in the associated skill. This overall result is not surprising as it is similar to that reported by Mouton et al. (1999) where teachers reported that they struggle with assessment in their teaching of Technology and as a result they need more training especially with group assessment.

Considering all four broad skills, of the 28 sub-skills or competences required for the effective teaching of Technology the majority of teachers reported that they were competent in only 17 of these. (These sub-skills had 50% or more (10 and above) teachers reporting competence.) There was no sub-skill in which the majority felt they were incompetent but many in which they were not sure. When skills are compared they appear less confident of their methodology skills (37%) and assessment skills (50%) and most confident with communication skills (67%) and classroom management skills (67%). The mere fact that some teachers reported

uncertainty about the possession of some skills indicates that these teachers had not received enough training in the teaching of Technology if they had had any at all. The fact that the majority of teachers do not report competence in 11 of the 28 sub skills indicates a general lack of specific skills which could be a constraint to the effective teaching of Technology.

4.3 Technology Understanding

ASSERTION 3: Teachers have a common understanding about what technology is but differ on what should be emphasized in technology Learning Area.

Teachers were given a number of open ended questions to respond to dealing with the definition of technology. These responses were analysed and grouped into similar categories. Of the 20 teachers who returned questionnaires, 11 defined technology in a similar manner to the way it is defined in Curriculum 2005 documents. That is “a disciplined process using knowledge, skills and resources to meet human needs and wants by designing, making and evaluating products and processes” (Department of Education, 1996a, p. 5). Two teachers saw technology as a “ process”. For example a “process posing problems ending with products” and “a process to improve man-made products or making of new designs to improve life”. Two teachers defined technology as “application of science” e.g. “application of scientific knowledge, methods and techniques in a modern world”, and “practical application of scientific theories to make life better”. The other five teachers provided a variety of explanations like the following; “Technology means conversion of ideas into real things”, and “It is an area of inventions”. Overall the definitions were generally similar or partly similar to those provided by the policy documents.

Concerning what should be included in the Technology, different teachers emphasized different aspects. Six teachers regarded learning in Technology as “provision of life-skills”. This surfaced from the following statements, “Technology is a learning area providing skills and knowledge”, “It is a learning area to develop survival skills in learners”, “Technology should include contexts linked to socio-economic priorities e.g. health and nutrition, housing, etc. Mouton et al. (1999) found similar comments from teachers in his study and classified them as ‘preparation for life’. Yet another six teachers emphasized the involvement of

“problem solving” aspect in the teaching of Technology. For example, “Technology is about problem-solving and devising strategies to solve these problems”; Technology is about solving problems and satisfying needs and wants of people in all possible ways”; “Technology is about teaching learners problem-solving skills, skills of designing something”. Three teachers saw Technology as an opportunity of inculcating “creativity” in learners. For example, “It is a creative learning area”. “Learners should be encouraged to be as creative as possible”. Four teachers emphasized “practical applications” in teaching and learning of Technology. For example, “There should be hands-on work with apparatus”. “More practical work is necessary when learning Technology”; “Kids must learn to use their hands as well as their thinking skills to plan and design things”; “In Technology learners must learn to use their hands as a result they become job creators not job seekers”.

The above discussion indicates that teachers understand the definition of technology as given by Curriculum 2005 but a variety of different aspects are emphasized when it comes to what should actually be taught in a class of Technology. Same findings of confusion about what technology should really entail or emphasize were made by Khumalo (2006). This is perhaps indicative of the fact that teachers had not been involved in the overall process of curriculum development and producing the technology learning programme guides or of being introduced to these at workshops. According to Chapman (2002), while referring to the curriculum design- “no one knew with any clarity what was eventually to be presented to learners in the classroom” (p. 237). He further found in his study of the curriculum development process that no particular perspective was declared but rather it was a hybrid of perspectives. This should not be a significant constraint if the teacher is working alone in a school trying to interpret the curriculum documents. All it will result in is different emphasis being placed on parts of the curriculum. However, this has the potential to be a constraint if a group of teachers in a school are involved in implementing and they disagree about the focus to take.

4.4 Teacher Attitudes

ASSERTION 4: Teachers have a positive attitude to the introduction of Technology Learning Area in the curriculum but suggest that it be combined with Natural Science Learning Area at the senior phase.

All teachers responded 'yes' to the importance of Technology Learning Area and substantiated their choices with statements like "Technology plays an important role in the economic growth of a country"; "It teaches learners to be constructive and to be able to recognize and solve problems"; and "It is a vital need in this era since there is a rapid advance in technology these days". Out of the 20 respondents to the second set of questionnaires, 19 agreed with the introduction of Technology as a learning area in the South African curriculum giving reasons similar to those above. Only one was against because "we have not trained for this learning area, no workshops and we are following ideas of the textbook only". The finding is that teachers are positive about the need of Technology in the school curriculum. A similar finding was made by Chisholm et al., (2000), that teachers have a positive attitude to the intent and purpose of Curriculum 2005 as a whole and are taking seriously the challenges of implementation.

On the question of separate or integrated Technology, out of the 20 teachers, 14 opted for a combined science and technology learning area claiming that "Science and technology are closely related and should thus be combined into one learning area so as to facilitate the relationship between the two", or that "Technology is just an application of scientific knowledge and skills". This is a view strongly supported by Kahn and Volmink (1997). This, they claimed, would do justice to technology itself as well as ensure the safe and successful implementation of Technology into schools. Such a move would be consistent with the goals of Curriculum 2005, which calls for integration across disciplines. The same recommendations have been made by Chisholm et al. (2000) that technology (as applied science) be introduced in the learning area Natural Sciences and that 'design' features of technology are included in the life Orientation learning area. Out of 20 respondents, only six preferred to separate Science and Technology giving reasons such as "because Technology needs its special attention" and "has to be done to cover its scope although it can be integrated with Science".

I witnessed a close link between Science and Technology as I observed one of the lessons. In fact I could not understand whether the lesson was rightfully a Technology or a Science lesson. The teacher came to class with small cells that had their mountings and connections. He gave a set of cells and mountings to each desk where two learners were seated. He then gave to each pair a sound device that made a soft buzzing sound when connected to the cells. The sound device had as its connections a red and a black wire. Learners were instructed to

connect the device to the battery of cells in series such that it emitted the sound. They started connecting and for some the buzzing sound came at the first attempt. Others became worried about theirs and fiddled and changed the connections until they got the sound. Soon the class was full of the buzzing sound. It nearly got out of hand when the teacher gave an instruction to disconnect but learners played around by disconnecting and connecting. He had to be forceful. Learners were afforded an opportunity to 'discover' that a red wire had to be connected to a red (positive) terminal and a black wire to the black (negative) terminal of the battery. Seemingly it was a resource task imparting a specific knowledge and skill. Learners were further required to increase the number of cells in the mountings. The result was an increased buzzing sound. They were led to them 'discovering' that more cells in series release more electrical energy. He assessed the learners understanding by asking a number of questions.

To me this lesson left a question mark as to whether this was a Science or a Technology lesson. It made me think that there is a close relationship between Science and Technology learning areas as it is taught in schools at the moment. Unfortunately further analysis would require more context such as its place in the learning programme, the lessons that took place before it and what was still to come. All that can be said from this single observation is that some lessons are very similar to normal science lessons. This is not unexpected as many of the teachers are science teachers who had to integrate it into science during the previous three years of the intermediate grade i.e. when teaching Grade four to six.

In general teachers reported that Technology was an important learning area and needed to be implemented. The majority focussed on two major reasons. Firstly, that it helps children to develop problem-solving skills and to be creative. Secondly, that it is instrumental in the economic development of the country. However, the majority of teachers favoured a combined Science and Technology curriculum in the senior phase of schooling similar to that in the intermediate phase whilst a few preferred a separate curriculum as currently implemented in the senior phase. In the following chapter these findings are summarised and the implications and suggestions for action are discussed.

CHAPTER 5

CONCLUSION

The study set out to address the following key question: What constraints are experienced by Grade 7 teachers to the effective teaching of Technology? A number of specific research questions were generated from this main question.

Specific question 1: Are there relevant physical resources available for the teaching of Technology in schools?

Specific question 2: Do teachers possess the required skills to teach Technology?

Specific question 3: Are teachers' understandings of the Technology Learning Area similar to official department policy?

Specific question 4: What attitudes do teachers have towards the new Technology Learning Area?

Given the resources available to conduct the study and the type of questions that needed answering, the study was restricted to a case study of a school district. The main data collection instrument was a survey questionnaire to the schools in the district followed up by teacher interviews and classroom observations in nine of the schools. Data collected was captured in a spreadsheet format and analysed using interpretive analysis. The detailed description and analysis was presented in the previous chapter. In the current chapter the summary of the findings is given followed by limitations of the study with implications and suggestions for further research.

5.1 Main Findings

In most cases, schools in the district do not have the specific resources required for the teaching of Technology in Grade 7. While most had general physical school infrastructure this was not always in a good condition.

Many if not most of the schools constituting this case study found the lack of both general resources for teaching and learning and specific resources for technology teaching a severe constraint to the effective teaching of Technology. It was obvious that Technology has been introduced to schools whilst schools' infrastructure and the much needed quantity and quality of resources had not been properly considered for such a major undertaking. This study has

found that most schools still lack much of the specific physical resources utilized in a Technology class such as tools and materials. A few schools also lacked much of the basic infrastructure. A particular constraint identified was a lack of electricity. Besides making the teaching and learning environment difficult it means these schools cannot use modern technological equipment such as computers, photocopiers and electric tools often used in technology teaching. The poor condition of classrooms causes poor concentration by the learners during lessons. Though many of the schools had furniture to a satisfactory level in their classrooms, the desks used (i.e. table and seat attached together) were rigid and did not allow easy movement around. Despite group work being encouraged the physical resources made it difficult to promote this. Fabiano (1995) and Chapman (2002) both noted that to promote the effective teaching of Technology, governments should provide funds to establish infrastructure and to purchase equipment and materials to support the published curriculum if there is to be a chance of successful implementation.

Teachers do not have many of the skills or competencies required to teach Technology. The majority of teachers who had been assigned to teach Technology had not received sufficient training. Where some training had taken place, the majority found it not very useful.

Teachers are expected to teach both a new learning area and to do this using a new OBE approach. According to Taylor and Vinjevoold (1999b) indications are that “teachers have accepted the desirability of learner-centred pedagogy, but are unable to practise it” (p. 142). The fact that so few teachers were trained as Technology teachers was an obvious constraint to the effective teaching of technology in this district. A number of new practices are demanded from teachers to align themselves with the new approach. For example learner-centred approaches are more emphasized as opposed to those which are teacher-centred. Teachers are required to act as facilitators. Many of the teachers of Technology are mature teachers who still believe in the success of traditional methods of teaching. To make these teachers relinquish their old practices and adopt new practices should have been tackled systematically. Also many teachers reported uncertainty about the competence in 11 of the 28 sub skills indicates a general lack of specific skills which could be a constraint to the effective teaching of technology. Unfortunately in the current study training was a constraint for most teachers, with there being reported a lack of initial training, INSET and follow-up professional support for the teaching of technology. Those teachers who have been assigned to teach Technology either have not been trained or have not received sufficient quality

training to teach Technology effectively. Chisholm et al. (2000) also found that the majority of South African schools do not have teachers who have any education or training in Technology. In Mouton's study (1999) teachers interviewed on the importance of in-service training almost all indicated that in-service was absolutely essential to the implementation of Technology, and that lesser amounts of training would not be adequate. It appears that the mistakes of the recent past are not being rectified.

Teachers have a common understanding about what technology as a discipline is but differ on what should be emphasized in technology education at school. Teachers had a positive attitude to the introduction of Technology Learning Area in the curriculum but suggest that it be combined with Natural Science Learning Area at the senior phase.

Most teachers had similar understandings of what technology was and these matched what was in the curriculum documents. However, they had varying views about exactly what should be taught and how teaching should be done in the Technology Learning Area. This indicates that there has been little involvement of teachers in developing the strategies for implementation of the Technology curriculum at school level. This should not be a significant constraint as long as indecision about what is intended by the curriculum documents does not lead to inaction. Perhaps this was why many teachers did not return the questionnaires as they were confused as to exactly how technology should be implemented and there was inaction in their school. Teachers were positive about the introduction and teaching of Technology at school and needed to be implemented because of its value in developing problem solving and its potential contribution to economic development. This is an indication that there is general acceptance of its position in the curriculum and there can be no going back but we need to go on and seek methods that will ensure a smoother implementation. Despite the strong feeling that Technology Learning Area is necessary and important they felt that it should be subsumed in the Natural Science Learning Area as presently done in the earlier school grades. Most teachers agreed with the recommendation of the Chisholm report (Chisholm et al., 2000) that technology should be taught as part of the Natural Sciences contrary to current practice. This area needs further investigation.

5.2 Limitations

There are three main limitations that I felt could affect the findings of the research study. Firstly, my research was limited to one district only and therefore one wonders if the findings could be the same if the research study is extended to other educational districts. While it is expected that similar results will be found in similar districts it is accepted that there are more urban districts which are generally well resourced and who attract more qualified teachers. It is suggested that the constraints to effective technology teaching in these schools could be different. Secondly, the response I got from schools was very poor, for example, the 31% questionnaire returns. This percentage concurs with Bless and Higson-Smith (1995) who estimate returns of posted questionnaires to be from 20 to 40%. One reason for a low number of returns in my case could be principals who did not want to pass the questionnaires to their teachers perhaps because their schools were not implementing technology in the curriculum and did not want this revealed. Other reasons could be that the teachers lacked interest and misplaced questionnaires, did not bother to fill them in or were too busy to fill them in (Bless & Higson-Smith, 1995). The implication is that the situation could actually be worse than presented in this study. Thirdly, is the design of the data gathering instruments. For example, whilst the research was taking place I discovered that I could improve the questionnaires, hence a second set of questionnaires. On reflection, these instruments could have been further refined. In the same way some of the questions used at interviews could have probed deeper into issues and reasons for actions obtained. Despite these limitations, I have confidence in the findings as they apply to this particular case at this particular time.

5.3 Implications and Recommendations

Chisholm et al. (2000) found that the implementation process” was not always carefully thought through, properly piloted or resourced and enormous stresses and strains were consequently placed on already over-burdened principals and teachers in widely divergent educational contexts” (p.4). Teachers, for example, had to struggle on their own to design suitable learning activities pertained to technological literacy. This study has also shown that there are a number of constraints that prevent teachers from planning and teaching technology lessons. The two most important constraints involve physical resources and human resources and these are discussed below.

From this study we learn that schools with sufficient physical resources are more likely to teach Technology effectively than those that are constrained by a lack of resources. It is generally accepted that historically disadvantaged schools still lack many resources like textbooks, stationery, paper, photocopying facilities and other technologies for supporting teaching and learning (HSRC, 2005). One can realistically conclude that there are very few schools having sufficient resources to teach Technology effectively in rural areas. However, the resource constraint is not necessarily a factor in the former Model C schools, situated in relatively affluent areas which used to be provided with more than their fair share of funding by the government prior to 1994 and in present times can raise money through school fees from their surrounding communities. On the other hand the remaining schools are often situated in less affluent areas and are poorly resourced both from an infrastructural perspective such as classrooms and general resources of the school and from resources specific to the teaching and learning of Technology. It is unlikely they can change their situation themselves.

The onus is upon the Department of Education to improve the infrastructure in these schools and remove a major constraint to effective technology education. In addition, allocation to schools based on the Norms and Standards for School Funding should allow for the specific resources and consumables required for the teaching of Technology. To protect this allocation a fixed percentage from the schools' allocation based on the number of learners doing Technology could be put aside, ring fenced for core resources in Technology. According to Chapman when referring to the resourcing of the schools (2002) there is an economic liability upon the policy makers to ensure that its policies are implantable.

As a first basic step in sorting out the physical resources to improve the teaching and learning environment the schools should be properly fenced to curb vandalism and to safeguard school buildings and any equipment inside. Secondly, non- governmental organizations that help in the building of schools and the Department of Education itself should view seriously the plans used in the construction of classrooms making sure that there is adequate storage and display space in technology classrooms. The design of the classrooms and in particular the placement of windows should be reconsidered. It was found that the learners were easily distracted by movements outside the classrooms due to the classroom windows. The simple change of placing the windows at a higher level such that learners are unable to see outside through them when seated might assist with learner concentration on the tasks at hand. More buildings

imply more floor space and as a result less overcrowding. Building of special purpose technology classrooms could be a better solution. Thirdly, a basic resource in all schools should be electricity to allow the usage of equipment such as photocopiers and other modern technological equipment to support the teaching of Technology. Fourthly, it is also recommended that the desks currently used in most schools (i.e. seat attached to slanted table) should be abolished. Easily moved tables and chairs are more suitable to the current approach to teaching where learners have to move about when doing tasks and need to form groups and work from a common surface. Finally, all schools teaching technology should be supplied with the basic equipment and then each year a budget for materials required for implementing the projects required by the curriculum and assessment guidelines. It is not realistic to expect rural schools to find the money to purchase materials required for many projects. This study has found that lessons conducted where there were sufficient technology resources appeared more effective. Mouton et al. (1999) also found that many teachers reported that they were able to implement the curriculum because sufficient resources and instructional materials were supplied to these schools. It seems obvious that the Education Department must supply the resources if it wants schools to implement the curriculum. If they don't, the lack of resources is a major constraint to the effective teaching of technology.

The second major constraint identified involves the skills of the human resources i.e. the technology teachers. The shortage of important skills reported in this study demanded by the new approach to teaching and the new learning area indicates that the training of teachers is of utmost importance. Implementation of the new technology curriculum puts unacceptable stress on teachers who have not been adequately trained. In-service training of teachers should thus be intensified. Mouton et al. (1999) are of the opinion that "The ideal situation is to have an unlimited and ongoing in-service programme for all teachers in all schools" (p.45). The question is what form should this training take place. From the current study it was found that besides initial training teachers needed ongoing support in particular focused on classroom activities. Chapman (2002) recommended that there must be follow-up training to ensure sustainability. Two ways of addressing this are recommended.

Firstly, models of continuing professional teacher development (CPTD) used by RAUTEC (Engelbrecht, Ankiewicz & De Swardt, 2006) are reported to be showing success. These are the school based and the school focussed models in which training interventions are carried out by higher education institutions funded by trade and industry partners. According to them

they “were successful in providing training to educators that addressed their needs and problems, equipping them with conceptual knowledge with regard to the technological themes, procedural knowledge with regard to applying the technological process, and new insight into the instructional methodology of technology” (p. 20). Given that financial constraints are often considered a problem for doing quality INSET (Reitsma & Mentz, 2006) these partnership models appears promising.

Secondly, a more self sustaining model in which teachers help themselves assisted by the relevant technology subject advisors is advocated. The aim as in the models above will be to train teachers in the use of technology resources to promote effective classroom teaching. Training must be ongoing and as frequent as possible. It is felt that training workshops will have more impact if they are done within districts and on site. The focus here will be on establishing skills development workshops preceded by needs assessment. I suggest the use of the following on-going cyclic feedback model:

1. Cluster workshop on the next technology topic that will be taught.
2. Implementation in the classroom by individual teachers.
3. Meeting to review tasks and their effectiveness.
4. Feedback of success into planning of next workshop topic.
5. Next workshop on new topic.

Teachers in clusters where they teach could come together at a central point and with the help of the learning area advisor discuss a manageable section or topic of Technology which was to be taught in the next month. In these workshops both the process and content of technology should be treated. Discussions would address the issues of what is to be done to tackle the section in class considering the different environments of schools. The timing of lessons could be discussed so resources could be shared among cluster schools. The discussion would then be followed by the implementation process. On a set date the implementation process would be reviewed and successes and failures noted. These would be used as a basis for the planning of the next topic so that with time the successes would increase and the failures would be minimized.

This active feedback model would allow the in-service workshops to slowly become more effective as the lessons learnt from previous workshops are fed back into the subsequent workshop. It is felt that this model will have a chance of success if it is supported and facilitated by the department. In the report on C2005, Chisholm et al. (2000) found that

teachers were working hard at improving their skills to cope with the demands and challenges of the new curriculum and were eager to participate in any programme that would help them in this regard. This is a situation which could thus be exploited especially as it was found that in this study teachers were positive about the teaching of technology. What they require is support.

5.4 Further Research

Given that this is a new learning area it is a rich area for research. Unfortunately there is not a large amount of research studies similar to those found in science to assist policy makers and curriculum developers in their decision making (Malcolm & Alant, 2004). Three possible areas of research stand out at this time. Firstly, the Technology curriculum in Curriculum 2005 is for all the Intermediate phase (Grade 4 to 6) and Senior phase (Grade 7 to 9) learners. At present this learning area does not continue into the Further Education and Training band (Grade 10 to 12) but only specialist technological or engineering areas are offered. Consequently the majority of learners do not continue with Technology after Grade 9 which according to Stevens (2005) is “essential if the visionary goals of technology education are to be fully realised” (p. 7). How the senior phase students are affected by the absence of Technology in Further Education and Training band needs to be investigated. Does the learning from the senior phase dissipate or does it carry through resulting in technologically literate school leaving population? Secondly, in the long term it would also be of value to determine if the introduction of Technology to the curriculum impacts on technological jobs and helps in any way to grow our economy. If it does not then perhaps our scarce resources should be placed elsewhere. Thirdly, whether to have one Science and Technology curriculum or separate the two is still a debatable issue. Serious research based decisions need to be made and supported economically as the decision to continue with the present separate Technology learning area in the higher grades has been shown in this study to have major resource implications.

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APPENDIX 1**FORM A****TECHNOLOGY LEARNING AREA DIAGNOSTIC STUDY – GRADE 7****TEACHER PROFILE QUESTIONNAIRE**

1. Surname and initials of teacher:.....
2. Name of school:.....
3. Age.....
4. Gender.....
5. Home language.....

6. We are interested in your Technology-teaching career. Write about your training in Technology Education prior to teaching. Please complete the table as accurately as possible.

Certificate /Diploma or any other qualification that involve Technology	Institution e.g. College/University, etc. where obtained	Year obtained

7. List all the in-service courses that you have attended during the past 3 years. Write about the impact you think they had on your teaching of technology with possible reasons why you say so.

Year	Aspects trained in: (e.g. Materials Development/Skills Development, etc.	Rating – Least helpful/Moderately helpful/Very helpful	Reasons for your choices

- 8. In what other grades are you teaching technology?.....
- 9. Number of years teaching technology.....
- 10. Number of TOTAL years teaching experience.....

Thank for your time taken in filling in this questionnaire.

OooooooooOOOoooooooo

APPENDIX 2**FORM B****TECHNOLOGY LEARNING AREA DIAGNOSTIC STUDY****SCHOOL PROFILE QUESTIONNAIRE (With particular focus on Grade 7 offering Technology Learning Area)****A. GENERAL INFORMATION**

1. School.....
2. Type.....
3. Principal's name:.....
4. Ex-Department:.....
5. School Grades:

Grade 1	
Grade 2	
Grade 3	
Grade 4	
Grade 5	
Grade 6	
Grade 7	
Grade 8	
Grade 9	
Grade 10	
Grade 11	
Grade 12	

(Tick appropriate box)

6. Different racial groups in school:.....
7. Number of learners in Grade 7.....
8. Number of boys.....
9. Number of girls.....
10. Percentage pass in technology learning area in 2001.....

B. PHYSICAL RESOURCES

Which of the following resources are typically available and in what condition is it? Use the following definitions to guide your responses:

POOR: Resource is totally inadequate and not able to be utilized.

FAIR: Resource is in use and meets minimum requirements for use.

GOOD: Resource adequately serves its purpose and is frequently utilized.

FACILITY	YES/NO	CONDITION OF FACILITIES		
		POOR	FAIR	GOOD
CLASSROOM FACILITIES				
Grade 7 classrooms (permanent)				
Grade 7 classrooms (temporary)				
Desks per classroom				
Writing board(s)				
Dedicated display area (for charts e.g.)				
Teacher's table				
Teacher's chair				
Cupboards				
Textbooks				
Stationery (paper, exercise books, etc.)				
Writing aids (pens, pencils, etc.) for learners				
Science corner				
ADMINISTRATIVE FACILITIES				
Staff room				
Principal's office				
Senior phase HOD's office				
EDUCATIONAL FACILITIES/AIDS				
Library				
Library books				
Library shelves				
Science laboratory				
Laboratory equipment				
Computer laboratory				
Computer(s)				
VCR, TV, Radio				
Overhead projector				
Photocopy machine				
RECREATIONAL FACILITIES				
Sports Field(s)				
Sport equipment				
INFRASTRUCTURE				
Toilets				
Security system				
Access by road				
Water availability				
Electricity				

APPENDIX 3

FORM C

TECHNOLOGY LEARNING AREA DIAGNOSTIC STUDY

TEACHER INTERVIEW SCHEDULE

PART ONE

1. RESOURCES

1.1 Do you have adequate resources to teach the units?

.....
.....
.....

1.2 Where and how are the resources stored?

.....
.....
.....

1.3 How are they shared between different teachers/ classrooms?

.....
.....
.....

1.4 Are you able to get the required resources in cases where they had not been supplied?

.....
.....
.....

2. Describe how you use technology education material in your classroom in relation to the training you received (exactly as shown during training, less so because of difficulties experienced, more so because you expand on what you have been trained to do?).

.....

.....

.....

3. How valuable have you found in-service training provided?

.....

.....

.....

4. How valuable have you found other forms of support (e.g. from your colleagues, the principal etc).

.....

.....

.....

.....

PART TWO

5. If a parent were to ask you what technology as a learning area is all about, what would you say?

.....

.....

.....

6. When you think about teaching Technology, what are your concerns?

.....

.....

.....

.....

PART THREE

7. How essential are the support, materials and resources to the implementation of Technology Education? Could a lower level of resources and support still do the job?

.....
.....
.....
.....
.....

8. Do you think your school is implementing Technology as a new curriculum learning area? Why or why not?

.....
.....
.....
.....

9. What assessment strategies do you use for your learners? How are these strategies working out?

.....
.....
.....
.....
.....

APPENDIX 4

FORM D

TECHNOLOGY LEARNING AREA DIAGNOSTIC STUDYCLASSROOM OBSERVATION SCHEDULE

A. GENERAL

1. Name of School.....
2. Name of teacher.....
3. Date of observation.....
4. Time/period observed.....
5. Type of technology task: CAP RES CASE ST
6. How many learners are present?.....
7. How many learners are absent?.....
8. How many learners share a desk?.....
9. Do all learners have appropriate instructional materials (e.g. learners guide)?

YES		NO	
-----	--	----	--

10. Do all learners have writing materials (e.g. pens/pencils/paper)?

YES		NO	
-----	--	----	--

11. Do all learners have the resources necessary for the lesson or task (e.g., Scissors, wood, glue, paper, ruler, fabric, etc.)?

YES		NO	
-----	--	----	--

B. PHYSICAL CONDITION OF THE CLASSROOM

1a) Please tick the applicable block(s) regarding the physical condition of the classroom.

	YES	NO
Are there signs of vandalism?		
Are the walls and floor clean?		
Is the room adequately ventilated?		
Is the temperature of the room conducive to learning?		
Is the light in the classroom adequate?		
Is the writing board/ visual aid(s) visible to all learners?		
Are learning aids (if available) accessible to learners?		
Is there enough space between desks / tables for the teacher and learners to move around?		
Are there enough chairs/ spaces at worktables for all the learners?		

1b) Additional comments on physical condition:

.....

.....

.....

.....

C. TECHNOLOGY RESOURCES

1. Please tick the applicable block(s) to indicate the technology resources in the classroom.

	YES	NO	N/A
Are the resources provided appropriate to the lesson task?			
Are resources easily accessible to students?			
Are there sufficient amounts of resources for all students?			
Are there reference materials available in the classroom?			
Is there a first aid kit in the classroom?			
Is there adequate storage space for students' projects?			

2. Comments on the quantity and quality of the resources:

.....

.....

.....

.....

D. LEARNERS

1a) Please tick the applicable block(s) regarding the learners

GENERAL	YES	NO
Do the majority of learners wear school uniform?		
Are the majority of learners appropriately dressed according to the weather?		
Are more than 25% of the learners coming late (10 minutes + after the lesson was scheduled to start)		
Other relevant observation:		

1b) Comments on the physical appearance, behavior and interaction of the learners:

.....

.....

.....

.....

2a) Please tick the applicable block(s) regarding the majority of the learners to stay on the learning task, and rate learners using the scale below when YES IS TICKED:

1 = POOR 2 = MODERATELY WELL 3 = VERY WELL

	YES	NO	RATING
Does the teacher involve the majority of learners in the learning task?			
Do the majority of learners pay attention?			
Are the majority of learners following instructions?			
Are the majority of learners participating actively in the learning task?			
Are the majority of learners asking questions?			
Are the majority of learners responding to the teacher's questions?			
Do the majority of learners appear to understand the learning task?			
Do the majority of learners appear to understand what is expected from them?			
Is the lesson disrupted by > External factors (e.g. noises)			N/A
> Teacher called away			N/A
> Other learner's behavior			N/A
> Other (please specify)			

2b) Comments on the ability of the pupils to stay on the learning task:

.....

.....

.....

.....

3. Which language is most often being used by the majority of learners (tick one)?

LANGUAGE USED	
English	
Mother tongue	
Both English and mother tongue (code switching)	
Other (please specify)	

E. TEACHER**1. How does the teacher define the learning task objective?**

.....

.....

.....

2. Evaluator's brief description of classroom activities/ lessons observed:

.....

.....

.....

3a) The rating scale below is used to assess the teacher's skills in presenting the lesson.

0 = Not applicable 1 = Poorly 2 = Moderately well 3 = very well

	RATING
1. Spells out the learning task clearly	
2. Appears familiar with the topic	
3. Encourages active learner participation in activities	
4. Uses a variety of assessment techniques (e.g., self, peer, informal observation)	
5. Assesses learners continually	
6. Adjusts lesson/activities to feedback from learners	
7. Orients learners toward task periodically	
8. Integrates daily life examples into the lesson	
9. Relates the lesson to other learning areas	
10. Provides continual feedback to learners	
11. Praises learners' progress	
12. Other (please specify)	
.....	
.....	

3b) Comments on the skill of the teacher in presenting the lesson:

.....

.....

.....

4. Linguistic competence of the teacher in English

Inadequate 1.....2.....3.....4.....5 Good

5. The extent to which the teacher uses the pupil's home language to enhance learning

Limited extent 1.....2.....3.....4.....5 Great Extent

F. LESSON PRESENTATION

1a) Please indicate whether the teacher uses the following facilitation techniques during the lesson, according to the rating scale below.

0 = Not applicable 1 = Not at all used 2 = Used frequently 3 = Used all the time

FACILITATION METHODS	RATING
Small group work or projects	
Individual work or projects	
Small group discussion	
Large group discussion	
Lecture	
Different assignments for different levels of pupils	
Independent study	
Other (please specify)	

1b) Comments on the use of teaching methods and on the teacher as a facilitator:

.....

.....

.....

2. Does the lesson include:

	YES	NO
Direct instruction of content?		
Recognition of prior learning?		
Assessment of what has been learnt?		
Summary activity or discussion at end of lesson?		
Homework assignment?		
Other (please specify)		

3a) Please indicate which of the following forms of assessment were used during the lesson.

FORMS OF ASSESSMENT	YES	NO
Question and answer techniques		
Pupils complete examples from the instructional materials		
Pupil self-assessment		
Peer assessment		
Teacher assessment via questions/ tasks assessing learners' abilities/ understanding		
Task/Project evaluation		
Traditional group assessment (e.g., pencil and paper)		
Other (please specify)		

3b) Comments on the use of assessment techniques by the teacher.

.....

.....

.....

.....

4a) Please indicate whether the teacher to consolidate the lesson uses the following consolidating strategies.

CONSOLIDATING STRATEGIES	YES	NO
Individual exercises		
Small group exercises		
Large group exercises		
Demonstration of solution		
Learners complete examples from the instructional material		
Learners complete worksheets/ examples designed by the teacher		
Teacher reviews activities/lesson		
Teacher presents problem to the learners, the learners verbalize their responses		
Other (please specify)		

4b) Comments on the consolidating strategies used by the teacher

.....

.....

.....

.....

5. Regarding homework assignments.

	YES	NO
Were any assignments given to the children prior to the lesson?		
Does the teacher check if the pupils did the assignments?		

G. MANAGEMENT OF LEARNERS

Please comment on how the teacher managed the learners with regard to:

1. Learners that have not done their homework assignments

.....

.....

.....

2. Maintaining order in the classroom

.....

.....

.....

3. Rewarding learners

.....

.....

.....

4. Punishing learners

.....

.....

.....

H. GENERAL SUMMARY COMMENTS

1. Assess in general terms the kind of teaching methodology you observed in the classroom on the scales below:

a) Traditional, teacher – centred	1	2	3	4	5	child-centred
b) Predominantly rote learning	1	2	3	4	5	active participation by pupils
c) Disorganized classroom	1	2	3	4	5	well-managed classroom

2. Additional general comments

.....

.....

.....

APPENDIX 5

Form 1A

Name of School: _____

Name of Grade 7 educator: _____

Questionnaire on physical resources utilized in a Technology class

A. AVAILABILITY

Rate the availability of resources in each case and substantiate your choice. **Tick the correct box.**

1. Resources provided by the school

Very poor	Poor	Fair	Good	Excellent

Reason of choice

2. Resources obtainable from the immediate vicinity of the school.

Very poor	Poor	Fair	Good	Excellent

Reason of choice

3. Resources improvised by the teacher.

Very poor	Poor	Fair	Good	Excellent

Reason of choice _____

B. STORAGE

In a Technology class learners often design and make products. Where do you store these in your school?

C: USEFULNESS

Are you satisfied with the usefulness of resources you are able to get hold of? Tick the correct box and substantiate your point of view.

<input type="checkbox"/>	<input type="checkbox"/>
Yes	No
<input type="checkbox"/>	<input type="checkbox"/>

Reason of choice: _____

Thank you for your time taken to complete this questionnaire.

APPENDIX 6

Form 1B

Name of School: _____

Name of educator : _____

Questionnaire on professional development of Technology educators.

1. Have you been trained at college or university to teach Technology?

Yes		No	
-----	--	----	--

If Yes: a) Did you train part time or full time?

Yes		No	
-----	--	----	--

b) What qualifications in Technology do you have?

c) How do you think the above helps you in the teaching of Technology?

2. Have you been involved in any in-service professional development programme in Technology education since you started teaching Technology?

Yes		No	
-----	--	----	--

If Yes: a) state the number of times you have been involved. _____ times.

b) Recall any of these professional development programmes you found useful and explain how useful they were or have been in your teaching of Technology.

c) Recall any of these professional development programmes you found useless and explain how useless they were or have been in your teaching of Technology.

Thank you for your time taken to fill in the questionnaire.

APPENDIX 7

Form 2

Name of School : _____

Name of Grade 7 educator: _____

Skills competence checklist

In the list below are most of the skill related competences required of educators in Technology Education as set out in Technology 2005 Project (Teacher Education Committee, 1997). They have been categorized according to relatedness to communication, methodology, classroom management and assessment.

You are required to rate your competence in each case and indicate the frequency by which the competence is generally applied in your class. **Tick the relevant box.**

A. Communication skill

Competence	Rating			Frequency		
	Incompetent	Not sure	Competent	Seldom	Not sure	Often
1. Command of the language medium						
2. Articulation of what is being taught in a clear language.						
3. Framing unambiguous questions.						
4. Ability to use non – judgemental language.						
5. Generate and facilitate discussion.						
6. Make use of other forms of communication e.g. graphics, visual and symbolic						

B. Methodology skill

Competence	Rating			Frequency		
	Incompetent	Not sure	Competent	Seldom	Not sure	Often
1. Facilitation of learner– centred classroom practice.						
2. Identification of suitable occasions for teaching the class as a whole, in groups, in pairs or as individuals.						
3. Creation of contexts in which learners are encouraged to reflect and to make own critical choices.						
4. Employment of methods demanding different thinking skills						
5. Employment of methods which develop skills in problem-solving.						
6. Encourage learners to take initiatives in and become responsible for their own learning.						
7. Select and use in a considered way a wide variety of resources.						
8. Evaluate teaching and learning						
9. Employment of methods which encourage the child to integrate problem-solving with practical hands-on activities (task based learning).						

C. Classroom management skill

Competence	Rating			Frequency		
	Incompetent	Not sure	Competent	Seldom	Not sure su	Often
1. Maintenance of good discipline and development of self-discipline.						
2. Purposeful and effective class management in terms of class size, time, teaching and learning aids, activities, space, physical resources and safety.						
3. Facilitator, monitor and information resource person.						
4. Organization of the learning environment to develop social and thinking skills.						
5. Cultivate the skills of Technology Education.						
6. Sustain interest and motivation of learners.						

D. Assessment skill

Competence	Rating			Frequency		
	Incompetent	Not sure	Competent	Seldom	Not sure	Often
1. Understand the principles of assessment with appropriateness.						
2. Understand the concept of norm-referenced and criterion referenced assessment.						
3. Assess individual learners' achievements in terms of national agreed specific outcomes.						
4. Record in a systematic manner learner and learner group's progress.						
5. Give descriptive, constructive and immediate feedback to enhance learning.						
6. Use of assessment as a means of diagnosis, with a view to devising remedial exercises.						
7. Continuous assessment.						

Thank you for your time taken to complete the questionnaire.

APPENDIX 8**Form 3****Name of School:** _____**Name of Grade 7 educator:** _____**Technology learning area - understanding**

1. In your opinion what is Technology?

2. What do you think is or should be entailed in Technology Education?

3. How would you explain to the layman what Technology learning area is about?

4. What would you consider as the general aim of Technology Education?

Thank you for your time taken to respond to the above questions.

APPENDIX 9

Form 4

Name of School: _____

Name of educator: _____

Questionnaire on attitudes

A. Importance of Technology learning area.

a)

Tick the box relevant to your point of view.
Technology is a necessary learning area.

Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
-----	--------------------------	----	--------------------------

Substantiate your point of view.

b)

Now that Technology has been introduced in South African curriculum, are you for or against the idea. Tick the correct box.

For	<input type="checkbox"/>	Against	<input type="checkbox"/>
-----	--------------------------	---------	--------------------------

Substantiate your point of view.

B. Separate or combined Science & Technology Education

Of the two views; separate or combined Science & Technology what would you support?

Separate S & T	<input type="checkbox"/>	Combined S & T	<input type="checkbox"/>
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Substantiate your point of view.

C. Professional development programmes

a) Write your comments about professional development programmes in Technology.

b) Write your recommendations about future professional development programmes.
