SCIENCE FOR ALL - MYTH OR REALITY?

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DECLARATION

This research represents original work by the author and has not been submitted in any other form to another university. Where use was made of the work of others, it has been duly acknowledged in the text.

DEDICATION

I dedicate this work to my parents Daniel and Susannamma Valiathazhel who passed away just before the commencement of this study

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Contents

1. Abstract

Different educational projects around the world have made *Scientific Literacy* a world-wide concern. This study through a literature review shows that *Scientific Literacy* is a term that has many definitions and interpretations. This literature review reveals that, in the present system *Science for All* is a myth for various reasons. Governments around the world in general, and South Africa in particular, are in the process of introducing different projects such as the Year of Science and Technology (YEAST), science week and science exhibitions for the purpose of popularising science and technology. The Department of Education in Thailand has modified its education system to accommodate S*cience for All.* In this literature review among other issues the status quo in South African science education and the Thailand model were examined. A few recommendations to achieve *Science for All* are also included in this project.

2. Introduction

The intensification of the debates on the *public understanding of science* and *scientific literacy* reflects a renewed concern for the role of science in society. This is evident when one reviews the literature of the last two decades in which the public understanding of science and the need for a science curriculum (or science curricula) to encompass all primary and secondary school students is widely studied (AAAS 1990; Fensham 1985; Fensham 1986/87; Hodson 1993; Howie & Hughes 1998; Kahn 2000; Kyle 1995; Shamos 1995; Solomon & Thomas 1999; Zaaiman 1998). In this essay, with the aid of literature review, I will be looking at the purpose of school and science education in the society.

In tracing the origins of scientific literacy, most writers agree that there is an amount of uncertainty in the definition of scientific literacy. Shamos (1995) refers to the concept (scientific literacy) being 'clouded by vagueness and imprecision'. According to Shamos (1995) the term 'scientific literacy' was originally used in connection with science policy and later (in the 1960's - post sputnik era) was used in a broader sense to cover science education for all. I shall look into the various definitions of *scientific literacy* that are available in the literature and shall also investigate the reasons for the apparent reluctance (or negative attitude) on the part of the general public to be sufficiently scientifically literate.

The status quo of the South African situation will also be explored. Scientific developments, scientific policies and the use of scientific information by governments are starting to affect the public consciousness as never before. The recent debate in this country over the cause(s) of AIDS is an example of how politicians will try to use scientific information to (mis)inform the public to make short term economic decisions/gains. Politically, the idea of promoting scientific literacy is very appealing. This is due to the general belief among the public that scientific advancement in a society can bring economic prosperity. This notion will be examined critically. What there is that science education can offer to the public will also be explored. Finally, I will make some recommendations to achieve this idea of *Science for All.*

3. Purpose of School

Fensham (1985: 416 – 417) claimed that, "school systems are established in society to achieve a range of purposes that relate to societal needs and social needs". He listed some of these purposes. Firstly, "schools are expected to reproduce the knowledge, skills and expertise that is required to maintain whatever is the existing status quo of a society". Secondly, "they are expected to produce new sorts of persons with hitherto unavailable skills and knowledge that have become essential to the development of an economy or to the changing needs of the society". Thirdly, "they are required to contribute to 'law and order' by passing on a request and appreciation of traditional knowledge, values and culture".

The existence of a school system might mean other things, such as social mobility, reinforcement of existing ideas, etc... to individuals. In a report published by the Royal Commission on Learning (1994), a set of purposes of schools in the Canadian context were outlined. In my opinion these purposes are also relevant in the South African context. They are, *"intellectual development, learning to learn, citizenship, preparation for work career development and instilling values".* According to the Royal Commission (1994) "schooling should be enriching, challenging, and intellectually rewarding". In a speech delivered by the Director-General of UNESCO, Koichiro Matsuura (Matsuura 2000) at the closing session of the *Asia Pacific Education for All 2000 Conference,* claimed that, "education is universally understood to be the key to all development. Individual development, social development, sustainable economic development *[sic]*. This awareness is the great achievement on which we must now base our future efforts". Seemingly many educational leaders and politicians believe that there is close relationship between economic success and educational improvement of the citizens.

Jenkins (1999) argues that "one of the functions of schooling is the development of an informed citizenry, and this at the end of the 20th century, is widely assumed to require that all students receive an education in science". According to Jenkins (1999) *Science for All* is an old slogan "which now has a global resonance, with many countries revising or reforming school science curricula", for economic rather than democratic reasons.

These days seemingly it is fashionable for the politicians to call for an education system that can produce more scientifically and technologically skilled citizens. For example, while addressing a gathering recently President Thabo Mbeki made a plea that, "the African century we are talking about must produce doctors, engineers, and scientists" (Schuler 2000: 1). It seems that in recent times more people are talking about science education than before.

4. Purpose of Science Education

According to Fensham (December 1986/January 1987) science education has three major functions. They are: (i) *a political function*, in which few students are "filtered through" to study physical sciences and allowed to move into professions of social status and economic security, (ii) *economic function*, in which scientific skills and expertise are employed to maintain and expand a variety of aspects of economy and (iii) *the function of subject maintenance.* He claimed that scientists "in research institutions and universities are now a powerful faction with a major interest in maintaining their subject as an elite and important field".

Fensham (1985: 416 – 417) further argued that, since the 1950s two very distinct societal demands have been placed on science education in many countries. The first is the demand for specialist manpower so that societies and economies can keep pace in a world where scientific knowledge and technology are being exploited in a rapidly increasing way. The second is the demand for a more scientifically literate common people. According to Lloyd *et al* (1998) "school science education is intended to offer individuals not only initial scientific knowledge but also the capacity for coping with rapid changes in science and technology that affect their daily lives at home in society and work". The critique of the nature and level of scientific literacy among both the adults and school students during the last decade or so has been termed by some "the crisis of scientific literacy" (Mathews, as quoted in Membiela 1999: 721). The search for a new understanding of scientific literacy, as Hodson (1993: 541) has suggested, is, on the one hand, to make science education more socially orientated, and on the other hand, more student centred. According to Jenkins (1999) the common rhetoric is that "citizens need to be scientifically literate in order to be able to contribute to decision-making about issues that have a scientific dimension, whether these issues be

personal (e.g. relating to medication or diet) or more broadly political (e.g. relating to nuclear power, ozone depletion or DNA technologies)".

5. A new slogan: *Science for All* – a myth?

5.1 Scientific literacy

According to Fensham (1985: 417), the above demands, especially the second one, which calls for more scientifically literate common citizens, has developed a slogan which is, *Science for All*. Knain (1999) noted that initiative such as *UNESCO 2000+ Scientific and Technological Literacy for All* has made scientific literacy a world-wide concern. However, Shamos (1995) as quoted by Kyle (1995: 896) asserted that science educators have not been very successful in achieving the elusive goal of scientific literacy for all. According to Shamos (as quoted by Kyle 1995: 896) the reason for this is that science educators have never really defined what scientific literacy means. In his opinion, until the science educators have greater degree of consensus as to what constitutes scientific literacy, it will be difficult to establish the degree to which they have been successful in achieving their goal – namely *scientific literacy for all.*

Shamos (1995: 158) noted that,

> the goal of "scientific literacy" has become almost synonymous with today's science teaching. Never mind that its meaning remains vague and that the methods of achieving whatever one takes it to mean are still unknown: ask any present-day curriculum developer the purpose of science education for the general student and the answer is almost certain to include scientific literacy as a major objective.
>
> Over the next few years we will see a continuing flood of books and articles deploring the sad state of scientific literacy ... many offering formulas for reversing this "trend", as it is often called. Actually, it is hardly a trend but rather business as usual, for we have already seen that never ... has there been a time when the public at large, or even its highly educated segment, could be considered literate in science.

Kyle (1995: 896) argued that since the dawn of modern science, science educators have debated <u>*what*</u> should be the emphasis and <u>*how*</u> should science be taught to the

general citizenry that was literate. He believed that, during the last half century, science educators have engaged in many reform efforts, most of which have been oriented toward enhancing the scientific literacy of all students. Shamos (1995: 158) argued that such efforts have failed to have any lasting impact in the context of the general public's literacy in science. Therefore, it seems that, science educators have not been successful in transcending school science literacy to adult science literacy. According to Kahn (2000: 20), "a helpful working definition is that scientific literacy means being comfortable, confident and competent with scientific and technical matters and artefacts". Such a definition includes both *knowing why* and ... *knowing how.* I tend to agree with Kahn's definition of scientific literacy. I believe that, science educators, educational researchers and media must engage in discussions/debates regarding the *why* of science education rather than restricting conversation/discussion to the *what* and *how*.

In addition to the above, there are various definitions of *scientific literacy* available in the literature. According to Bauer (1994) scientific literacy has three components: (i) the substantive concepts/facts within science; (ii) the nature of scientific activity and (iii) the role of science in society and culture. Popli (1999) has defined a scientifically literate person as one who "is equipped to take care of her own health to a large extent, to contribute to community health, to understand issues related to preservation, pollution and plundering of the environment, to quantify and measure in an elementary way all that is quantifiable in daily life, and to understand agricultural/industrial products in a scientific way". Perhaps the most comprehensive definition is provided by the American Association for the Advancement of Science. According to them (AAAS: 1990) a scientifically literate person is one who "is aware that science, technology and mathematics are inter-dependent human enterprises with strengths and limitations, understands key concepts and principles of science, is familiar with the natural world and recognises both its diversity and unity, and uses scientific knowledge and scientific ways of thinking for individual and social purposes". According to the Department of Education in South Africa (Department of Education: 2000), the overall objective for science, mathematics and technology literacy is "to ensure that the public is competent, confident and comfortable with the products and processes of science". These definitions show that there is considerable uncertainty in the definition of scientific literacy. Knain (1999) also believes that scientific literacy is

an "imprecise and ambiguous term". He quotes Jenkins and Roberts (Jenkins (1997) and Roberts (1983) as quoted in Knain 1999) and maintains that this ambiguity "is useful as a slogan for focussing interest and effort to bring about changes in science education".

Young and Glanfield (1998: 1-2) claimed that along with other school subject specialists, science educators made very little contribution to the debates about lifelong learning and the learning society. The Association for Science Education (1995) in the United Kingdom published a discussion document, in which they suggested that; "science should be a major area of specialisation in post-compulsory education and part of everyone's lifelong learning". I think the message of "lifelong learning" of science has not reached the masses.

Knain (1999) describes "three aspects of science as necessary for a public understanding of science". These aspects are: (i) "understanding some aspects of a science content; (ii) understanding the scientific approach to inquiry and (iii) understanding science as a social enterprise". Scientific literacy has various dimensions. Shen (as quoted in Knain 1999: 3) introduced "*functional scientific literacies*". According to Shen functional scientific literacy "enables an individual to solve practical problems, in particular for health and survival". Knain (1999) noted that "*Civic Scientific Literacy* makes it possible for an individual to participate in democratic debates on issues of public interest". He writes about a third dimension, namely *Cultural Scientific Literacy* which "enables individuals to appreciate science as a major human achievement".

5.2 Changing perceptions and role of science

The changing perceptions and role of science in the wider society have to be marketed well among the citizens. One of the reasons for science being unpopular among many old and young people is that, the practical aspect of science is neglected or overlooked in the school curriculum. This is especially true in the case of the South African (schools) education system. This view is held by Layton, Young and Glanfield (Layton 1973; Young 1976, 1998, as quoted in Young & Glanfield 1998: 2). They argued that,

> ... physics, chemistry and biology followed in the path of the established school subjects like Latin, Greek and Mathematics and developed a scholastic or academic rather than a practical approach to learning and knowledge.

According to Young & Glanfield (1998: 2) there is a steady decline in the numbers of pupils specialising in science. They have noted two major reasons for this decline in numbers. Firstly, perceptions and role of science in the society are changing. Secondly, there are a number of contradictions in the school science curriculum. The first contradiction refers to "the tension between the almost inherent exclusiveness of science as a specialist and esoteric body of knowledge and the claims for its universality and potential accessibility to all that have been made since the Enlightenment" (Young & Glanfield 1998: 2). The second contradiction is between the claims of science as a critical enquiry and intellectual emancipation and the experience of many students that so much school science seems to be about "over – heavy syllabuses and learning how it is". The third contradiction is between the continuing ability of scientists to make new discoveries to the benefit of people's lives and the increasing unease people feel over some of the consequences of applying scientific knowledge, especially the impact on environment. They (Young & Glanfield 1998) argued that, these contradictions are not easily resolvable and they have led to increasing uncertainty about the role of science in the curriculum and to a drop in the proportion of young people studying science.

5.3 School science – for an elite group only?

Regarding science education in the United Kingdom, McCulloch (1998: 43) argued that, excellence at the top was not matched by high standards for the majority of children in the United Kingdom. According to McCulloch (1998:43), there were certain first-class schools in the United Kingdom and their best students compared with the best in the world. But by comparison with other industrialised countries, achievement by the average student in the United Kingdom was not good enough. It was revealed recently by the *Third International Mathematics and Science Study - Repeat* (TIMSS - R) that the performance of the average South African student in mathematics and science is also not comparable with the rest of the world (HSRC

2000). It seems from my own experience that, in South Africa, the ex-model C schools and private schools produce better calibre pupils than learners from township schools. Maybe the quality of learner intake is a contributing factor here.

McCulloch (1998) claimed that, the importance of mass education was neglected at the end of the nineteenth century and has been only slowly recognised during the twentieth century. Gowing (as quoted by McCulloch: 1998) identified five possible reasons for the failure of science education for the majority of learners during the last part of the 19th century in the United Kingdom. They were "money, administrative structure, social class, the influence of the church and imperial purpose". Some of these reasons are valid even in the present day schooling. At least money and administrative structure are playing a part in the South African situation. For example, a century old prestigious high school in the Eastern Cape, sent out a document (Appendix A) to all Grade 9 pupils and their parents during the last quarter of 1999 and in 2000. This document was prepared to guide pupils and parents to choose subjects for Grade 10 to Grade 12. Later a meeting was organised to explain this document to the pupils and parents and seemingly a deliberate attempt was made by the principal to discourage pupils from choosing mathematics and physical science. A list of careers and the subject requirements for each career was given in the form of a spreadsheet. The principal stressed that, out of 54 careers only 13 of them required the study of physical science and 22 careers required the study of mathematics. Towards the end of her talk the principal (who is also the Grade 12 physical science teacher) said that, even if all the Grade 10 pupils wanted to select careers which require physical science and mathematics, the school could not afford it for two reasons. She said, firstly, the school did not have enough physical science and mathematics teachers to teach all Grade 10 pupils (administrative issue). Secondly, the school did not have sufficient funds to appoint privately paid teachers to teach physical science and mathematics to all Grade 10 pupils (the issue of money). May be this is a way of ("gate keeping") allowing only a certain (elite) group of pupils to continue with the study of physical science and mathematics.

The status quo in South Africa and most other developing countries is that, the majority of students are not studying science after Grade 9. According to Fensham (1985: 418) in most countries only about 20% of the total school population is

allowed to study science. He argued that, the selection and preparation process in most countries is a way of "gate keeping". Again, Fensham (1985: 418 - 419) argued that, the mathematics and science curricula have various characteristics that discourage students from learning science at school. Some of these characteristics are: (a) the study of science involves, "the rote recall of large number of facts" that are not useful in everyday life, (b) it involves "too little familiarity with many of the concepts to enable their scientific usefulness to be experienced", (c) study of science includes concepts that have been "defined at high levels of abstraction that are inadequately acknowledged in the school context and hence prevent appropriate explanation of their consequential limitations in real situations", (d) "it involves life experiences and social applications only as exemplary rather than as the essence of science learning", and (e) "its content gives a high priority, even in biology, to the quantitative, and in chemistry this priority is probably greater than it is for many practising chemists". He argued that these curricula are quite successful in meeting the societal needs of an elite group.

Until recently, in South Africa one population group was considered and geared to be this elite group. The state did whatever it could to achieve this. Fasheh (1990) argued that top-down structures function to create and maintain hegemony for the dominant group. This has been particularly evident in South Africa where apartheid education was openly engineered to create minority control and to provide inferior education for the majority in order to sustain their position of social, political and economic subjugation. Different population groups of South Africa have been exposed to different educational experiences especially in terms of access to resources. Goldstein *et al.* (1991) confirmed that the situation prevailed in South African education system was not conducive to learning.

> The debacle of Bantu Education has left a legacy of overcrowded, under-equipped classes; teachers whose education, training and confidence has been undermined; and children who have been denied the opportunity to develop their full potential. These conditions combine with rigid, authoritarian teaching methods to produce a double depression of achievement levels in Department of Education and Training Schools (Goldstein, *et al.* 1991: 17).

During the period of Bantu Education in South Africa the teaching of mathematics and science were particularly affected. "In 1991, of the 290 918 pupils who wrote Department of Education and Training school leaving examinations, only 392 passed mathematics at the higher grade with a C and better" (Goldstein, *et al.* 1995:79). They further argued that, in classrooms across the country, (including the so-called independent states such as Transkei, Bophuthutswana, Venda and Ciskei) in both townships and rural areas, mathematics and science were considered as foreign constructs and as integral parts of the structure of oppression. Goldstein, *et al.* (1995) claimed that in South Africa mathematics and science were identified and regarded as school subjects for the culturally and academically advantaged. Table 1 below shows that in South Africa black students tend to attain a far smaller proportion of the qualifications than white students, especially in the field of science and technology (Zaaiman 1998: 7).

Table 1: Distribution of qualifications awarded by South African Universities in 1991

Qualifications (Degrees, diplomas and certificates)	Black %	White %
All Faculties	27	61
Arts	45	42
Health sciences	23	64
Mathematics	12	75
Natural sciences	11	77
Computer science	2	89
Engineering	2	92

The Department of Education and Training (DET) black student's educational disadvantage was the greatest in mathematics and science. The ex-DET schools still have few qualified science and mathematics teachers and inadequate physical facilities (Arnott et al as quoted in Zaaiman 1998: 9). As a result, small percentages

of black students matriculate in mathematics and science subjects as shown in table 2 below.

Table 2: Matric pass rates for South African students attending black schools in 1993

Subject	Percentage of all black matriculants writing the subject (%)	Percentage of all black matriculants passing the subject (%)
Mathematics	26	7
Physical Science	15	8
Biology	87	30

6. *Science for All* – a reality?

So far in this essay I have tried to point out that, *science education for all* is a myth in the present day schooling system in South Africa. As I tried to explain so far, for various reasons only a small percentage of pupils are learning physical science up to Grade 12 level. From my many years of teaching/lecturing experience I could identify some of the reasons for the relative difficulty of school pupils in science subjects. Those reasons include, (a) difficult subject matter is introduced at an early stage, (b) complex language usage and vocabulary, (c) overloading of the syllabus and (d) the gender issue, where science subjects are perceived as masculine subjects. This situation, whereby only a small percentage of student population is studying science has to be changed.

6.1 Science education – for the reconstruction of society

According to Solomon & Thomas (1999:61) "education has now gone well beyond the aim of transmitting knowledge to the next generation..." They argued that, the basic aim of education is not only the transmission of knowledge but through it, a preparation to take some part in "the reconstruction of society". By the phrase, 'the reconstruction of society' they (Solomon & Thomas) meant the application of what

was learnt to the problems which each generation has to face as times and technologies change. This second aim of science education (namely, the reconstruction of society) is more relevant than the first to improve the public understanding of science. According to Burger (2000) Reconstruction and Development Programme (RDP) is a declared policy of the ANC government in this country. The Reconstruction and Development Programme is an integrated, coherent socio-economic policy framework that seeks to mobilise this country's people and resources towards the final eradication of apartheid and the building of a democratic, non-racial and non-sexist future (Burger 2000). The government must do everything in its power to make the majority of citizens of this country scientifically literate, which might transform this young democracy to an industrial giant on the African continent. This in turn would create more job opportunities for the citizens thereby reducing the crime situation in this country. This view is also held by Robottom and Hart and they believe that a greater number of science graduates results in a more skilled and productive work force. Improved productive work force might enhance the economic state of the nation (Robottom & Hart 1993: 591)

6.2 Science education – to meet the social demands

A survey was conducted in the UK to investigate the level of public understanding of science. The survey results showed that the level of scientific knowledge was greater amongst the young adults, who had most recently left school, and also who had higher qualifications in science. This result was not surprising and which confirmed that people with formal science education have a greater understanding in science and technology in the later years too (Solomon & Thomas 1999:63). In my personal experience, I have noticed that, some of my female colleagues without any science background were not even confident enough to connect a video cassette recorder to a television. One cannot expect every member of the society to know what Ohm's law states, but at least majority of them should be able to connect two wires to an electric plug and to a light bulb.

After the Dainton and Swan Reports in the UK and the post-Sputnik response and Rickover Report in the US, the demand for change in the Science Curriculum and call for 'science for all' were mounting (Fensham 1985: 417). Many Governments

and education authorities realised that the supply of technological and scientific manpower is important to the maintenance and development of the social, economic and defence needs of their countries. As a result, those countries have made the necessary changes in their school curriculum to meet the new demands. Consequently, some of these countries have produced a surplus over what the national economy can afford. For example, a study conducted in India confirms this view. According to Visaria (1998) the nature of work opportunities sought by the youth in India has been changing because of the considerable growth in the number of high school and college graduates. According to the census data relating to the educational qualifications of the youth, during 1981-91, the number of high school graduates or matriculants (including those obtaining a technical or non-technical diploma not equal to a degree) has increased by 75 percent from 17.76 to 31.00 million; and that of college graduates has risen by 96 percent from 2.43 to 4.77 million. The underlying average annual rates of growth of 5.8 and 7.0 percent are much higher than the rate of growth of employment in the organised sector, in which the matriculants and college graduates seek to be absorbed. Of course, not all the matriculants and graduates enter the labour force; but they do face problems in finding work. In other countries, (especially in Africa, including South Africa) there is still a shortage of science-based specialists in many fields. Perhaps looking into the student background in South Africa could shed some light on the reasons for the underachievement of South African students in mathematics and science.

6.3 Science education – the status quo in South Africa

Howie & Hughes (1998: 33 – 75) have conducted studies on *the student background* of students in South Africa and other countries. Their studies have produced some interesting findings. They found that, just over 50% of the South African sample took physical science, whereas approximately 85% of students in their sample in South Africa were enrolled for biology. According to them this is due to the high proportion of schools traditionally offering biology as a compulsory subject. They reported that students perceived biology to be an easy subject to pass. In this survey, students were asked to indicate their proposed career directions. Most of the students nominated Engineering and the least number of students nominated physics and

chemistry (Appendix 2, Table 3.3). Maybe these unrealistic expectations were due to the lack of proper career guidance at school level.

Another contributing factor to the poor performance of the South African students could be the low educational qualification of their parents. It is really surprising to note that most students did not know the educational level of their parents (Appendix 2, Table 3.6). Maybe it is due to the fact that, in general, parents with very low educational levels avoid discussing the issue with their children. Only a small percentage of parents had the experience of university studies. Students were also asked about the various ways in which they spent their out-of-school time. The activity occupying more of South African students' time than all other activities was *doing jobs at home* (Appendix 2. Table 3.7).

Howie & Hughes (1998) found that, South African students (both boys and girls) were the oldest (among the 11 countries that participated), they spent most time on household chores and their parents had close to the lowest educational levels. These unique features (among others) are likely to limit academic performance considerably. They claimed that, the literacy test was designed to test students' general scientific knowledge and the items were selected on the basis that they reflected questions that relate to real life situations. The example items in the science literary test varied from chloroflurocarbons to nuclear energy. On all the items (Appendix 2, Table 6.6 – 6.9) the performance of South African students was the lowest among the participating countries. In this present situation the future looks bleak. Loucks-Horsley & Matsumoto (1999: 258) reported that the situation in the USA is also grim. They stressed that "we need more teachers who are well prepared to teach more challenging standards and who can help all students learn." I believe that calls for more South African scientists, engineers and technologists can only be answered if disadvantaged students with potential for science-based studies are identified and given adequate academic support. The existing admission practices and study programmes of South African Universities and Technikons should be evaluated and modified where necessary. According to Zaaiman (1998) "a lack of students in science, technology and engineering programmes and the under representation of black students in these programmes are mentioned in many countries". Zaaiman (1998) stressed the significance of a mathematics and science

based foundation year for the disadvantaged students in South Africa and in other countries.

7. Recommendations to achieve Science for All

7.1 Alternative forms of school science – the Thailand model

Although the growth of scientific knowledge has been (and remains) very rapid, this has not led to a great diversity of content in science courses at school level. In South Africa the grade 11 and 12 physical science and mathematics syllabi had the last (cosmetic) changes in 1987. Very few schools have introduced new courses such as computer science. I think it is high time to make changes in the physical science and mathematics syllabi and to introduce computer science as a school subject in all schools. At the same time more funds will be needed to improve and maintain the laboratory facilities in the townships and rural schools.

In the present situation, apparently the majority of the school population learns that it is (almost) impossible to study science as it has been presented at our schools. One way of overcoming this difficulty is by presenting alternative forms of science to meet the needs and abilities of all the students. At present in South Africa and in many other countries science is offered as a compulsory subject during the first nine years of learning. During the final three years of schooling a student can be at school without learning any science subject at all. Thailand is a third world country which has a "6,3,3, school structure, with specific science curricula associated with each of the blocks of schooling levels" (Fensham 1985: 422 – 423). Fensham (1985) reported that all students in Thailand would study some form of science during each year of their 12 years of schooling. The organisational structure of Thailand school system is given in Table 3 and appears to provide very real possibilities for effective *Science for All* that are lacking in many other developed and developing countries.

Table 3: Thailand school system

Vocational Schools			Academic Schools	
Upper Secondary Schooling	3 2 1	(Broad Vocational streams) Specifically designed science courses for each stream	**(Science Stream)** Physics Chemistry Biology	**(Humanities Stream)** Physical Science
Lower Secondary Schooling	3 2 1	(All pupils) General Science		
Primary Schooling	6 5 4 3 2 1	(All pupils) Life experiences (including science)		

During the first nine years all pupils follow the same curriculum in Thailand. During these nine years of schooling, all pupils learn *life experiences* which include science, and later they learn general science. After these nine years of schooling, some pupils continue with more specialised academic or vocational education. The academic stream is further divided into two streams, namely science and humanities streams. Students of the science stream study physics, chemistry and biology while the humanities streams study a more generalised curriculum called physical science. The students in the different vocational streams each have a closely related science curriculum designed to support their broad vocational goals (Fensham 1985: 422 – 423).

The above set up in Thailand takes science very seriously as a part of the total education for all the pupils in that country. Developed countries such as, Australia, Britain and the USA and developing countries in Southern Africa including South Africa can adopt this model of Thailand and thereby avoid certain serious problems that exist in the education system. In these countries only a minority of students do physical science at senior secondary school level. In South Africa a majority of students study Biology at the senior secondary level. According to the South African Science and Technology Indicators during the first half of the last decade nearly 90% of all population group of Standard 10 students enrolled for Biology. On the other hand only less than 50% of white students and less than 20% of black students enrolled for Standard 10 Physical Science (South African Science and Technology Indicators 1996). This situation has disastrous consequence that primary teachers (vital persons if *Science for All* is to succeed) tend to be drawn from these non-science students or from the biology-only group. (It is a pity to note that writers such as Fensham (1985) and Young & Glanfield (1998) have excluded Biology from 'science' in their essays. Actually, Biology is an important scientific learning area, which is essential to understand environmental and conservation issues as well as health, particularly in this era of HIV-Aids, genetic engineering, cloning, and environmental degradation). These primary school teachers are expected to teach all the subjects in a given grade including (general/physical) science. These teachers might not be confident to teach subjects such as, mathematics and (general/physical) science, which they did not study at senior secondary school level. This could lead to develop negative attitudes in the students towards these subjects. This is an extremely sad situation.

The above system of education was introduced in Thailand nearly 20 years ago. In an address delivered by Chuan Leekpai, Prime Minister of Thailand at the opening ceremony of *Education for All 2000 Assessment* claimed that, "student enrolment at all levels of education has increased from less than 12 million or about 55% of the school-age population in 1990 to over 14 million or 74% last year" (Leekpai 2000). He noted that their endeavour to provide education for all had placed enormous pressure upon "educational management and administration, the physical infrastructure of education, and the availability of instructional materials". He maintains that human resources is Thailand's "most valuable asset" and his

government is working hard to address the above issues. From the President's speech (even though he is talking in general terms and not specifically about science education for all) one can see that, the new system of education introduced earlier is paying dividends now. Dividends in the form of increased enrolment, greater educational opportunity for the children and youth and eradication of illiteracy are visible (Leekpai 2000).

7.2 Science exhibitions

Science exhibitions/festivals such as Scifest in Grahamstown are a great idea in the popularisation of science. However modifications to the current organisation/format of Scifest could be looked at. Even though this national festival attracts large number of people, many persons from the rural areas of this country are not able to attend this annual event due to the vast size of the country. I feel that, if this festival is decentralised and organised at regional levels the message of the festival *(science for the new millennium)* could reach the grass-root levels, thereby the organisers could take the science festival to the people. It was encouraging to note that in South Africa 1998 was declared as the Year of Science and Technology (YEAST) and exhibitions were conducted at various regional centres. This provided opportunities to various communities to participate in the festivities. Seemingly it was a once-off activity and during the following years the Science festival was conducted in Grahamstown only. In South Africa one of the most innovative toys available today is the home-made wire-frame car usually made by poor African children. Perhaps these cars are also supposed to be in the Scifest along with the steam cars from the University of Natal. I think these cars are under exploited as a teaching tool.

Scientists and experts in science could be invited to schools to deliver motivational and informational talks. This will allow students to see and interact with science specialists. Also, students could see that scientists are real people and not just TV personalities.

7.3 Greater financial assistance for learners and teachers

More bursaries must be offered to science faculty students at the Universities and Technikons than students at other faculties. This might motivate the students at schools to learn science subjects. Science teachers/lecturers must also get a special science allowance. This could encourage science teachers to continue in the teaching profession. At the moment science graduates get better salaries in industry than in teaching. On the other hand it is possible to be well qualified but a weak teacher. South Africa needs well-qualified and committed science teachers to produce a scientifically literate society.

7.4 Curriculum revision for - *Science for All*

The school curriculum should be revised so that each and every student studies at least one science subject throughout his/her school years. The content must be so compelling that everybody should have a chance to learn it. The curriculum should involve content that has personal and social relevance to the learners. The contents should have application in the world outside the school and it should be a basis for further science learning in the later years of schooling. The revision of the science curriculum should not frighten or intimidate teachers especially in the primary level.

In-service training must be an ongoing process. INSET programmes need not be held at five star hotels. Teachers' centres and unused classrooms can be used for training purposes, thereby reducing the cost of in-service training. The need for in-service education is not unique to South Africa. For example through an evaluation study conducted in the United Kingdom over a period of 3 years, Parker and Spink (1997) came to the conclusion that trainee primary school teachers developed a negative attitude and feelings of apprehension towards science as a result of their past learning experiences. They (Parker and Spink) recommended that interventions must be made to avoid these student teachers entering the teaching profession with negative views and attitudes. They also recommended interventions and in-service training for practising science teachers as well.

Also, Eick & Samford (1999: 34) suggest that, "experienced science educators should help new teachers implementing hands-on teaching practices in their classrooms". The British Commonwealth Curriculum Workshop in Cyprus spelled out the broad topic fields for a basic minimum care of science education in schools. These broad topic fields are listed below in Table 4 (Fensham 1985: 430-432).

Table 4: Umbrella topic fields for a basic minimum care of science education in schools (Cyprus Workshop)

1	The senses and measurement as extension of the senses
2	The Universe
3	The human body
4	Health, nutrition and sanitation
5	Food
6	Ecology
7	Resources (natural & man-made)
8	Population
9	Pollution
10	Use of energy
11	Technology
12	Quality of life

One could justify the presence of these topics in the table. For example, topic 1 is so important in that, measurement both extends our senses and overcomes the limitations of them and through the learning of topic 10 one could understand the efficiency in energy use and this could lead to an enhanced quality of personal and family life.

8. Reflections

The topic for this research project, *"Science for All – Myth or Reality?"* really fascinated me and as a result I have collected large volumes of literature to read. My reading became a never-ending process and it delayed the beginning of the writing. With hindsight I feel that it would have been better to start writing as I went on with the reading.

When certain politicians and educators talk about science education in South Africa it appears that the problems of science education are unique to this country. However it was interesting to note that many aspects of South African science education are similar to the rest of the world.

I have been teaching/lecturing physical science for nearly twenty-five years and have a special interest in this subject. Personally I feel that every child must be given the opportunity to learn science. During this literature review I found that in South Africa all pupils are not given the opportunity to learn science. Even those who are doing it are encouraged by the educators to take it on standard grade because they (the educators) want a higher percentage of pass rate in their subjects. Apparently what is happening in the South African school system is that all who are involved in education – from the National Minister of Education to the educator in the classroom – are after a higher (percentage of) pass rate. It appears that in this process quality of education is forgotten or ignored.

In my discussion with a few students from two prestigious schools in the Eastern Cape Province of South Africa, it appeared to me that the Grade 12 students of these schools did not do any physical science experiments during the year 2000. This is a sad situation. These are well-equipped schools with all the necessary apparatus to demonstrate most of the school science experiments.

For the purpose of this study I collected literature from university and technikon libraries. To collect materials I also used the Internet, inter-library loans, SABINET and EBSCOHOST mostly with the assistance of the Technikon librarian. I found EBSCOHOST to be extremely user friendly and accessible even from the comfort of

my home. I remember, during one session of the M.Ed. contact class at Rhodes (in the year 2000) some of my classmates raised the issue of the shortage of literature they were faced with in their projects. I introduced them to EBSCOHOST and they were delighted to see the usefulness of it. Because of the relatively easy availability of the materials (using mainly EBSCOHOST) I found it interesting to collect more and more materials. With hindsight I realise that, it was undesirable to go beyond the scope of the purpose of the work that I was doing and collect large volumes of materials.

I found that literature review is a tool used world-wide in research. Since large volumes of material is available one has to be selective in using the material. I did not use all the materials that I collected for the purpose of this study. I eliminated a lot of materials using certain criteria. Firstly, I tried to use the recently published materials – mostly materials published in the 90s and a few from the 80s. Secondly, I identified materials published in the (so-called) well-reputed international journals.

The materials I collected include articles of Fensham (1985 and 1986) which describe among other things, a system of education practised in Thailand in which all school going pupils learn some form of science. These articles were published nearly fifteen years ago and the above system of education was introduced in Thailand almost 20 years ago. Hence I was interested in finding out whether the Department of Education in Thailand is still practising science education for all after 20 years of implementation. I could not find any relevant material in this regard and after a certain period frustration grew. Eventually I obtained a speech delivered by the Prime Minister of Thailand at the opening ceremony of *Education for all 2000 Assessment* and it assisted me to some extent.

During 1999 and 2000 I had several discussions and consultations with my supervisors Mrs. Gill Boltt and Dr. Jaap Kuiper. From these meetings I discovered that a literature review summarises, interprets and evaluates existing "literature" (or published material) in order to establish current knowledge of a subject. The purpose for doing so relates to ongoing research to develop that knowledge. According to them the literature review may resolve a controversy, establish the need for additional research and (or) define a topic of inquiry. From this literature review it appears that Science for All is far from reality and further research in this topic is necessary.

Further research is necessary to establish: (i) is Science for All feasible and practical in the South African context, (ii) can this be achieved using the present educators (considering the qualifications and commitment of educators) and (iii) are the South African schools equipped to take this challenge of Science for All?

I hope this literature review will raise interest among some of the readers to take up this topic for further research.

9. Conclusion

School systems are instituted in society to achieve a range of purposes that are related to the needs of the society. Various writers put forward a variety of purposes of schools in society, however individual development and thereby sustainable economic development are two common themes that emerge from these authors' writings.
School science education should empower the citizens to cope with the rapid changes in science and technology that could affect their daily lives at home and outside. According to Jenkins (1999) the main aim of Science Education is to make the citizens scientifically literate so that they can participate in decision-making from an informed position.

Different projects around the world have made *scientific literacy* a world-wide concern. Scientific literacy has many definitions and interpretations available in the literature. These wide ranging definitions make it "an imprecise and ambiguous term" (Knain 1999). Scientific literacy has three main dimensions. They are: (i) Functional Scientific Literacy (Shen as quoted in Knain 1999: 3) which "enables an individual to solve practical problems in particular health and survival; (ii) Civic Scientific Literacy, (Knain 1999) which makes it possible for the citizens to participate in issues of public interest (such as pollution, nature conservation and ozone depletion) and (iii) Cultural Scientific Literacy, (Knain 1999) which allows individuals to appreciate science as a major human achievement.

Science for All is a vision worth exploring. Currently, it is a myth in practice for various reasons. Science educators are partly to be blamed for the unpopularity of science among the common people. Currently at the school level the practical aspect of science is neglected or overlooked. Even in the ex-model C schools, where there are enough equipment available, no (or very few) experiment(s) is/are conducted mainly because there is no practical examination in grade 12 and/or also due to the lack of confidence among science teachers in performing experiments.

There are a number of contradictions in the school science curriculum. As Young and Glanfield (1998) argue these contradictions are not easily resolvable. Currently only a minority of students are (allowed to do) doing physical science in the senior secondary

level. Some form of "gate keeping" is in place in many countries and as a result only about 20% of the total school population is allowed to study (physical) science. In South Africa during the period of Bantu Education the teaching of physical science was affected to a greater degree. Very few black students were successful in the science subjects and proceeded to Universities or Technikons.

In the present day schooling, science education for all is a myth. The general public must realise the need for science education. Science education can act as a tool for the reconstruction of society and also it can meet many social demands.

Howie and Hughes (1998) found that in South Africa for various reasons, the majority of the students took Biology while only a smaller percentage of students took physical science as a grade 12 subject. Zaaiman (1998) advocates the importance of a mathematics and science based foundation year for the disadvantaged students in South Africa and in other countries.

It appears that, in the present system successful science education is only for an elite minority group. Various studies revealed that in South Africa black students are still underachieving in mathematics and science. Science educators, media and government must work together to make *Science for All* a reality. People must realise that one function of science education is to reconstruct and transform the society.

The Thailand model of schooling can be extended to both developed and developing countries. In this model every child would get an opportunity to learn some form of science up to grade 12 level. This system of education was introduced in Thailand nearly 20 years ago. According to the Prime Minister of Thailand (Leekpai 2000) the system is working and they are beginning to reap the fruits of their labour now.

To popularise science, science festivals could be organised at regional levels. Tertiary science students should receive attractive financial assistance from the government, NGOs and industry. Appropriate modifications must be made to school curriculum to enable all students to do at least one science subject. As Anderson (1999: 46) pointed out, "children may only be 10 percent of our population, but they are 100 percent of

our future." If one care for them and for the future of their nation, then mathematics and science must be made available to all children.

10. References

American Association for the Advancement of Science. (1990). *Science for all Americans*, NY: Oxford University Press.

Anderson, H.O. (1990). Teaching for the future. *The Science Teacher*, 66(8), 46-49.

Association for Science Education. (1995). *Open Science: A discussion Document*, Hatfield, ASE.

Bauer, H.H. (1994). *Scientific Literacy and the Myth of the Scientific Method.* Chicago: University of Illinois Press.

Burger, D. (Ed.) (2000). *South Africa Yearbook 2000/01.* Pretoria: Government Communication and Information System.

Department of Education. (2000). *Draft Intervention Strategy for Science, Mathematics and Technology Education.* Pretoria.

Eick, C. & Samford, K. (1999). Techniques for New Teachers. *The Science Teacher*, 66(8), 34-37.

Fasheh, M. (1990). Community Education. *Harvard Educational Review*, 60,19-36.

Fensham, P.J. (December 1986/January 1987). Science for All. *Educational Leadership,* partially referenced.

Fensham, P.J. (1985). Science for all: A reflective essay. *Journal of Curriculum Studies.* 17(4), 415 – 435.

Goldstein, C., James, N. and Rodwell, P. (1991). I'm a Culprit Because I'm a Victim. *Proceedings of the 14th National Convention on Mathematics and Natural Science Education.* (pp. 17-26), Cape Town, South Africa.

Goldstein, C., Mnisi, P., and Rodwell, P. (1995). Changing Teaching in a Changing Society. *Proceedings of the 19th International Conference for the Psychology of Mathematics Education.* (pp. 78-89), Lisbon: University of Lisbon.

Hodson, D. (1993). In search of a Meaningful Relationship: an Exploration of Some Issues Relating to Integration in Science and Science Education. *International Journal of Science Education,* 14(5), 541-562.

Howie, S.J. & Hughes, C.A. (1998). Mathematics and Science Literacy of Final-Year School Students in South Africa. *TIMSS South Africa.* Pretoria: HSRC.

HSRC. (11 December 2000). *International study finds South African conditions not conducive to the learning of mathematics and science.* Media release from the Human Sciences Research Council: 6 December 2000.
http://www.hsrc.ac.za/corporate/media/2000/dec06_2.html

Jenkins, E.W. (1999). School science, citizenship and the public understanding of science. *International Journal of Science Education,* 21(7), 703-710.

Kahn, M. (2000, 01 February). Why Do We Know So Little Science? *Daily Mail & Guardian.* P.20.

Knain, E. (1999). Sense and Sensibility in Science Education: Developing Rational Beliefs Through Cultural Approaches. *Studies in Science Education,* 33, 1-29.

Kyle, W.C. (1995). Scientific Literacy: How Many Lost Generations Can We Afford? *Journal of Research in Science Teaching.* 32(9), 895-896.

Leekpai, C. (11 December 2000). *Education for All 2000 Assessment*: opening address. http://www.moe.go.th/English/speech4.htm

Lloyd, J.K., Smith, R.G., Fay, C.L., Khang, G.N., Wah, L.L.K., Sai, C.L. (1998). Subject Knowledge for Science Teaching at Primary Level: A Comparison of Pre-

service Teachers in England and Singapore. *International Journal of Science Education*, 20(5), 521-532.

Loucks-Horsley,S. & Matsumoto, C. (1999). Research Professional Development for Teachers of Mathematics and Science: The State of the Scene. *School Science and Mathematics*, 99(5), 258-269.

Matsuura, K. (11 December 2000). *Education for All 2000 Assessment*: Closing address. http://www.moe.go.th/English/speech-close.htm.

McCulloch, G. (1998). Historical Studies in Science Education. *Studies in Science Education*, 32, 31-54.

Membiela, P. (1999). Towards the Reform of Science Teaching in Spain: The Social and Personal Relevance of Junior Secondary School Science Projects for a Socially Responsible Understanding of Science. *International Journal of Science Education*, 21(7), 721-730.

Parker,J. & Spink, E. (1997). Becoming Science Teachers: an evaluation of the initial stages of primary teacher training. *Assessment and Evaluation in Higher Education*, 22(1), (17-31).

Popli, R. (1999). Scientific literacy for all citizens: different concepts and contents. *Public understanding of Science*. 8: 123-137.

Robottom, I. & Hart, P. (1993). Towards a meta-search agenda in science and environmental education. *International Journal of Science Education*, 15(5), 591-605.

Royal commission on learning. (1994). *For the love of learning.* Ontario: Queens Printer.

Schuler, C. (2000). Why South Africa's Schools Don't Make the Grade? *Christian Science Monitor*, 92(34), 1.

Shamos, M.H. (1995). *The Myth of Scientific Literacy.* New Brunswick, NJ: Rutgers University Press.

Solomon, J. & Thomas, J. (1999). Science Education for the Public Understanding of Science. *Studies in Science Education*, 33, 61-90.

South African Science and Technology Indicators. (1996). *High School and College Education in Science and Mathematics.* Pretoria: Directorate for Science and Technology Policy Foundation for Research Development (pp. 17-18).

Visaria, P. (1998). *Unemployment among youth in India: level, nature and policy implications.* New Delhi: University of New Delhi.

Young, M. & Glanfield, K. (1998). Science in Post-Compulsory Education: Towards a Framework for a Curriculum of the Future. *Studies in Science Education,* 32, 1-20.

Zaaiman, H. (1998). *Selecting Students for Mathematics and Science: The Challenge Facing Higher Education in South Africa.* Pretoria: HSRC.

11.1 Appendix A: A document from an Eastern Cape School

29 October 1999

Dear Parents

The time has come for your daughter to choose her subjects for the final phase of her school career. This choice is of the utmost importance as it influences your daughter's future.

You and your daughter are invited to a Grade 9 evening in the school hall on THURSDAY 4 NOVEMBER 1999 at 17:30 – 18:30. The teachers who have been and will be teaching your daughter will be available should you wish to consult them.

It will be greatly appreciated if you will attend this meeting. It is an opportunity for you, as parents, and us, as teachers, to meet and discuss a matter which is important to us all - your daughter's future.

The Grade 10 Subject Choice form must be completed and returned to me by FRIDAY, 12 November 1999. It is essential that these forms are handed in, as they must be checked and class allocations for teachers must be made for 1999.

PLEASE complete the tear-off slip and give it to your daughter to return to me on the first day of next term.

Your co-operation in this matter will be greatly appreciated.

Yours faithfully

11.2 Appendix B: Excerpts from TIMSS South Africa

Table 3.1: Proportions of final-year South African students taking mathematics

Level of mathematics taken	%
Did not take mathematics up to std 10	29,7
Functional grade mathematics std 10	3,9
Standard grade mathematics std 10	39,8
Higher grade mathematics std 10	26,5

Table 3.2: Proportions of South African students enrolled for science courses

Level of science course taken	Most advanced course taken in physics (%)	Most advanced course taken in chemistry (%)
Did not take physical science up to std 10	45,6	46,7
Std 10 functional/standard grade physical science	21,7	21,1
Std 10 higher grade physical science	32,6	32,1

Table 3.3: Students' preferences concerning intended future study

Area of intended study	%
Biological sciences (e.g. botany, ecology, zoology)	10,7
Business (e.g. accounting, marketing, finance, administration, management)	17,2
Chemistry (e.g. chemistry, biochemistry)	1,8
Computer and Information sciences (e.g. sytems analyst)	6,5
Earth sciences (e.g. geology, oceanography)	3,0
Engineering (e.g. chemical, civil, electrical, mechanical engineering)	18,4
Health occupations (e.g. dental assistant, practical nursing, veterinary assistant, X-ray technology)	11,9
Health sciences (e.g. dentistry, medical doctor, optometry, pharmacy, physical therapy, registered nursing, veterinary medicine)	13,6
Mathematics (e.g. calculus, statistics)	4,6
Physics (e.g. astronomy, physics)	0,9
Other fields of study	11,5

Table 3.4: Students' reports on how well they perform in mathematics and science

	Doing well in mathematics				Doing well in science			
	Agree or strongly agree		Disagree or strongly disagree		Agree or strongly agree		Disagree or strongly disagree	
Country	% of students	Mean mathematics literacy score	% of students	Mean mathematics literacy score	% of students	Mean science literacy score	% of students	Mean science literacy score
Australia	72	544	28	477	73	554	27	470
Canada	67	542	33	476	75	548	25	489
Czech Republic	55	487	45	441	71	500	29	463
Denmark	76	566	24	498	72	535	28	469
Germany[1]								
Netherland	63	581	37	527	63	570	37	540
New Zeal	66	557	34	456	68	557	32	471
Russ. Fed	58	494	42	441	78	489	22	457
South Africa	58	367	42	353	73	349	27	366
Sweden	62	563	38	507	66	586	34	515
USA	76	476	24	423	83	491	17	440

Table 3.5: Students' reports on how much they like mathematics

	Dislike a lot		Dislike		Like		Like a lot	
Country	% of students	Mean mathematics literacy score	% of students	Mean mathematics literacy score	% of students	Mean mathematics literacy score	% of students	Mean mathematics literacy score
Australia	14	455	25	513	47	538	14	578
Canada	17	476	22	501	46	529	15	573
Czech Republic	19	435	48	447	28	501	5	575
Denmark	7	460	14	506	44	551	34	586
Germany	xx[12]	xx	xx	xx	xx	xx	xx	xx
Netherland	[13]	-	-	-	-	-	-	-
New Zeal	18	468	29	491	42	547	11	592
Russ. Fed	6	442	32	449	52	480	10	511
South Africa	8	334	14	363	40	367	38	372
Sweden	13	468	29	521	42	574	16	625
USA	13	414	21	446	45	465	21	509

Table 3.6: Parental educational levels of South African students

	Father	Mother
Completed primary school	24,6	31,5
Partially completed secondary school	18,8	22,8
Completed secondary school	13,3	14,2
Completed vocational/technical education after secondary school	7,6	5,0
Partly completed university study	2,6	1,6
Completed university study	6,2	4,8
Don't know	26,9	20,3

Table 3.7: South African students' reports on how they spend their leisure time

Activity	Time (Average hours per day)
Watching television or videos	1,2
Playing computer games	0,2
Spending time with friends outside of school	1,1
Doing jobs at home	2,2
Working at a paid job	0,9
Playing sports	1,3
Reading a book for enjoyment	1,3

Table 5.2 The performance of students by their use of the language of the test

Province[21]	Use of language of instruction	Mathematics average literacy score	Science average literacy score
Eastern Cape	always	315	319
	sometimes	323	310
	never	315	303
Free State	always	436	482
	sometimes	324	320
	never	334,5	320,5
Gauteng	always	463	471
	sometimes	342	327
	never	361	333
Kwazulu-Natal	always	451	464
	sometimes	331	317
	never	319	306
Mpumalanga	always	441	466
	sometimes	317	299
	never	323	302
Northern	always	316	307
	sometimes	314	292
	never	321	308
North West	always	337	336
	sometimes	325	309
	never	337	312

21 The Northern Cape and Western Cape Province were not included in Table 5.2 as these scores were not representative due to the small size of the sample. These provinces' scores are presented below:

Northern Cape	*always*	*434.5*	*473*
	sometimes	*447*	*484*
Western Cape	*always*	*622*	*628*
	sometimes	*541*	*592*
	never	*617*	*636*

Table 6.6: Science literacy: percent correct for example Item 1

Country	Percent correct
Australia	89
Canada	91
Czech Republic	92
Denmark	93
Germany	87
Netherlands	89
New Zealand	86
Russian Federation	88
Sweden	90
USA	81
South Africa	55
International average percent correct	*87*

Table 6.7: Science literacy: percent correct for example Item 2

Country	Percent correct
Australia	69
Canada	84
Czech Republic	92
Denmark	83
Germany	66
Netherlands	89
New Zealand	79
Russian Federation	66
Sweden	93
USA	77
South Africa	39
International average percent correct	*77*

Table 6.8: Science literacy: percent correct for example Item 3

Country	Percent partially correct	Percent fully correct
Australia	17	53
Canada	18	51
Czech Republic	22	28
Denmark	25	39
Germany	13	52
Netherlands	23	55
New Zealand	23	45
Russian Federation	22	31
Sweden	24	47
USA	18	24
South Africa	9	10
International average percent correct	*20*	*41*

Table 6.9: Science literacy: percent correct for example item 4

Country	Percent correct
Australia	42
Canada	40
Czech Republic	38
Denmark	51
Germany	44
Netherlands	41
New Zealand	37
Russian Federation	50
Sweden	54
USA	41
South Africa	26
International average percent correct	*40*

DEVELOPING AND EVALUATING THE USE OF LEARNING MATERIAL IN SCIENCE - A CONSTRUCTIVIST APPROACH TOWARDS LEARNING NEWTON'S LAWS

A RESEARCH PROJECT

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF EDUCATION

OF

RHODES UNIVERSITY

BY

JAMES DANIEL VALIATHAZHEL

SUPERVISOR: MRS. GILL BOLTT

JANUARY 2002

DECLARATION

This research represents original work by the author and has not been submitted in any other form to another university. Where use was made of the work of others, it has been duly acknowledged in the text.

DEDICATION

I dedicate this work to my parents Daniel and Susannamma Valiathazhel who passed away just before the commencement of this study

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- ☆ **My family for their patience, encouragement and tremendous support.**
- ☆ **Finally, my God with Whom all things are possible and from Whom there came the strength to commence and complete this Masters degree. (*I can do everything through Him who gives me strength. Philippians 4: 13*).**

Abstract

The Government of National Unity in 1994 introduced a new educational policy for South Africa. This represented a shift in paradigm from a transmission mode of teaching and learning to a learner-centred education. The shift marks a transformation from a content-based curriculum to an Outcomes Based Education (OBE).

Various authors found that different sections in the Physical Science syllabus in South Africa are often misunderstood by students for different reasons. One of the reasons was that students had their own ideas about laws of nature and these (mis)conceptions were resistant to change. From the literature and from the author's personal experience it was found that Bodies in Motion is a topic that is difficult to conceptualise by students of different age groups. The challenge facing educators is how to tackle this issue.

In this research project a diagnostic test is developed and used to identify the topics where students have conceptual problems. To address these problem areas further, concept sheets/work sheets where developed and implemented. The different challenges and tasks given in the work sheets/learning material are organised in such a way as to make the students aware of their own ideas about Bodies in Motion in general and the key-concepts in particular and also to make them aware of the ideas of their peers (group members). It was also aimed at offering the learners the scientific alternative to their own beliefs.

At the end, it was discovered that, even though the general understanding of the learners has improved in this topic (namely, Bodies in Motion), their original beliefs were largely unaffected.

It is the hope of the researcher that the project would be the basis for further research on the development of learning material in science.

CONTENTS

1. Background and context

In the post apartheid South Africa, the idea of teaching science using scientific-inquiry processes that promote meaningful learning is seemingly at the heart of Curriculum 2005 (South Africa 1997). There is evidence that the inquiry-oriented and learner-centred teaching methods are widely used by the science education community (Ahern-Rindell & Amelia 1999: 203). Most South African science teachers might claim that they are "good" teachers, but on the other hand, apparently year after year the pass rate in Grade 12 Physical Science has not improved noticeably (Foundation for Research Development 1996: 18-19). In fact the pass rate for higher-grade physical science has decreased from 21% to 17% during the years 1996 – 1998 as given in the table below.

Table 1: Results in selected grade 12 subjects: 1996 – 98 (Forgey, *et al.* 2000: 117)

Subject	Year	Number of candidates per subject	Percentage pass (S.G.)	Percentage pass (H.G.)
Mathematics	1996	215 061	50%	10%
	1997	252 617	46%	9%
	1998	279 702	42%	7%
Physical Science	1996	122 899	67%	21%
	1997	141 278	65%	19%
	1998	157 174	66%	17%

Various authors (Kuiper 1991; McClelland 1985) found that different sections in the Physical Science syllabus in South Africa are often misunderstood by students for different reasons. One of the reasons was that students had their own ideas about laws of nature and these (mis)conceptions were resistant to change (Kuiper 1994).

2. Research questions

In this study I investigate the following research questions:

1. What ideas on *Bodies in Motion* do the Tertiary Foundation Course students at the Technikon predominantly use in answering questions involving Newton's laws of motion?
2. Can existing misconceptions of students about *Bodies in Motion* be addressed effectively by means of learning materials produced specifically for this purpose?

3. Reasons for choosing the topic: *Bodies in Motion*

I chose this topic, namely *Bodies in Motion* for various reasons. Firstly, it is my personal experience as a teacher and lecturer in Physical Science that learners have conceptual problems with *Bodies in Motion*. Also, I have found that many learners come to the classroom with different preconceived ideas about this topic. Secondly, it is reported by various writers that, this topic is a particularly difficult one. For example, Gunstone and Watts (in Driver *et al.* 1981:85) claimed that,

> in the large numbers of studies of children's conceptions of natural phenomena which have been undertaken in recent years, no content area has received more attention than that described by 'force and motion'.

Again Terry & Jones (1986:291) quote Clement (1982), Viennot (1979) and Watts & Zylbersztajn (1981) and report that, "students over a wide range of age and educational backgrounds harbour basic misconceptions which interfere with their understanding of many aspects of mechanics".

Before writing this report, I had not researched the topic under discussion. However, over the years I have seen similarities in the (mis)conceptions of learners across cultures and languages (in India, Lesotho and North-west and Eastern Cape Provinces

of South Africa) in their understanding of *Bodies in Motion.* It seems that students develop similar kinds of conceptions despite the differences in their language, culture or geographical location (Gunstone and Watts in Driver *et al.* 1981). This is also a topic in the syllabus that I teach the Foundation Students at the Technikon. For these reasons I decided to choose this topic namely, *Bodies in Motion* for the purpose of this study.

Firstly a diagnostic test (Appendix 1, pages 2-7), was given to the entire group of **Tertiary Foundation** Students (60 students) at the Technikon. (**The Tertiary Foundation programme** at the Technikon is an alternative access programme which aims to offer remediation/consolidation of the students' knowledge and understanding of prior learning of Physical Science and Mathematics together with their communication skills thereby equipping them to succeed in Science and Technology based Tertiary programmes. The target group is students from disadvantaged educational backgrounds who fail to meet the minimum entry requirements for main stream technology based programmes. The majority of students in the Tertiary Foundation programme come from school backgrounds that have not adequately prepared them for Tertiary Education. All these students have a Senior Certificate with a minimum of an F symbol (S.G.) in Mathematics and Physical Science. The TFC programme is a yearlong one, which fits into the normal mainstream academic year-programmes of the Technikon). The diagnostic test (Concept sheet 1) was aimed at identifying the (mis)conceptions of these students. Based on the result/outcome of this diagnostic test and with the help of the literature review, key-concepts would be identified. Further learning materials, Concept Sheet 2, 3 and 4 (Appendix 1, pages 8-16), were developed and administered to a smaller group of students. The reasons for using a smaller group will be explained later in the report. Concept Sheet 5 (Appendix 1, pages 17-18) was designed to consolidate the concepts introduced and investigated using Concept Sheets two to four. Finally, Concept Sheet 6 (Appendix 1 pages 19-20) was designed to evaluate and affirm the students' understanding of *Bodies in Motion.* Presentations of these lessons were planned for six sessions of 1 hour 30 minutes each.

To evaluate the effectiveness of each Concept Sheet a discussion was conducted by the facilitator at the end of each lesson. The facilitator requested the presence of a colleague (a Head of Department, at the Technikon) to observe and evaluate these lessons. This colleague was asked to complete a questionnaire at the end of the last lesson. Another questionnaire was prepared for the learners to complete at the end of the implementation of concept sheet 6.

A pilot study was conducted in 1999 and a second round of study was undertaken during the year 2000. Comparisons were made between the results of these two studies and conclusions were drawn from the results.

4. Research methodology

4.1 Interpretive and normative research paradigms

This study is underpinned by the interpretive research paradigm. According to Cohen and Manion (1994: 36 – 39) interpretive research paradigm seeks to understand phenomena and interpret meanings within the social and the cultural context of the natural setting. They believe that unlike positivism (normative paradigm), the interpretive paradigm acknowledges the subjective perspectives of the individuals. Schwandt (1994: 119) also holds the view that the goal of this particular research paradigm is "the grasping or understanding of the "meaning" of social phenomena". In table 2 below Cohen and Manion (1994: 39) summarise some of the broad differences between *normative* and *interpretive* approaches.

Table 2: **Differing approaches to the study of behaviour**
Cohen and Manion (1994: 39)

Normative	Interpretive
Society and the social system	The individual
Medium/large-scale research	Small-scale research
Impersonal, anonymous forces regulating behaviour	Human actions continuously recreating social life
Model of natural sciences	Non-statistical
'Objectivity'	'Subjectivity'
Research conducted 'from the outside'	Personal involvement of the researcher
Generalising from the specific	Interpreting the specific
Explaining behaviour/seeking causes	Understanding actions/meanings rather than causes
Macro-concepts: society, institutions, norms, positions, roles, expectations	Micro-concepts: individual perspective, personal constructs, negotiated meanings, definitions of situations

This study falls within the parameters of most of the items listed on the right hand side column of table 2. In this study using a diagnostic test I gathered responses from each (individual) student from the Tertiary Foundation group at the Technikon. This was a non-statistical, small-scale research project. I was present and participated in the whole exercise. For these reasons the interpretive paradigm proved to be suitable for this study. The other framework for this research project is based on the principles of constructivism.

4.2 Constructivism

Until recently, many teachers/educators believed in the old 'bucket-theory', in which they considered students as empty vessels (*tabula rasa*) to be filled by the teachers. According to this approach, educators focussed on transferring knowledge from themselves to the students. It is also true that; many researchers investigated ways of improving this approach. I remember, my teachers used to tell us that, they could only 'take a horse to the river, it had to do the drinking for itself'. In my school days, from this statement I assumed that, they could only teach us, but it was entirely up to us as students to learn. Many educators found evidence in this hypothesis as Bodner (1985)

claimed, "teaching and learning are not synonymous; we can teach, and teach well, without having the students learn." It seems that this approach is gradually giving way to a new approach of teaching/learning called the 'constructivist' approach.

4.2.1 Literature review on 'Constructivism'

According to Bodner (1985:873), the constructivist model can be summarised in a single statement, "knowledge is constructed in the mind of the learner." Matthews (1992:299-307) suggested that Constructivist Theory is far superior to the behaviourist theory, because (i) it stressed active student participation in learning, (ii) it emphasised the importance of the understanding the learner has (pre-conceived ideas) in a particular area, (iii) it highlights the importance of dialogue and communication and (iv) it places lots of importance on the understanding of concepts rather than on rote learning. Kilpatrick (1987) and Lerman (1989) (as quoted by Matthews 1992) suggested that, "the core epistemological theses of Constructivism are:

(1) Knowledge is actively constructed by the cognizing subject, not passively received from the environment.

(2) Coming to know is an adaptive process that organizes one's experiential world..."

According to Hodson and Hodson (1998) there are two forms of Constructivisms, namely Radical Constructivism and Social Constructivism. Radical Constructivism has roots in Piaget's theory. It emphasises the idea of individual construction of knowledge through cognitive adaptation – assimilation and accommodation (Bodner 1985). According to Radical Constructivists knowledge is created in the mind of the individual with thought process being considered primary and the language secondary in the learning process. According to Social Constructivists, construction of knowledge is based on experiences and previous knowledge (Ernest 1991). Ernest (1991) argued that learning is a social construction. The social construction of knowledge is attained through negotiation with others. Negotiation takes place through communication and communication is achieved through the usage of language.

Hodson and Hodson (1998:33-34) noted that constructivist views of learning provide enough pointers towards teaching strategies that include the development of learning material which might assist students in the task of conceptual reconstruction. They include, identifying students' ideas and views, creating opportunities for students to explore their ideas, make predictions and where necessary change their ideas and views. They further indicated that, in the constructivist approach, "the teacher's task is to lower the status of the existing idea and raise the status of the new one." In the same article Hodson and Hodson (1998:34) portrayed some of the limitations of constructivism. They quoted Matthews (1993, 1995) in which Matthews claimed that, "constructivist approach is open to the charge of neglecting and trivialising scientific understanding" (Hodson & Hodson 1998:34). They (Hodson & Hodson) also quoted Driver (1994) and reported that, "if knowledge construction is seen solely as an individual process then this is similar to what has traditionally been identified as discovery learning" (Hodson & Hodson 1998:34). According to Solomon (1994:7) three new aspects of constructivism emerged in the early 1980's. They were "(a) the theory of personal constructs, (b) the notion of 'Children's Science', and (c) the social construction of knowledge". When learning materials are developed in the constructivist approach, the facilitators have to take these points into consideration. The material must provide opportunity to the learners for interaction among the learners. Also, the material must create cognitive dissatisfaction with existing (mis)conceptions and must establish the scientific view in the minds of the learners.

4.3 Sample groups

During the pilot study in 1999 the diagnostic-test (Concept Sheet 1: Appendix 1, pages 2-7) was administered to the entire group of Tertiary Foundation students at the Technikon. In 1999 the Technikon had a period of student unrest and as a result valuable teaching/lecturing time was lost. For the purpose of this project I requested the participation of volunteers from the Tertiary Foundation group and Concept Sheets

2 to 6 were administered during the July holidays. The final round of the study was conducted in 2000 and once again the diagnostic-test was administered to the entire group of Tertiary Foundation students. Concept Sheets 2 to 6 were administered to a subgroup of 15 students. These 15 students form a convenient sample and their selection process is given elsewhere in this report.

5. Development of the diagnostic-test

Firstly, in 1999 a diagnostic-test (Concept Sheet 1: Appendix 1, pages 2-7) was administered to the entire group of Tertiary Foundation Students (60 students) at the Technikon. The diagnostic test was aimed at obtaining information on (mis)conceptions of the students about *Bodies in Motion.* There is enough evidence in the literature to demonstrate that *Bodies in Motion* is a problem area for many people from a wide range of age and sophistication. McClelland (1985: 159-162) argues that force, resultant force, tension, change in momentum and work are topics that learners find difficult to conceptualise. Terry *et al* (1985: 162-165) have found that many physics students have a poor understanding of static equilibrium, the relationship between force and acceleration and Newton's first and second laws. According to them (Terry *et al* 1985: 162-165), "the students believe that to maintain motion, a constant force is always required". Halloun and Hestenes (1985: 1057) believe that "impetus is such a natural common sense concept that some version of it occurs to a substantial fraction of students today". Trowbridge and McDermott (1981: 242) found that

> a significant number of students from a wide variety of courses confused the concepts of velocity and acceleration. Students who succeeded in making the distinction could discriminate between the concepts of instantaneous velocity and change in velocity but often failed to take the corresponding time interval into account. At the completion of instruction fewer than half of the students demonstrated sufficient qualitative understanding of acceleration as a ratio to be able to apply this concept in a real situation. Even with assistance in making the necessary observations, these students were unable to combine this information in a manner that permitted successful comparison of two accelerations.

From the above literature review it appears that the problematic concepts for students from the topic *Bodies in Motion* that are repeatedly appearing in the literature are force, acceleration and Newton's laws.

With the help of these findings from the literature, the ideas from a website (Physics Classroom: 1999) and from my own experiences a diagnostic test was developed. The diagnostic test is an important element of this research because I hope to identify the misconceptions of my students in the learning area *Bodies in Motion* using this test. I prepared 15 questions for this purpose covering Newton's three laws however due to time constraints I instructed them to ignore questions 13 to 15 which were based on Newton's third law. In the next section I will be looking at the rational behind each question in the diagnostic test (Concept Sheet 1: Appendix 1, pages 2-7).

For each question students were asked to give the best answer in the space provided and to give brief explanation for each answer.

The first question in the diagnostic test is the following.

1. *Imagine a place in the cosmos far from all gravitational and frictional influences. Assume that an astronaut in that place throws a rock. The rock will ...*
   a. *gradually stop.*
   b. *continue in motion in the same direction at constant speed.*

According to Newton's first law the rock will continue in motion in the same direction at constant speed. Various authors (McClelland (1985: 159-162), Terry *et al* (1985: 162-165), Halloun and Hestenes (1985: 1057), Trowbridge and McDermott (1981: 242) found that most students know the statement of Newton's first law but failed to apply it in practical situations. To test this aspect Question 1 is included in the diagnostic test.

Questions 2 to 5 are based on an application of Newton's first law, namely inertia.

2. *Mac and Josh are arguing in the cafeteria. Mac says that if he flings the jelly with a greater speed it will have a greater inertia. Josh argues that inertia does not depend upon speed, but rather upon mass. Who do you agree with?*

3. *If you were in space in a weightless environment, would it require a force to set an object in motion?*

4. *Ben is being chased through the woods by an elephant, which he was attempting to photograph. The enormous mass of the elephant is extremely intimidating. Yet, while running if Ben makes a zigzag pattern through the woods, he will be able to use the large mass of the elephant to his own advantage. Explain this.*

5. *Two bricks are resting on the edge of a lab table. Shirley (who is vertically challenged) stands on her toes and spots the two bricks. She acquires an intense desire to know which of the two bricks are most massive. Since Shirley is vertically challenged, she is unable to reach high enough and lift the bricks; she can however reach high enough to give the bricks a push. Discuss how the process of pushing the bricks will allow Shirley to determine which of the two bricks is most massive. What difference will Shirley observe and how can this*

observation lead to the necessary conclusion?

Josh is correct in question 2. Inertia is a quantity that solely depends on mass. (Momentum is a quantity that depends on both mass and speed/velocity). Even in space (weightless environment) objects have mass and hence inertia. Therefore even in a weightless environment a force is required to set an object in motion. In question 4, the large mass of the elephant means it has a large inertia. Ben can easily change his own state of motion (make quick changes in direction) while the elephant has extreme difficulty changing its state of motion. In question 5 also learners' understanding of inertia is being tested. Inertia is directly proportional to the mass of the object. The brick with the greater mass will offer the greater resistance.

According to Newton's first law if an object is in motion it will stay in motion with those very same motion characteristics. It does not take any force to maintain that same state of motion. Nevertheless Terry *et al* (1985: 163) note that "students believe that to maintain motion, a constant force is always required". To test this misconception among the students the following question (number 6) is included in the diagnostic test. This question (number 6) also deals with Newton's Second law. In this question the acceleration of the moving object is zero (object moves with constant velocity). Therefore, F = ma, i.e., F = 4 kg. x 0 $m.s^{-2}$, $\therefore F = 0$.

6. *A 4.0-kg object is moving across a frictionless surface with a constant velocity of 2 m/s. Which one of the following horizontal forces is necessary to maintain this state of motion?*

   a. 0 N *b. 0.5 N* *c. 2.0 N* *d. 8.0 N*
   e. depends on the speed.

Again, Newton's first law states that, as far as forces acting on an object are concerned, a situation in which an object is at rest is not different from the situation where the object is in uniform linear motion. Question 7 is asked to find out whether students have this understanding of Newton's first law.

7. If the forces acting upon an object are balanced, then the object
a. must not be moving.
b. must be moving with a constant velocity.
c. must not be accelerating.
d. none of these

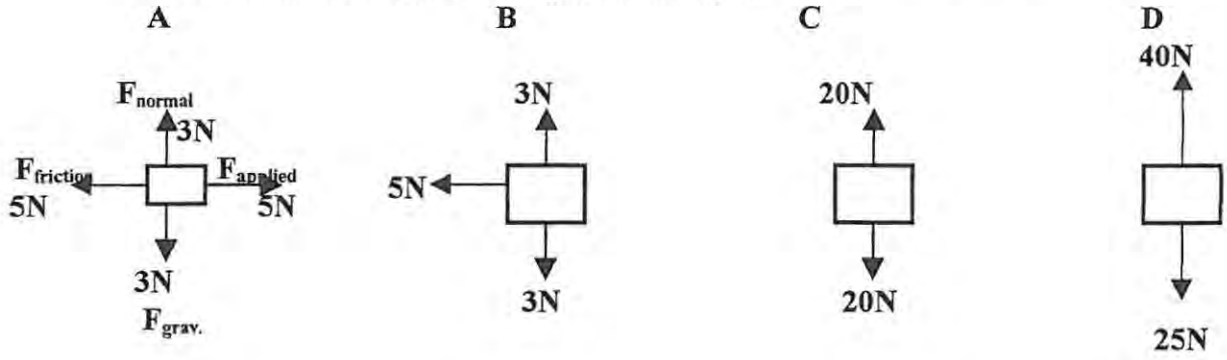
From my own teaching/lecturing experience, I have noticed that students find it difficult to apply Newton's laws of motion in practical situations. This is also a reason for including Question 7 in the diagnostic test. In question 7, the answer could be "**a**" or "**b**", however those answers are incomplete. (The answer could be "**a**" but does not have to be "**a**" and the answer could be "**b**" but does not have to be "**b**"). On the other hand an object having balanced forces definitely cannot be accelerating. Therefore the most acceptable answer is "**c**".

Questions 8, 9 and 10 in the diagnostic test deal with "free-body diagrams". In question 8, various situations are given and students are expected to draw free-body diagrams. In question 9, free-body diagrams for four situations are given and students are asked to determine the net force acting upon the object in each case. In question 10, the net force and some other force/s are given and the students are to complete the magnitude of the missing forces.

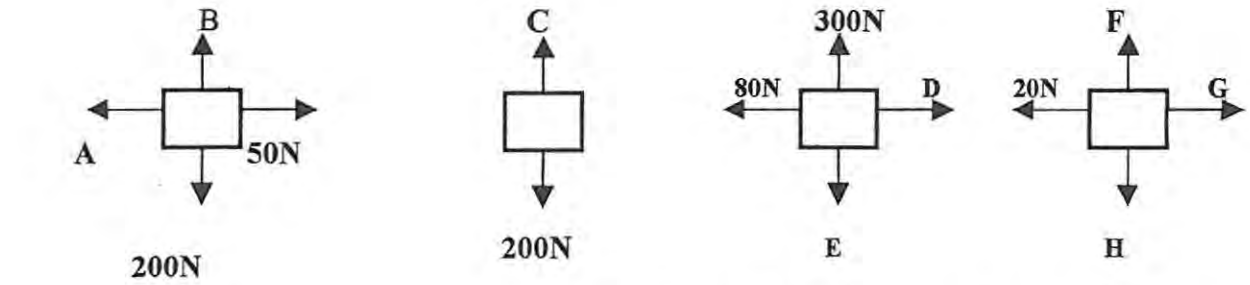
8. Construct free-body diagrams for the various situations described below.

a) A book is at rest on a tabletop.
b) An egg is free-falling from a nest in a tree.
c) A rightward force is applied to a book in order to move it across a desk with a rightward acceleration.
d) A rightward force is applied to a book in order to move it across a desk at constant velocity

9. *Free-body diagrams for four situations are shown below. For each situation, determine the net force acting upon the object.*



10. *Free-body diagrams for four situations are shown below. The net force is known for each situation. However, the magnitudes of a few of the individual forces are not known. Analyse each situation individually and determine the magnitude of the unknown forces.*



$F_{res.}$ = O N

$F_{res.}$ = 900 N up

$F_{res.}$ = 60 N Left

$F_{res.}$ = 30 N right

To answer the questions 8, 9 and 10 (above) it is important to know the various types of forces, such as the normal force, applied force, frictional force, gravitational force, resultant force, balanced force, unbalanced force, etc.

Question 11 in the diagnostic test deals with (i) net force acting on a moving object and (ii) interpreting dots/ticks made by a ticker-timer on tickertape. In question 11 A, the net force is in the same direction as the direction of the moving car and in 11 B, it is in the opposite direction to the direction of the moving car.

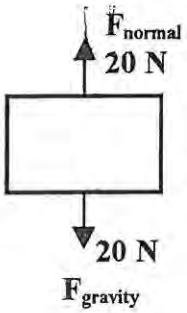
11. *Consider the two ticker tape traces below for an acceleration of a car. From the trace, determine the direction of the net force which is acting upon the car.*

A 

B. 

From the literature (McClelland (1985: 159-162), Terry *et al* (1985: 162-165), Halloun and Hestenes (1985: 1057), Trowbridge and McDermott (1981: 242) it is evident that students have serious conceptual problem in the learning area, *balanced forces*. This aspect was tested in question 12 of the diagnostic test, which is given below.

12. *Two students (Anna and Noah) are discussing an object which is being acted upon by two individual forces (both in a vertical direction); the free-body diagram for the particular object is given below.*



During the discussion, Anna suggests to Noah that the object under discussion could be moving. In fact, Anna suggests that if friction and air resistance could be ignored (because of their negligible size), the object could be moving in a horizontal direction. According to Anna, an object experiencing forces as described above could be experiencing a horizontal motion as described below.

. . . . . .

Noah objects, arguing that the object could not have any horizontal motion if there are only vertical forces acting upon it. Noah claims that the object must

be at rest, perhaps on a table or floor. After all, says Noah, an object experiencing a balance of forces will be at rest. Who do you agree with? Explain your answer.

If the forces acting on an object are balanced and the object is in motion, it will continue in motion with the same velocity. In fact forces do not cause motion but forces produce acceleration. Hence in question 12 Anna is correct.

As it is mentioned elsewhere in this research report, the diagnostic test was administered to the entire group of Tertiary Foundation Students at the Technikon. The diagnostic test played an important part in identifying the key-concepts. Students' responses to the questions in the diagnostic test was also used to identify the key-concepts.

5.1 Conceptual issues identified from the diagnostic test

In this section students' responses to all the questions in the diagnostic test will not be discussed. However, those responses where the students demonstrated considerable misconception in three key concepts will be discussed.

Question 6

6. *A 4.0-kg object is moving across a frictionless surface with a constant velocity of 2 m/s. Which one of the following horizontal forces is necessary to maintain this state of motion?*

a. 0 N *b. 0.5 N* *c. 2.0 N* *d. 8.0 N*
e. depends on the speed.

In their response to this question all the participants gave the incorrect answer. Their answers were either "**d**" or "**e**". Among the participants 67% gave the answer "**d**". Those who obtained "**d**", used the formula, F = ma. Seemingly, they were confused and used 2 $m.s^{-1}$ as the acceleration. According to others the answer is "**e**", and their explanations demonstrates their misconceptions in this topic.

For example, one student (student number 2) wrote, "*the force necessary to maintain motion really depends on the speed, greater the speed the greater the force required. Therefore I do not know what the actual force is*". Another student (student number 8) wrote that, "*friction is a force opposing motion and the applied force must be greater than the friction for the object to move with constant velocity*".

As a result of these kind of responses and the fact that all of them obtained incorrect answer in question 6, I came to the conclusion that perhaps *Newton's first law* in general and *balanced and unbalanced forces* in particular are concepts that need special attention.

Question 1 in the diagnostic test was based on Newton's first law and inertia. It appears that most students knew the definition of inertia and certain aspects of inertia. However there is evidence that they did not have proper conceptual understanding of inertia. For example, the response of one student (student number 14) to question 1 was, "*continue in motion in the same direction at constant speed because of the gravitational and frictional influence*". The answer, " *continue in motion in the same direction at constant speed*" is acceptable whereas the explanation " *because of the gravitational and frictional influence*" is unacceptable. Another student (student number 10) wrote, "*continue in motion in the same direction at constant speed because the gravitational force in the moon is smaller than that of the earth*". Once again lack of scientific understanding is demonstrated in their explanations.

Question 3 also deals with inertia. The response of student number 11 to question 3 was that, *it would not require a force because in space everything is light*". The response of student number 9 to question 3 was that, *in space in a weightless environment no force is required to set an object in motion because there is no mass and gravitational force in space.*

From the above examples it seems that these students have no proper understanding of the concept of *inertia.*

Question 11 deals with (i) the net force acting on a moving object and (ii) interpreting dots made by a ticker-timer on tickertape. In the question it is given very clearly that the cars are accelerating. They were asked to determine the direction of the net force acting upon the cars. Most of the participated students provided correct answers to question 11. However during the post-test discussion they indicated that they have a degree of confusion in this area of analysing ticker-tapes. Three of the most common responses are given below.

Student 16

11 Consider the two ticker tape traces below for an acceleration of a car. From the trace, determine the direction of the net force which is acting upon the car.

It is moving with constant velocity to the right

A . . . . . 

It is moving with constant velocity to the left 

B . . . . . .

Student 23

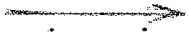
11 Consider the two ticker tape traces below for an acceleration of a car. From the trace, determine the direction of the net force which is acting upon the car

A . . . . . to the right

B . . . . . to the left

Student 30

11 Consider the two ticker tape traces below for an acceleration of a car. From the trace, determine the direction of the net force which is acting upon the car

A . . . . . 

B . . . . . .

To address the conceptual issues in question 11, I have decided to give special attention to Newton's Second law. Newton's Second law deals with the relationship between acceleration produced and (a) force applied and (b) mass moving. It also gives the students the opportunity to learn the skills to analyse the dots/ticks on a ticker-tape and to become familiar with it.

Using the above information the following (problematic) key-concepts were identified.

5.2 Key-Concepts

In this area of learning, namely *Bodies in Motion*, I have considered the following as key-concepts.

(i) Balanced and unbalanced forces,

(ii) inertia and

(iii) relationship between acceleration produced and (a) force applied and (b) mass moving.

5.2.1 Balanced and unbalanced forces

It seems that, learners generally link objects in motion with steady force applied. This apparent belief leads to different wrong assumptions. As Thijs (1992:155) pointed out, apparently many learners believe that,

> (1) in a rest situation, no forces (or only the force of gravity) are present; (2) when an object moves at a constant speed, a force is acting in the direction of the motion, which is necessary to overcome counter forces; (3) a force exerted on an object is imparted to that object as an acquired "impetus"...

Therefore I feel that, a proper understanding of the meaning and applications of the concepts *balanced and unbalanced forces* is essential in the study of *Bodies in Motion* in general and Newton's first law in particular. Moreover, in a diagnostic test

(Appendix 1, pages 2-7) administered to the Foundation Studies students at the Technikon, 75% of the learners gave incorrect answers to a question in which they were asked what would happen to an object thrown in outer space. (More details of the administration of the diagnostic test and learning material will be given in the following pages.) Even the students, who gave the correct answer, provided an inaccurate explanation/reason. Question 7 (Appendix 1, p.3) in the diagnostic test was directly related to balanced and unbalanced forces and all the learners who answered question 7 submitted incorrect answers. Also in question 12 (Appendix 1, p.6) 75% of them obtained the incorrect answer while 25% did not answer this question at all.

5.2.2 Inertia

Newton's first law implies that since a force is necessary to change the state of motion of an object, all objects resist such a change. It appears that many students have difficulty in understanding the concept inertia. But with familiar examples such as travelling in a car, a teacher can make this concept an area that is easy to understand. In the diagnostic test (Appendix 1, pages 2-3) questions 2 to 5 are related to inertia. Learners did not show consistency in their understanding of inertia. In question two, 75% of them obtained the correct answer, whereas in question five only 25% of them got it right.

5.2.3. Relationship between acceleration produced and (a) force applied and (b) mass moving

If the learners can establish *the relationship between acceleration produced and* (a) *force applied* and (b) *mass moving* and can apply it in real life situations then they have learned Newton's Second Law as required at their level of study. This is a group of Foundation Programme students who have done *Bodies in Motion* at Grade 12 level during the previous year. Many of these students knew the statement of Newton's Second Law and the formula F = ma, however did not know the real meaning of

Newton's Second Law. Farnaham-Diggory (1994: 465) argued "that a student can repeat a definition does *not* necessarily mean the student has any understanding of what the word signifies, or what the word *means*". Farnaham-Diggory went on and raised the question, "what good are the words (the names, dates, the formulas) if they don't accompany personal understanding?" This might be one of the problems of rote learning, that students were not in a position to apply the theory learned into real life situations. In the diagnostic test (Appendix 1, p.3) question 6 was based on Newton's Second Law. When answering this question 67% of them gave answer 'd', in which they have used the formula F = ma and did not take note of the fact that the object was moving with uniform/constant velocity. Driver and Erickson (1983:47) claimed that,

> students possess many common sense beliefs about phenomena which are not in accord with the way that these phenomena are interpreted in school science. One important factor that may account for students' learning difficulties then, is the reluctance, or perhaps inability, of students to alter their present commitments in favour of the school-sanctioned interpretation.

When I prepared concept sheet 1 (diagnostic test) (Appendix 1, pages 2-7) I had the above view of Driver *et al* in my mind. I prepared Concept Sheet 1 (Diagnostic test) to identify the key-concepts as well as to get an idea of their (mis)conceptions in this learning area namely *Bodies in Motion*. I now feel that it was a good exercise, because I was able to get an in-depth idea of their level of understanding in this learning area. When I prepared the diagnostic test, I had hoped to tackle Newton's three laws, but because of time constraints I had to stop at the second law. I think that when one uses the constructivist approach, one should not underestimate the time required to cover a certain topic. Further, I feel that, it will be a good idea to build in extra time when planning these types of lessons.

6. Can the learning material be identified as "Constructivist"?

According to Jaworshi (1994:14), "Constructivism is a philosophical perspective on knowledge and learning". In other approaches such as the behaviouristic approach, the emphasis is on chalk and talk and it is teacher centred. But in the learning material (which include diagnostic test and other challenges in the concept sheets) (Appendix 1), the chalk and talk method is replaced by student activity method, and hence it is student centred. In the constructivist approach it is recognised that, the 'conceptual change takes place within a person's head'. (Duit and Treagust: 1996). In the learning material (Appendix 1) I tried to recognise and apply these aspects of the constructivist approach. I agree with Bodners'(1985:874) view, that 'active students learn more than passive students'. My students were active throughout the implementation of these learning materials. Rita (1998:25) listed some of the constructivism-based strategies that he used in his classroom which are given below:

- Giving students the autonomy to pursue their own questions;
- Using open-ended questions;
- Increasing wait-time
- Accepting student responses with a neutral "okay" that neither confirms nor rejects their answers;
- Starting units by asking what students think about a topic before giving input. By unearthing student preconceptions, I can tailor activities to dispel false ideas and to promote student inquiry and debate; and
- Occasionally starting units with a hands-on activity rather than lecture, giving students something to mentally refer to during lecture."

During the implementation of these lessons I also used similar strategies. Because of these reasons this learning material can also be identified as "constructivist".

6.1 How the learning material will support the development of an 'appropriate understanding' among the learners of the 'key-concepts' identified?

I have considered that *balanced and unbalanced forces* are to be the first key-concept and *inertia* to be the second key-concept in this learning material. In the concept sheet 2, I have focussed on *balanced and unbalanced forces and inertia*. Challenge 1 in concept sheet 2 is focussing specifically on balanced and unbalanced forces. Within challenge 1 there were different tasks for them to perform. The students were expected to predict the result of each task as an individual and as a group. Then they were expected to perform the task and record the observation and explanation. In this way, first of all they could see the weaknesses in their understanding or belief (preconceived idea) and then they could see the strength in the school science and then they might accept the school science from their own experience which they had in the laboratory. Challenges 2 and 3 in concept sheet 2 focus on inertia.

Photo 1 Balanced forces acting on an object

Photo 2 Demonstration of Inertia – using boiled and fresh eggs

Photo 3 Demonstration of Inertia – using coin and cardboard

Photo 4 (acceleration) a α F (Force)

In concept sheet 3, the focus is on the relationship between acceleration produced and force applied. Challenge 1 in concept sheet 3 is aimed at recalling the learner's understanding of analysing a tickertape, (which he/she had done earlier in the year). They were expected to distinguish between constant velocity, increasing velocity and decreasing velocity as marked by a ticker-timer on a ticker-tape. Challenge 2 in concept sheet 3 required the students to investigate the relationship between force applied and acceleration produced.

All the groups came up with the conclusion that, as the force applied increases, the acceleration produced also increases, (i.e., direct proportionality). At the end of all the challenges in each concept sheet there was a discussion lead by the facilitator. In these discussions at the end of concept sheet 3, there was consensus among the learners regarding the relationship between acceleration produced and force applied.

In concept sheet 4, students were expected to investigate the relationship between acceleration produced and mass moving. At first, they were required to determine the acceleration of a moving trolley with the aid of a ticker-timer. Then they were required to determine the acceleration of the trolley with an additional 1kg mass piece on it. In both instances, the force applied was kept constant. At the end of the experiments the students came up with the conclusion that, acceleration is inversely proportional to the mass moving.

Consolidation of concept sheet two, three and four was done with the aid of concept sheet 5. Concept sheet 6 was used to solve practical problems involving Newton's First and Second Laws.

All these concept sheets are learner centred and require active learner involvement. They could not sit back, relax and listen to a lecture/talk/lesson. They had to engage in (i) predictions, (ii) hands on experiments, (iii) communication between group members and (iv) draw conclusions, thereby ensuring the necessary understanding of the key-

concepts. In a way they had to 'construct' the understanding on their own and in their group.

6.2 Strengths and weaknesses of the learning material

As I mentioned earlier, the greatest strength of this learning material is that, it is learner centred. Secondly, it is student activity based and hence the chalk and talk method is replaced by active student participation. During the implementation of this learning material, there was dialogue between the learners and hence communication between the learners had taken place. Intervention was used by the facilitator to make sure that effective learning took place. It will be interesting to note some of the comments made by the students in the evaluation form given to them (Appendix 2, p.21). All the learners who have completed the evaluation form gave positive responses to this learning material.

Even though students responded positively, and I also personally feel that the production and implementation of this learning material was a success, there is plenty of room for improvement in this material. Easy to understand words or phrases could have been used. For example, in Concept Sheet 1 (diagnostic test), page 3, question 5, line 3, instead of using, "*since Shirley is vertically challenged,*" it could have been better to use, "*since Shirley is short...*" Again in Concept Sheet 2 (Appendix 1 page 11) challenge 3.1, the usage of "*...flick a cardboard...*" is not so clear according to my colleague who observed and evaluated these lessons. In the evaluation form (Appendix 3) he suggested that, the "language choice/phraseology needs to be so carefully considered when dealing with African students (2^{nd} language students)". I tend to agree with him fully and believe that it is even true for first language English speaking learners. Another issue that I have noted during the implementation of these lessons was that the time allocated was insufficient for the majority of the students. I fully agree with Louden & Hounshell (1998:51) in their argument regarding time allocation in learner-centred instruction. They argue that,

> student-centred instruction consumes more time than traditional instruction (in which a teacher or text book imparts information to students) because students must be allowed time to explore, inquire, and gather new information. Students make mistakes, require guidance, and need time to change the direction of their inquires.

7 Instruments used in the evaluation of learning material

Due to the time lost during the student strike action at the Technikon during 1999, the closure of the Technikon for the June holidays was delayed by one week. Also due to the same reason, I could not implement these lessons (for the purpose of the pilot study) during the normal lectures. Hence I asked for the assistance of volunteering students. 12 students were willing to come after the mid-year examinations specifically for these lessons. I also made a request to my Head of the Department (H.O.D) to attend and to evaluate these lessons. He was also willing to heed my request. The 12 students who attended these lessons were very willing and may have been more motivated than the other students in a class of 60. I must admit that, possibly this influenced the outcome/success of these lessons. I gave a questionnaire to my H.O.D. and to each student. I also gave concept sheet 6 in which I asked some of the questions from concept sheet 1 (diagnostic test) and some other questions. At the end of each lesson (concept sheet) I also facilitated discussions with the group and gathered their viewpoints and made necessary changes for the lessons that followed. Some ideas obtained from the results of the pilot study were used to modify the concept sheets applied in the second and final round of study in the year 2000.

7.1 Results of the implementation of the learning material – pilot study

In general, the implementation of the learning material went very well. As mentioned earlier there is a lot of room for improvement in this learning material. All the students who returned the evaluation form responded positively and suggested that this new approach be used in future. The key-concepts were introduced and investigated using concept sheet 2, 3 and 4. Concept sheet 5 was used to consolidate their understanding.

Everything went reasonably well up to this stage. That is, they gave me an impression that, they understood the concepts very well. They also arrived at the scientifically accepted relationships and definitions. However, when they submitted the answers to Concept Sheet 6 (Appendix 1, pp.19-20), they presented a different picture. Even though at this stage they had the scientific understanding of *Bodies in Motion*, most of their basic (original) beliefs had not changed. For example, in the diagnostic test 75% of the learners gave the wrong answer to a question in which they were asked what would happen to an object thrown in outer space. When the same question was asked in Concept Sheet 6 only 50% of the learners gave the correct answer. This (resistance to change their beliefs) is true for most of the questions in Section A of Concept Sheet 6. Meanwhile most of them gave correct answers to the questions in Section B of Concept Sheet 6.

These results suggest that, despite the series of lessons based on the constructivist approach, students still experience difficulty (i) in manipulating the concept and (ii) to changing their preconceived ideas. Some of these preconceived ideas resemble ideas held by Aristotle and other scientists of the Middle Ages. In other words, these preconceived ideas are not so stupid. And this may be one of the reasons why they are so resistant to change.

8. Strengths and weaknesses of the research approach, techniques and instruments

As mentioned in the previous paragraph questionnaires were given to all participating students and to the H.O.D. to complete. There are no leading questions in either of these questionnaires filled by the students (Appendix 2) and by the H.O.D. (Appendix 3). In both these questionnaires no complex questions were asked. I believe, I have not used any irritating questions or instructions (Cohen & Manion 1994: 92-95). I assume that, these are some of the strengths of the evaluation part of this assignment.

As I look back at the evaluation process now, I can identify some of the weaknesses in the evaluation of this learning material. According to Cohen & Manion (1994:90), there is sampling error if the sample fails to represent accurately the population under survey. I must admit that, the sample size used in this exercise was too small. Firstly, I could only persuade 12 students out of 60 from a Foundation group at the Technikon to attend these (special) lessons after the Mid-year Examinations. (However I believe that this low number of participants was not a major problem since this was only a pilot study). Secondly, all these 12 students were volunteers who were prepared to come specifically for the implementation of these lessons. Many of them had to travel up to 30 km to the Technikon, sacrificing not only their time but also money (for transport and food). Probably these students were more motivated than other students. Their motivation and positive attitude might have contributed to the (relatively) 'successful' outcome of the implementation of these lessons. For some unknown reasons only 8 out of 12 students returned the completed evaluation forms. The H.O.D. who completed the questionnaire suggested that, there was unclear phraseology in the questionnaire.

9. Final round of study - Year 2000 students

During the year 2000 I repeated this study with another group of foundation students at the Technikon. This group comprised of 60 students who had successfully completed the grade 12 examination with physical science and mathematics as two of their school subjects.

The diagnostic test given in the pilot study was modified and administered to the entire group of 54 foundation students present on that particular day out of 60 foundation students at the Technikon. In Concept Sheet 1 (Diagnostic test), page 3, question 5, line 3, the phrase, "*since Shirley is vertically challenged*" was replaced with "*since Shirley is short...*". In another question a diagram was added to improve the clarity of

the usage of "*...flick a cardboard...*". Also during the implementation of these Concept Sheets/lessons students were continuously encouraged to ask for clarity and explanation of the usage of difficult language or phrases used in the Concept Sheets. This was done because, during the pilot study it appeared to me that, the usage of (difficult) language could be an impediment in the learning of science by (English) second language students. As in 1999, six sessions of one and a half hours each were planned and implemented during the year 2000. It was interesting to note that the answers given by the students in the year 2000 to the diagnostic test were very similar to the ones found in the pilot study. As I mentioned earlier students across cultural and geographical background have similar (mis)conceptions in this topic *Bodies in Motion*. Not only that, but these misconceptions are common among many students of almost every new batch of foundations studies at the Technikon.

In 1999 I prepared the concept sheets 2 – 6, largely based on the diagnostic test results to address their misconceptions. In the year 2000 I used the same concept sheets 2 – 6 to present the lessons in *Bodies in Motion* (Newton's first and second laws) to the foundation students at the Technikon. The same concept sheets (2 – 6) were used in 1999 and 2000 because they might be good for the purpose of comparisons. The responses to the diagnostic test by both batches were similar.

The Technikon experienced student unrest in 1999 and lost more than one month of valuable teaching/lecturing time and as a result I had to conduct the pilot study during the July (winter) holidays and had to use willing (and maybe dedicated) students for the purpose of this study. Year 2000 was a peaceful period for the academic activities of the Technikon and no teaching/lecturing time was lost or wasted. Hence for the purpose of this study I used "simple random sampling" (Cohen & Manion 1994: 87) of students. At the Technikon the foundation students are placed in various groups with a maximum number of fifteen students in each group for the purpose of physics and chemistry practical sessions. These students are arranged numerically according to their student numbers and the first fifteen students are placed in group A, second

fifteen students in group B etc.... Each group attends the practical session at a particular time. I have decided to use group A for the purpose of this study. Unlike other groups this group had an almost equal representation of male and female students (7 male and 8 female students). According to Cohen & Manion (1994: 87), "in simple random sampling, each member of the population under study has an equal chance of being selected". They (Cohen & Manion 1994: 87) further suggested that one problem associated with this sampling method is that "a complete list of the population is needed and this is not always readily available". Due to the relatively small size of the population the above issue was not a problem in this study.

9.1 Analysis of the responses to the Concept Sheets (1 – 6)

Analysis of the concept sheets was done earlier in this report. In 1999, (in the pilot study) these concept sheets were implemented during the July (winter) holidays and as a result students had ample time to complete their tasks. All the groups utilised nearly an hour of extra time. Consequently they (1999 batch) had more time for thinking, group discussion, doing the experiments/tasks and writing. In 2000, these lessons/concept sheets were implemented during normal practical lessons. They did not have any extra time for the above activities. Perhaps this time constraint might have affected the responses of the group of students in the year 2000. Their (students of 2000) responses/answers were incomplete in some cases.

9.1.1 Concept Sheet 1 (Diagnostic test)

From concept sheet 1 (diagnostic test) the following problems of students in *Bodies in Motion* were identified. In a given situation students were not sure about the forces acting on a body – what force in which direction and what causes that force to act in that direction. Most of the participating students believe that force is directly related to motion and an object moves because there is a force in the direction of the motion (impetus). The response to question 7 in the diagnostic test (Appendix 1, p3) by all the

participants was that if the forces acting upon an object are balanced then the object must not be moving. They could not accept the fact that the forces acting on a body moving with a constant velocity are also balanced. 56% (30 out of 54) of the participants believed that there is no force acting on an object when it is at rest. 30% (16 out of 54) of them considered that gravitational force is the only force acting on an object at rest. Only 14% (8 out of 54) of the participants had the school science view.

The first five questions in the diagnostic test were based on Newton's first law and inertia. Even though most of them knew the definition of inertia and the statement of Newton's first law, they did not understand the concept of inertia. In these five questions they gave incorrect explanations even where they (might) have "guessed" the correct answer.

Question 6 in the diagnostic test (Appendix 1, p. 3) deals with an object moving with constant velocity. All the participants believe that friction is a force opposing motion and it has to be overcome by a greater force in order for an object to move with a uniform velocity.

Questions 8, 9 and 10 (Appendix 1, p.3-5) deal with resultant and normal forces. In question 8, they were required to draw *free-body diagrams*. In question 9, *free-body diagrams* were given and they were asked to determine the net force acting upon the object. In question 10 they were expected to determine the magnitude of certain unknown forces from the *free-body diagrams*. From their responses to these three questions it became evident that they were often not aware at all of the concept of resultant force. Most of the time they took the greatest force as the resultant force.

Question 11 (Appendix 1, p.5) was intended to recall what they had learned earlier in the year (to analyse a tickertape) at the Technikon. Except for two students all the others arrived at the correct answers. During the post diagnostic test discussion it became evident that most of the students obtained the correct answers in this question

because they had actually done the analysis of tickertape and trolley experiments (in the topic displacement-time, velocity-time and acceleration-time relationships) earlier in the year at the Technikon. The two students who obtained the wrong answers did not do the trolley experiments at the Technikon (as they were absent) and hence they did not have first hand experience in analysing the tickertape. Perhaps this shows the importance of practical work in science lessons.

Question 12 (Appendix 1, P.6) deals with the effect of balanced forces on an object. Once again it appeared to me that students were confused at the given situation. Almost half the group (26 out of 54) believed that once the forces were balanced the body was at rest. The other half was of the opinion that the object was moving with a constant velocity.

Due to the shortage of time students were asked not to answer questions 13 to 15 which were mainly based on Newton's third law of motion.

All the students of the foundation programme (during 1999 and 2000) at the Technikon were from an historically disadvantaged rural background. English being a second language to all these students made it extremely difficult for most of them to understand the questions/instructions themselves and to express their ideas in English. Lerman (1992) emphasises the importance of language and communication and argues that, "talk in the classroom is essential to learning and concept-formation". According to him this talk includes "teacher-talk and student-student-talk". Therefore proficiency in the English language is a contributing factor in concept-formation in content subjects such as physical science.

9.1.2 Concept sheets 2 – 6

Concept sheets 2, 3 and 4 (Appendix 1, p.8-20) were used to address the misconceptions of students in relation to *Bodies in Motion*. It was very interesting to see how the students realised the shortcomings in their understanding. First of all they were expected to make predictions on the given situation on their own. Secondly they were expected to make predictions on the same situation as a group of two or three students. Then they were expected to perform the given task and compare the results obtained with their predicted results. By this way they could see the shortcomings in their conceptual understanding in this topic *Bodies in Motion*.

Concept sheet 5 (Appendix 1 p.17) was used to consolidate what was learned with the aid of concept sheet two, three and four. Concept sheet 6 (Appendix 1 p.19) was designed to test their understanding mainly in Newton's first and second laws. Section A, (Questions 1 to 7) was extracted from concept sheet 1 (diagnostic test). Questions in section B were *new* to them in the sense that they were applications of Newton's first and second laws, which they did not solve at the Technikon. While answering concept sheet 6 students showed some shift in their understanding of *Bodies in Motion*. The answers to section A demonstrated that 67% (10 out of 15) of students hold the school science view. This is a considerable improvement in comparison to the responses received to the diagnostic test given earlier. The other 33% (5 out of 15) of participants hold different inaccurate views similar to the ones explained earlier. It was disappointing to note that only two students managed to answer all the questions of section B accurately. Seemingly others were confused while answering the questions of section B.

These results obtained in the year 2000 are similar to the one obtained from the pilot study in 1999. These results once again suggest that, despite a series of lessons based on the constructivist approach the majority of students resist making changes in their conceptual beliefs in relation to *Bodies in Motion*.

I feel that these concept sheets should be modified once again before using them. While modifying these concept sheets the following points must be taken into consideration. Firstly, simple language must be used. Secondly, more student activities/challenges must be incorporated. There should be enough tasks to make the students dissatisfied with their current conceptual model of the situation. More examples from everyday life could also be included.

A questionnaire (Appendix 2) which was used in the pilot study was once again used to evaluate the implementation of these concept sheets one to six. After the implementation of concept sheet 6 students were given the questionnaires and all of them (15 out of 15) were returned to me. All the students enjoyed the new approach based on the constructivist principles. According to the students, they enjoyed it because they were actively participating in the lessons all the time.

Students found the major difference between this approach and the usual teaching/lecturing as that, in this instance students were working in a group (of two or three) and that gave them more confidence in answering and "taking risks" while performing specific tasks.

All of them found that the concept sheets were unambiguous and easy to understand. I think here they have contradicted themselves because while performing the tasks and answering the questions I noticed their difficulty in interpreting some of the challenges in the concept sheets. All the participants would like to see the lecturers of this Technikon using this approach in their everyday teaching/lecturing.

10. Conclusion

For the purpose of this report, I decided to choose the topic *Bodies in Motion* for various reasons. I have found evidence from my own experience, from the literature review and from a diagnostic test (to the sample students) that, students come to the classroom with different (mis)conceptions in this learning area, namely *Bodies in Motion*. The key-concepts identified for these lessons are (i) balanced and unbalanced forces, (ii) inertia and (iii) relationship between acceleration produced and (a) force applied and (b) mass moving. These key-concepts were identified with the aid of literature review and with a diagnostic test administered at the beginning of the implementation of these lessons.

It was found in the literature review that, according to various writers in a constructivist view "knowledge is constructed in the mind of the learner". Some of these writers suggested teaching strategies that might assist students in the task of conceptual reconstruction. These strategies include, identifying students' ideas and views, creating opportunities for students to explore their ideas and making predictions, giving students the autonomy to pursue their own questions, providing ample time to complete the task given etc... These aspects are also apparent in this learning material and hence it may also be considered as based on the principles of constructivism.

The different challenges and tasks given in the learning material are organised in such a way as to make the students aware of their own ideas about *Bodies in Motion* in general and the key-concepts in particular and also to make them aware of the ideas of their peers (group members). It was also aimed at offering the learners the scientific alternative to their own beliefs.

This learning material has strong and weak points. The greatest strength of this learning material is that it is learner centred and activity based. However, there is plenty of room for improvement in this learning material. The instruments used in the evaluation

process are questionnaires.

In general, the implementation and evaluation of this learning material went very well. The results obtained from the pilot study in 1999 and from the final round in 2000 were similar and comparable. At the end, it was discovered that, even though the general understanding of the learners has improved in this topic (namely, *Bodies in Motion*), their original beliefs were largely unaffected. Some of the preconceived ideas are similar to the ideas held by the scientists of the Middle Ages and hence these beliefs are not so silly. And this may be one of the reasons why it is hard to change the existing beliefs of these learners.

Perhaps one of the weaknesses of the research design was that I was not sure whether the students who gave the correct answers to the diagnostic test were in the volunteering group in 1999 and the selected subgroup in 2000. Maybe the limited success of the project cannot be attributed to the effectiveness of the learning materials produced but due to the possible presence of the same (able) students in the same group. The worksheets used in the project might have helped them to think differently. These students have deep-rooted experiences of 19 to 20 years of life before joining the Foundation group at the Technikon. Maybe this is also a reason for their resistance to change from their own ideas to the school science. Perhaps by allocating more time for practical work, hands on experiments and for the implementation of work sheets/concept sheets their pre-conceived ideas may be shifted to scientifically accepted ideas. This study could be extended to the entire group of Tertiary Foundation students at the Technikon if it was a full-scale research.

11. References

Ahern-Rindell, & Amelia, J. (1999). Applying Inquiry-Based and Cooperative Group Learning Strategies to Promote Critical Thinking. *Journal of College Science Teaching*, 28(3), 203.

Bodner, G.M. (1985). Constructivism: A Theory of Knowledge. *Journal of Chemical Education*, 63(10), 873.

Cohen, L., & Manion, L. (1994). *Research Methods in Education* (4th ed.). London : Routledge.

Driver, R., & Erickson, G. (1983). Theories-in-Action: Some Theoretical and Empirical Issues in the Study of Students' Conceptual Frameworks in Science. *Studies in Science Education*, 9(10), 37-60.

Duit, R., & Treagust, D.F. (1996). Learning in Science – From Behaviourism Towards Social Constructivism and Beyond. In B.J. Fraser & K.G.Tobin (Ed.), *International Handbook of Science Education* (p. 17). Dordrecht/Boston/London: Kluwer Academic Publishers.

Ernest, P. (1991). Social Constructivism as a Philosophy of Mathematics. *The Philosophy of Maths. Education.* 'Lecture handout, partially referenced'.

Farnaham-Diggory, S. (1994). Paradigms of Knowledge and Instruction. *Review of Educational Research.* 64(3), 463-477.

Forgey, H., Jeffery, A., Sidiropoulos, E., Smith, C., Corrigan, T., Mophuthing, T., Helman, A., Redpath, J., and Dimant, T. (2000). *South Africa Survey 1999/2000 Millennium edition.* Johannesburg: South African Institute of Race Relations.

Foundation for Research Development. (1996). *South African Science and Technology Indicators 1996.* Directorate for Science and Technology Policy Foundation for Research Development, Pretoria.

Gunstone, R., & Watts, W. (1981). Force and Motion. In Driver, R., Guesne, E., & Tiberghien, A. (Eds.). *Children's Ideas In Science.* Open University Press, London.

Halloun, I.A., & Hestenes, D. (1985). Common sense concepts about motion. *American Journal of Physics,* 53(11) 1058 – 1059.

Hodson, D., & Hodson, J. (1998) From constructivism to social constructivism: a Vygotskian perspective on teaching and learning science. *School Science Review,* 79(289), 33 – 34.

Jaworshi, B. (1994) Constructivism: A Philosophy of Knowledge and Learning. *Investigating Mathematics Teaching.*'Lecture handout, partially referenced'.

Kuiper, J. (1991). *Ideas of force: A study of the understanding of the concept of force of secondary school students in Zimbabwe.* Ph.D. Thesis, Free University Amsterdam.

Kuiper, J. (1994). Student ideas of science concepts: alternative frameworks? *International Journal of Science Education,* 16(3), 279-292.

Lerman, S. (1992). *The position of the individual in Radical Constructivism: In search of the subject.* 7th International Congress on Mathematics Education, Quebec.

Louden, C.K., & Hounshell, P.B. (1998). Student-centered Scheduling. *The Science Teacher,*65(5), 51.

Matthews, M.R., (1992) Constructivism and Empiricism: An Incomplete Divorce. *Research in Science Education,* 22, 299 –307.

McClelland, J.A.G., (1985). Misconceptions in mechanics and how to avoid them. *Physics Education,* 20(1), 159-162.

Physics Classroom. (15 June 1999). Newton's Laws of Motion. http://www.glenbrook.k12.il.us/gbssci/phys/Class/newtlaws/u211b.html.

Rita, R.D. (1998). Integrated Constructivism. *The Science Teacher,*65(5), 25

Schwandt, T.A. (1994). Constructivist, Interpretivist Approaches to Human Inquiry. In Denzin, N.K. & Lincoln, Y.S. (Eds.). *Handbook of Qualitative Research* (pp. 119). California: Sage Publications, Inc.

Solomon, J. (1994). The Rise and Fall of Constructivism. *Studies in Science Education,* (23), 1 – 19.

South Africa (Republic). (1997). *Curriculum 2005: Lifelong learning for the 21st century.* National Department of Education: Pretoria.

Terry, C., & Jones, G. (1986). Alternative frameworks: Newton's third law and conceptual change. *European Journal of Science Education,* 8(3), 291.

Terry, C., Jones, G and Hurford, W. (1985). Children's conceptual understanding of forces and equilibrium. *Physics Education,* 20(1), 162-165.

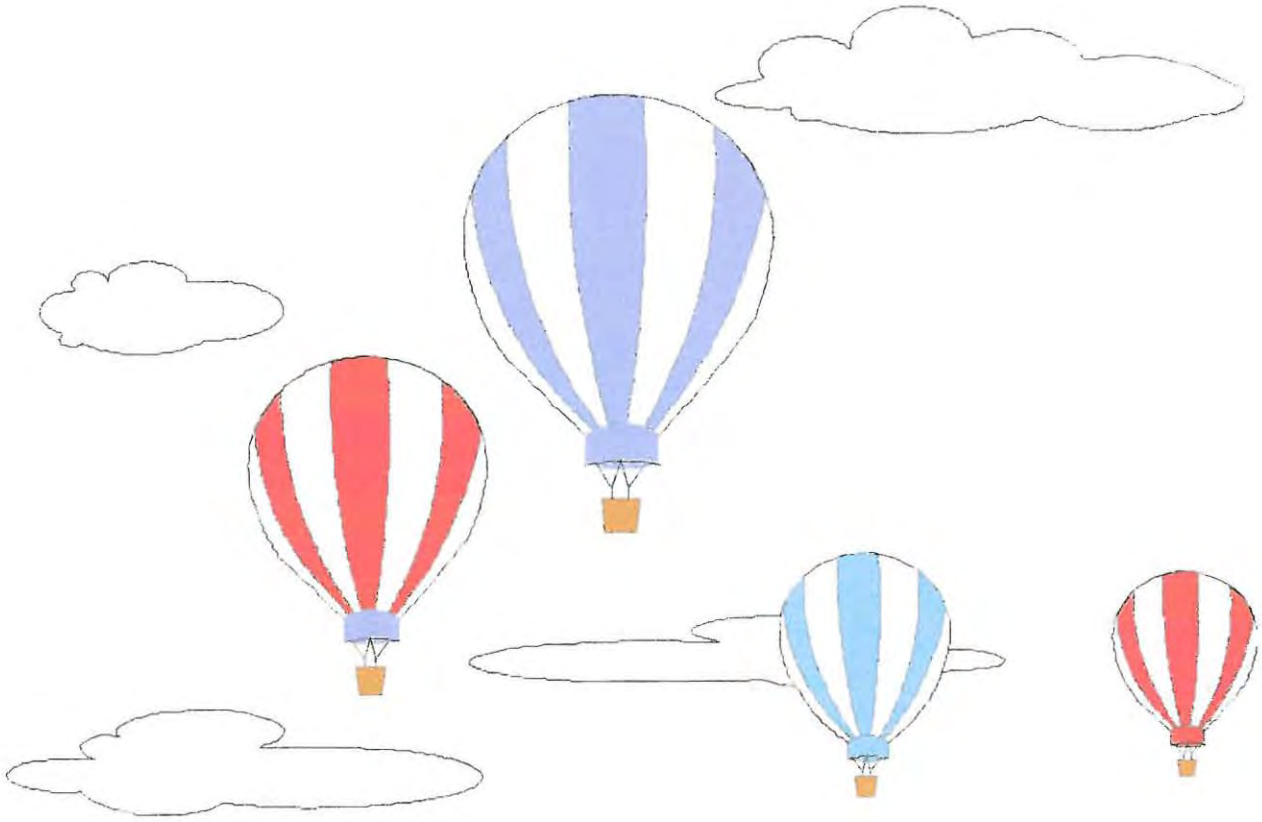
Thijs, G.D. (1992). Evaluation of an Introductory Course on "Force" Considering Students' Preconceptions. *Science Education.* 76(2), 155.

Trowbridge, D.E. and McDermott L.C. (1981). Investigation of student understanding of the concept of acceleration in one dimension. *American Journal of Physics,* 49(3), 253.

Ward, K., Dubos, B., Gatlin, L., Schulte, P., D'Amico, N., & Beisenherz, P.C. (1996). Constructing Scientific Knowledge. *The Science Teacher*, 63(12), 23.

APPENDIX 1

Bodies in Motion



A Learning Material for the study of Newton's Laws

Facilitator – James D. Valiathazhel

APPENDIX 1

Name .....
Starting time ..... **Finishing time** .....

Bodies in Motion

Concept sheet 1 – (Diagnostic test)

Write down the best answer in the space provided. Give brief explanation for each answer.

1. Imagine a place in the *cosmos* far from all gravitational and frictional influences. Assume that an astronaut in that place throws a rock. The rock will
   a. gradually stop.
   b. continue in motion in the same direction at constant speed.

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

2. Mac and Josh are arguing in the cafeteria. Mac says that if he flings the jelly with a greater speed it will have a greater inertia. Josh argues that inertia does not depend upon speed, but rather upon mass. Who do you agree with?

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

3. If you were in space in a *weightless environment*, would it require a force to set an object in motion?

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

4. Ben is being chased through the woods by an elephant, which he was attempting to photograph. The enormous mass of the elephant is extremely intimidating. Yet, while running if Ben makes a zigzag pattern through the woods, he will be able to use the large mass of the elephant to his own advantage. Explain this.

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

5. Two bricks are resting on the edge of a lab table. Shirley (who is very short) stands on her toes and spots the two bricks. She acquires an intense desire to know which of the two bricks are most massive. Since Shirley is vertically challenged, she is unable to reach high enough and lift the bricks; she can however reach high enough to give the bricks a push. Discuss how the process of pushing the bricks will allow Shirley to determine which of the two bricks is most massive. What difference will Shirley observe and how can this observation lead to the necessary conclusion?

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.....
.....

6. A 4.0-kg object is moving across a frictionless surface with a constant velocity of 2 m/s. Which one of the following horizontal forces is necessary to maintain this state of motion?

a. 0 N b. 0.5 N c. 2.0 N d. 8.0 N
e. depends on the speed.

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

7. If the forces acting upon an object are balanced, then the object
   a. must not be moving.
   b. must be moving with a constant velocity.
   c. must not be accelerating.
   d. none of these

8. Construct free-body diagrams for the various situations described below.

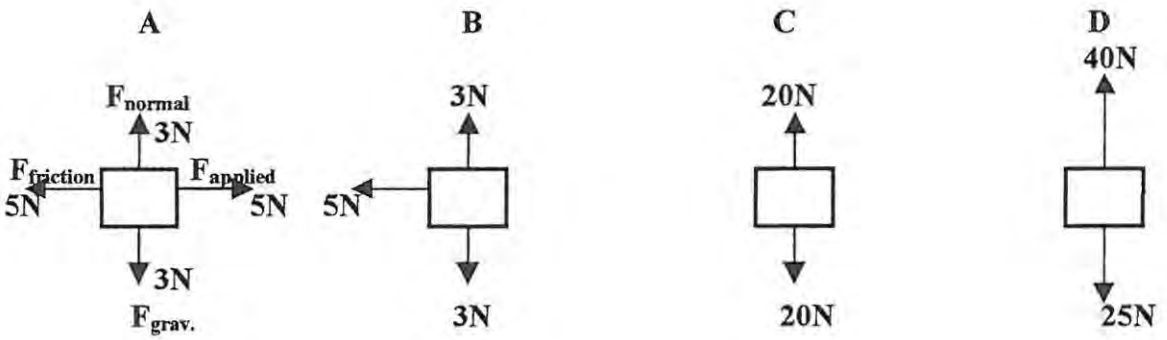
a) A book is at rest on a table top.

b) An egg is free-falling from a nest in a tree.

c) A rightward force is applied to a book in order to move it across a desk with a rightward acceleration.

d) A rightward force is applied to a book in order to move it across a desk at constant velocity

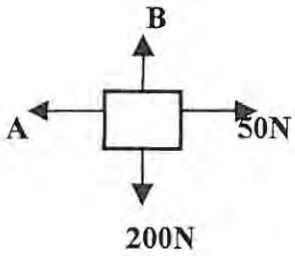
9. Free-body diagrams for four situations are shown below. For each situation, determine the net force acting upon the object.



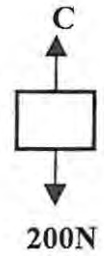
Ans.

APPENDIX 1

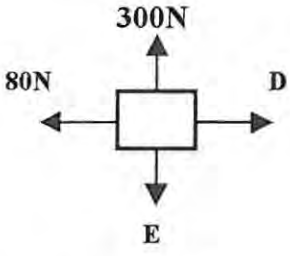
10. Free-body diagrams for four situations are shown below. The net force is known for each situation. However, the magnitudes of a few of the individual forces are not known. Analyse each situation individually and determine the magnitude of the unknown forces.



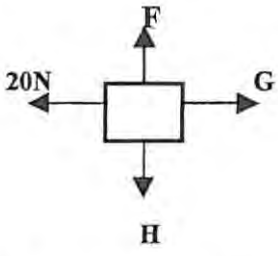
$F_{res.}$ = O N



$F_{res.}$ = 900 N up



$F_{res.}$ = 60 N Left



$F_{res.}$ = 30 N right

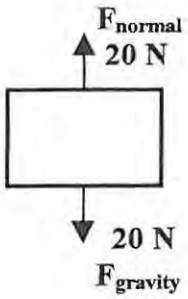
11. Consider the two ticker tape traces below for an acceleration of a car. From the trace, determine the direction of the net force which is acting upon the car.

A . . . . . .

B. . . . . .

APPENDIX 1

12. Two students (Anna and Noah) are discussing an object which is being acted upon by two individual forces (both in a vertical direction); the free-body diagram for the particular object is given below.



During the discussion, Anna suggests to Noah that the object under discussion could be moving. In fact, Anna suggests that if friction and air resistance could be ignored (because of their negligible size), the object could be moving in a horizontal direction. According to Anna, an object experiencing forces as described above could be experiencing a horizontal motion as described below.

. . . . . .

Noah objects, arguing that the object could not have any horizontal motion if there are only vertical forces acting upon it. Noah claims that the object must be at rest, perhaps on a table or floor. After all, says Noah, an object experiencing a balance of forces will be at rest. Who do you agree with? Explain your answer.

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

13. While driving down the road, Thabo observed a bug striking the windshield of his car. The bug hit the windshield and the windshield hit the bug. Which of the two forces is greater: the force on the bug or the force on the windshield?

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

14. Rockets are unable to accelerate in space because ...
    a. there is no air in space for the rockets to push off of.
    b. there is no gravity is in space.
    c. there is no air resistance in space.
    d. ...nonsense! Rockets do accelerate in space.

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

15. A gun recoils when it is fired. The recoil is the result of action-reaction force pairs. As the gases from the gunpowder explosion expand, the *gun* pushes the *bullet* forwards and the *bullet* pushes the *gun* backwards. The acceleration of the recoiling gun is ...

a. greater than the acceleration of the bullet.
b. smaller than the acceleration of the bullet.
c. the same size as the acceleration of the bullet.

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

APPENDIX 1

Name .....

Starting time..... **Finishing time** .....

Bodies in Motion

Concept sheet 2

You have filled Concept Sheet 1 with your best ideas about force and bodies in motion. This concept sheet looks at some similar and new situations. I hope you will enjoy it.

Challenges to your understanding of force and motion of objects.

Challenge 1

In this challenge you are expected to pull a 1kg mass piece using a spring balance.

1.1 Will there be any reading on the spring balance **just before the mass piece begins to move**? (*Yes or No*)

Your prediction	Prediction of your group

1.2 Now you may pull the mass piece using the spring balance and answer question 1.1 below

Your answer	Answer of your group

1.3 Can you name (identify) the forces acting in the horizontal plane (parallel to the table surface), just before the mass piece begins to move.

Your answer	Answer of your group

1.4 Are the above forces (identified in task 1.3) are balanced or unbalanced.

Your opinion	Opinion of your group

1.5 Now you are expected to use **two spring balances** and pull the mass piece from either side, in such a way that the readings on both the spring balances are the same.

1.5.1 Predict whether these forces (applied on either side of the mass piece) are balanced or not.

Your prediction	Prediction of your group

1.5.2 You may perform the experiment in 1.5. Now do **you** consider these forces to be balanced?

....

What is the opinion of **your group**?.....

1.6 What effect do balanced forces have on the state of motion of an object?

Your answer

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

Answer of your group

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

1.7 What effect do unbalanced forces have on the state of motion of an object?

Your answer

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

Answer of your group

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

APPENDIX 1

Challenge 2

You are given two eggs, one boiled and the other a fresh one. You know that ***there is a certain amount of liquid mass in the fresh egg*** and ***only solid mass in the boiled egg***. On the space provided you may make a cross (X) to indicate *your prediction/opinion* on what will happen when these eggs are allowed
(i) to spin and (ii) to stop suddenly and released.

	Spins very well	Spins reluctantly	Continue to spin even after stopping suddenly and released	Does not continue to spin once stopped suddenly and released.
Boiled egg				
Fresh egg				

Prediction/opinion of your group

	Spins very well	Spins reluctantly	Continue to spin even after stopping suddenly and released	Does not continue to spin once stopped suddenly and released
Boiled egg				
Fresh egg				

You may now spin the eggs. The one that is marked **B** is the boiled egg and the one without any mark is the fresh one. Record your observation.

	Spins very well	Spins reluctantly	Continue to spin even after stopping suddenly and released	Does not continue to spin once stopped suddenly and released
Boiled egg				
Fresh egg				

Discuss your observation in your group and write the agreed upon explanation of your group below.

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

Challenge 3

3.1 ***In this challenge you are expected to flick a cardboard which is placed on an empty beaker. A coin is also placed on the cardboard. What will happen when you flick the cardboard?***

Your prediction	Prediction of your group

3.2 ***Now you may perform challenge 3.1 and write down the observation and explanation.***

Your observation and explanation	Observation and explanation your group

3.3 What do you call this phenomenon? .....

3.4 On what does this phenomenon of an object depend?.....

Challenge 4

Write down whatever you have learned? Anything unexpected, anything new, anything interesting, anything challenging etc. Discuss it with your friends.

APPENDIX 1

Name .....
Starting time..... **Finishing time** .....

Bodies in Motion

Concept Sheet 3

You have filled Concept Sheet 2 with your best ideas about force and bodies in motion. This concept sheet looks at some similar and new situations. Enjoy it.

Introduction

You know that, if an unbalanced force is exerted on an object, the object accelerates.

Challenge 1

Study the following patterns of dots produced by a ticker-timer. A trolley, which was moving from, left to right pulled a length of ticker-tape through a ticker-timer. In each case predict whether the trolley was moving with uniform (constant) velocity, increasing velocity (positive acceleration) or decreasing velocity (deceleration).

1.1 • • • • • •

Your prediction	Prediction of your group

1.2 • • • • • • • • • • •

Your prediction	Prediction of your group

1.3 • • • • • • • • •

Your prediction	Prediction of your group

APPENDIX 1

Challenge 2

Place the runway on the table and attach a ticker-timer to it. Lift the end of the runway where the ticker-timer is attached to compensate (neutralise) for friction. Place the trolley on the runway. At the other end of the runway attach a G-clamp with pulley. Now tie one end of a string on the small hook at the middle of the trolley. Take 20 ten gram mass pieces and hook 5 of them on the other end of the string and place the remaining 15 mass pieces on the trolley itself. Thread a ticker-tape through the ticker-timer and attach it to the trolley. If you release the trolley now, it will move to the other end. Now switch on the ticker-timer and release the trolley. Take the tape and mark it as tape 1.

2.1 Examine the tape.
2.1.1 Was the trolley moving with acceleration?
2.1.2 How do you know there was acceleration?
2.1.3 If it was moving with acceleration, what caused the acceleration?

	Your answers	*Answers of your group*
2.1.1		
2.1.2		
2.1.3		

Now remove 5 ten gram pieces from the trolley and add them to the hanging mass pieces. That means there are 10 mass pieces on the trolley and 10 on the hook. Once again thread a ticker-take through the ticker-timer and attach it to the trolley. Switch on the ticker-timer and release the trolley. Take the tape and mark it as tape 2.

2.2 Examine the ticker-tape once again.
2.2.1 How do you compare the motion of the trolley this time with the first time.
2.2.2 Give reason(s) for your answer in 2.2.1

	Your answers	*Answers of your group*
2.2.1		
2.2.2		

Repeat the above procedure with 15 ten gram pieces on the hook and the remaining 5 ten gram pieces in the trolley. Take the tape and mark it as tape 3. Finally, attach all the 20 ten gram mass pieces on the hook and repeat the above procedure. Take the tape and mark it as tape 4.

2.3 Place the 4 tapes next to each other and compare them.
2.3.1 Which trolley was moving with the highest acceleration?
2.3.2 What do you think is the reason for your answer in 2.3.1?
2.3.3 Was the total mass moving constant in all 4 occasions?
2.3.4 What was the force applied in each case?

	Your answers	*Answers of your group*
2.3.1		
2.3.2		
2.3.3		
2.3.4	*Tape 1* *Tape 2* *Tape 3* *Tape 4*	

The frequency of your ticker-timer is 50 Hz. Therefore the period of the ticker-timer is .....

Now you may use the ticker-tape and determine the acceleration produced in each case. Do the calculations on a separate sheet and enter the answers in the table below.

Tape	*Acceleration ($m.s^{-2}$)*
Tape 1	
Tape 2	
Tape 3	
Tape 4	

Can you see any relationship between the force applied and acceleration produced?

Your answer	*Answer of your group*

Challenge 3

Write down whatever you have learned? Anything unexpected, anything new, anything interesting, anything challenging etc. Discuss it with your friends.

APPENDIX 1

Name .....

Starting time..... **Finishing time** .....

Bodies in Motion

Concept Sheet 4

You have filled Concept Sheet 3 with your best ideas about force and bodies in motion. In concept sheet 3 you have also seen few aspects of force and acceleration. This concept sheet looks at some similar and new situations. I hope you will enjoy it.

Challenge 1

Place the runway on the table and attach a ticker-timer to it. Lift the end of the runway where the ticker-timer is attached to compensate (neutralise) for friction. Place the trolley on the runway. At the other end of the runway attach a G-clamp with pulley. Now tie one end of a string on the small hook at the middle of the trolley. Take 20 ten gram mass pieces and hook all of them on the other end of the string. The string must pass through the groove of the pulley. Thread a ticker-tape through the ticker-timer and attach it to the trolley. If you release the trolley now, it will move to the other end. Now switch on the ticker-timer and release the trolley. Take the tape and mark it as tape 1.

2.1 Examine the ticker-tape.

2.1.1 Was the trolley moving with acceleration?

2.1.2 How do you know there was acceleration or not?

2.1.3 If it was moving with acceleration, what caused the acceleration?

2.1.4 What is the magnitude (quantity) of force applied in the direction of motion of the trolley?

2.1.5 If the frequency of the given ticker-timer is 50 Hz, calculate the rate of change of velocity in this case. *(Answer this question as a group)*

	Your answers	*Answers of your group*
2.1.1		
2.1.2		
2.1.3		
2.14		
2.1.5		

Now place a one kilogram mass piece on the trolley, and repeat the above experiment with the same set-up. Take the ticker-tape and mark it as *tape 2*.

2.2 Examine the second ticker-tape.

2.2.1 Was the trolley moving with acceleration?

2.2.2 What is the magnitude (quantity) of force applied in the direction of motion of the trolley?

2.2.3 Is the applied force constant in both cases?

2.2.4 If the frequency of the given ticker-timer is 50 Hz, calculate the rate of change of velocity using the second tape. *(Answer this question as a group)*

2.2.5 How do you compare the motion of the trolley this time with the first time.

2.2.6 Give reasons for your answer in 2.2.5.

	Your answers	*Answers of your group*
2.2.1		
2.2.2		
2.2.3		
2.2.4		
2.2.5		
2.2.6		

Can you see any relationship between the mass of an object and the acceleration produced?

Your answer	*Answer of your group*

Challenge 2

Write down whatever you have learned? Anything unexpected, anything new, anything interesting, anything challenging etc. Discuss it with your friends.

APPENDIX 1

Name .....

Starting time..... **Finishing time** .....

Bodies in Motion

Concept Sheet 5

All of you may come together to form one group. Now let us conclude what we have learned so far.

1. What conclusions can you make from **concept sheet 2**?

Your answer	Answer of your group

2. What conclusions can you make from **concept sheet 3**?

Your answer	Answer of your group

3. What conclusions can you make from **concept sheet 4**?

Your answer	Answer of your group

During the last 4 lessons we have investigated certain aspects of bodies in motion. These investigations were originally conducted by Sir Isaac Newton (1642 –1727). He has formulated the results of his investigations in the form of three laws. We call them as Newton's laws of motion.

Newton's first law of motion *states that a body will remain at rest or continue with uniform velocity in a straight line unless it is acted upon by an external resultant force.*

Inertia *is the property of an object to resist any attempt to change its state of motion.*

Newton's second law of motion *states that when an unbalanced force acts on an object, the object is accelerated in the direction of the force. This acceleration is directly proportional to the applied force and inversely proportional to the mass of the object.*

We can express the second law mathematically as, **F=ma**, where F= force, m=mass and a=acceleration. The unit of force in the SI system is newton (N).

One ***newton*** *is that force which produces an acceleration of* $1 m.s^{-2}$ *on a mass of 1 kg.*

APPENDIX 1

Name .....

Bodies in Motion

Concept Sheet 6

You have completed concept sheets 1 to 5 with your best ideas about force and bodies in motion. In this concept sheet 6 you are asked to answer the following questions individually and then discuss your answer in your group. Finally submit your answers to the facilitator for corrections.

SECTION A

1. Imagine a place in the *cosmos* far from all gravitational and frictional influences. Assume that an astronaut in that place throws a rock. The rock will
   a. gradually stop.
   b. continue in motion in the same direction at constant speed.

2. Mac and Josh are arguing in the cafeteria. Mac says that if he flings the jelly with a greater speed it will have a greater inertia. Josh argues that inertia does not depend upon speed, but rather upon mass. Who do you agree with?

3. If you were in space in a *weightless environment*, would it require a force to set an object in motion?

4. Ben is being chased through the woods by an elephant, which he was attempting to photograph. The enormous mass of the elephant is extremely intimidating. Yet, while running if Ben makes a zigzag pattern through the woods, he will be able to use the large mass of the elephant to his own advantage. Explain this.

5. Two bricks are resting on the edge of a lab table. Shirley (who is very short) stands on her toes and spots the two bricks. She acquires an intense desire to know which of the two bricks are most massive. Since Shirley is vertically challenged, she is unable to reach high enough and lift the bricks; she can however reach high enough to give the bricks a push. Discuss how the process of pushing the bricks will allow Shirley to determine which of the two bricks is most massive. What difference will Shirley observe and how can this observation lead to the necessary conclusion?

6. A 4.0-kg object is moving across a frictionless surface with a constant velocity of 2 m/s. Which one of the following horizontal forces is necessary to maintain this state of motion?

   a. 0 N b. 0.5 N c. 2.0 N d. 8.0 N
   e. depends on the speed.

7. If the forces acting upon an object are balanced, then the object
   a. must not be moving.
   b. must be moving with a constant velocity.
   c. must not be accelerating.
   d. none of these

SECTION B

1. Use Newton's Laws to explain questions 1a, 1b and 1c.
   a. A passenger in a car tends to lose his balance when the car goes round a sharp bend.
   b. A person standing inside a bus must hold on to the seat to prevent him from falling over when the bus starts moving.
   c. It is advisable that the driver of a car should wear a safety belt in case he gets involved in a head-on collision.

2. While driving his car at a high speed on a slippery road, the driver realises that his car does not react when he tries to negotiate a sharp bend in the road.
   a. State the law of motion, which can be used to explain why the car did not react to the turn of the steering wheel.
   b. With reference to the above-mentioned law, state what is necessary to enable the car to turn.

3. An ice-skater slides out of control at a constant velocity across an ice-rink (*rink means an area of natural or artificial ice for skating)* until her motion is stopped by the rail which is covered with a thick layer of sponge.
   a. Draw a forces diagram of all the forces acting on the ice-skater when she
      (i) is sliding across the rink (ignore friction);
      (ii) collides with the rail and comes to a stop.
   b. Explain the laws of motion applicable in this situation.

4. A man with a mass of 100 kg stands on a scale on the floor of a lift. The scale is calibrated in newtons. Calculate the reading on the scale if the lift
   a. is stationary;
   b. accelerates downwards at 4 $m.s^{-2}$
   c. accelerates upwards at 3 $m.s^{-2}$
   d. moves downwards at a constant speed of 12 $m.s^{-1}$
   e. cable breaks and falls freely.

****

Appendix 3: Questionnaire completed by a colleague 22

EVALUATION FORM

Dear colleague

May I take this to thank you for your time and willingness to evaluate/assess my lessons? These lessons are part of a project of my M.Ed. studies in which I am required to develop a learning material and evaluate the use of the learning material. You may remain anonymous.

A. Do you agree with the following statements:
Make a cross **(X)** *in the appropriate column*

Learners conduct a focused in investigation in which:	**Agree**	**Disagree**
1. Phenomena are identified and questions are posed.	**X**	
2. situations are analysed and investigative questions are formulated	**X**	
3. Observations are made?		**?**
4. hypothesis are formulated		**?**
5. predictions are made	**X**	
6. investigative plans of action are formulated		**?**
7. evidence is collected and recorded	**X**	
8. evidence is analysed, evaluated and interpreted	**X**	
9. conclusions are formulated	**X ?**	

B. In your opinion were where the principles of OBE and Curriculum 2005 evident in these lessons? Please substantiate your response.

Conceptually – the approach certainly is based on OBE whereby students are supposed to self-discovery procedures.
However, I was not informed of the preamble offered which comprised some of the basic techniques expected of the learners through the exercises (for e.g. Concept of period, interpretation of a tickertape, gamiiarity with the equipment used.)

C. Was the learning material designed from a constructive perspective?
Motivate your response?

Yes. Guidance, however, needed to be presented to direct learners sphere of investigation of investigation (which will need to be the preliminary component of OBE in the naturals science field at whatever level)
Learners were guided to construct their own interpretations of the inherit concepts (which is what I imagine the methodology will entail at a more sophisticated level of study).

D. Do you have any other comments on these learning materials?

It struck me that language choice/ phraseology needs to be so carefully considered when dealing with African students (second language students). (E.g. concept sheet2. The difficulty in understanding the expectation in 3.1 of "flick of cardboard").

Also, in the table above, I had some difficulty in interpreting the student for some- although I could participate what was intended.

The final page of concept sheet 5 provided a summation of the expected outcome; learners could then see and identify with the purpose(s) of the procedures to reach the outcome.

Learners generally, went about their tasks keenly and appeared to enjoy the aspects of "experiment for self-gain"

Overall, a series of interrelated, sequential learner- centred investigation

TRANSFORMATION AT A HISTORICALLY DISADVANTAGED TECHNIKON IN SOUTH AFRICA

A RESEARCH PROJECT

SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF EDUCATION

OF

RHODES UNIVERSITY

BY

JAMES DANIEL VALIATHAZHEL

SUPERVISOR: MRS. GILL BOLTT

JANUARY 2002

DECLARATION

This research represents original work by the author and has not been submitted in any other form to another university. Where use was made of the work of others, it has been duly acknowledged in the text.

DEDICATION

I dedicate this work to my parents Daniel and Susannamma Valiathazhel who passed away just before the commencement of this study

ACKNOWLEDGEMENTS

I wish to express my sincere gratitude to the following persons:

- ☆ **To my supervisor Mrs. Gill Boltt for her encouragement, invaluable assistance, guidance, advice and her patience with me throughout my study.**
- ☆ **Dr. Jaap Kuiper for his assistance during the early stages of this study.**
- ☆ **Mr. Marc Schäfer for his help in various ways.**
- ☆ **My family for their patience, encouragement and tremendous support.**
- ☆ **Finally, my God with Whom all things are possible and from Whom there came the strength to commence and complete this Masters degree. (*I can do everything through Him who gives me strength. Philippians 4: 13*).**

ABSTRACT:

South Africa is in the seventh year of democracy. During the first term of office, the ANC government proposed radical shift from the system(s) of education that was/were in existence in this country. A change in the education system in South Africa was inevitable. The ANC government have realised the need and proposed plans for a change in the education system in this country. We might be able to overcome the inequalities of the past and have an education system relevant for all South Africans that promote an equal opportunity for success as envisaged by Outcomes Based Education (OBE). This research project, using a qualitative case study methodology, reports on the readiness of Border Technikon in implementing Outcomes Based Education (OBE) as a teaching/lecturing strategy. Since 1998 Border Technikon organised a series of staff training workshops to empower the academic staff in Outcomes Based Education.

A preliminary study on the topic was conducted during 1999, in which questionnaires (to 16 academic staff) and semi-structured interviews (with three academic staff) were used to collect data. During 2000, when the second and final round of this study was conducted semi-structured interviews were employed with 4 staff members to gather data. Literature review and document analysis was also part of the research.

The analysis of data indicated that the very nature of most of the Technikon Programmes demands an OBE approach in teaching/lecturing and hence OBE based teaching/lecturing is largely practised at Border Technikon. However a few areas of concerns were identified. Some of these concerns were: (i) Technikon employed academic staff (from industry etc...) with no professional qualification in teaching and it was difficult to provide OBE training to such people and (ii) lack of sufficient support from the Technikon Management might be a cause for the poor attendance of academic staff during the training programme. Another aspect emerged from the data analysis was that all academic staff participated in this study expressed the need for further training in OBE and related topics.

Transformation at a Historically Disadvantaged Technikon in South Africa

Contents **Page**

1. Introduction

Searching for *the right answer and the truth* has resulted in the memorisation of facts becoming the most acceptable way of teaching and learning (Cornbleth 1987). This results in non-thinking people who may have been very successful through rote learning and now are a liability to the society. In South Africa Christian National Education (CNE) and Fundamental Pedagogics were the dominant ideologies in relation to education. Also in this country, the National Party Government used education as a tool to indoctrinate people and to maintain an unjust, immoral system of apartheid.

Goodson (1990) points out that, the curriculum will reflect the history of the time and it must therefore change with the times. We live in a time of immense change and transitions. South Africa is in the seventh year of democracy. During the first term of office, the ANC government proposed a radical shift from the system(s) of education that was(were) in existence in this country. A change in the education system in South Africa was inevitable. The ANC government has realised the need and proposed plans for a change in the education system in this country.

It seems that the change in political ideology in South Africa during the last decade necessitated a shift in the education system in this country. The new curriculum was named Curriculum 2005 and was based on the principles of Outcomes Based Education (OBE). The philosophy and objective of implementing this new curriculum was well explained in the opening paragraph of the Report of the Review Committee on Curriculum 2005. According to the Review Committee Report (Department of Education 2000: 1)

> Curriculum 2005 is probably the most significant curriculum reform in South African education of the last century. Deliberately intended to simultaneously overturn the legacy of apartheid education and catapult South Africa into the 21st Century, it was an innovation both bold and revolutionary in the magnitude of its conception. As the first major curriculum statement of a democratic government, it signalled a dramatic break from the past. No longer would curriculum shape and be shaped by narrow visions, concerns and identities. No longer would it reproduce the limited interests of any one particular grouping at the expense of another.

> It would bridge all, and encompass all. Education and training, content and skills, values and knowledge: all would find a place in Curriculum 2005.

All sectors of educational institutions, Primary, Secondary and Tertiary institutions were expected to shift to this new curriculum. These are redefined to *General Education and Training Band*, *Further Education and Training Band* and *Higher Education and Training Band* respectively. Technikons fall in the Higher Education and Training Band. In this context I would like to examine the transformation that has taken place at a Historically Disadvantaged Technikon since its inception.

2. The Research Context – The Technikon from inception to present

2.1 Early History

In 1983 a Homeland Government in South Africa commissioned a local University to undertake an exhaustive needs study to ascertain the feasibility of establishing a Technikon within the jurisdiction of the geographical area of the homeland. This study revealed conclusively that, the establishment of such an institution had every chance of success. By the promulgation of Act 15 of 1984, the establishment of an unnamed Technikon was formalised. According to the Act, it was mandatory to have a Council with strong representation from organised Industry and Commerce in the region. Different names were suggested and rejected for the Technikon for various reasons. Finally after three years of deliberations everyone concerned has agreed on a name for the Technikon. The fictitious name I would like to give to this Technikon for the purpose of this project is *Homeland Technikon.*

Homeland Technikon opened its doors for academic programmes in the latter part of nineteen eighties. According to the information given in the Technikon Prospectus 1999, sixty-six students were registered for various certificate courses in 1988. The student enrolment data provided by the Technikon official shows an intake of only 13 African students in 1988 (Appendix 9.1). I could not verify the authenticity of this number, as there was no other record to rely on. In mid 1989, diploma courses were introduced and more courses in Secretarial Studies and Management studies were offered to meet the regional requirements. With the rapid increase in student enrolments and courses offered, the Technikon outgrew its available space in its "place of birth". In May 1991 the Technikon was able to move to its custom designed main campus at a new site, (within the boundaries of the homeland that established the *Homeland Technikon*). In my opinion the then political set up demanded the Technikon to be established on the homeland soil. Therefore it could not be attached to an established South African town or city

This new site is only 10 km away from one of the largest African Townships in South Africa. The prospective students of this Township only have a Teacher Training College as a Tertiary institution in their Township. By establishing a Technikon at the doorstep of this Township the homeland Government could silence the masses to some extent in their claim that the homeland regime was oppressive and not caring of the people. *Homeland Technikon* not only attracts students from this township, but also from a large area of the region. School leavers, who were previously forced to leave the region, now have facilities, which are more conveniently sited, thereby offering more affordable opportunities. This has in turn assisted local commerce and industry to recruit qualified people within the region with direct benefits to the Province. In May 1991, the Technikon had a staff complement of over 40 and an enrolment of 450 full-time and 170 part-time students.

2.2 Influence of political change in South Africa

During 1990 -1991 period South Africa was undergoing rapid change in the political sphere. To mention a few, Nelson Mandela was released, liberation movements were unbanned, Military had taken over the administrations of certain homelands through *coup d'état* and so on. Anything associated with the apartheid structures was seen in a negative context. The very name *Homeland Technikon* was a problem. There was reluctance on the part of Commerce and Industry to offer financial aid for *Homeland Technikon* in particular and for the students of this institution in general for fear of possible political reprisals. In this background the Technikon Council submitted a proposal to the Cabinet of the homeland administration for consideration of the name of the *Homeland Technikon* to be changed to *Rainbow Technikon* (another fictitious name for the purpose of this project). In its submission to the Cabinet, the Council explained that for the Technikon to grow fully it must see the whole region as its catchment area and the name must reflect it. Eventually the Cabinet approved and gazetted the new name in 1992.

2.3 Developmental stage

In 1991, the Technikon only had two departments, namely The Department of Management and the Department of Secretarial Studies. During the second half of 1991, the then *Homeland Technikon* identified the need for a foundation programme for Mathematics and Physical Science and recruited a course co-ordinator and a lecturer. The Tertiary Foundation Programme is a one-year full-time bridging initiative serving to remediate and consolidate a student's matriculation background in English, Physical Science and Mathematics. During successive years many more programmes, such as Information Technology, Analytical Chemistry, Engineering, Tourism and Hospitality Studies, Marketing, Human Resources Management, Accounting, Education and Communication Studies have been introduced to meet regional requirements. Student enrolment has grown remarkably from 13 in 1988 to 4024 in 1998. This growth in student enrolment can be attributed to many factors. The Public Relations Department has carried out a reasonably good marketing exercise. They have conducted school visits, organised guidance teachers' meetings at the Technikon and in conjunction with local NGOs', used the local FM Radio Station to broadcast to the region a 30 minute program on each department of the Technikon once a week for a few months and they also used the print media such as the local newspaper and F&T Weekly for the effective marketing of the Technikon. I also think that, there has been a shift from University education to Technikon education during the last few years. In the meantime the National Education Department has restricted student intake at Colleges of Education. The public awareness on the importance of technology has increased and more and more peoples are talking about and showing interest in technology. All these factors might have contributed to the increase in student numbers at the Technikon. But, I believe that, in few years time there will be more technicians than South Africa can employ, unless more technology based jobs are created. Politicians must plan for industrialisation before the market reaches a saturation point with job seekers. For example, during apartheid, South Africa produced more teachers than it could actually employ and as result now we are faced with the issue of redeployment, retrenchment and right sizing. Table 1 given below shows the increase in student enrolment for a ten year period.

Table 1 Student enrolment figures for the Technikon *(Appendix 9.1)*

YEAR	AFRICAN	COLOURED	INDIAN	WHITE	TOTAL
1988	13	0	0	0	13
1989	6	0	0	59	65
1990	301	0	0	28	329
1991	*Detailed data not available for 1991*				548
1992	565	4	1	68	638
1993	814	4	1	94	913
1994	1167	1	3	14	1185
1995	1410	1	4	31	1446
1996	2080	2	3	68	2153
1997	3167	3	5	133	3312
1998	3882	6	4	132	4024

2.4 Consequences of rapid increase in student enrolment

The sudden increase in student numbers has both positive and negative implications. Since the number of applicants increased, the Technikon is in a better position to choose students with good symbols in their matriculation examinations, thereby improving the quality of intake. For example, in our Foundation Programme we used to accept students with 'G' and 'H' symbols in Mathematics and Physical Science, whereas in 1999 we haven't enrolled any student with such low symbols. The increase in student numbers can improve the financial situation of the Technikon. As the student number increases the income through student fees and Government subsidy also increases.

2.4.1 Student Accommodation

One of the major problems of the increase in student numbers is the issue of accommodation. There are hostel facilities only at the main campus. Apart from the porterhomes/parkhomes acquired in 1997, there have been no additions to the residences since the Technikon moved to its present site. In 1991 the Technikon acquired its present main campus with 254 beds in the residences for the accommodation of a student population of 548. The number of beds available then was sufficient to meet the demand for accommodation at that time. The student enrolment has increased steadily over the years and it is more than 4000 now. At present there are 398 beds available, which includes 254 beds in the residences and 144 beds in the parkhomes. Meanwhile, in reality more than 1000 students sleep on campus. Each student in the residence sub-lets his/her room to two more students who share the available facilities and the cost of accommodation. The students who are "tenants" bring their own mattresses and sleep on the floor. The Technikon does not provide any accommodation at the satellite campuses. Once again the accommodation issue is a major problem facing the Technikon at present.

Student leaders and the Technikon management have been meeting on various occasions to resolve the issue of accommodation without success. The Technikon was closed indefinitely due to student strike action (Appendix 9.2) which started on 22 February 1999. Students claim that they were promised a R24 million student resident facility in 1998 with the aid of the Development Bank of Southern Africa (DBSA). Students took the senior management hostage during the morning hours of 22 February 1999 and the Public Order Police (POP) had to storm the Technikon to release the management at about 10:40 p.m. Another problem that the Technikon is facing is also derived from the increase in student number and lack of accommodation, is the mushrooming informal settlement in front of the Technikon's main gate across the road. Even though during the last decade informal settlements have been erected all over South Africa largely by the homeless people of this country, I have noticed that the informal settlement in front of the Technikon is mainly occupied by the Technikon students. At a distance of about 75m from the main gate, a squatter camp has developed during the past few years. These tin

houses, caravans and even some permanent structures are a real shame in front of the modern buildings and lush surrounding landscape of the main campus. However, it reflects the reality of South Africa, on one side of the road there exists first world facilities and across the road the third world predicament prevails.

2.5 Further expansion - new campuses

During 1993 the Technikon acquired a Campus *(Campus A)* outside the jurisdiction of the homeland (in a South African City) and established another Campus *(Campus B)* in a homeland town itself. (The names, Campuses A, B, C etc. are also fictitious for the purpose of this project). The School of Applied Art was established in July 1994 at Campus A. At the beginning only part-time evening classes were offered at Campus B in various Management courses. From January 1995 onwards full-time Information Technology classes were also introduced at Campus B in addition to the part-time evening classes in Accounting and Management studies. When the Technikon began functioning at the main campus, it only had a small library. A modern Resource Centre was completed in October 1994 at a cost of R9,4 million and became operational from January 1995. The Resource Centre provides an attractive and functional facility that caters for the needs of the entire Technikon community. Shelving and storage for approximately 50 000 volumes (comprising books, periodicals, newspapers, audio-visual material, computer software and multimedia) is provided.

2.6 Democratisation

The Chancellor of the Technikon is a high profile political leader of the Province and South Africa. The highest decision making body of the Technikon is its Council, headed by another well renowned person in the new South Africa. The Council is comprised of the Vice-chancellor, Vice-Rector, Registrar, Ministerial Appointees, representatives of the Academic Board, representatives of Donors, staff union representatives, SRC representatives and the representatives from the community. While the Council is responsible for policy making and major decisions the Rectorate is responsible for the

day to day running of the institution. Members of the Rectorate are, the Vice-Chancellor, Vice-Rector, Registrar, Deputy Registrar, Director of Studies, Director of Human Resources, Director of Student Affairs, and Strategic Planner. The Senate (previously called the Academic Board) has representation from all the academic programmes, resource centre, staff unions and SRC.

In my opinion there has been a considerable shift in the Technikon's method of staff appointments over the years. In June 1992, the first two Associate Directors of the Technikon were appointed for two departments, the Management Department and the Department of Secretarial Studies. Apparently, there was no transparency or staff/student representation in the selection process. Later, students ousted one of these Associate Directors. Even though I do not have evidence in black and white, I have been with this institution long enough to make such an observation with reasonable surety. Whereas, from 1996, all the stakeholders are involved in staff selection and appointment procedures at all levels. Student and staff representation is visible in all structures of the Technikon. During the fourth quarter of 1998 the first two Deans were appointed through a democratic process. The members of the respective Faculties elected the Deans and the position of the Dean is held for a period of three years. (Council together with the transformation forum has laid down the qualifications of persons who are eligible for election as Dean). At present there are two Academic Faculties namely, the Faculty of Applied Technology and the Faculty of Human Science. The Academic Schools/Departments of each Faculty are given in the next page.

In 1996 another campus *(Campus C)* was established. The School of Engineering, which started functioning in 1996 was operating from a Technical College, moved to the latest campus, Campus C in January 1998. The main Campus was officially opened in 1997 and the first Chancellor and Vice-Chancellor and Principal, were inaugurated at a joint ceremony in which the first Graduation Ceremony was also held. Students of this institution had boycotted graduations in the past as a protest to the ideology of Bantu Education and Homeland system which had prevailed in the country.

2.7 Academic faculties and other departments

Table 2 Schools/Departments in the Academic Faculties *(Prospectus 1999)*

ACADEMIC FACULTIES	
FACULTY OF APPLIED TECHNOLOGY	**FACULTY OF HUMAN SCIENCE**
School of Engineering Electrical Engineering Mechanical Engineering Building/Civil Engineering	**School of Secretarial Studies and Education** Secretarial Studies and Education
School of Information Technology Computer Studies End User Computing	**School of Human Resources Management** Human Resources Management
School of Applied Science Analytical Chemistry	**School of Marketing** Marketing
School of Tourism & Hospitality Hospitality & Tourism	**School of Accounting** Accounting
School of Applied Art Applied Art	**School of Management** Management
Department of Foundation Studies Tertiary Foundation Course	**School of Communication Studies** Communication

In 1998, Campus C was officially opened and dedicated to the Faculty of Applied Technology. An Academic Development (AD) Centre was inaugurated at the Technikon in May 1996. The AD Centre is directed by a full-time Academic Development Officer responsible to the Director of Studies, overseen by a staff representative from each department and the Education and Transformation Officer of the SRC. The aim of the establishment of the Academic Development Centre is to make a meaningful contribution to the improvement of teaching and study skills. The AD Centre runs different programmes. They include Supplemental Instruction (SI), Tertiary Teaching Seminars,

workshops in Staff Personal Development and Student Life Skill Courses etc... At the beginning of 1999 a Research Officer was appointed to facilitate and guide research activities to enable academic staff to achieve higher qualifications. He is expected to promote the general development of a research culture at the Technikon.

The Department of Student Affairs is headed by its Director and is responsible for various student activities, the SRC is one of them. Students actively participate in about 20 different codes of sport. The Department of Student affairs is also responsible for residences, health services and student counselling. The Health Services function with a qualified nurse, who provides first aid medical care for students and staff. This department is also responsible for the organisation of the *Miss Rainbow Technikon* pageant. In 1997 *Miss Rainbow Technikon* won the Miss South African Technikon title. In early 1997, the Student Affairs Department organised additional accommodation facilities to students on campus in the form of porterhomes. In one of the Technikon brochures this department expressed its hope to build and make permanent student accommodation available during 1998 (Technikon review 1997: 26). Later the Technikon suffered from the consequence of the non-fulfilment of the above promise. As mentioned earlier, the Technikon had to close indefinitely on this particular issue of accommodation. I strongly believe that, one should not make false or unattainable promises to anyone.

The Department of Development and Estates is responsible for the building and maintenance of all property of the Technikon. This department is administered by the Manager of Development and Estates and assisted by a range of support staff. This department provides vehicles for official use by staff and students. There are two mini buses with 25 seats, two small mini buses with 18 seats, a pick-up van, a passenger car and a tractor.

A cafeteria provides on-site catering for all students and staff throughout the daytime, as well as meals for residential students at other times.

There are also Departments of Administration, Examination, Finance, Personnel, Information Technology Services, Public Relations, Co-operative Education and Strategic Planning. All these different departments work together to ensure the smooth running and effective teaching/lecturing at the Technikon.

There are different committees such as the Institutional Forum Committee, Finance Committee, Staffing Committee, Strategic Planning Committee, Student Affairs Committee and Tender Committee entrusted with different tasks. The Institutional Forum Committee has the responsibility to make sure that transformation is taking place at all levels of the Technikon. All these committees were established in the recent past and are instrumental in bringing about transparency, transformation, re-dress and equity. All the stakeholders are represented in these committees thereby ensuring the implementation of democratic principles. The number of academic and administrative staff according to different population groups is given below. It is ironic that in a supposedly non-racial country the staff structure of the Technikon is given per population group. However this is to demonstrate that the Technikon has come a long way in the process of transformation. Even though in 1989 the Technikon did not have a single African academic or administrative staff the situation is now changing remarkably.

Table 3 Staff appointments – per population group (1999)

STAFF	AFRICAN	COLOURED	INDIAN	WHITE	TOTAL
ACADEMIC	35	5	8	69	117
ADMINISTRATIVE	61	1	2	26	90

When I joined this institution in January 1992, there were only 4 African lecturers employed here. Currently the number of African lecturers is increasing steadily in most of the departments. The majority of the administration staff is also Africans.

2.8 Facilities at the Technikon

As I mentioned earlier, *Rainbow Technikon* has 4 campuses, the main campus and the satellite campuses A, B and C. The physical buildings are well designed with ceilings and iron roofing and each window in the classroom is fitted with blinds/curtains, which prevents great ranges in temperature and allows for a pleasant condition conducive to teaching and learning. Each classroom is fitted with overhead projectors (OHP), screen for OHP and white and green/black board. The facilities available at each campus are given below.

Table 4 Facilities at the Technikon – Main Campus

Classrooms	**21**		**Accommodation**	
Workstations	**1135**			
Offices	**20**		**Residences**	**16**
Workstations	**40**		**Beds**	**254**
Typing labs	**2**		**Parkhomes**	**12**
Workstations	**52**		**Beds**	**144**
Simulated office	**1**		**Total beds**	**398**
Workstations	**24**			
Computer labs	**5**			
Workstations	**120**			
Total workstations	**1371**			

Table 5 Facilities at the Technikon – Campuses A & B

Campus A		Campus B	
Offices	10	Offices	4
Studios	16	Classrooms	9
Library	1	Computer lab	1
Total workstations	346	Total workstations	275

Table 6 Facilities at the Technikon – Campus C

Classroom/lecture room	36	Butchery	1
Offices	72	Dining hall	1
Computer labs	3	Hotel rooms	2
Wine cellar	1	Restaurant	1
Kitchen	3	Cold rooms	3
Scullery	1	Printing room	1
Resource centre	1	Catering studio	1
Pattiserie	1	Boardroom	1
Total workstations	2015		

Video projectors, slide projectors, video machine and television are available on campus for lecturers to present lectures. These can be obtained through prior booking with the resource centre. Each academic staff member and most of the administration staff members are given computers that are connected to a wide area network. All staff and students also have access to Internet and e-mail facility.

2.9 Research focus of project

By undertaking this project I hope to find out:

- Whether this Technikon is ready for a shift in educational ideology.
- Whether the academic staff of this Technikon are ready to cast off the shackles of fundamental pedagogics which contrived to manipulate and disempower teachers/lecturers and to put up with a foreign ideology, designed to give credibility to an immoral system.
- Whether this Technikon is ready to take responsibility for future curriculum changes.
- Whether the academic staff of this Technikon are prepared to embark on a new ideology that will challenge their power in the classroom.
- Whether the academic staff of this Technikon are ready to work hard and employ new methods to stimulate and motivate their students.
- Whether this Technikon is prepared to accept Outcomes Based Education (OBE) and Curriculum 2005.

3. Literature review

3.1 The issue of change in the current educational context

According to Farrant (1980), education is an essential process in human development. He further claims that universally all societies have engaged in some form of education at the different stages of their developments (Farrant 1980:18-20). He claims that education and schooling are not the same. Schooling is only one form of providing education. He argues that, "education is society's cultural reproductive system. By education, society reproduces itself, passing on its main characteristics to the next generation" (Farrant 1980:19). Therefore I believe that the business we are engaged in, that is educating the present generation is of utmost importance to the recipients in particular and the nation in general. Since South Africa's first national democratic elections in 1994, the new government has issued several curriculum-related reforms intended to democratise education and eliminate inequalities in the post-apartheid education system. The most comprehensive of these reforms has been labelled Outcomes-Based Education, an approach to education which underpins the new Curriculum 2005 (Department of Education 2000). We might be able to overcome the inequalities of the past and have an education system relevant for all South Africans that promote an equal opportunity for success as envisaged by Outcomes Based Education (OBE).

3.2 What is OBE?

I would like to extend the literature review to look briefly into what OBE is. Glatthorn (1993: 354) claims that "OBE is both a comprehensive reform strategy and a curriculum model". According to Spady and Marshall (1991: 67) OBE is anchored on three basic premises. These premises are, (i) "all students can learn and succeed (but not on the same day in the same way) (ii) success breeds success and (iii) schools control the conditions of success" (Spady and Marshall 1991: 67). Various other writers (Van der Horst and McDonald (1997: 7); Boschee and Baron (1993: 2)) also maintain that, OBE is a learner-centred, results-oriented approach which is based on the above three premises. Spady and

Marshall (1991) claim that OBE is growing throughout North America at a rapid rate. They point out three reasons for this growth. Firstly, during the past decade many states have successfully implemented OBE in schools and subject areas of all categories. In other words, the implementation of OBE has fostered major improvements in student learning in the USA during 1980s. Secondly, "successful outcomes are now both the starting points and the bottom lines of educational policy thinking and action in both the United States and Canada" (Spady and Marshall 1991: 67). According to Spady and Marshall (1991: 67) this was due to the demands placed by the policy making bodies in those countries on improved student outcomes. Thirdly, they believe that there is growing consensus among educators, business executives and political leaders that the education system needs a new approach. These leaders (in their own areas of expertise) believe that the "new paradigm must be success-based in philosophy and outcome-based in Practice" (Spady and Marshall 1991: 67).

According to Spady and Marshall (1991: 68) due to the rapid growth of OBE, different educators are drawn to "an outcome-based approach in different ways and with different understandings of its potential applications and implications for curriculum design, instructional delivery, and student assessment and credentialing". They (Spady and Marshall) have given different names to these approaches, namely, (i) Traditional OBE, (ii) Transitional OBE and (iii) Transformational OBE. I would like to look at these three approaches briefly.

3.2.1 Traditional OBE

Spady and Marshall (1991: 68) point out that the Traditional OBE has the characteristics of current OBE approaches and is highly effective in improving student achievement. However, Traditional OBE is mainly concerned with Curriculum-Based Objectives (CBO) and not intended goals and outcomes (Spady 1988). Traditional OBE encourages educators to take their existing curriculum content and (re)structure their lessons, courses and programs so that their students can learn to perform at a higher level. Once the CBO priorities have been set, they are used as the basis of curriculum, teaching methods and

evaluation practices. Spady and Marshall (1991: 69) claim that, after teachers begin to apply OBE principles in their classrooms, students experience improved success "even within the time and programmatic constraints imposed by the traditional school structure". They list various drawbacks of Traditional OBE which includes among others the following:

(i) The content and structure of the curriculum remains the same as before the implementation of the new approach. As a result the outcomes are very similar to the traditional content-dominated teaching/learning practices that do not relate to real-life situations.

(ii) Educational institutions are presumed to be the only context in which teaching/learning takes place.

(iii) Exit outcomes are not clearly defined and the graduate is not holistically dealt with. It appears that the approach is to make the graduate an "academically competent student".

(iv) Traditional OBE seldom challenges the traditional nature of schooling. By focussing basically on course outcomes it looks for and finds greater success within the constraints, rather than seeking to modify or eliminate them.

3.2.2 Transitional OBE

According to Spady and Marshall (1991: 69), Transitional OBE lies between "traditional subject-matter curriculum structures and planning processes and the future-role priorities inherent in Transformational OBE". They state that, Transitional OBE is basically concerned with students' capabilities at graduation time and the curriculum and assessment are designed towards "higher-order exit outcomes". Spady and Marshall (1991: 69) claim that Transitional OBE staff "almost universally give priority to higher level competencies, such as critical thinking, effective communication, technological applications, and complex problem solving rather than particular kinds of knowledge or information". In their experience Spady and Marshall (1991: 69-70) found that the implementation of Transitional Exit Outcomes goes through three stages of maturity. According to them these stages are *incorporation, integration and redefinition.* The first

stage namely *incorporation,* deals with the recognition of the fact that textbooks are not the only source of learning materials. *Integration* is the interdisciplinary work where various specialists work together to achieve/address the same outcomes. *Redefinition* is the shifting of focus from Transitional OBE to Transformational OBE. Spady and Marshall (1991: 70) claim that, *redefinition* is the maturity stage where, "shared concepts and problems, not content per se, are linked to ever higher-order forms of demonstration and application in the fulfilment of what truly do become Outcomes of Significance".

3.2.3 Transformational OBE

According to Spady & Marshall (1991: 70-72) Transformational OBE "represents the highest evolution of the OBE concept". It is in full agreement with the four OBE operational principles which according to Spady and Marshall (1991: 70) are (i) "ensure clarity of focus on the outcomes of significance", ... (ii) "design down from ultimate outcomes", ... (iii) "emphasise high expectations for all to succeed" ... and (iv) "provide expanded opportunity and support for learning success". According to Spady and Marshall (1991: 71-72) Transformational OBE recognises the existence of schools in order to equip all students with the knowledge and competence required for success after schooling. When viewed from this life-role perspective success in school is of limited benefit unless learners are able to transfer this success to more challenging high-tech future life experiences. Spady and Marshall (1991: 70) believe that the Century-old, Industrial age curriculum structure and delivery model "lack credibility and capacity" to meet the challenges of the educational needs of the 21st Century. The following table (Table 7) (Spady and Marshall 1991: 68) depicts ten attributes of traditional education and ten alternatives proposed by the advocates of Transformational OBE.

Table 7

In contrast to 10 attributes of traditional (and current) education, advocates of Transformational OBE propose 10 alternatives:

Transformational OBE *is not.*	Transformational OBE *is.*
1. Calendar defined (schools, programs, processes, credentialing, and decision-making priorities);	Outcome defined (schools, programs, credentialing, and decision-making priorities);
2. Constrained in opportunity (which limits time for teaching and successful learning to occur);	Expanded in opportunity (which enables successful teaching and learning for all to occur);
3. Custodial in credentialing (credit based on seat-time attendance and ambiguous criteria);	Based on performance credentialing (credit through accomplishment, using clear criteria, and demonstrating success of priority outcomes);
4. Tied to curriculum coverage (approach to teaching and testing);	Aided by instructional coaching (fostering successful performance for all students on essential outcomes);
5. Segmented in content(curriculum structure, instructional delivery, testing, and credentialing);	Integrated in concepts (cross-curriculum approach to outcomes, curriculum structure, instructional delivery, and assessment);
6. Based on cumulative achievement (approach to curriculum planning, teaching, testing, and grading);	Based on culminating achievement ("end-result" approach to outcomes, curriculum design, instruction, assessment, and grading);
7. Selection oriented (opportunity structures, grading, and curriculum tracking);	Oriented to inclusionary success (structure of curriculum cross-grouping, learning, assessment, and credentialing opportunities);
8. Characterised by contest learning (students compete for scarce rewards);	Characterised by co-operative learning (to foster learning success for all);
9. Dependent on comparative evaluation (emphasising relative quality of work accomplished and grades assigned);	Confirmed by criterion validation (expectations of high-level performance on clearly defined outcomes and standards);
10. Composed of cellular structures (school and curriculum organisation, learning environments, and credentialing).	Formed on collaborative structures (for curriculum planning, instructional delivery, and student learning).

The Director-General of the Department of Education in South Africa (South Africa: 1997) claims that, "the Ministry of Education is committed to Transformational OBE and to play its part in changing our society into a lifelong-learning society".

3.2.4 New Challenges

With reference to these three approaches namely Traditional OBE, Transitional OBE and Transformational OBE, Evans and King (1994: 12) claim that Spady and Marshall are creating complication in the education system. They (Evans and King) argue that, the first approach can operate in the existing system while the last two approaches require the creation of a whole new system.

King and Evans (1991: 73-75) claim that, OBE has tremendous potential for changing the present school system, however it presents huge challenges to educators. I think this is true in the South African situation also where it appears that teachers are having difficulties in implementing OBE. King and Evans (1991: 73-75) suggest that if OBE is to succeed the educators must "marshal the will and the resources to make it a top priority of the next decade". They claim that, OBE is attractive because it has something for everyone. At the same time they caution educators that there is no guarantee that OBE will fare any better than previous models of education. They believe that for OBE to succeed there are various challenges to be resolved. These challenges include (among others) major curriculum developments and intensive staff development programmes in which ongoing monitoring procedures are essential.

Since South Africa's first democratic elections, the Ministry of Education has introduced various "national curriculum reform initiatives focussed on schools" (Jansen 1998: 321). The first attempt was "to purge the apartheid curriculum (school syllabuses) of racially offensive and outdated content" (Jansen 1997, as quoted in Jansen 1998: 321). The second reform was that of introducing continuous assessment into South African schools (Lucen *et al.*, 1997, as quoted in Jansen 1998: 321). The Status Report for the Minister of Education in South Africa (Department of Education 1996: 6) claims that the new democratic government that came into power in 1994 "has unleashed profound changes that are at work in our education system". The Status Report has a long list of reforms or changes brought about by the new government which includes Curriculum 2005. The report claims that, "Curriculum 2005, the new approach to learning and teaching is

designed to break the shackles of the old South African pedagogy, and lift our learning system into the future." The same report (Department of Education 1996: 17) claims that Outcomes-Based Education is a learner centred approach in which teachers play the role of facilitators. The report further claims that, "OBE places strong emphasis on co-operative learning, especially group work on common tasks". Similar claims have been made by the National and Provincial Ministries of Education since 1996 (South Africa 1997a). The Senior Phase Policy Document (Department of Education 1997: 22) argues that "based on the philosophy that all learners can learn, Outcomes-Based Education clearly defines what learners are to learn ... and learners should be given enough time to meet their potential". These claims and arguments have generated heated debates through the media in South Africa (and even abroad) (Mulholland 1997, Bengu 1997, Mark 1999, etc.). In criticising OBE Mulholland (1997) argued that, OBE rejects the need for competition and hence individual excellence. He claimed that, "OBE is based on the group and it seeks equality of outcome". According to him "in the new world of OBE, no one fails". He argued that by this practice, where no one fails, South African children are insulated from the realities of life (where failure is part of life).

A barrage of letters written by laymen, politicians and academics criticising Mulholland's article appeared in the Sunday Times during the subsequent weeks. In his response, the Minister of Education (Bengu 1997: 29) dispelled the belief that only the ANC and its allies were involved in the curriculum development process. He claimed that, Curriculum 2005 was developed with the input from all the stakeholders. He explained the importance of group work and defended the introduction of OBE and Curriculum 2005. At times it appeared that, Bengu's response was directed at the author (Mulholland) rather than to the issues that are raised in the article.

Jansen (1997) has strongly argued that OBE would fail in South Africa for various reasons. Among others, his reasons were (i) OBE was implemented in isolation and (ii) the language associated with OBE was too complex and confusing. According to him, the claims made by the policy makers in South Africa were mostly misleading. For example, according to him one of the claims made by the policy makers was that OBE would bring

economic development. He further argued that, "not only does OBE offer a solution to economic problems it is also sold as a solution to universal and deeply-entrenched pedagogical problems". He believed that "OBE is destined to fail in the South African education system because it is based on flawed assumptions ..."(Jansen 1998: 329). In his response to Jansen, Mark (1999: 140) argued that it is not the weakness of the policy (related to OBE) but the difficulty in policy implementation that is the issue in the South African Educational system. According to him "apartheid's legacy is both a desperately under-educated population and a schooling system lying in tatters. OBE is a significant attempt to seize the opportunities generated by a society in change to address this dismal situation" (Mark 1999: 140). Jansen (1998: 331) is of the opinion that the apartheid curriculum required radical reconstruction but, the introduction of OBE would further "undermine the already weak culture of teaching and learning in South African schools by escalating the administrative burden of change". It appears that while criticising OBE in South Africa, Jansen does not offer any concrete alternative models.

4. The Research Design

4.1 The Philosophy Underlying the Research Project

This research project is located within a qualitative paradigm. Wolcott (1990:25) argues that, in a qualitative study, progressive problem setting and focus, fieldwork and analysis takes place in a complementary fashion and the writing proceeds as an integral part of the fully co-ordinated research process. Tesch (1990: 4,43) argues that in this form of research the analysis is the process of making sense of narrative data, and not concerned with variables and their measurement. Denzin and Lincoln (1994: 4) also argue that "the word *qualitative* implies on emphasis on processes and meanings that are not rigorously examined, or measured (if measured at all), in terms of quantity amount, intensity, or frequency".

The researcher will embark on a small-scale survey. A survey is a data-gathering process that asks questions to a sample of respondents using either a questionnaire or an

interview. Moreover, the interview schedules designed were in the form of a semi-structured interview, to allow for follow-up or probing questions (Cohen and Manion, 1994; Janesick, 1994; Kvale, 1996; Sanders and Pinhey, 1974). According to Cohen and Manion (1994: 271-276) and Walker (1985: 117), an interview opens areas of dialogue. In this study, mostly open-ended questions were used in the interviews. I also used the "funnel" approach, which is the kind of open-ended question which "starts with a broad question or statement and narrows down to more specific ones" (Cohen and Manion, 1994: 277). Both the questionnaire (in the preliminary study in 1999) and the interview schedule (in 1999 and 2000) were pilot tested to ensure that any ambiguities were minimised as far as possible (Janesick 1994: 213).

4.2 The Research Purpose: Aims and Objectives

In this study I would like to investigate:

1. **the groundwork done by the Technikon in the capacity building of its Academic Staff in OBE.**
2. **the level of implementation of OBE type of teaching/lecturing at this Technikon.**

4.3 Data Collection Methods

I would say that the biggest problem while gathering data was the fact that I have been part of this institution for nearly 10 years. I think my biased views clouded my judgement in some instances and my questions were probably guided by a preconceived response. If I could undertake a situational analysis of another institution, the issue of bias could be avoided to a large extent. But there could be practical difficulties in obtaining data. To overcome this bias, I have tried to be as neutral as possible. To remain neutral I have collected the following documents from various people at the Technikon and analysed them. Furthermore, I have also interviewed key-persons (explained elsewhere) to gather data.

The SAPSE officer at the Technikon supplied me with the student enrolment data from inception to date and she also provided me with the building report (all the details of number of classrooms and other facilities).

The Chief-Librarian gave me access to the archives of the Technikon. From the archives I was able to obtain a copy of a letter that the first Rector of the Technikon wrote to the then Minister of Education. This letter gave me a lot of insight into the history of the Technikon.

In the preliminary study (which was conducted during 1999) my intention was to use the staff of the Technikon for sampling to gather data. I prepared a questionnaire and an interview schedule (Appendices 3 & 4) and consulted the newly appointed Research Officer at the Technikon. He gave me some guidance and directions to modify my questionnaire and the interview schedule. While I was busy with the modification of the questionnaire and the interview schedule, the students took the staff as hostage and eventually the Technikon was closed indefinitely on 22 February 1999 (Appendix 9.2).

I gave questionnaires to 16 lecturers and managed to get all of them completed. As the Technikon was officially closed by the High Court, I had real trouble in contacting the lecturers. Even though the Technikon was officially closed I travelled daily to the Technikon and was fortunate to find a few lecturers at different times. I gave the questionnaires to those staff members that I met during this period. I cannot claim with confidence that my selection of lecturers was at random. I gave the questionnaire to a lecturer I found at the main campus of the Technikon when I happened to be there while the Technikon was officially closed due to the strike action. May be these were the more committed staff, who came to work during the strike period. During this preliminary study I also interviewed three academic staff (Appendix 9.4).

The first person whom I interviewed was (BC), my own Head of the Department. I started with him because; I thought that due to the familiarity with him I could also build my confidence to interview other people and at the same time gather data from our own

department which is more relevant to me. The second person I interviewed was (GS), the Associate Director of the Department of Accounting. I chose him because, he is involved with administration, lecturing full-time students at the main campus and also lecturing part-time students at *Campus C*. The third person I interviewed was (PS), a senior lecturer in Communication Studies. I chose him because he was one of the first lecturers of this Technikon and he is the founding president of the staff union. Originally, I prepared 21 questions for interview, (Appendix 9.4) for practical reasons (time for transcribing) I only used approximately the 10 most relevant questions. The Research Officer at the Technikon provided guidance in reducing the number from 21 to approximately 10 most relevant ones.

4.4 Analysis of research tools used in the preliminary study

The questionnaire I used last year (1999) in the preliminary study contained 21 questions. Each question was included with a specific objective. Questions could be grouped together according to the objectives.

TABLE 8

Questions	Objectives
1 – 3	To find out the lecturing/teaching experience and the attitude towards lecturing/teaching of the lecturer.
4 – 11	To find out the depth of understanding of the lecturer in OBE.
12 – 13	To find out the attitude of the lecturer towards receiving training in OBE.
14 – 18	To evaluate the way in which the training was advertised and conducted.
19 – 21	To find out whether the lecturer is practising OBE in his/her lecturing

During the preliminary study I used 10 questions in the interview schedule. At that stage I was a novice in research and did not have sufficient experience in interviewing. As a

result the interview questions had deficiencies such as lack of clarity and focus. However the general aim of the questions in the interview schedule was to evaluate the attitude of the academic staff towards the implementation of OBE based teaching/lecturing. I tried to rectify these deficiencies and improved the clarity and focus of the interview schedule in the final round of study conducted in 2000.

4.5 The final round

The second and final round of this study was conducted in the year 2000. Since 1998, the Academic Development Officer (ADO) of the Technikon has organised a series of workshops for the academic staff to capacitate them in Outcomes Based Education (OBE). An open invitation was sent out to all academic staff by the ADO. To investigate the groundwork done by the Technikon in the capacity building of its Academic Staff in OBE and the level of implementation of OBE type of teaching/lecturing at the Technikon I made arrangements with four staff members (in the year 2000) to interview them. Even though I received written permission from these staff members to use their names in this report I am only using fictitious names for confidentiality (Cohen and Manion, 1994: 367). These staff members are (i) Ms. Lynette Stone, (LS), The Academic Development Officer; (ii) Mrs. Candice Mathew, (CM), Senior Lecturer, Department of End User Computing; (iii) Mrs. Anna Eddy, (AE), Senior Lecturer, School of Secretarial Studies; and (iv) Mr. Martin Phillip, (MP), Lecturer, School of Marketing. I interviewed these staff members for certain specific reasons. LS who is the Academic Development Officer was the facilitator of the workshops aimed at providing staff training in OBE. CM and AE are two senior lecturers from two different faculties (CM is from the Faculty of Applied Technology and AE is from the Faculty of Human Science). Both of them attended the OBE staff-training workshops on a regular basis and hence received the training. The fourth person I interviewed (MP) is a lecturer from the School of Marketing who could not attend the staff-training workshops and hence could not receive the training in OBE. This is because during the time of these workshops, he was on study leave in the United States of America pursuing his Masters Degree.

4.5.1 Interview Schedule

This year (2000), during the second and final round of this study, I prepared three different interview schedules (Appendix 9.5). The first interview schedule was prepared for the facilitator (LS) of the staff-training workshops. The second one was prepared for the two senior lecturers (CM & AE) who received the training. The third and final one was prepared for the staff member (MP) who could not receive the training. The core structure and the majority of questions of the interview schedule remained the same for all four interviewees.

The interview schedule was divided into four categories. These categories were:

1. Background to workshops
2. Analysis of the training and implementation (of OBE)
3. OBE at the Technikon today and
4. The way forward.

In the interview schedule for MP (who did attend the staff training), the second category, namely *Analysis of the training and implementation (of OBE),* was replaced with *Understanding in OBE.*

The intention of using the category *background to workshops* (Appendices 5A, 5B, 5C: Questions 1) was to explore the way in which the workshops were conducted and the general support the workshop facilitator received from the management of the Technikon. In the case of LS, CM and AE the second category *analysis of the training and implementation (of OBE)* (Appendices 5A & 5B: Question 2) was employed to assess the success or failure of the training programme. For the interview with MP (who did attend the staff training) the second category *understanding in OBE* (Appendix 9.5.3: Question 2) was applied to evaluate the depth of his understanding in OBE and related topics. In one of the presentations, the facilitator of the workshops (LS) expressed the desire to implement OBE based teaching/lecturing by all academic staff at the Technikon by June 2000. The third category of questions namely, *OBE at the Technikon today* (Appendices

5A, 5B & 5C: Question 3) was included to find out the level of implementation of OBE at the Technikon. The fourth category *the way forward* (Appendices 5A, 5B & 5C: Question 4) was used to find out the direction in which the Technikon is proceeding in terms of OBE based teaching/lecturing. In these interviews I asked mostly open-ended questions. According to Cohen and Manion (1994: 277),

> open-ended questions have a number of advantages: they are flexible; they allow the interviewer to probe so that she may go into more depth if she chooses, or to clear up any misunderstandings; they enable the interviewer to test the limits of the respondent's knowledge; they encourage co-operation and help establish rapport; and they allow the interviewer to make truer assessment of what the respondent really believes.

Even though I prepared an interview schedule in advance, occasionally I had to deviate from the schedule to gather more information on the basis of the responses that I received from the interviewee. For example to my question JV13 (Appendix 9.6.3, Paragraph JV13), in which I tried to explore the success or failure of the OBE training and implementation, the response of one of the senior lecturers was as follows:

> "AE13: The programme or the presenter? Because that is a broad question.
>
> JV14: **Just the two aspects, the training and the implementation.**
>
> AE14: The implementation needs a lot of attention still. I've got my view on that. I think as far as implementation goes somebody actually has to sit with you, either on an individual basis or in a very small group. And we take an area, which is familiar to the group, like typing a letter, for instance. How do we do typing a letter as an OBE lesson? That would be the implementation. I think that needs a lot of attention still. I don't think any attention has actually been given to that. We've been receiving training and we have been left with it.
>
> JV15: **Yes, there was no follow-up?**
>
> AE15: There was no follow-up. We actually have to... we actually have to see now...okay I have to implement this, how am I actually going to do that. There is a lot of thinking in that. Implementation is huge. It's for the rest of ... whenever. Training is one thing. I can tell you how to do it; I can show you how to do it. But now you actually need to be taken by the hand and sit down at the desk

and say now okay let's do one example together, because I have no idea, when I say "I" ... you know ... "a person".

JV16: **In your opinion did the training go well?**

AE16: The training went well, but I still have a lot of questions, like I said to you. I have missed all the workshops in assessments, so I still have a huge amount of questions. I know I haven't got the issue of assessments sorted out in my head and assessment is a crucial part".

Even though I did not deviate from the main theme of the interview schedule, I had to adjust and modify the questions to gather more information and explanations from the interviewee. This kind of flexibility and the possibility to probe are the advantages of open-ended questions (Cohen and Manion 1994: 277).

4.5.2 Research procedure

I had discussions with each interviewee prior to the interview (at least 3 days in advance) and the interviews were held at mutually agreed venues. The venue of the interview of LS was a room adjacent to her office and of AE and MP was my office. Since CM was on study leave I conducted the interview with her at her residence. During the interviews with AE and MP to avoid interference, I took the telephone off the hook, switched off my cellular phone, the room was closed and a notice was placed outside the room, not to disturb since a meeting was in progress. I think to avoid distractions during interviews the researcher should arrange ahead of time for the interview to take place in a quiet room away from the main flow of activity. It is better to avoid the interviewee's office to overcome common workplace interruptions such as telephones' ringing, staff interruptions and doors opening and closing.

To avoid equipment failure I checked and reconfirmed that the tape-recorder was fully functional. I placed batteries in it to ensure that recording would continue uninterrupted in case of a power failure.

To avoid transcription error, I hired a professional transcriber who is using audio-typing in her everyday job situation and she did an excellent job. I went over the transcribed material while listening to the audio-tapes to make sure that there was no word that was misunderstood or misinterpreted. I also looked for inaccurate punctuation and made necessary corrections. Even though I took all these precautions to avoid common pitfalls as described by Easton *et al* (2000), during audio-typing it was noted that the audio cassette on which the interview with CM was recorded had various background noises such as birds singing and the sound of passing motor cars. As I mentioned earlier, this interview was conducted at her residence because she was on study leave. The researcher and the interviewee were seated next to a window for convenience (such as availability of plug point, chairs, table etc....). Maybe the window was not closed properly and that might have let the background noise into the room. While undertaking research one has to take extra precautions to avoid these types of pitfalls.

5. The Situation of the Technikon as Emerged from the Questionnaires, Interviews and My Own Personal Observations

5.1 Results from the Preliminary study

Out of 16 lecturers who completed the questionnaire, 9 of them had more than 10 years experience and 5 of them had less than 3 years experience. Each of the other two lecturers had experiences ranging between 4 to 6 years and 7 to 9 years respectively.

All the lecturers who responded except one had expressed their job at the Technikon as either stimulating or challenging. Only one lecturer finds it problematic to work at the Technikon and he/she has less than 3 years experience of lecturing. Fourteen of them have heard about Curriculum 2005 and all of them have heard about OBE. Most of them are either interested or curious about the imminent changes in our education system. All except one person, who has more than 10 years of experience, agrees that there is a need to change the education system in South Africa.

The respondents were asked to identify and mark the characteristics of the new approach to education (OBE) from table 9 given below.

TABLE 9

	FEW CHARACTERISTICS OF OLD AND NEW APPROACHES	FREQUENCY OF RESPONSES
1	**Passive learners**	**0**
2	**Active learners**	**14**
3	**Learners are assessed on an on-going basis**	**11**
4	**Critical thinking, reasoning, reflection and action**	**12**
5	**Flexible time-frames allow learners to work at their own pace**	**11**
6	**Rote-learning**	**1**
7	**Learner-centred; teacher is a facilitator**	**13**
8	**Emphasis on what the teacher hopes to achieve**	**1**
9	**Syllabus is content-based and broken down into subjects**	**2**
10	**Emphasis on what the learner becomes and understands**	**12**

From the responses it was clear that most of the lecturers have a reasonably good understanding of OBE. All of them believe that, it is good to interact and share ideas within a department. The majority of the respondents claim that they were already practising an OBE approach. Most of the lecturers with more than 10 years of experience believe that there is no need for them to change their teaching style. It is very interesting to note that all those who said that either they are not prepared to be retrained or it is not necessary for them to be retrained are the lecturers with more than 10 years of experience. The Academic Development Officer at the Technikon conducted the workshops on OBE at this institution. Out of 16 respondents 15 of them have at least heard about Outcomes Based Education (in 1999). Only 10 of them have attended the workshops. The majority of them (81%) believe that the Technikon is doing enough to bring about the OBE system.

I interviewed three staff members and all of them agreed that the Technikon had over the years achieved a fair amount of success but also some failures. The Associate Director

(GS) who lectures both full-time and part-time students believes that the part-time students are more motivated than their full-time counterparts. The Communication lecturer (PS) believes that students are motivated but lack of communication skills discourages them from participating in the class. The mathematics lecturer (BC) believes that as the year progresses their level of motivation also improves. All of them have tried different teaching methods to improve the motivation of the students. But they believe that the students are generally hesitant to participate in group discussions and other activities that require their involvement.

Two of them (BC and PS) believe that there is need for change in our education system. The other person (GS) is not sure whether a change is necessary or not. None of them really feel that OBE is imposed on us and they believe that, once effected successfully, there is much to be gained.

One of them (GS) believes that we had different systems of education in the past, and one could choose the best out of it and modify it rather than coming up with something revolutionary in the form of OBE.

Two of them (BC and PS) feel that some form of training in OBE is necessary for lecturers. But BC feels that the reason for failure of the workshops last year was the non-attendance of staff. The information regarding the running of the workshops came as an invitation and not as an instruction and many staff did not attend the OBE workshop organised by the Academic Development Officer. All of the lecturers interviewed were doubtful about the fact that one single system of education (even as flexible as OBE) will be able to meet the needs of all South Africans. This comment reveals the lack of understanding among the academic staff of the Technikon regarding the wider implications of an Outcomes Based approach to education.

Most educators and learners have experienced educational environments where other people took decisions for them. A prescriptive syllabus was provided, 80% of attendance was compulsory (at this Technikon) and autocratic rules were in place. This might have

produced people who did not really have to think. They simply had to implement what other people thought was right for education and it was very easy to do. At this Technikon, in many of the programmes such as Information Technology and Hospitality Management the practice of Traditional OBE is already evident. As it was mentioned in the literature review (page 19) Traditional OBE is more concerned with curriculum rather than with intended outcome. This Technikon has to change and Transformational OBE is the route to go.

5.2 Results from the final round

Looking back at the staff-training workshops, the facilitator (LS) and the participants/trainees (CM & AE) agreed that the workshops were poorly attended by the academic staff. LS explained that "the workshops were advertised for everyone. They were presented on Wednesday afternoons, which was supposed to be a time when lecturers were free ... " (Appendix 9.6.1: LS2). However only about 15% of the academic staff attended these workshops. LS said that she did not realise "how much pressure it would take to get people to attend" (Appendix 9.6.1: LS2). In future, when similar workshops are organised she would like to see it be mandatory. Both the staff members who received the training (CM & AE) have a view which is opposite to that of the facilitator regarding mandatory attendance at the workshops. CM is of the opinion that "making it mandatory is not going to be conducive to opening their minds" (Appendix 9.6.2: CM3). She would like to see the academic staff attending, but she doesn't want it to be mandatory. She suggests the introduction of some form of encouragement to persuade people to attend. On the other hand AE is not fully in agreement with this idea of "incentives for attendance". Both of them (CM & AE) have reservations in making it mandatory but at the same time they feel that, it is imperative for the staff to attend these workshops.

LS felt that the staff who attended the workshops had a positive attitude towards the training. They attended because they wanted to learn the concept of OBE and practice it in their teaching/lecturing. She said the first workshop was the best attended but her

presentation as the facilitator on that one was the weakest. May be that was a contributing factor towards the poor attendance in the subsequent workshops. She believes that the support from the Technikon Management for these workshops was inadequate. According to LS the management realised the need for the training in OBE and related topics but did not offer any physical support in terms of presence (by a member of the management team) and hiring someone who could do this kind of training intensively. The facilitator and the trainees confirmed that the facilitator used the principles of OBE in some of her own presentations. CM and AE are of the opinion that, it would have been better, if the facilitator could have used a bit more explicitly the OBE approach as a vehicle to educate people in the philosophy underpinning OBE.

The design of Learning Support Material is an important aspect of OBE (Department of Education 2000). LS believed that she mentioned the design of Learning Support Material briefly in the workshop. AE said with reasonable surety that it was not mentioned in the workshop at all. CM thought that this aspect was given to the trainees as a follow up task. It is possible in one's presentation to skip (involuntarily) certain important aspects and at the same time one may think that one has mentioned that aspect. In my opinion to avoid such issues, maybe one can think of using a team of facilitators instead of one individual making all the presentations. If one member of the team has forgotten or skipped certain topics, other member(s) can always remind the team-mates about this forgotten theme.

The facilitator and the trainees were of the opinion that these workshops were organised as an introduction to OBE and various aspects of OBE such as assessment, evaluation and outcomes were discussed. Regarding the success or failure of the OBE training and implementation programme at the Technikon, the responses were wide-ranging. The facilitator feels that, most people at the Technikon are aware of OBE while CM believes that there is still a lot of confusion in this respect (Appendices 6A & 6B: LS19 & CM14). AE does not believe that any attention was given to the implementation aspect. According to AE the staff were trained and left on their own. LS feels that in her opinion

more than 50% of the academic staff members of this institution are not ready and are not making any attempt to empower themselves in the implementation of OBE.

CM feels that, the very nature of Technikon programmes such as teaching a person to use a tool, for instance a computer, makes it easy to apply the OBE principles in the teaching/lecturing. In AE's opinion the practical nature of *Information Administration* (that is, secretarial studies) provides ample opportunity to employ the principles of OBE in the context of Technikon teaching/lecturing.

All the participants believe that there are huge difficulties in implementing 'Transformational OBE', which is not calendar defined but outcome defined. According to CM discussions were conducted in her department to overcome this issue of constraint of time. AE also feels that the idea of Transformational OBE is wonderful and if one is creative it will be easy to implement it.

LS and AE feel that, very little *integration of learning areas* takes place at this Technikon. AE feels that integration of learning areas is a great idea and she and few (former) lecturers in her department used to practise it but no longer do so. She feels that, it requires lot of hard work. CM said that, since all the lecturers in her department (End User Computing) are lecturing/teaching the same topics there is integration of learning areas in her department.

LS would like to see more involvement from the side of the Technikon Management. Involvement such as making more money available for manpower and real, physical commitment from the top management. She feels that, someone has to be hired with the specific task of the implementation of OBE. This person can have intensive training programmes for two to three days. Then this person can work with the trained people in their classrooms. According to LS this should not be seen as policing but as a supportive procedure. Finally, with the support and commitment of the departments, the implementation of OBE can be achieved to a greater extent Appendix 9.6.1: LS 30 & LS 31).

Both CM and AE, (senior lecturers with many years of experience) are involved in staff development programmes in their own departments. They feel that this is the contribution that they can make at present. However CM feels that, it is extremely difficult for the trainers to train academic staff with no educational training. It is a fact that over the years the Technikon has recruited academic staff with no professional qualification in education from industry and (also those who have completed National Diploma successfully) from this Technikon itself.

MP is a lecturer with five years teaching/lecturing experience. During this period of five years he was also absent for a couple of years from the Technikon to attend to his higher studies. According to MP the system in which he was educated (prior to the democratic election in 1994) and the system in which he is an educator are the same. In other words he does not see any difference between these systems of education. He claims that he has been practising OBE since 1995. From the way he explained OBE principles, one can understand that he has limited understanding in OBE. At the beginning he claimed that, the other lecturers in his department were also practising OBE. Later he has confirmed that in his department there is neither continuous assessment nor integration of learning areas. He also feels that Transformational OBE is not practical due to the time constraints. At this stage he has contradicted himself by saying that OBE is not taking place at this Technikon and each lecturer is in his/her own compartment. He feels that there should be greater co-operation between departments and between lecturers.

All the participants felt that there is a need for further training in OBE and related topics. In these future training programmes the inclusion of the three forms of OBEs, namely, Traditional OBE, Transitional OBE and Transformational OBE is of paramount importance. Perhaps exposure to these three forms of OBEs might inform the academic staff of this institution that what they practice at present in the name of OBE is largely Traditional OBE and they are far from implementing Transformational OBE.

6. Reflections on the research process

During the second half of 1998 I submitted an application to Rhodes University to pursue a degree in Masters in Science Education. At that time I had my doubts whether I would be able to complete the course because during this period (the second half of 1998) I lost both my parents in a space of three months and was in a terrible emotional state. During the first quarter of 1999 I had to be at Rhodes University for a week of block lectures. The first task given to me by my supervisors was to interview one of my peers and introduce him to the rest of the group. While talking/interviewing him it appeared to me that other people were also going through different but similar problems in life. Somehow life has to go on. Even though I did not bring my personal problems to the attention of my supervisors, with hindsight I can report with gratitude that the positive approach and constant encouragement of my lecturers were wonderful experiences.

The first written assignment given to me was that of a situational analysis of my institution. I found this task to be interesting and challenging. It was interesting because, I had the opportunity to peruse through the archives of my institution and read the history of this institution from inception to present. It was also interesting to note the different viewpoints of different people regarding the same issue. It was challenging because I had to collect data scientifically through interviews, questionnaires and document analysis. In my opinion when a person undertakes a part-time study, it becomes more than challenging because this individual has to attend to his full-time job, family and social commitments. But at the end the part-time student has to strike a balance between his study and other commitments.

I received the article by Spady and Marshall (1991) late in the research process. If I were in possession of this article at the beginning of my research, I would have included aspects of the three forms of OBE as explained by Spady & Marshall (1991) in the questionnaire and interviews. This research has refined my own understanding in OBE and will probably have an impact in my own future teaching/lecturing.

I think it was appropriate to use semi-structured interviews to gather data in this project. It gave me the flexibility to deviate slightly from the prepared questions and to probe and get an in-depth response from the interviewees. On the other hand if I had used the structured interviews it would not have been different from the use of questionnaires.

I used a tape-recorder to record the interviews and in general it was quite useful. However this technique had its shortcomings. Although I had sought permission from respondents to use a tape-recorder during the interview, I noticed that they were less open in their responses. During the conversation after the interviews they were prepared to talk more openly than at the interview. May be one should not rely on one technique to record the data.

Certain situations were beyond my control. For example, the closure of the Technikon due to students' strike action hampered the data collection for this project.

Due to the nature of this small project I only used a small non-representative sample in this study. May be in a future study the use of a bigger representative sample of the staff compliment might be a better idea.

In this study I was looking at the transformation taking place at a historically disadvantaged Technikon. I believe that the Technikon is not just made up of bricks, cement and iron but mainly by the people that are associated with this institution. Therefore the transformation has to take place in the attitudes and approaches of the people that makes this Technikon towards education in general and change in particular.

7. Conclusion - The Road Ahead

It appears that the shift in political ideology in South Africa during the last decade necessitated a shift in the education system in this country. A new curriculum, namely Curriculum 2005, based on the principles of OBE was introduced by the new government. All the sectors of educational institutions were expected to shift towards a learner centred curriculum based on the principles of OBE. In this project I examined the transformation that has taken place at a Historically Disadvantaged Technikon.

This Technikon was established by a Homeland government in South Africa during nineteen eighties and had an initial enrolment of less than 20 students. This institution had grown to a fully fledged Technikon and currently has an enrolment of over 4000 students and four campuses. The programmes offered ranges from one-year certificate programmes to four-year B. Tech. Degrees. The decision-making bodies such as the council, senate, staffing-committee, institutional forum committee, etc. are now fully representative and have undergone enormous transformation. Even though in 1989 the Technikon did not have a single African academic or administrative staff member, the situation has been changing remarkably so that the demography of the region is almost reflected in the current staff structure.

Various authors (Boschee and Baron 1993: 2, Spady and Marshall 1991: 67, Van der Horst and McDonald 1997: 7) argue that, OBE is a learner-centred, results-oriented approach, which is based on three basic assumptions. These assumptions are that all individuals can learn successfully (but not on the same day in the same way), success results in further success and schools create and control the conditions of success. Spady and Marshall (1991) categorised Outcomes-Based Education into, (i) Traditional OBE, (ii) Transitional OBE and (iii) Transformational OBE. The Director-General of the Department of Education in South Africa (South Africa 1997b) claims that, his department is committed to Transformational OBE. King and Evans (1991: 73-75) argued that even though OBE has tremendous potential for changing the present school system it introduces huge challenges to educators. In South Africa various authors

(Bengu 1997, Jansen 1997 & 1998, Mulholland 1997) were involved in public and academic debates around OBE and related issues.

In this project, I have looked at the groundwork done by a Historically Disadvantaged Technikon in South Africa in the capacity building of its academic staff in OBE. I also looked at the level of implementation of OBE type of teaching/lecturing at this Technikon. I conducted this study over a period of two years. The preliminary study was conducted in 1999 and the final round of the study was undertaken in the year 2000.

This Technikon with its wealth of human resources and technological facilities can play an important and meaningful role in the implementation of OBE. It is a good sign to note that, most of the educators feel that, a shift is necessary from the old system. The biggest problem in this process of change is that people are reluctant to participate and they must first be prepared to change their attitude towards transformation in education.

Most of the educators at the Technikon will agree with me in that, we did not give the backing to the Academic Development Officer that she deserves. The academic Vice-Rector must see to it that educators do attend workshops organised for them. It seems that there are huge differences in the understanding and practices of OBE between the lecturers who received the training and those who did not. This clearly shows that each and every lecturer should receive the required training in OBE. There are certain lecturers who claim that they are already practising an OBE approach in their teaching/lecturing. Seemingly they are not aware that they are in fact practising Traditional OBE and not Transformational OBE. The South African Cabinet decision on Curriculum 2005 (Appendix 9.7) also emphasises "the need for intensive, innovative in-service teacher development programmes ... to ensure a general enhancement of the capacity of teachers". Moreover in an address delivered by the Minister of Education of South Africa (Appendix 9.8) on 6 March 2000, it was clearly stated that, "Outcomes Based Education remains the chosen approach of government and that the decision to apply it across the entire education system (emphasis mine) is not under reconsideration at this time". The

academic staff of this institution is left with little choice – they must make themselves available for training in OBE and must be prepared to implement this new approach.

We must all agree on the ideology underpinning the new educational curriculum. All educators must realise that they are going to be the agents of change. We as educators need to take responsibility for our education and not wait for someone to tell us what to do. It appears that this Technikon has the potential to accept the challenges posed by Curriculum 2005 and OBE and it is ready to go forward in the right direction.

8. References

Bengu, S.M.E. (1997, 6 July). Ignoring what's good in the new curriculum. *Sunday Times, Johannesburg,* P.29.

Boschee, F. & Baron, M.A. (1993). *Outcome-Based Education: Developing programs through strategic planning.* Lancaster: Technomic.

Cohen, L., & Manion, L. (1994). *Research Methods in Education* (4th ed.). London : Routledge.

Cornbleth, C (1987) The persistence of myth in teacher education and teaching. In Popkrwitz, T.(Ed) *Critical studies in teacher education: Its folklore, theory and practice.* New York: Falmer Press.

Denzin, N.K. & Lincoln, Y.S. (Eds.) (1994). *Handbook of Qualitative Research.* California: Sage Publications, Inc.

Department of Education. (1997). *Senior Phase (Grades 7 to 9) Policy Document.* Pretoria.

Department of Education. (1999). *Status Report for the Minister of Education.* Pretoria.

Department of Education. (2000). *A South African Curriculum for The Twenty First Century.* Report of the Review Committee on Curriculum 2005. Pretoria.

Department of Education. (2000, 12 April). *The NQF and Curriculum 2005: A SAQA position paper.* SAQA: Strategic Support Unit, Pretoria.

Easton, K.L., McComish, J.F., & Greenberg, R. (2000). Avoiding Common Pitfalls in Qualitative Data Collection and Transcription. *Qualitative Health Research*, 10(5), 703-708.

Evans, K.M. & King, J.A., (1994). Research on OBE: What we know and don't know. *Educational Leadership.*, 51(6), 12-17.

Farrant, J.S. (1980) *Principles and Practice of Education.* London: Longman.

Glatthorn, A.A. (1993). Outcome-Based Education: Reform and the Curriculum Process. *Journal of Curriculum & Supervision,* 8(4), 354-364.

Goodson, I. (1990). Studying curriculum: towards a social constructivist perspective. *Journal of Curriculum Studies,* 22(4), 299-312.

Janesick, V.J. (1994). The Dance of Qualitative Research Design: Metaphor, Methodolatry, and Meaning. In Denzin, N.K. & Lincoln, Y.S. (Eds.). *Handbook of Qualitative Research.* California: Sage Publications, Inc.

Jansen, J.D. (1997, March). *Why OBE will fail?* Macro Education Policy Unit, Faculty of Education, University of Durban Westville, Durban.

Jansen, J.D. (1998). Curriculum reform in South Africa: A critical analysis of Outcomes-Based Education (1). *Cambridge Journal of Education,* 28(3), 321-331.

King, J.A., & Evans, K.M. (1991). Can We Achieve Outcome-Based Education? *Educational Leadership,* 49(2), 73-75.

Kvale, S. (1996). *Interviews: An Introduction to Qualitative Research Interviewing.* London: Sage Publications.

Mark, M. (1999). Outcomes-Based Education in South African curricular reform: A response to Jonathan Jansen. *Cambridge Journal of Education,*29(1), 137-144.

Mulholland, S. (1997, 1 June). The Dumping of SA's School Children. *Sunday Times, Johannesburg,* P.28.

Sanders, W.B. & Pinhey, J.K. (1974). *The Conduct of Social Research.* New York: Holt, Rinehart and Winston.

Spady, W.G. (1988). Organising for results: the basis of authentic restructuring and reform. *Educational Leadership,* 46(2), 4-7.

Spady, W.G., & Marshall, K.J. (1991). Beyond Traditional Outcome-Based Education. *Educational Leadership,* 49(2), 67-72.

South Africa (Republic) (1997a) *Curriculum 2005 - Life long learning for the 21st century.* Issued by the National Department of Education, Pretoria.

South Africa (Republic) (1997b). *Curriculum 2005: Implementing OBE– 1, Classroom Practice.* Issued by the National Department of Education, Pretoria.

Technikon. (1997). R*eview.*

Technikon. (1999). *Prospectus.*

Tesch, R. (1990). *Qualitative Research: Analysis of types and software tools.* New York: The Falmer Press.

Van der Horst, H., & McDonald, R. (1997). *Outcomes – Based Education: A Teacher's Manual.* Pretoria: Kagiso Publishers.

Walker, R. (1985). *Doing Research: A handbook for Teachers.* London: Methuen.

Wolcott, H.F. (1990). *Writing up Qualitative Research.* London: Sage Publishers.

9. APPENDICES

[redacted] TECHNIKON

DATE: 10 March 1999

SUBJECT: ENROLMENT FIGURES FOR THE [redacted] TECHNIKON

YEAR	AFRICAN	COLOURED	INDIAN	WHITE	TOTAL
1988	13	0	0	0	13
1989	6	0	0	59	65
1990	301	0	0	28	329
1992	565	4	1	68	638
1993	814	4	1	94	913
1994	1167	1	3	14	1185
1995	1410	1	4	31	1446
1996	2080	2	3	68	2153
1997	3167	3	5	133	3312
1998	3882	6	4	132	4024

The information provided for the years 1988-1995 are extrapolated from Mrs. Zelda Knoetsec's records. Unfortunately, for the year 1991 there is no verifiable information available for the breakdown of student numbers. The actual number of students registered for 1991 is recorded as: 548

Please note:
The above information is to be used for academic purposes only.

Thanks,

Liza [redacted]
SAPSE OFFICER

Demonstrating students take lecturers hostage to support demands

Police storm Tech campus

By Matt Ramsden

Crime reporter

The [redacted] Technikon campus at [redacted] was tense last night after police clad in riot gear stormed an administration building and freed eight lecturers who had been taken hostage by demonstrating students.

The day of drama began at about 10 am when about 200 students barricaded themselves and staff in the technikon's council chamber.

Other lecturers and staff members tried to resolve the situation, but the students stated they would stay for a week or until their demands were met.

Police negotiating unit chief Captain [redacted] Meyer said the students were demanding the readmission of students expelled for financial reasons, the extension of hostels to cater for 600 students and the upgrading of facilities.

At 5.30 pm members of the public order policing unit, formerly the riot unit, were called in and set about preparing for a possible storming of the building.

Drawings of the block were made by a member of staff so that police could plan their tactics.

After two rounds of negotiation, the unit which comprises Meyer, Inspector Andrew Hack and Insp Dean Swanepoel, withdrew and informed operations chief Capt Paul Loest that they had not reached agreement with the students.

A plan of attack was implemented and about 34 unit members moved towards the building.

The first team smashed their way through the front door with sledgehammers while the second entered through a back door.

Screams and shouting greeted the police as they stormed into action, smashing their way into the barricaded chamber and securing the release of the hostages, who included vice-chancellor Professor [redacted].

The hostages were escorted out of the building while armed police stood guard over the students who seemed shocked by the swift, strong action.

Capt Wynand Skein told the students that they had acted illegally which was why the police took such action.

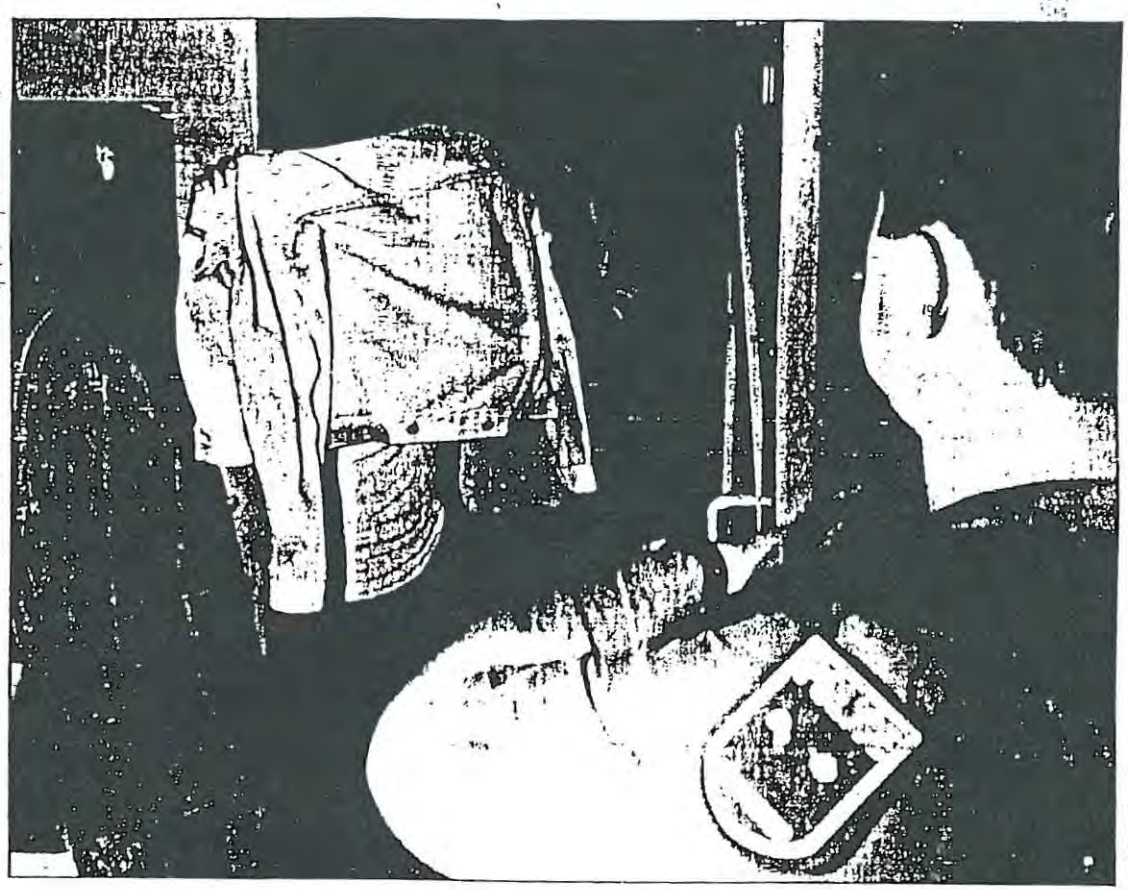
Student leaders then withdrew to their hostels to discuss what had happened.

A police presence remained in case of further trouble.

Outside the technikon the hostages gathered to talk about their experiences but declined to speak to the media.

They said questions would be answered by [redacted] who is believed to have a heart condition, but he was unavailable for comment.

Before the storming the police said Premier [redacted] had reportedly given the go-ahead for the strong action, but this was unconfirmed by [redacted]



DESPONDENT Students returning to their hostels are watched b a police inspector who formed part of a unit that stormed an administration block at the [redacted] Technikon at [redacted] last night to secure the release of eight staff members

Picture by [redacted] KUKARD

Appendix 9.2

APPENDIX 9.3

QUESTIONNAIRE

TECHNIKON'S POTENTIAL RECEPTIVENESS TO AND READINESS FOR CHANGE AS ENVISAGED BY CURRICULUM 2005

Dear colleague

This questionnaire is aimed at gathering data as part of a project on our "**Technikon's potential receptiveness to and readiness for change as envisaged by curriculum 2005.**" Kindly answer the following questions and return to me (James D. Valiathazhel) as early as possible. You may remain anonymous. **All information given in this questionnaire will remain confidential. Please make an X in the appropriate space.**

The numbers in blue are the frequency of responses.

1. How many years of **teaching/lecturing experience** do you have?

0 to 3 Years	4 to 6 Years	7 to 9 Years	10 or more Years
5	1	1	9

2. How do you rate your job as an educator at This Technikon?

Stimulating	**3**
Challenging	**9**
Fulfilling	**1**
Monotonous	**1**
Problematic	**3**
Intimidating	**0**

(one person has ticked both stimulating and problematic)

3. How do you feel before you are about to present a lecture?

Excited	**1**
Confident	**12**
I wish it were over	**1**
Indifferent/apathetic	**1**
It is my job/duty	**1**

4. Have you heard about **Curriculum 2005**?

Yes	No
14	2

5. Have you heard about **Outcome Based Education (OBE)** *[the **new approach** in South Africa and elsewhere]*

Yes	No
16	0

6. How do you feel about the imminent changes to our education system? (i.e. shift to **OBE**)

Excited	**1**	**Curious**	**6**	**Interested**	**9**
Disinterested	**0**	**A waste of time**	**0**	**Frightened**	**0**

7. Do you think there is a need to change the old education system?

Yes	No
15	1

8. The **new approach (OBE)** shifts considerably from the **old approach** of teaching/learning. From the following phrases or sentences, please select the characteristics of **OBE** by placing an **X** next to it.

	FEW CHARACTERISTICS OF OLD AND NEW APPROACHES	
1	**Passive learners**	0
2	**Active learners**	14
3	**Learners are assessed on an on-going basis**	11
4	**Critical thinking, reasoning, reflection and action**	12
5	**Flexible time-frames allow learners to work at their own pace**	11
6	**Rote-learning**	1
7	**Learner-centred; teacher is a facilitator**	13
8	**Emphasis on what the teacher hopes to achieve**	1
9	**Syllabus is content-based and broken down into subjects**	2
10	**Emphasis on what the learner becomes and understands**	12

9. In OBE, *"teachers/lecturers are encouraged to **interact and share their ideas with one another"**.*

9.1. Do you agree with this kind of approach?

Yes	No
16	0

9.2. Do you consider this as a **practical or functional** approach?

Yes	No
15	1

If your answer to Q.9.1 is "Yes", please answer Q. 9.3. If your answer to Q 9.1 is "No", you may skip 9.3 and proceed to Q.10.

9.3 How do you rate the interaction and sharing of ideas in your department?

1. Does not happen at all	2. Very little	3. Sometimes	4. Most of the time	5. All the time
1	1	6	8	0

10. Do you give tasks to your students which demand **group work**?

Yes	No
13	3

11. Do you try to cover the syllabus in a **predetermined amount of time**?

Yes	No
15	1

12. Do you think you need to change your teaching style?

Yes	No
10	5

(One person did not answer)

13. Are you prepared to be retrained?

Yes	No	Not necessary
12	1	3

14. Have you heard of any workshop on OBE at the This Technikon?

Yes	No
15	1

15. Have you attended workshops on OBE?

Yes	No
10	6

If your answer to Q.15 is ***yes****, you may answer Q.16. If your answer to Q.15 is* ***no*** *you may skip Q.16 and proceed directly to Q.17.*

16. Who organised the workshop?

Academic Development Officer	**6**
Not Applicable	**1**
I do not know	**1**
Academic Development	**3**
Ac. Dev. + Edn. Dept. staff	**1**
SAAAD - Petermaritzburg	**1**
N/A (I am a part-time lecturer)	**1**
No answer	**2**

.....

17. Do you think This Technikon is doing enough to bring about the new system of education (OBE)?

Yes	No
13	3

18. If your answer to Q.17 is **no**, what are your suggestions to implement OBE at This Technikon? If you feel that the implementation of OBE is not necessary at This Technikon, you may skip this question and proceed directly to the next question.

Acd. Dev. Council and Research Council should be given more facilities to implement the programme. (1)
N/A (1)
I actually feel that lecturers should help themselves. I also do not know if OBE is still going to be relevant in 5 years. (1)

19. Do you think it is acceptable for students to challenge the lesson content presented by the lecturer?

Yes	No
14	2

20. How often do you **monitor the progress** of a learner/student?

1.Daily	2.Weekly	3.Fortnightly	4.Monthly	5.At the end of each section in the syllabus	6.Only after the final examination
1	2	5	3	5	

21. What strategy do you employ for **continuous assessment**?
If applicable, you may mark X in more than one block.

Peer-Assessment	Self-assessment	Project work	Assignments	Tests	Other
0	0	8	13	15	1

If *other*, please specify **Discussion in the class (1)**
Did not answer (1)
None (1)

I would like to thank you for your time, support and co-operation.

XXXXXXXXXXXXXXXXX

APPENDIX 9.4

INTERVIEWS

PRELIMINARY STUDY – 1999

Appendix 9.4.1

INTERVIEW WITH GS,
ASSOCIATE DIRECTOR – SCHOOL OF ACCOUNTING

JV: GS, this interview is aimed at gathering data as part of a project on this Technikon's potential receptiveness to readiness for change as envisaged by curriculum 2005. All information revealed in this interview will remain confidential. Please be open as much as possible.

GS, how long have you been lecturing at this Technikon?

GS: Since 1993, it's five years

JV: How would you describe the performance of this Technikon since you started – Academic performance

GS: Looking at it from a concept of change which I think is which is where your thrust is I think there have been immense changes. I think the one significant aspect that has not been successful has been convincing the outside world that the standards in Technikons are equivalent to or better than universities. I think that we have a marketing job to do there.

JV: In your opinion GS, the students at this Technikon, are they motivated to learn?

GS: No, I don't believe they are.

JV: What do you think are the reasons?

GS: I don't think I can answer that question, I am a bookkeeper, not a psychologist.

JV: O.K. Thanks GS. Have you tried to change your teaching style to motivate the students?

GS: Yes, I have over the years and perhaps I could answer your question previously because I found that my efforts to motivate the students have been far better received by our part-time students than our full time students and with some small exceptions our part-time students tend to be the older more mature students who are in a working environment who start to understand the true value of education. So maybe that is the problem.

JV: That's very interesting, so you teach both part-time and full-time students.

GS: That's correct.

JV: O.K. And the part-time students according to you are more motivated that the full-time students.

GS: Absolutely.

JV: Thank you GS. Do you think that a change in the education system is necessary?

GS: I don't know. I am not an expert in the field of education by any means. I think that there are major problems in our education system. I'm concerned that maybe they need to be addressed more chronologically, if I could use that term, by going to the basic pre-primary education and working from there upwards. I have some reservations about going in at a tertiary level and trying to rectify problems that may not be tertiary problems.

JV: GS, one of the obvious changes is OBE and curriculum 2005. This is our change, change for the good of the people. Do you think it has been imposed on us?

GS: I don't believe that it has been imposed upon us. I think perhaps it hasn't been adequately explained and I am also not convinced that it's necessarily especially OBE thought through because perhaps there are other priorities that needed to be addressed first of all and before we put in a new system like this. In other words, I am saying I thing that the timing of the introduction of OBE may have been imposed upon us and I think that's unfortunate.

JV: If that is the case, is it the old system was a failure, now if they impose the OBE, is this also going to rub people up the wrong way and also make them negative? By people, I mean the educators.

GS: There was no old system. There were many old systems and that was the problem. I think that it may have been better to have tried to take the best of the several old systems and come up with a model rather that effectively throwing out the baby with the bath water and introducing something that is pretty revolutionary in the form of OBE.

JV: Most of us at this Technikon do not know much about OBE. Do you think some sort of training is necessary?

GS: I would be as part of an education system, I would be very foolish to say that training is not necessary in any field, but I think we must also look to ourselves that OBE has certainly been the buzz word for quite some time and if we don't know about it we perhaps should be looking at ourselves.

JV: There is a lot of inequality in our education. Do you think a single curriculum will meet the needs of all South Africans?

GS: Very, very difficult to say and I have a problem with me been asked that question because I believe that question should have been researched before we jumped into a single curriculum and if we don't know the answer to that question before we got into it, why are we in it.

JV: Thanks GS. Thanks for your time.

GS: My pleasure.

Appendix 9.4.2

INTERVIEW WITH BC,
HEAD OF THE DEPARTMENT OF FOUNDATION STUDIES.

JV: This interview is aimed at gathering data as part of a project on this technikons potential receptiveness to and readiness for change as envisaged by curriculum 2005. All information revealed in this interview will remain confidential. Please be open as much as possible.

How long have you been lecturing at this Technikon?

BC: James, I started in here in 1992.

JV: How do you describe the performance of the Technikon since you started.

BC: Well, there are different ways to interpret performance. If you're referring to academic performance my own experience within our own programme which is the Tertiary Foundation Course has had its fair shares of successes and failures. Our purpose is to offer consolidation remediation to students who counter to the schooling system as matriculants but have weaknesses in areas of Mathematics, Physical Science and English. So our aim is to upgrade them in those spheres. Some of them have responded more positively, the more diligent ones but there have been some who have either not taken any trouble at all to self-motivate themselves and put the necessary effort and even some who just not even lectures because the lecture attendance now at this institution is non compulsory. A bridging programme such as this is essential that the students commit themselves to attend. Otherwise they are not going to get the necessary input. So getting back to your question, we have actually increased our pass rate through the years, I think we've actually broken the 50 % barrier in 1998 which is quite remarkable because in previous years we did some very poor statistics which generated by the results from our students. But when we think of the successes, it is very interesting to note that the first official graduation ceremony held at this institution, when the students came by the stage to receive diploma's where could actually identify so many who'd actually been to our programs, preliminary to their main stream studies. And also of interest is the fact that currently in the Information Technology in the End User Computing school, we have two staff members who started their tertiary careers through the TFC programme. So, yes, there have been successors.

JV: Thank you BC. Are the students motivated to learn?

BC: Generally, I find that at intake, the students lack confidence in their abilities to cope with tasks that have been set to them and I think it's a spin off from the schooling system where the approach is very rigid. In a tertiary institution, we try and encourage lateral thinking and develop self-development within students. So when it comes to the concept of self-motivation, I think they lack confidence to apply themselves initially. We find that as the year progresses

this does improve. Certainly the introduction of a special course offered by our director of academic development has helped greatly. She does school training and academic development which incorporates learning and studying skills and time management and those sort of aspects. So that has been to their advantage.

JV: Thanks BC. Have you tried to change your teaching style to motivate the students?

BC: Through the years, I have, I've tried different approaches. I think they still expect us as lecturers to be a replica of what they are accustomed to at school and as soon as you deviate and you ask for their input or you ask for interaction amongst students in a class situation, there's a great deal of hesitation. I've recently introduced a tutorial system whereby I actually encourage interaction between students and interaction with myself. That's characteristic of our students here possibly from the backgrounds which they come. But for the initial months of the year, very few questions or answers are even offered in class.

JV: Do you think a change in the education system is necessary?

BC: I think if we're going to level the playing field, there's no doubt there needs to be a change to a unified system. I am a little bit concerned about how students accepted into tertiary level training might cope. If you are looking at OBE which entails a lot of self-effort by students the schools must get it right in the first place and then we can build onto that. So really the core to the success is that is implemented successfully implemented at the lower levels.

JV: One of the obvious changes is OBE and Curriculum 2005. Has it been imposed on us?

BC: Well, I think the answer to that must be yes, because it's a decision made at national level within the education ministry. So yes, it has been imposed, will be introduced, but I think there's positive spin-offs to it. Once effected successfully, there's much to be gained.

JV: Our old system was a failure, now if they impose OBE, is this also going to rub people up the wrong way and also make them negative?

BC: James, certain lecturers here and I suppose this is characteristic as well in teachers in schools are probably well established in their careers and such are quite fixed in their routines. Then it is going to be difficult. There's no doubt about it in my mind that they are going to have difficulty in adapting to the changes. But the newer, more innovative lecturers/ teachers will adapt to the system and I think through the efforts of our AD department of our campus, where workshops are been held and continue to be held and to which lecturers are invited. I think success will ultimately be the result.

JV: Most of us at this Technikon do not know much about OBE. Do you think some sort of training is necessary?

BC: Well, as I just mentioned, our academic development officer has undertaken the training programme through the course of a number of seminars started mainly last year and continuing this year. She wasn't that to any great extent in her endeavours to enforce attendance by lecturing staff and as such then attendance, I feel was reasonably poor. The committed lecturers were those who responded and I think they gained from those inputs. She will continue this year and I'm hoping that the support from the Vice-Rector's office will be stronger and more of an instruction to attend rather than an invitation to attend.

JV: There is a lot of inequality in our education. Do you think a single curriculum will meet the needs of all South Africans?

BC: That's very difficult to answer in the broadest interpretation. We know about the inequities as evidenced in the apartheid years and it will take some while before those are irradicated and at the school levels all the students are brought up to the same level which would mean that our intake would start from a common base. So, I think that's going to take time. How effective the removal of the inequities of the past is, is debatable.

JV: Thanks BC, thanks for your time.

Appendix 9.4.3

INTERVIEW WITH PS
SENIOR LECTURER – SCHOOL OF COMMUNICATION STUDIES.
(FOUNDING PRESIDENT OF THE STAFF UNION.)

JV: PS, this interview is aimed at gathering data as part of a project on this Technikons potential receptiveness to readiness for change as envisaged by curriculum 2005. All information revealed in this interview will remain confidential. Please be open as much as possible. PS, how long have you been lecturing at this Technikon?

PS: This is my tenth year that I've been lecturing Communication.

JV: You were also instrumental in organising the Staff Union and you were the first President of the staff union, I still remember that. So, I'm sure that you can give me a lot information on the Technikon.

PS: Yes, I do know the history of the Technikon.

JV: How do you describe the performance of the Technikon since you started?

PS: O.K. That's a very wide question. The performance of the Technikon, it has been what I would say, met expectations in certain courses and areas, particularly in I think in Government training/courses, Public service courses where things have been very specific where we've known exactly what to do. As far as the performance of the Technikon in Industry and trade is concerned, we are not sure, we don't seen to have any feedback so we don't really know whether we produced students of a calibre required. The Technikon itself is a professional institution. I find people strive to change to do their best and has the normal academic atmosphere and it does not have any serious disadvantages apart from its students who are third language English speakers. We have expanded our number of courses, we've also introduced various academic skills development modules, especially in Communication and in student support.

JV: In your opinion, are the students motivated to learn?

PS: Yes, the students are motivated to learn although there are things that strongly discourage them such as the major difficulty with language.

JV: What do you think are the reasons?

PS: Students, a lot of students do realise that they have had opportunities that their parents have not had before. They are also part of the new South Africa and the new feeling and they want to learn, however, a lot of this in my mind, a lot of the desire to learn and want to learn is the desire to road-learn which they've learnt at school so when they come in eager, they believe that if they road-learn everything, they'll be able to give it back and they will get their degrees and

diploma's and I think that this is a element that scores a lot of failure where people don't realise that it's their performance in the end that's going to matter, the understanding of concepts which they haven't had practical with like business or whatever which they have only dealt with on a theoretical basis so, I think if I were an average Technikon student, I would have a lot of things discouraging me. As I said first of all, there would be all this terminology and language that comes from the West or areas which I've had very little experience of and secondly, I really wouldn't know what is expected of me. I don't think. And after I saw what was expected of me, perhaps what we expect of a normal student anywhere else in the world it would be very disheartening for me to realise that I am very innocent and naïve and it would take me a long time perhaps to have the skill and experience that other students have and ours don't.

JV: In other words, you're saying that the students are motivated to learn but the circumstances beyond their control can discourage them to some extent.

PS: Yes, perhaps I dwelt too long of discouraging.

JV: Thanks PS. Have you tried your teaching style to increase the motivation of the students?

PS: Yes, we have tried, I know yourself as well, we've been members of SAAD from the early days and we've always tried to adapt our courses to what we believe is most effective and most acceptable and most received. From that point of view, we've worked on our language, we've made our language more acceptable. We use FOG indexes even if we don't use them all the time, we still have them in the back of our mind when we write. We've made sure that our exams are easily understood by students and in our actual Communication courses we have right from the beginning and this is perhaps where communication fits little bit more easily into the new OBE than many of the other systems in that we have centered all our Communication activities on practical activities that the student will experience in real life or in his business so it's concentrated on performance in the real circumstances.

JV: Thanks PS. Do you think a change in the educational system is necessary? Change from the old system? In fact we had old systems, different systems for different styles.

PS: Yes, I do. I do think that not only is it necessary because of our past history but it's necessary because of the major advancements in the world, which we might call globalisation or whatever you like. I think its necessary from that point of view technology has changed, the teaching mediums have changed, focus has changed and our systems were based on the very old road learning systems, and on bodies of knowledge, perhaps western knowledge or other knowledge that has very little relevance in our modern context and in South Africa.

JV: One of the obvious changes is OBE and Curriculum 2005. Do you think it has been imposed on us?

PS: If I were a primary school teacher, I would say yes. If I were as a technikon lecturer, we are in a field where we always try to relate everything to direct experience in real world training and from that point of view, I don't think it's been imposed on us. It's just perhaps structured our thinking and forcing us to move to a certain structure. But I think if I were a teacher and having being schooled in one system my whole life and having to suddenly deal with a new system like this, I would see it as been thrust upon us and I would see it as very dangerous from that point of view and that it might not succeed. It would have many problems in many areas. I especially think that you cannot change a system without teachers willingly changing their attitudes as well. I don't think what system you want to teach will work unless it's willingly supported by pupils and teachers alike.

JV: In other words, the change would not be possible if the people's attitudes do not change.

PS: Yes, I think so. The whole attitude will have to change and I mean in some ways, it would have to go right up to the employer, their expectations of the work.

JV: Most of us at this Technikon do not know much about OBE. Do you think some sort of training is necessary?

PS: Yes, but some of the training so far has not been satisfactory, but is it's certainly necessary. It's something that, it was pointed out in a meeting, I went to today by Fred Aboagye, that the minister himself could not explain exactly what he meant by OBE or how it would apply to various areas or exactly what the philosophy was, translated into real terms. So, I think, to most of us it's a very vague and confused area and we see it perhaps contributing more to a breakdown in standards than to raising standards at this stage and that's our fear. When I talk to other lecturers, they see it as a system that we don't know enough about or we personally is not structured enough to blend in successfully.

JV: At the Technikon, who's duty is to train us.

PS: That would have to be the Academic Vice-Rector downwards. He would have to find or assign that duty. I would think.

JV: There is a lot of inequality in our education. Do you think a single curriculum will meet the needs of all South Africans?

PS: I don't know. To be honest, I'm not exactly sure of the new Curriculum. I haven't investigated enough to know how it will accommodate people with different level, experience and ability and skills. I don't know that. A good education system will accommodate people who lower, less skills as well as people who are very creative and have higher skills. I don't know how this will work.

JV: Thank you very much PS. Thanks for your time.

APPENDIX 9.5

INTERVIEW SCHEDULE

FINAL ROUND

Appendix 9.5.1

Interview – Lynette Stone, Director, Academic Development Centre

Introduction

Lyn,

This interview is aimed at gathering data as part of a project on our "Technikon's potential receptiveness to and readiness for change as envisaged by Curriculum 2005 or OBE based teaching". Thank you for giving me the time to talk to you.

1. Background to workshops

1.1 Lyn, I understand that you were involved in the staff training and implementation of Outcomes Based Education (OBE) from as early as 1998. How was the training organised?

1.2 How often was the training held? (*The frequency of training*)

1.3 Was it mandatory?

1.4 What was the attitude of the staff towards training?

1.5 Did you receive adequate support from the Management of this Technikon in the training and implementation of OBE?

1.6 I remember that, in one of your presentations, you expressed a desire of implementing OBE by most of the academic staff by June 2000. How many departments or schools at this Technikon have implemented OBE as a means of teaching or lecturing? (*Which departments are they?*)

2. Analysis of the training and implementation

2.1 In your opinion, did the lecturers who were exposed to OBE training support the underlying principles of OBE?

2.2 Did they support the implementation of OBE?

2.3 Do they practice OBE in their everyday teaching or lecturing?

2.4 Do you believe that the academic staff of this Technikon has received adequate training to implement OBE based teaching/lecturing?

2.5 Did you use the principles of OBE in your own methodology of training?

2.6 Could you please assess the success or failure of the OBE training and implementation programme.

3. OBE at this Technikon today

3.1 What is your opinion on the level of understanding of OBE by the academic staff of this Technikon?

3.2 Do you have any ongoing "monitoring of progress" in place to monitor the effective implementation of OBE based teaching by the academic staff of this Technikon?

3.3 Is this Technikon ready to implement an OBE based teaching?

3.4 What form/s of assessment/s is/are employed by the departments that claimed to have implemented OBE based teaching?

3.5 According to William Spady (Educational Leadership, p.68, 1991), Transformational OBE is not calendar defined but outcome defined. (To put it differently, according to Department of education (1997), *OBE framework* is flexible and creates genuine possibilities for all learners to achieve success relative to their own pace and style of learning). In your opinion is this practical in the case of this Technikon in particular and tertiary institutions in SA in general?

3.6 Is there any evidence of integration of *learning areas* taking place?

4. Way forward

4.1 Recently the Review Committee on Curriculum 2005 presented a report to the Minister of Education. One of the major proposals in the report was to phase out C2005 and phase in C21. What is your understanding of the difference between Curriculum 2005 and Curriculum 21?

4.2 How the Technikon can ensure the implementation of C21 and other SAQA policies? Do you consider it necessary to broaden the Academic Development Centre to establish a task team to monitor the progress of the implementation of such policies?

4.3 What role, in your opinion, can individual lecturers of this Technikon play to enhance the quality of OBE based teaching and learning?

If I have some more questions, could you please allow me to come back to you at a later stage?

Appendix 9.5.2

Interview – Staff members

Introduction

Dear Colleague (*name*),

This interview is aimed at gathering data as part of a project on our "Technikon's potential receptiveness to and readiness for change as envisaged by Curriculum 2005 or OBE based teaching". Thank you for giving me the time to talk to you.

1. Background to workshops

1.1 I understand that you attended most of the staff training programme conducted by the Director of Academic Development Centre of this Technikon in 1998 and 1999. How was the training organised?

1.2 How often was the training held?

1.3 Was it mandatory?

1.4 In your opinion why was it (not) mandatory?

1.5 In future if similar training is to be conducted, do you want to see the management of this Technikon making it compulsory for all academic staff and why?

2. Analysis of the training and implementation

2.1 What is your opinion regarding the way in which the training was conducted?

2.2 Did the trainer/presenter use the principles of OBE in her own methodology of training?

2.3 Was the design of Learning Support Materials (LSM) part of the training?

2.4 Which other aspects of OBE were included in the training?

2.5 Do you believe that the academic staff of this Technikon has received adequate training to implement OBE based teaching/lecturing?

2.6 (Name), this *is a personal question*. Do you believe that at present you are in a position to implement OBE based teaching/lecturing?

2.7 Could you please assess the success or failure of the OBE training and implementation programme conducted by the Director of Academic Development Centre.

3. OBE at this Technikon today

3.1 Do you practice OBE in your everyday teaching/lecturing?

3.2 Do other lecturers in your department (also) practice OBE in their teaching/lecturing?

3.3 What form/s of assessment/s do you employ in your teaching/lecturing?

3.4 According to William Spady (Educational Leadership, p.68, 1991), Transformational OBE is not calendar defined but outcome defined. (To put it differently, according to Department of education (1997), *OBE framework* is flexible and creates genuine possibilities for all learners to achieve success relative to their own pace and style of learning. In your opinion is this practical in the case of this Technikon in general and *End User Computing* (Dept. name) in particular?

3.5 You have many years of teaching/lecturing experience. In your opinion, what does the new OBE framework mean for learners who experience barriers to learning?

3.6 Is there any evidence of integration of *learning areas* taking place in your department?

4. Way forward

4.1 Recently the Review Committee on Curriculum 2005 presented a report to the Minister of Education. One of the major proposals in the report was to phase out C2005 and phase in C21. What is your understanding of the difference between C2005 and C21?

4.2 Do you consider it necessary to run new staff training programmes in C21 and why?

4.3 What role, in your opinion, can individual lecturers of this Technikon play to enhance the quality of teaching and learning in general and OBE based teaching and learning in particular?

If I have some more questions, could you please allow me to come back to you at a later stage

Thank you very much.

Appendix 9.5.3

Interview – Mr. Martin Phillip

Introduction

Martin,

This interview is aimed at gathering data as part of a project on our "Technikon's potential receptiveness to and readiness for change as envisaged by Curriculum 2005 or OBE based teaching". Thank you for giving me the time to talk to you.

1. Background to workshops

1.1 In 1998, the Director of ADC conducted a series of staff training – mainly in the form of workshops – in Outcomes Based Education (OBE). I understand that, during that period you were in United States of America for your higher studies. As a result you could not receive the training in OBE. Is that right?

1.2 How long have you been lecturing at this Technikon?

1.3 Do you have experience in teaching/lecturing in any other institution? If yes for how long?

2. understanding in OBE

2.1 In your opinion, is there any difference between the system in which you were educated and the present system in which you are an educator?

2.2 Martin, as you know, the first democratically elected government came into power in 1994, and in 1995 the then Minister of Education announced the introduction of a new curriculum. This new curriculum was later named as C2005. The underlying principle in this new curriculum was an Outcomes Based teaching/lecturing. What is your understanding of OBE?

3. OBE at this Technikon today

3.1 Do you practice OBE in your everyday teaching/lecturing?

3.2 Do other lecturers in your department (also) practice OBE in their teaching/lecturing?

3.3 What form/s of assessment/s do you employ in your teaching/lecturing?

3.4 According to William Spady (Educational Leadership, p.68, 1991), Transformational OBE is not calendar defined but outcome defined. (To put it differently, according to

Department of education (1997), *OBE framework* is flexible and creates genuine possibilities for all learners to achieve success relative to their own pace and style of learning. In your opinion is this practical in the case of this Technikon in general and Marketing Department in particular?

3.5 In your opinion, what does the new OBE framework mean for learners who experience barriers to learning?

3.6 Is there any evidence of integration of *learning areas* taking place in your department?

4. Way forward

4.1 Recently the Review Committee on Curriculum 2005 presented a report to the Minister of Education. One of the major proposals in the report was to phase out C2005 and phase in C21. What is your understanding of the difference between C2005 and C21?

4.2 Do you consider it necessary to run new staff training programmes in C21 and why?

4.3 What role, in your opinion, can individual lecturers of this Technikon play to enhance the quality of OBE based teaching and learning?

If I have some more questions, could you please allow me to come back to you at a later stage

Thank you very much.

APPENDIX 9.6

Interview

Final round of study - 2000

Appendix 9.6.1

Interview with Ms. Lynette Stone

Director, Academic Development Centre

JV-LS1: Lynette, this interview is aimed at gathering data as part of a project on *"this Technikon's potential receptiveness to and readiness for change as envisaged by Curriculum 2005 or OBE based teaching."* Thank you for giving me the time to talk to you.

Lynette, I understand that you were involved in the staff training and implementation of Outcomes Based Education (OBE) from as early as 1998. How was the training organised?

LS1: Ah ... Do you mean were we doing workshops or how often or what type of information are you looking for?

JV-LS2: **I am looking at ... how often, that is ... the frequency of the training? Was it mandatory? ... ... that kind of information.**

LS2: It was not mandatory. I would have liked it to be. At that stage I was too naïve to realise how much pressure it would take to get people to attend. So the workshops were advertised for everyone. They were presented on a Wednesday afternoon, which was supposed to be a time when lecturers were free, so that they could attend meetings. So they were advertised to the staff at the time, that I understood, that most staff would be available. We had a series on Outcomes Based Education but I think it was only about three in a row. Each an hour and a half in length. First dealing with Outcomes Based Education in general and then more specifically how one would go about writing outcomes and how that would change ones classroom approach.

JV-LS3: **Only you were involved?**

LS3: No, I also involved two people, who had been to Australia on linkage projects related to education, so I used somebody from the Education Department. So we were three people on our staff who had been to Australia in this project. One had looked particularly at curriculum design, another had looked at active learning and a third ... no, two had gone to Australia but there was a third who was involved in the project after the people came back and that was to do the assessment. So I used those people as well, so that they could look at those aspects of OBE in the presentation, so I did involve others as well who had spent some time studying.

JV-LS4: **Do you know why it was not mandatory?**

LS4: I think probably because I assumed that people would come. And I did not think any further than that. I thought that an advert would be enough to draw a sufficient number of people.

JV-LS5: **Looking back at it now, what percentage of academic staff, did Attend? Was there a good turn out?**

LS5: I would say about a sixth, say about 15%.

JV-LS6: **What was the attitude of the staff, those who attended, towards training?**

LS6: Those who attended were interested. It was always been that those who are interested come and they participate and they ask questions, and they want to know. The first was the best attended, I think. Perhaps because it was new. But it was also unfortunately the weakest in presentation. I think some people then decided that this was not something that they could benefit from greatly. I think

the subsequent ones were better. Yea ... generally I think people who were interested were willing to participate. Those who are not interested simply don't come. So, ... those who did come are interested. Sometimes a department would ask me to come and talk just specifically to the people in their department, but it was usually; *"talk to us for ten minutes or twenty minutes."* That was very short. You know that kind of things. In 1999 I did, I think two general workshops but that was more related to curriculum design than to OBE as such. And then this year I have done something for new staff again.

JV-LS7: **Thank you Lynette. How do you perceive the support received from the Management of this Technikon in the training and implementation of OBE?**

LS7: There isn't any. I think they got now to where they have heard it enough, that they've realised that something has to happen, but it doesn't go beyond the fact that they would like to see something happening. But there's no physical support in terms of presence, themselves at that kind of training, in terms of hiring somebody who can do that kind of training intensively, (pause) ... in terms of making the times free for people to be able to go. So theoretically yes, they have got to where they are anxious about it and they know they have to do it but not to where they actually ... no physical support ... Yea.

JV-LS8: **I remember that, in one of your presentations, you expressed a desire of implementing OBE by most of the academic staff by June 2000. How many departments or schools at this Technikon have implemented OBE as a means of teaching or lecturing?**

LS8: I think that to some extend a few have, I think ... and of course some subjects are so much outcomes based in their very nature that they have been doing it all the

time. For example, if you're in a computer studies class, you have to be able to write the programmes, you have to be able to do the work. So, that has always been outcomes based by the nature of what they are doing. Tourism and Hospitality expressed considerable interest in it and of course with Hospitality ... again ... a lot of things are so practically oriented that they're outcomes based just by nature of what they are doing. The ones who have done the most in re-writing their study guides and try to design their approach in an OBE way is the Secretarial Department. They have really quite gone to town in doing it that way.

JV-LS9: **In your opinion, did the lecturers who were exposed to OBE training support the underlying principles of OBE?**

LS9: I think so, to the extent that they understood them. Yes. I think they understand that its important that should be able to do that, but when it comes to understanding how to implement themselves, that is different.

JV-LS10: **Did they support the implementation of OBE?**

LS10: Support in theory, yes, but I think that sometimes they think they are doing it but they are not. Like if I say to them, you know, if I give them an exercise where they have to write outcomes, they will think students should understand this thing they think that an outcome in OBE and is not because the questions is that they don't understand that until its *how do I know*, that they understand, how will I know that they know, so they can just say, students will understand and it is an outcome, they haven't realised the transition into something that's observable and doable.

JV-LS11: **Do they practice OBE in their everyday teaching or lecturing?**

LS11: I think some try to, but again, I think some of them actually don't have the idea. They think if they are doing group work then it is OBE. But it could be group work just on getting facts out of a book. So I don't know whether they are really doing what they think they are doing.

JV-LS12: **Maybe they practice certain aspects of OBE but at the same time maybe that is not OBE.**

LS12: Yes.

JV-LS13: **Do you believe that the academic staff of this Technikon has received adequate training to implement OBE based teaching/lecturing?**

LS13: No. I don't. I think, its been available to them to understand the general outline of it and to make an attempted beginning, but I think to be able to practice it, really they need people working with them in the classrooms. At that level it has not been done. So to some extent, yes, but I think not enough to really do it very well.

JV-LS14: **Did you use the principles of OBE in your own methodology of training?**

LS14: When I was presenting the workshops?

JV-LS15: **Yes.**

LS15: To some extent, yes, I think I was particularly aware of it when I was doing presentations on OBE, but at the end I would say; *now these were my objectives that I had for this session, and now let us look and see how many we have achieved.* And I think that I do try to show them how these things can be implemented but I don't always do it to the extent that I can say, I know for sure whether my desired outcome has been achieved or not.

JV-LS16: **Was the design of Learning Support Materials (LSM) part of the training?**

LS16: I only mentioned it very briefly, we did not do that in any great detail.

JV-LS17: **During the training, they did not do any designing of LSM, but you gave them some outlines of how to do it?**

LS17: Yes

JV-LS18: **Which other aspects of OBE were covered in the training?**

LS18: It was really just an introduction and then beyond the introduction and getting to know the concepts to actually let them apply it to lessons that they were teaching at the time. To think of a lesson that they were about to teach and get them to say what are your objectives what do you want to achieve, and then seeing whether they could write those objectives in such a way that they would actually be implementable. So it was mostly that, and then I also gave them examples of what might be considered outcomes and ask them to decide whether those were really outcomes related to outcomes based education or not, why or why not. So I try to get them at least to where they could think of what they were doing and the purpose of what they were doing. Whether that be at a course level or at a single lesson level. That is as far as we went.

JV-LS19: **Could you please assess the success or failure of the OBE training and implementation programme, at this Technikon.**

LS19: I think everybody is now aware of it, I don't know how much of that is because of my training or how much of it is because it's been spoken about it much now that everybody has to know. So I think there is an awareness amongst most people. There have been attempts to implement it at least in some departments. Some people are still just ignoring it, and going their merry way. So I would say there is

partial success but I would say probably less than 50% success, probably I would rate myself at about 40% successful.

JV-LS20: **Lynette, so much about the history and background, about the training and the implementation of OBE at this Technikon. Now, I would like to deal with the OBE at this Technikon, today. What is your opinion on the level of understanding of OBE by the academic staff of this Technikon? Do they all know about it, I know that, they all might know the name and they might have read about it in the media and otherwise. Are most of them ready to implement OBE in the classroom?**

LS20: There are some who are and there are many who aren't. I would say more than 50% are not ready and are not even making any attempt.

JV-LS21: **Do you have any ongoing "monitoring of progress" in place to monitor the effective implementation of OBE based teaching by the academic staff of this Technikon?**

LS21: Theoretically yes, in practice no. Theoretically in that, at each academic development committee meeting there is suppose to be a report from the various departments on how things are going in their departments, but it doesn't really happen, certainly not in any meaningful way.

JV-LS22: **Yes, I know that OBE is a standing item in the agenda of the Academic Development Committee meetings.**

LS22: Yes. We usually spend more time talking about curriculum development than about actual classroom practice. So in theory, yes. In practice no, and I don't think that the departments individually have set up any kind of mechanism for making sure that it happens.

JV-LS23: **Overall, is this Technikon ready to implement an OBE based teaching/lecturing?**

LS23: In some departments, yes, in some no. So you know, one really has to look at individual departments. If I were to look at the institution as a whole simply because there are some many who aren't, I have to say no. But there are some who are very ready.

JV-LS24: **In your opinion, what form/s of assessment/s is/are employed by the departments that claimed to have implemented OBE based teaching?**

LS24: I don't know that they have any ... real assessment systems in place, what they have done is, they have prepared their study guides. They have, made sure that their study guides are that way, and so if the lecturers are following what have been written in the study guide, then it will be happening. But I don't think there's any system of reporting back or of classroom observation in the classroom support to ensure that it is happening. I think it is just an assumption that people will act in good faith.

JV-LS25: **In the next question, I would like to hear your personal opinion. According to William Spady (Educational Leadership, p68, 1991), Transformational OBE is not calendar defined but outcome defined. To put it differently, according to Department of Education (1997), OBE framework is flexible and creates genuine possibilities for all learners to achieve success relative to their own pace and style of learning. In your own opinion is this practical in the case of this Technikon in particular and tertiary institutions in South Africa in general?**

LS25: I think there is a tension there that nobody has been able to solve. The tension between something that is constraint by time and on the other hand you know, where a course is really worth ten notional hours and a particular student may

spend 30 hours to be able to master that same material, unless we had vast resources of manpower to allow that kind of flexibility, I don't think it is really practical. So to some extent yes, you can work towards those outcomes and you can make it, more outcomes based and you can try to help students. But as it stands at the moment, they still have to achieve that within a given time, just because the whole registration system is that way. If you could change the way the students registered ... or ... if ... like ... somebody doesn't complete it in 3 months, they need 5 months, where are they going to go for those other 2 months, if the lecturer is not offering that course because there is now somewhere else. So in terms of the administration of it, I think there are huge difficulties.

JV-LS26: **So at least transformational OBE is not practical because of the time and other limitations.**

LS26: Yes, because of the administration of that and providing the people that are needed.

JV-LS27: **Is there any evidence of integration of learning areas taking place in this Technikon in any of the departments?**

LS27: I think very little, because we are still sitting with the old NATED requirements, which are very much in little boxes. At the same time that we are supposed to be implementing something different. I think that mostly people tend to stick with their own things. In the education department I think they have tried to move away from that a little and of course they are the ones who are most aware of OBE which is probably why they are making those moves, but for the rest people tend to stay mostly to themselves. I think they would like to mix more but they don't really see practical ways in terms of the funding that is available and the man hours and it could mean changing old things and you have to go through the 18 month process to make it happen. So I don't think it is really happening very much.

JV-LS28: **We have almost come to the end of this interview, and I would like to talk about the way forward. Recently the Review Committee on Curriculum 2005 presented a report to the Minister of Education. One of the major proposals in the report was to phase out Curriculum 2005 and phase in Curriculum 21. What is your understanding of the difference between Curriculum 2005 and Curriculum 21?**

LS28: I haven't read any official documents on that so I am really just going by impression from newspaper reports. But, to me they are both outcomes based but what the problem was with 2005 is that it was so cumbersome. There was so much paper work; it was so detailed it was an administrative nightmare. And so I see ... that ... my understanding is that, Curriculum 21 is still outcomes based but without all the detail about phase organisers and all these other things, they had so many things they had to write down and so many things they had to check. So I think it will be perhaps be a little bit simpler not as complex in the recording and the detail that has to go into planning in a lesson if you where to do it in the strict way that was required in 2005.

JV-LS29: **In your opinion, is there any need for new staff training programme to train staff in Curriculum 21?**

LS29: I don't think that at the Technikon level that's the problem, because I don't think we ever took 2005 to the kind of detail that was being required at the schools. So I think that what we are doing is probably more in the spirit of Curriculum 21 than it ever was 2005 because we didn't get down to that kind of finicky little detail, that was being practised particularly in the Primary Schools.

JV-LS30: **According to you, how can the Technikon ensure the implementation of Curriculum 21 and other SAQA policies? Do you consider it necessary to**

broaden the academic development centre, to establish a task team to monitor the progress of the implementation of such policies?

LS30: A couple of things. I think first is that it would have to be a genuine priority for the institution. First thing is that management would have to say, they really want it and they really mean what they say, so that they would allow the time for the training and that they would provide the money for the manpower that it would need. So I think the first thing is that it would need the actual physical real commitment of top management. Once that happens I think the next thing is the building of awareness, but of course once top management think it is a priority, the word kind of spreads. So there is a building of awareness ... that would not need more people it is just a matter of attitude and exposure.

JV-LS31: **Making it mandatory?**

LS31: I think that, that would come later. That is the next step. The first step would be to hire somebody who would have no other responsibility but purely to work with the implementation of the OBE. That should be done intensively so that there would be time off where people can have thorough workshopping at the beginning. Perhaps 2 or 3-day workshop, where they have no other responsibilities, that's all they have. And then, working with people in the classroom and it must be seen not as a policing but as a supportive thing. I think that is part of the problem that if somebody works with them they feel threatened by it rather than feeling that somebody is trying to help them. Yes, working with them in the classroom, besides that the development of teams where people can work together and exchange ideas. So it would really mean a big change in mind set. But, I think that can happen without too much disruption as long as time is allowed and as long as personnel are allowed and as long as it becomes a priority within the department.

JV-LS32: **You have already answered my next question. I was going to ask you: what role, in your opinion, can the Management of this Technikon play to enhance the quality of teaching and learning in general and OBE based teaching and learning in particular in this institution?**

LS32: Well, I have already answered that one.

JV-LS33: **Lynette, thank you so much, thanks for your time. If I have some more questions, could you please allow me to come back to you at a later stage?**

LS33: Yes.

END OF INTERVIEW

Appendix 9.6.2

Interview with Mrs. Candice Mathew

Senior Lecturer, Department of End User Computing

JV-CM1: Candice, this interview is aimed at gathering data as part of a project on *"this Technikon's potential receptiveness to and readiness for changes as envisaged by Curriculum 2005 or OBE based teaching"*. Thank you for giving me the time to talk to you.

Candice, I understand that you attended most of the staff training programme conducted by the Director of Academic Development Centre of this Technikon in 1998 and 1999. How was the training organised? How often was the training held? Was it mandatory for the academic staff?

CM1: The training was not mandatory. It was requested that staff attend. It was organised as a series of workshops. The workshop started with the concept of outcomes based education and then went into other areas such as assessment etc ... and it was actually linked – a little bit with the Australian LINKS Projects. I don't know if you remember?

JV-CM2: **Yes, I remember that.**

CM2: So, it was actually interwoven. It wasn't a stand-alone section.
There were lots of links with those workshops.

JV-CM3: **I had an interview with Dr. Lynette Stone, yesterday. In one of her responses she said that less than 15% of the academic staff attended these workshops. In future if similar training is to be conducted, do you want to see the**

management of this Technikon making it compulsory for all academic staff and why?

CM3: I would like to see all academic staff attending, but I have a problem with forcing them to attend. I think they need to be receptive to workshop and making it mandatory is not going to be conducive to opening their minds. I think that, rather there must be some form of an encouragement. Maybe one can begin by being creative ... some form of encouragement ... you know.

JV-CM4: **What about some time off ... from normal lecturing time?**

CM4: Something, I am sure ... we can think of something. Just to force them to go isn't going to work.

JV-CM5: **What is your opinion regarding the way in which the training was conducted?**

CM5: You know I am now thinking back. This was mainly in 1998, ... in the beginning of 1998, two years back. As I recall, it took place in the form workshops, explanation of and a little bit of practical. I think it was a good introduction. To take that back into your own department, really requires a lot of work. I am not saying that the training was inadequate but I do think that more support could have been there.

JV-CM6: **Did the trainer/presenter use the principles of OBE in his/her own methodology of training?**

CM6: I think that is an interesting question. In some workshops they said: *" At the end of this workshop we should be able to achieve this outcome or that ... "* But it wasn't actually clarified as such. I think it could have been a bit more explicit that they were using OBE approach as a vehicle for teaching. It wasn't really.

JV-CM7: **Was the design of Learning Support Materials part of the training?**

CM7: We were meant to be able to go back to our departments and to start working at what we had and to re-examine our course structures. Many of our course structures – which obviously didn't do well – could look into their course at that stage. I think looking at that aspect was one of the tasks. That part was given to us to follow up.

JV-CM8: **Which other aspects of OBE were included in the training?**

CM8: Assessment was definitely a major part, in Outcomes Based Education you know, assessing Outcomes. Which was very important. And then we did have evaluations, as to how to get the outcomes evaluated. So, yes the training did follow the correct path.

JV-CM9: **So the different aspects of OBE were covered?**

CM9: Yes, they were.

JV-CM10: **Do you believe that the academic staff of this Technikon has received adequate training to implement OBE based teaching/lecturing?**

CM10: I don't think that actually is a fair question because, I think if they had received an educational training initially even if the traditional educational training ... professional training, and then this OBE would have been more meaningful. The fact that they largely have not been exposed to any methodologies of teaching/learning you know, ideas of it makes it extremely difficult.

JV-CM11: **Are you suggesting that since some of the academic staff are from industry, they don't have the training in teaching?**

CM11: Yes, they don't have professional qualifications, and to give them a course on OBE ... there is no connection ... no foundation. It is extremely difficult for the trainers and I mean obviously there is no basic educational training ... You now know what we're talking about, HDE or similar professional training ... I feel personally that without such basic educational training it is difficult to provide a training in OBE.

JV-CM12: **Candice, this is a personal question. Do you believe that at present you are in a position to implement OBE based teaching/lecturing?**

CM12: Yes.

JV-CM13: **Could you please assess the success or failure of the OBE training and implementation programme conducted by the Director of Academic Development Centre, in broad terms.**

CM13: Are you asking me to ... sort of evaluate?

JV-CM14: **Please evaluate the training and the implementation. Just your opinion.**

CM14: Again it is because the trainers had a very difficult situation. I feel that it wasn't really sufficient. I don't think many of those people can go and just sit down and with ease get the training in a new concept. I think still there is lot of confusion, it is because particularly Curriculum 2005 with those major outcomes, seven critical outcomes. No, it was a very difficult concept to provide training with ease ... not that it couldn't.

JV-CM15: **You said that you have practised OBE in your everyday teaching/lecturing. What about other lecturers in your department or in your programme, do they also practice OBE?**

CM15: They do. The very nature of teaching a person to use a tool like a computer. You don't even have to think about it, we actually are unfairly privileged in that sense, you know, because of its very nature. What you are expected to do in one section leads you to the next and it goes on to the next section.

JV-CM16: **What form/s of assessment/s do you employ in your teaching/lecturing?**

CM16: Personally or in the department?

JV-CM17: **Personally and in the department, in general.**

CM17: Let us just look at the department in general, because I actually do most of my lecturing in the IT Diploma Course. I do very little End-user Computing. So in the End-user department, as far as the assessment is concerned, we use continuous assessment and computer based assessment, it is practical and students actually have to do what they have been taught, you know, and they got to do it. So they actually have to practically carry out what they have been taught and this is assessed.

JV-CM18: **Is this done on a daily basis?**

CM18: No, this is not done on a daily basis. ... Yes, we usually try to get about 4 assessments for a semester course. There will also other forms of minor assessments.

JV-CM19: **Is this for the 1st year or the second year students?**

CM19: Mainly 1st year level. Most of the client departments require teaching at the first year level.

JV-CM20: **Candice, according to William Spady (Educational Leadership, p.68, 1991), Transformational OBE is not calendar defined but outcome defined. (To put it differently, according to Department of Education (1997), *OBE framework* is flexible and creates genuine possibilities for all learners to achieve success relative to their own pace and style of learning. In your opinion is this practical in the case of this Technikon in general and End User Computing in particular?**

CM20: If I am honest with you, We struggle a lot with the timetable in our Technikon in general. I mean, for this to be implemented you should have a very flexible timetable. And I don't see that working. OK. Now, within our own department we have spoken about it. If a student is not ready to do the word processing we would like that student to come at a later stage and take the test rather than an ordinary test on a particular week with the entire group.

JV-CM21: **Later stage means, after hours or ...?**

CM21: No, after a few more weeks of practice and we have been talking about that just within our own department that we would like to do it that way. We all feel that, you know when a student is ready to take a test he must be given the opportunity to do it. It will help the students. But then again, this land is not our land we share them with IT we share them with Communication. So they are not our land we can't ... we can't ... we haven't got solutions yet. But we are thinking and we're moving in that direction.

JV-CM22: **You have many years of teaching/lecturing experience. In your opinion, what does the new OBE framework mean for learners who experience barriers to learning?**

CM22: If it is explained to them that there are certain outcomes that should be achieved with a hierarchical structure, I think students would be able to guard against the barriers. If they have experiencing barriers to learning I think that at least they can start looking at them and seek assistance from lecturing staff or anyone else who will be able to assist them. They should feel little bit more confident... more in control. Any type barriers should be dealt with accordingly. That will make the students more comfortable, confident and be in control.

JV-CM23: **Is there any evidence of integration of learning areas taking place in your department/programme?**

CM23: What do you mean by integration of learning areas?

JV-CM24: **Say for instance, you teach a particular area and somebody else is teaching another area, within your department. And then...**

CM24: We all teach the same thing. This is very, very different to the IT Diploma. The End User Computing staff all teaches the same thing. So there is integration of learning areas.

JV-CM25: **Recently the Review Committee on Curriculum 2005 presented a report to the Minister of Education. One of the major proposals in the report was to phase out Curriculum 2005 and phase in Curriculum 21. What is your understanding of the difference between Curriculum 2005 and Curriculum 21?**

CM25: There isn't any difference I think it's just a matter of not having to deal with things really in time. I think that, in a way, the schools in general may not geared up resource wise to tackle Curriculum 2005. There are lots negative currents flowing

from teachers on the ground and back to Education Department. The whole sort of structure widened the gap between the advantaged and disadvantaged schools. Advantaged schools have resources including trained staff. And I just feel talking about it the limitations and giving people time. I think C21 is to give people more time. We all have spoken about the impossibility of 60 children in a class and the practicality of implementing Curriculum 2005.

JV-CM26: **What role, in your opinion, you as a lecturer can play to enhance the quality of OBE based teaching and learning at this Technikon?**

CM26: Well, I think with my main contribution, to date, is to assist staff because we have largely inexperienced lecturers and I have spent quite a lot of time looking at the tests they set. I am involved in sort of staff development in my own department totally on an ad hoc basis. We meet regularly and then I help them with OBE assessment. I try to ... I am not saying that I have all the experience ... at least I am more experienced than many of them in our department. I don't see myself going beyond that, at this stage.

JAMES: **Thank you Candice. Thank you for your time. If I have some more questions, could you please allow me to come back to you at a later stage?**

CM27 Oh! Yes.

END OF INTERVIEW

Appendix 9.6.3

Interview with Mrs. Anna Eddy
Senior Lecturer, Secretarial Studies

JV-AE1: Anna, This interview is aimed at gathering data as part of a project on *"this Technikon's potential receptiveness to and readiness for change as envisaged by Curriculum 2005 or OBE based teaching"*. Thank you for giving me the time to talk to you.

I understand that you attended most of the staff training programme conducted by the Director of Academic Development Centre of this Technikon in 1998 and 1999. Please give your general impression on the training. How often was the training held? Was it mandatory?

AE1: Okay. I think, at least it was tried to have these training programme on a regular basis, I think every attempt was made. So as far as that goes, you know, from managing, getting the Technikon ready from an *"old system"* to a *"new system"*. I think managing that every attempt was made to actually get the staff in a position, I mean, I think Lynette tried very hard. I must say that the staff didn't attend that training, at least the session that I went to was not attended very well. We would be 8 or 10 perhaps, whatever. I found what we did there very useful. Okay, because, I mean, I just knew at that stage, okay, OBE has come to us and I don't know much about it and if I am expected to teach in a certain way, or to adapt my curriculum in a certain way or whatever the case might be, to get familiar with language and things like that, then I have to go to these sessions. So, in general, I think I enjoyed it, I learned really a lot there. I don't know if I have covered all the aspects of the training. But I think this is it.

JV-AE2: **Let me to go back to one of the aspects you've mentioned now, regarding the attendance. I had an interview with the Director of Academic Development**

centre, few days before. She was saying that about 15% of the Academic staff attended these workshops. What is your response?

AE2: I wonder, 15% how that will correlate with my 8 to 10 people?

JV-AE3: **Which is correct. May be 8 or 10 lecturers attending each training session. It was not mandatory at all. But my next question is, in future if similar training is to be conducted, do you want to see the management of this Technikon making it compulsory for all academic staff and why?**

AE3: You know that is a very, I don't know ... if hard is the right word. Let me explain to you what I want to say. The moment that you start to say you make things compulsory, you move yourself into a territory that I would ask the question ... I don't like make things to be made compulsory, because I think it is, but ...in this case. It might perhaps be necessary, because we all have to adhere to that. Now what do you do to staff if there is a training session and they don't go? And it is such a thing of such an importance, you know, so personally I wouldn't like somebody to say to me: *"Look you have to go, you must go."* I am supposed to ... as an academic know that there is training of such kind that I should be there. So, I wouldn't like, in principle, I don't like things to be compulsory. But now it leads to the question: How do you get staff to understand? If staff display to management, that they, out of their own don't know the importance of going there, I should suppose that there must come a step to get the staff there, because eventually it is going to be that everybody in this institution must teach in such a way, you must understand the language you must know how, you must adapt the curriculum and things like that, you know, like outcomes; where? how?, does the whole structure fit into each other, you know. So I think it is a difficult one.

JV-AE4: **Is it a difficult one?**

AE4: It is a very difficult one. I think, I should rather see that that is perhaps idealistic. I would rather see create an atmosphere where people understand, look this is important ... encourage on a departmental basis, motivate the people and say; look people ... let us go, let us go and empower ourselves, lets know about these things.

JV-AE5: **Maybe the management of the Technikon can think about providing some form of encouragement by giving time off to attend workshops or something of that nature. Do you agree?**

AE5: Yea, incentives for the attendance. I don't know, you know you are touching on a whole sort of personnel management issues. How do you motivate people? How do you get people to go to these things? I don't think it should compulsory. It might seem an easy route to say: look, OBE is here you all have to teach, you all have to attend. I would rather see another way. I don't know which will work.

JV-AE6: **Did the trainer/presenter use the principles of OBE in her own methodology of training?**

AE6: Yes, that is now a question. There were some instances ... Yes. But now what you must understand, at that time when we as trainees attended these workshops, we were not familiar with OBE principles. So I have to answer that question now in retrospect. It means that I have to tap on my memory and I have to assess to which extend that actually ... there were instances that I can remember that the explicit language was used. *"The outcomes for today's session is this."* And then it was assessed whether we actually achieved the outcome. Let me stop there.

JV-AE7: **Was the design of Learning Support Material (LSM) part of the training?**

AE7: No. I remember how it was presented. No. I can't remember anything. It might have been one of the sessions that I missed. But I never got the impression ...

Look I read the invitations to this on a regular basis and see what was actually the topic that was addressed or whatever, but I can't remember that we actually did anything. I can say with reasonable surety that we didn't.

JV-AE8: **Which other aspects of OBE were included in the training?**

AE8: You know what I could perhaps say, I think what we can include here is that Lynette facilitated a workshop that we had a Decum, now in your studies you must have come across a Decum and how that is actually done. It stands for – designing a curriculum. That was a very successful workshop. You know, if ever, I think, there needs any training to be done, more Dacum training should be done. I know we have workshops.... As far as that goes.... To answer your question there. That not at the sessions really at the Technikon.

JV-AE9: **Do you believe that the academic staff of this Technikon has received adequate training to implement OBE based teaching/lecturing?**

AE9: Well, you see, that is a difficult question because I think the attempts were made to give them sufficient training, but I don't think....if you look at the numbers that attended, most of the academic staff have not received the proper training, because they did not attend. I also think that there is lot of areas that is still vague.

JV-AE10: **Anna, this is a personal question. Do you believe that at present you are in a position to implement OBE based teaching/lecturing?**

AE10: Personally, I think I am. Yes. Not perhaps 100%, but I understand the principles. If I have to design a lesson ... outcomes based lesson, because that is actually what I have been focussing on a lot, to me, it has been easier to work from the bottom up. What I mean by that is to sit down with a topic and say what are the outcomes for this topic, present the lesson, do the assessment or whatever... What I struggled with was with the interim registration project with SAQA, is our

convenor Technikon. The whole process they actually followed to get the co-operation from the other Technikon's on the critical outcomes and the specific outcomes, you know and all those outcomes, assessment criteria, and whatever. It was for me difficult to look at the whole programme and look at the outcomes for that. That is actually why they helped with Decum. But for me it is actually quite easy to do an OBE lesson.

JV-AE11: **Could you please tell me a little bit more about Decum?**

AE11: It stands for – developing a curriculum. So what it means is that you get people, representatives of industry, people who does the job. Let us just simplify it. I am training secretaries so I go and find secretaries. They do the job and then ask them...your analysis takes place on different levels, for instance, we would ask them, tell us about your job. What is it that you are doing? Then they will simply just start listing. I open mail, I type, I do this, and I do that. Okay and then you would divide it into what are knowledge requirements, what are skills requirements, what are competencies. And then there are also other sections ... Lynette facilitated the whole thing, where you ask them: what are the skills that will enable you to type a letter. Then they have to start this ... I must be able to type of course, because I type a letter. I must make the layout of the letter. I must be able to do shorthand perhaps because I must be able to get information from my boss. I must know how to edit. And then you break it further down. In editing, what is involved in editing? If you are involved in editing what enables you to be a good editor ... And then you break it down and you break it down and you break it down. And that is then all the things that you list. And then you start grouping the function together. For instance, these would be general office functions. These would all pertain to bookkeeping functions. Say for instance they say I do ledger or I do Petty Cash and I make conference bookings or whatever, then there would be say, travel ... there would be sections ... then you cluster it like that. Then you look at what are the skills and the competencies which is necessary for you to make travel arrangements. What are those steps in the

process? And what is it that you need knowledge-wise, skills-wise, competencies-wise. Actually, I forgot to mention there is a lot of emphasis on competency. What are the competencies needed? It takes quite a long while, about the first hour of the morning to explain to the delegates what are they there for. Because remember it is a whole new way of looking at things. Instead of taking a topic and writing objectives for it, or whatever, you know design lesson; the whole approach is turned around. I don't know if that makes any sense?

JV-AE12: **Yes that is quite interesting. Thanks, Anna.**

AE12: That was actually quite good. The Decum was one of my more worthwhile experiences in this whole OBE-thing.

JV-AE13: **Could you please assess the success or failure of the OBE training and implementation programme conducted by the Director of Academic Development Centre?**

AE13: The programme or the presenter? Because that is a broad question.

JV-AE14: **Just the two aspects, the training and the implementation.**

AE14: The implementation needs a lot of attention still. I've got my view on that. I think as far as implementation goes somebody actually have to sit with you, either on an individual basis or in a very small group. And we take an area, which is familiar to the group, like typing a letter, for instance. How do we do typing a letter as an OBE lesson? That would be the implementation. I think that needs a lot of attention still. I don't think any attention has actually been given to that. We've been receiving training and we have been left with it.

JV-AE15: **Yes, there was no follow-up?**

AE15: There was no follow-up. We actually have to... we actually have to see now...okay I have to implement this, how am I actually going to do that. There is a lot of thinking in that. Implementation is huge. It's for the rest of ... whenever. Training is one thing. I can tell you how to do it; I can show you how to do it. But now you actually need to be taken by the hand and sit down at the desk and say now okay let's do one example together, because I have no idea, when I say "I" ... you know ... "a person".

JV-AE16: **In your opinion did the training go well?**

AE16: The training went well, but I still have a lot of questions, like I said to you. I have missed all the workshops in assessments, so I still have a huge amount of questions. I know I haven't got the issue of assessments sorted out in my head and assessment is a crucial part.

JV-AE17: **I am coming to the issue of assessment later. Anna, Do you practice OBE in your everyday teaching/lecturing at this Technikon?**

AE17: I try to. I have tried very... let me rephrase it to you like this. I have made a conscious attempt this year, but I teach on 4 levels. So it is too big a job. So I looked at which route I will follow. I initially thought, I would concentrate on 1st years or 2nd years, whatever the case might be. And tried to do all of their work OBE this year but it was even too much for me. So when I come across a new section, it doesn't matter which level. I at least try to adapt the language. In my study guide I have done it for all the levels. As far as lesson presentation goes, when I came across something and I used ... and I could do it in OBE I tried to. But it is not perfect yet. I mean I haven't got a file that I can say look there is a couple of OBE lessons. I am not there yet.

JV-AE18: **Okay. Do other lecturers in your department also practice OBE in their teaching/lecturing?**

AE18: They try very hard. The practical nature of Information Administration at least allows us. But I feel there is still work to be done on; these are my outcomes; this is the lesson and this is the assessment. There is not coherent yet. We've got outcome. That we've got. But whether we actually assess the success of the achievement of that outcome. We assess their work, yes.

JV-AE19: **That's my next question actually. What form/s of assessment/s do you employ in your teaching/lecturing?**

AE19: You see ... just very interesting James, I have attended a benchmark research benchmarking workshop in Stellenbosch, three weeks ago and people were also talking about assessment. What people don't realise is that you have to change your whole assessment methodology because you are now assessing something else. So people, I think, are still carrying on in their old ways of assessment. And what they haven't realised yet, or that is my perception, is that I got the outcome, at the end I must ... how do I assess whether the outcomes where achieved? I think there is still a big gap there. It is not an unbridgeable gap but I think we still assessing in the old ways.

JV-AE20: **According to William Spady (Educational Leadership, p.68, 1991) ,..**

AE20: Ja, I have heard about him.

JV-AE21 **Transformational OBE is not calendar defined but outcome defined. (To put it differently, according to Department of education (1997), *OBE framework* is flexible and creates genuine possibilities for all learners to achieve success relative to their own pace and style of learning. In your opinion is this practical in the case of this Technikon in general and your department in particular.**

AE21: James.... anything is....you can do anything. The person can do anything, but then we have to make the shift up here *(pointing to her head)* and say if that is the system, the system must accommodate or facilitate, A,B,C,D. Then we must go and sit down and go to the drawing board and we must go and see how are we going to make a system that will give us those features. We cannot in our current structure of timetables, the way they are. But it's possible ... you can do it, you can do it. But you have to get away of the old ideas that it takes a year to do a course. That is a perception, you see, and that is the situation. I believe that, we can convert the system. I actually ... I was actually excited to see ... to me that would have been a challenge too. How can we change our present system to the new system to have it really like that? You know, I have heard, in America, for instance, there is a module being presented, say for instance, for a week. You go to that module and you are being assessed from the module. If you fail the module the module is offered a couple of times a year, for instance, and then you go and do the module again, for whatever. That is a way, I thought, it could be done and I actually wanted to do it, but we can't in our current structure, one department cannot do it. But because of SAPSE, you know, we get funding on the number of periods and number of FTE's and things like that. But you could make it work. It is possible. I think it is wonderful.

JV-AE22: **It's possible?**

AE22: It's possible. I think it's possible. But you've got to be quite creative.

JV-AE23: **Yes, I think so.**

AE23: Very original.

JV-AE24: **You have many years of teaching and lecturing experience ...**

AE24: High school and Technikon. I started in 1983. Close to twenty years.

JV-AE25: **Anna, in your opinion, what does the new OBE framework mean for learners who experience barriers to learning? Can OBE open new possibilities, new opportunities?**

AE25: I am not a fundi on learning, you know, how does a person learn. I just know ... I would consider my knowledge very limited. I just ... I know that there are different learning styles. I am quite fascinated by the topic of learning. I cannot really answer that question with my knowledge of OBE. I know how I learn, I know about my own learning style, which is perhaps, I grasp theoretical things. I don't ... in my opinion, James, I think I must just make this comment that; OBE to me is not a very ... it's not very academic, Okay. I don't ...I sometimes wonder. Let me put it to you like this, I have the question; whether the OBE will develop what's being requested. Critical thinkers, independent thinkers. Because we work in groups. Where does the independency come from? I've got concerns.

JV-AE26: **You've got concerns?**

AE26: I've got concerns, yes.

JV-AE27: **Is there any evidence of integration of learning areas taking place in your department or programme?**

AE27: That goes back to your previous question. That is a system that must be designed on the drawing board.

JV-AE28: **So at the moment, each lecturer is in his/her own compartment?**

AE28: We are each doing our own thing, whereas we could integrate, Management, Accounting, Secretarial departments, we all get together and say, Okay we got a project, what is the Management part of the project; Noelene *(HOD of*

Management Department) you work it out. Gillian *(HOD of Accounting Department)* give me the Accounting part, I give you the Secretarial part, and it is wonderful. You know in the old days when Ida *(An ex-Associate Director of Secretarial Studies)* was still here, she and Louise *(another lecturer who left the Secretarial Department)* and I were used to work something like that, and we even set examination papers together. So there were three examiners, because each put a question in from her on project. It worked wonderful; it was very nice, very, very, very nice. But you've got to design it on the drawing board. It is not going to happen by itself. It is a lot of hard work.

JV-AE29: **And also a lot of interaction?**

AE29: Lot of interaction.

JV-AE30: **Ongoing interaction?**

AE30: Ja, but it's more than just ongoing, interaction. You've got to go and sit together, you've got to plan the project and you've got to ensure that all the aspects are there. And then you've got to go and implement and you are going to have to assess it. No ... it's nice ... it's very nice because I have been part of something like that long before the talk of OBE. That was still even at the old campus. So it is the closest we could ever go.

JV-AE31: **We've come to almost the end of this interview now, just a few more questions to finish. Recently the Review Committee on Curriculum 2005 presented a report to the Minister of Education. One of the major proposals in the report was to phase out Curriculum 2005 and phase in Curriculum 21. What is your understanding of the difference between Curriculum 2005 and Curriculum 21?**

AE31: Well I wish you could tell me that, because I was going to ask you, you've got to give me definitions of Curriculum 2005. I think there is a lot of people that confuse the issue. The way I see it, Curriculum 2005 is one thing. What is it ... the way I understand it, what was meant, is that the OBE system should be fully in operation by 2005.

JV-AE32: **yes.**

AE32: Is that correct?

JV-AE33: **Yes.**

AE33: And then OBE is the way ... is the methodology. Now what I understand is that, they still want OBE but that will be ... they give it longer time for fully being implemented and I mean by the year 2021. Is that correct?

JV-AE34: **No. Curriculum 21 does not mean the curriculum to be implemented by the year 2021. The number 21 stands for the 21st century, not the year 2021.**

AE34: Oh, not for the year 2021?

JV-AE35: It is for the 21st century.

AE35: Oh! Thank you very much, now I am enlightened. Okay, so I don't know. You must please tell me what it is.

JV-AE36: I will explain to you later. If you are interested, I can also give you a copy of the interim report.

AE36: That will be nice ... ja ... thank you. But, is it on the Department of Education website?

JV-AE37: **Yes, it is there.**

AE37: What is it called?

JV-AE38: **I'll give you the name and the website-address after this interview.**

AE38: Okay...okay.

JV-AE39: **Do you consider it necessary to run new staff training programmes in Curriculum 21.**

AE39: Yes.

JV-AE40: **Do you think so?**

AE40: Yes, you have to because you get new staff and even old staff, you know ... you have to.

JV-AE41: **Okay, my last question is: what role, in your opinion, can individual lecturers of this Technikon play to enhance the quality of OBE based teaching and lecturing?**

AE41: I think what definitely can be done ... it should be recognised, say by the Academic Development Department, like you are for instance busy with your masters in so close a topic. You must be brought on board as part of that centre so that I can learn from you. You get certain sections and you do personal individual staff training because all of our disciplines, to use a mode one word now, are different. But I can give you the context of my material and you being in your OBE and we put the two together and we create a much better understanding. A general OBE training, I don't think will help me much now. I need specifics. And

I need it on Business Administration. Not Secretarial related, it must come so close to what I am teaching at the moment, then it is only going to make sense to me. And I think that is the phase that we should move into now.

JV-AE42: **Thank you Anna, thank you for your time. If I have some more questions, could you please allow me to come back to you at a later stage?**

AE42: It's is a pleasure. You may come back.

END OF INTERVIEW

Appendix 9.6.4

Interview with Mr. Martin Phillip,

Lecturer, School of Marketing

JV-MP1: Martin, this interview is aimed at gathering data as part of a project on *"this Technikon's potential receptiveness to and readiness for change as envisaged by Curriculum 2005 or OBE based teaching."* Thank you for giving me the time to talk to you.

In 1998, the Director of Academic Development Centre conducted a series of staff training – mainly in the form of workshops – in Outcomes Based Education (OBE). I understand that, during that period you were in the United States of America for your higher studies. As a result you could not receive the training in OBE. Is that right?

MP1: That's right.

JV-MP2: **How long have you been lecturing at this Technikon?**

MP2: For five years now.

JV-MP3: **Do you have experiencing in teaching or lecturing in any other institution?**

MP3: No! I have only been here.

JV-MP4: **Okay. Fine. Thank you.**

MP4: Before that, off course, I have worked in the private industry.

JV-MP5: **Okay. You were in the industry?**

MP5: Yes, in the industry.

JV-MP6: **Thank you. In your opinion, is there any difference between the system in which you were educated and the present system in which you are an educator?**

MP6: What do you mean?

JV-MP7: **You see, a few years back you were a student. You were studying in South Africa. Do you see any difference between the two systems, the system that existed before 1994, that is before the first democratic elections and the system in which you are an educator now?**

MP7: You are talking about higher education, primary education, secondary education?

JV-MP8: **In general. But since you are involved in higher education now, you may mainly focus in higher education.**

MP8: Well, I don't see any difference, so far. Especially in what I am involved in. Because, you know, I have always been claiming that I have been practising OBE since 1995, ever since I came here. Because it's basically allowing student to research and contribute a lot in class discussion, is based on what I have been doing all the years. So I really don't see any difference between what I used to do and what we are doing now.

JV-MP9: **Was it like this when you were a student or did they use different teaching methods? Did your teachers give you the opportunity for class discussion and research and those things?**

MP9: Oh, Yea. Except ... like say for primary up to standard ... say, six or seven, it was more one way ... sitting there listening to the teacher and then after that of course, high school. It was a little bit ... but it was more, again, one way than two way.

JV-MP10: **Okay. But later when you were doing your degree...**

MP10: But later when I was doing my degree ... then it was different. Because we were expected to do research and that kind of stuff.

JV-MP11: **So, in other words, you are saying that there is not much difference between the system in which you were educated and the system in which you are an educator now. There is no big difference?**

MP11: Well if you talking about what I am doing now and what the lecturers were doing, there's no difference.

JV-MP12: **All right, Okay, thank you. Martin, as you know, the first democratically elected government came into power in 1994, and in 1995 the then Minister of Education announced the introduction of a new curriculum. This new curriculum was later named as Curriculum 2005. The underlying principle in this new curriculum was an Outcomes Based teaching/lecturing. What is your understanding of OBE?**

MP12: My understanding of OBE is that, as I have already said, is allowing students ... more like teachers and not ... it is more like two way communication. Allowing students to research do more work on their own and then you just facilitate the education process. Teachers are facilitators more than teachers, because, I also believe that the students know a lot, but we don't know that they don't have this potential. So as part of ... I strongly believe that the whole concept is an excellent concept, but I don't know whether it's working.

JV-MP13: **You're talking about OBE?**

MP13: I am talking about OBE. I mean, theoretically, it sounds very nice, but I mean, I have been trying, I know in my classes, students don't want to talk, even if you force them to, they don't want to talk. Well I don't know whether it is because of the system from which they come from or is it because of the language because English is not their first language. Ja, because if I compare them to English speaking students or Afrikaans speaking students who learn in their languages they seem to be more participative and discuss a lot in the class. So I don't know what the problem is whether they don't have the ability, whether it is the language or whether they are poor, in like, academic field.

JV-MP14: **In other words you practice OBE in your everyday teaching or lecturing?**

MP14: Yes. As I am saying I am doing it since 1995, that is why I don't see any difference.

JV-MP15: **Do other lecturers in your department also practice OBE in their teaching or lecturing?**

MP15: Well they have been doing what I am saying but then we didn't call it OBE.

JV-MP16: **Okay. Fine. So, you didn't call it OBE, but this is what you have been practising anyway?**

MP16: This is what we have been practising all along.

JV-MP17: **What form/s of assessment/s do you employ in your teaching or lecturing?**

MP17: Case studies and tests, like, you know, the normal tests, you know the theory. Basically those two.

JV-MP18: **Any form of continuous assessment?**

MP18: No.

JV-MP19: **There is no form of continuous assessment?**

MP19: No.

JV-MP20: **Okay. Assignments?**

MP20: Assignments, off course, yes, research that kind of stuff.

JV-MP21: **According to William Spady (Educational Leadership, p.68, 1991), Transformational OBE is not calendar defined but outcome defined. (To put it differently, according to Department of education, South Africa (1997), OBE framework is flexible and creates genuine possibilities for all learners to achieve success relative to their own pace and style of learning. In your opinion is this practical in the case of this Technikon in general and in your department in particular?**

MP21: Well, quite frankly, because we don't have ... you say the students learn at their own pace. That's a problem, because we have deadlines and students don't want to work. So, I mean, I don't see the practicalities of that ... No, I don't see it being practised here, because of the deadlines that we have to meet. If they don't talk what do you do. If you have a deadline to meet ... so it is a problem.

JV-MP22: **Deadlines, such as...**

MP22: Like the end of the year exams, tests, semester exams, that kind of stuff. And if the students learn at their own pace and, as you know they don't want to learn you have to force them, then that is a problem.

JV-MP23: **Okay. Thank you. In your opinion, what does the new OBE framework mean for learners who experience barriers to learning?**

MP23: Allowing them, you know, is part ... the whole concept is to allow students to do more research on their own, you know. Kind of developing themselves and, you know, I am not sure about other institutions but I don't see it working here.

JV-MP24: **Yes, all right, okay.**

MP24: I really don't see it working here.

JV-MP25: **You mean OBE?**

MP25: I am talking about Outcomes Based Education.

JV-MP26: **OBE based teaching or lecturing is not happening here at this Technikon?**

MP26: It is not happening, although, I have been claiming that I have been using it all along. But as far as doing that, I mean, forcing students to talk, it is not ... it's more like against their will. They just want to sit in the class and listen to you. Saying whatever you are saying and to tell them when the test is and where it is going to be written and the assignments and that's it. They don't want to discuss, you know, engage in discussions in the class.

JV-MP27: **Is there any evidence of integration of learning areas taking place in your department?**

MP27: What do you mean?

JV-MP28: **You ... let's say, have a particular learning area to teach/lecture, maybe there is another lecturer who is lecturing in another learning area has a topic that has close relationship with your subject. Is there any co-operation between you two or in other words is there any integration of areas that are common, overlapping, that kind of thing?**

MP28: There is definitely, if I may use another term, duplication. Even in other departments you find that you are doing ... you teaching, for instance Financial Management, in Marketing, like to Marketing students and there's someone teaching Financial Management, in an Accounting Department. So there is duplication technically, there is no integration at all. Even within my department, you focus on a subject, you finish it and that's it.

JV-MP29: **Each lecturer is in his/her own compartment?**

MP29: Exactly. Within my department, Marketing Department you are in your own compartment.

JV-MP30: **You are on your own?**

MP30: Yes, you are on your own.

JV-MP31: **What about the departmental meetings, do you discuss the idea of this integration in learning areas in your meetings?**

MP31: No departmental meetings.

JV-MP32: **Oh, yes. Recently the Review Committee on Curriculum 2005 presented a report to the Minister of Education. One of the major proposals in the report**

was to phrase out Curriculum 2005 and phase in Curriculum 21. What is your understanding of the difference between Curriculum 2005 and Curriculum 21?

MP32: What I have actually heard is 2005 did not include more technological based kind of education. And that is basically what they wanted to integrate in Curriculum 21. It is more like technological based and I can't remember the other one and I know technology was not part of the 2005.

JV-MP33: **So in your opinion, the thrust is now in technology in Curriculum 21?**

MP33: Technology and other stuff, yea.

JV-MP34: **Okay. Do you consider it necessary to run new staff training programmes, at this Technikon, in Curriculum 21?**

MP34: Oh, yes. If it is gonna help the students then I would suggest that, you know, the Technikon runs it.

JV-MP35: **Okay. And finally, what role in your opinion, can individual lecturers of this Technikon play to enhance the quality of OBE based teaching and learning.**

MP35: As you correctly ... as you asked earlier on ... integration. Working together ... and ... co-operation.

JV-MP36: **Co-operation between lecturers...?**

MP36: Between departments, between lecturers within the departments and also the lecturers who might be in ... or work with, as for instance ... what I said earlier. I teach Financial Management to Marketing students and there is someone teaching

Financial Management to Accounting students. So if we could start within the department to work quite closely with other lecturers and also quite closely with the accounting department, that would make sense to me. And that would enhance our teaching like sit and discuss, even like share the question papers that kind of stuff. And I don't see that happening, so, which is a problem.

JV-MP37: **Thank you so much. If I have some more questions, could you please allow me to come back to you at a later stage?**

MP36: Oh, yes.

JV-MP38: **Thank you so much, thanks for your time.**

END OF INTERVIEW.

Appendix 9.7

CABINET DECISION ON CURRICULUM 2005

Issued by the Ministry of Education
31 July 2000

The Council of Education Ministers at its meeting in Pretoria today was informed of the Cabinet's deliberations on the review of Curriculum 2005.

At the meeting of Cabinet on 25 July 2000 the report of a meeting held on 24 July 2000 of Ministers and Deputy Ministers to discuss the review of Curriculum 2005 was considered.
Cabinet expressed continued support for the principle of outcomes based education and for the curriculum review process.

In particularly Cabinet agreed on the following:

1. The Department's proposal that Grade 4 and Grade 8 will continue in 2001 as originally planned, with the learning areas of Technology and Economic and Management Sciences being retained.

2. The development of a National Curriculum Statement, which will detail in clear and simple language the curriculum requirements at various levels and phases, and that this must begin immediately. Such a statement must also address the concerns around curriculum overload and must give a clear description of the kind of learner - in terms of knowledge skills values and attitudes -that is expected at the end of the General Education and Training band (Grade 9).

3. The need for intensive, innovative in-service teacher development programmes with a focus on Technology and Economic and Management Sciences to address the immediate lack of capacity in these learning areas. These programmes must also ensure a general enhancement of the capacity of teachers, school management teams and departmental officials to deliver the total curriculum including improved information technology connectivity.

4. Since the recommendations of the C2005 Review Committee amount to a strengthening and streamlining of C2005 and not its phasing out, and therefore do not depart from the original underpinning principles, and since they maintain the thrust of the original educational and societal goals, there is no need to change the name of the curriculum in use.

5. The retention of the description will also ensure that the only change in focus will continue to be the shedding of the old apartheid curriculum and its replacement by an effective and streamlined curriculum that is relevant for all South African citizens and one that prepares students for the 21st Century.

6. Since the curriculum impacts on the urgent Human Resource Development needs in the country the proposals around Human Resource Development which are currently being dealt with by the Ministers of Education and Labour must be brought to Cabinet as a matter of urgency.

7. The Department of Education would co-ordinate the involvement of other Departments who can contribute to the enhancement of the implementation of the curriculum and the other recommendations of the review committee. These are Departments such as Labour, Arts Science Culture and Technology, Agriculture, and Environmental Affairs and Tourism

The Council of Education Ministers welcomed the Cabinet support for the implementation of the Council's recommendations for both the streamlining of Curriculum 2005 and the strengthening of outcomes based education.

Appendix 9.8

ADDRESS BY MINISTER OF EDUCATION, TO ASSOCIATION OF PRINCIPALS OF JEWISH SCHOOLS OF SOUTH AFRICA,

Issued by: Ministry of Education

Herzlia Weitzmann Primary School, 6 March 2000
The Conference Chairperson
School Principals
Educators
Colleagues
Shalom

Apartheid enslaved many of us politically, economically, physically and geographically. It enslaved all of us educationally, socially and spiritually. Whilst we have overcome enormous adversity to achieve our democracy and the opportunity of hope and fulfilment for all South Africans we should not forget the words of Bertolt Brecht who wrote in his Songs of the Soldier of the Revolution:

When the difficultyOf the mountains is once behind
That's when you'll see
The difficulty of the plains will start.

We have attempted to chart a course across the plains since 1994 and are involved in ongoing course corrections and adjustments. I am reminded of a nation that traversed a desert for 40 years on its way to a promised land. Its people encountered several obstacles and self-doubt along the way but their faith dragged them to their dream. On reaching their promised land they had to learn to govern and organise their nation so that it would develop, thrive and survive. They had to set up systems, processes and procedures to ensure harmonious functioning and peace. They had to deal with the difficulty of the plains.

I thank you for inviting me to share in your conference and I hope you will share your experience in dealing with "the difficulty of the plains".
One of the issues I have been asked to address is the "Role of Independent Schools in the future of education in South Africa."

In January, I called upon all South Africans in the spirit of Tirisano (which means working together) to join hands with my Ministry and provincial education authorities to identify and address the most urgent problems in education. Several problems were highlighted, for example, dysfunctional institutions, lack of basic facilities, high levels of ill literacy, crime and violence in schools and the impact of HIV /AIDS.

As part of mobilising citizens to build a South African education and training system for the 21st Century, I identified nine priorities that collectively formed the basis of a strategy for the

development of a fully functioning education and training system that would drive South Africa into the 21st century and contribute to the health and prosperity of the nation.

The underpinning policy elements remain as in the first Education White Paper, namely, access, success, quality, equity and redress. However, these elements have to be viewed in the context of the changes since 1994 and within the current needs of the education and training system.

The nine priorities focused on building effective provincial systems, reducing youth and adult illiteracy, fostering positive relationships between schools and communities, ameliorating physical conditions in schools, enhancing teacher performance, making outcomes based education work, developing viable Further and Higher Education and Training sub-systems and tackling HIV / AIDS.

How will you, as Independent schools, respond to my Call to Action? As independent schools you are not separate from the public school system but you are still South African schools. What actions will characterise your South Africaness?

Will you align yourselves with the nine priorities? Will you help to find solutions to the most urgent problems in education I have identified?

How will you demonstrate your commitment to the development of a fully functioning education and training system that will drive South Africa into the 21st century and contribute to the health and prosperity of the nation? To what extent will you participate in a fundamental re-assessment and re-thinking of the very basis and foundations of our education and training system? How will you, as independent schools contribute to the preparation of our people for citizenship and nationhood? How will you ensure that you celebrate the rich diversity and heritage of our people even as you focus on your own? Are you organised and positioned to develop the skills and intellectual tools necessary to engage with the rapid changes resulting from the communications and information revolution; and the introduction of innovations in the learning and teaching process based on new technologies?

Will you use your resources; your expertise, your capacity and your commitment to root yourselves in the South African educational landscape or will you emerge as islands in a communal sea. Will the general public experience you as an elite group that concentrates its energies inwardly or will your actions lead the public to perceive you as a group that has some unique characteristics but is nonetheless ensconced in the broader societal milieu? The choices are yours to make.

In responding to these challenges you will arrive at an understanding of the "Role of Independent Schools in the future of education in South Africa."
The second issue I will address is the future of OBE and Curriculum 2005.

All our education policies and practices are subject to ongoing, cyclical and focused reflection and review. This is a necessary and expected process that indicates a structured, critical, disciplined and responsible approach by the national and provincial education authorities. The current ministerial Review Committee is but one mechanism linked to this ongoing process. It

would be a serious error to assume that the institution of the review committee amounts to a rejection of OBE and C2005 or a vote of no confidence in education officials, teachers and school management teams.

It must be clearly understood that Outcomes Based Education remains the chosen approach of government and that the decision to apply it across the entire education system is not under reconsideration at this time. The review is an honest and rigorous reflection on our interpretation, "packaging", curriculum design and implementation of outcomes based education.

The Curriculum Review Committee has been asked to focus on issues related to the structure of the curriculum, the level of teachers' understanding, the effectiveness of training, the conditions necessary for successful implementation (success factors), any actions that need to be taken to improve and strengthen general implementation and the implementation of Grade 4 and Grade 8
I assume that independent schools have had to deal with similar issues in their implementation of Curriculum 2005 and that they would have contributions to make to the review process. Please engage the Review Committee on these matters.

The review committee is geared to make its findings and recommendations by the end of May 2000; those that are accepted by my Ministry will impact on the implementation of C2005. Whether the accepted recommendations engender minor modifications or even radical overhauling of plans, they will be acted upon at the appropriate time, with a commensurate sense of responsibility, discipline and accountability.

It is logical to assume that Grade 4 and Grade 8 will be introduced as planned in 2001. If there were recommendations from the review committee that could be infused in this introduction they would be included. This will not be a new cohort of learners but the natural flow through of learners currently in Grades 3 and 7. Any substantive recommendations of the review committee would be carefully thought through, thoroughly planned and properly implemented within reasonable time frames.

CONCLUSION

The independent schools network, of which you are a part, has access to and control over substantial resources for education. What shared vision guides the use of these resources such that they impact on the country in general? In particular, how will you, as independent schools, use your resources to assist in breaking the back of illiteracy amongst youth and adults and how will you join the fight against the spread of HIV / AIDS?
We need to remind ourselves yet again of the words of Bertolt Brecht:
When the difficulty
Of the mountains is once behind
That's when you'll see
The difficulty of the plains will start.
How will we, collectively and individually, deal with the difficulty of the plains?
Shalom