# OUTCOMES-BASED MATHEMATICS TEACHING AT PUBLIC COLLEGES FOR FURTHER EDUCATION AND TRAINING

by

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**Dedication**

Dedicated to my wife Heslia and twin daughters Zania and Lanise.

## ACKNOWLEDGEMENTS

The genuine feeling inside my heart cannot be expressed in words. I do however want to express my sincere gratitude towards:

- God almighty that is always in control of my life. It is only through His never ending grace that this dissertation was made possible.
- My lovely wife and daughters for allowing me to spend so many hours on my own.
- My daughters who were always enquiring when I was going to complete this dissertation.
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- Laura van der Walt for her careful and meticulous typing.
- Members of staff at the different campuses for completing the questionnaires.
- The campus managers for allowing the staff to complete the questionnaires.

## SINOPSIS

Na afloop van die eerste demokratiese verkiesing gedurende 1994 in Suid-Afrika, het die hele onderwysbedeling verander. Wetgewing het die Suid-Afrikaanse Kwalifikasie Owerheid (SAKO) tot stand gebring. Die hoofdoel van SAKO is die ontwikkeling en implementering van die Nasionale Kwalifikasie Raamwerk (NKR). Die NKR maak voorsiening vir die beginsel van lewenslange leer, agt vlakke van kwalifikasies en drie bande van onderwys.

Die struktuur van die NKR maak voorsiening vir 'n nuwe benadering to onderwys naamlik Uitkoms Gebasseerde Onderwys (UBO). Gedurende 1998 is UBO geïmplementeer in alle graad 1-klasse in Suid-Afrika. Dié benadering word tans nog in Verdere Onderwys en Opleiding (VOO) skole infasseer.

Tegniese kolleges, tans bekend as Publieke VOO Kolleges, bied programme aan in die VOO band van die NKR. Geen betekenisvolle insette is nog by dié kolleges ontvang vanaf die Gauteng Departement van Onderwys nie. Dit is egter die skrywer se mening dat UBO wel ook mettertyd hier geïmplimenteer sal word.

Die studie poog dus om te bepaal of die wiskunde kurrikulum wat tans by VOO kolleges in plek is, aangebied word in 'n UBO-formaat. Indien nie sal riglyne verskaf word om dit wel te kan doen.

Die studie doen 'n situasie analise van die voormalige tegniese kolleges deur te kyk na:

- Die geskiedenis van tegniese kolleges en die verandering wat tot op hede plaasgevind het.
- Die profiel van die studente by tegniese kolleges.

- Programme wat aangebied word en die kwalifikasies wat verwerf kan word by tegniese kolleges vir ingenieursstudies.
- Loopbane waarvoor leerders voorberei word by tegniese kolleges vir ingenieursstudies.
- Vordering van tegniese kollege studente vir ingenieursstudies na instansies van hoër opleiding.
- Onderrigmetodes wat tans gebruik word by tegniese kolleges vir ingenieursstudies.

Daar word ook oor die algemeen gekyk na die verskillende onderrigmetodes op drie kontinuums, naamlik:

- Direkte teenoor indirekte metodes.
- Individuele teenoor koöperatiewe metodes.
- Direkte leer teenoor ontdekkende leer.



Konstruktiwistiese leerbeginsels word bespreek en die deurloop na UBO. Aspekte van UBO word bespreek en hoekom daar met 'n UBO-benadering voortgegaan behoort te word. Aangesien UBO ook 'n direkte en groot implikasie het op evaluering en assessering word daar ook verwys na wat evaluering en assessering is, sowel as verskillende vorme van assessering.

'n Vraelys is saamgestel wat deur wiskunde lektore van agt VOO-kampusse vir ingenieursstudies voltooi is. Die vraelys bepaal biografiese data van lektore sowel as data rakende:

- Huidige onderrigmetodes van wiskunde lektore aan VOO-kampusse vir ingenieursstudies.
- Toepassing van UBO-metodes van wiskunde lektore aan VOO-kampusse vir ingenieursstudies.

- Probleme wat wiskunde lektore ondervind met UBO aan VOO-kampusse vir ingenieursstudies.
- Assessering.
- Probleme wat wiskunde lektore ondervind met assessering aan VOO-kampusse vir ingenieursstudies.

Die ontleding van die data toon duidelik aan dat huidige lektore bitter min opleiding in UBO-metodes en assesseringmetodes ontvang het. Die volgende aanbevelings kan vanuit die studie gemaak word:

- Geïdentifiseerde modules, nie meer as drie nie, van die kurrikulum van elke graad kan met behulp van 'n UBO aanslag aangebied word. Die geïdentifiseerde modules moet die wees wat van die grootste belang sal wees as voorkennis vir die volgende graad.
- As gevolg van groot klasgroepe moet groepwerk en veral koöperatiewe leer met vrug gebruik kan word.
- Die wiskunde vakkommitees op die verskillende kampusse moet die lektore oplei in die toepassing van UBO-tegnieke.
- Die wiskunde vakkommitees op die verskillende kampusse moet die lektore oplei in die toepassing van assesseringtegnieke.

## LIST OF FIGURES


| Item | Description | Page |
|---|---|---|
| Figure 3.1 | Methods of teaching and learning | 32 |


## LIST OF TABLES


| Item | Description | Page |
|---|---|---|
| Table 1.1 | Structure of the NQF | 2 |
| Table 2.1 | Activities: Organisational objectives | 15 |
| Table 3.1 | Methods of direct instruction | 35 |
| Table 3.2 | Methods of direct instruction | 36 |
| Table 3.3 | Methods of indirect instruction | 38 |
| Table 3.4 | Independent learning strategies | 41 |
| Table 3.5 | Group learning strategies | 46-47 |

## TABLE OF CONTENT


| | | PAGE |
|---|---|---|
| | DEDICATION | ii |
| | ACKNOWLEDGEMENTS | iii |
| | SINOPSIS | iv |
| | LIST OF FIGURES | vii |
| | LIST OF TABLES | vii |
| | **CHAPTER ONE: GENERAL ORIENTATION** | |
| 1.1 | Introduction | 1 |
| 1.2 | Problem statement | 7 |
| 1.3 | Aim of research | 7 |
| 1.4 | The research method | 7 |
| 1.5 | Programme of study | 8 |
| | **CHAPTER TWO: THE TECHNICAL COLLEGE: A SITUATIONAL ANALYSIS** | |
| 2.1 | Introduction | 9 |
| 2.2 | Technical colleges | 9 |
| 2.3 | The student profile at technical colleges | 17 |
| 2.4 | Programmes and qualifications offered at technical colleges for engineering studies | 19 |
| 2.4.1 | Programmes offered at technical colleges for engineering studies | 19 |
| 2.4.2 | Qualifications obtained at technical colleges for engineering studies | 20 |
| 2.4.3 | Careers learners are prepared for at technical colleges for engineering studies | 22 |
| 2.4.4 | Progression of learners at technical colleges for engineering studies to institutions of higher education | 23 |

| | | |
|---|---|---|
| 2.4.5 | Current teaching methods applied at technical colleges for engineering studies | 24 |
| 2.4.5.1 | Lecture method | 25 |
| 2.4.5.2 | Textbook method | 25 |
| 2.4.5.3 | Review-teach-practise | 25 |
| 2.4.5.4 | Explanations | 26 |
| 2.4.5.5 | Demonstrations | 26 |
| 2.4.5.6 | Questions and answers | 26 |
| 2.5 | Summary | 26 |
| | **CHAPTER THREE: TEACHING STRATEGIES** | |
| 3.1 | Introduction | 29 |
| 3.2 | Teaching strategies | 29 |
| 3.2.1 | Choice 1: Direct versus indirect instruction | 32 |
| 3.2.1.1 | Direct instruction | 32 |
| 3.2.1.2 | Indirect instruction | 37 |
| 3.2.2 | Choice 2: Independent versus co-operative strategies | 40 |
| 3.2.2.1 | Independent strategies | 40 |
| 3.2.2.2 | Cooperative strategies | 42 |
| 3.2.3 | Choice 3: Rote versus discovery learning | 47 |
| 3.2.3.1 | Rote learning | 48 |
| 3.2.3.2 | Discovery learning | 48 |
| 3.3 | Constructivism | 49 |
| 3.4 | Outcomes-based education | 54 |
| 3.5 | Concepts of OBE | 57 |
| 3.5.1 | Introduction | 57 |
| 3.5.2 | Outcomes | 58 |
| 3.6 | Why forward with an OBE approach? | 60 |
| 3.7 | Assessment | 63 |
| 3.7.1 | Introduction | 63 |
| 3.7.2 | Why should assessment take place? | 64 |
| 3.7.3 | Types of assessment | 65 |

| | | |
|---|---|---|
| 3.7.3.1 | Diagnostic assessment | 65 |
| 3.7.3.2 | Formative assessment | 65 |
| 3.7.3.3 | Summative assessment | 65 |
| 3.7.4 | The aim of assessment of mathematics | 66 |
| 3.7.5 | Continuous assessment | 66 |
| 3.7.6 | Advantages of continuous assessment | 67 |
| 3.7.7 | Outcomes-based assessment | 67 |
| 3.7.8 | Assessment strategies that support OBE | 69 |
| 3.7.8.1 | Self assessment | 69 |
| 3.7.8.2 | Peer assessment | 69 |
| 3.7.8.3 | Assessment of projects | 70 |
| 3.7.8.4 | Assessment by means of portfolios | 70 |
| 3.7.8.5 | Group assessment | 70 |
| 3.8 | Summary | 70 |

**CHAPTER 4: RESEARCH METHOD, RESULTS, CONCLUSIONS AND GUIDELINES**

| | | |
|---|---|---|
| 4.1 | Introduction | 72 |
| 4.2 | Research method | 73 |
| 4.2.1 | Experimental group | 73 |
| 4.2.2 | Collection of data | 73 |
| 4.3 | Drafting of questionnaire | 74 |
| 4.4 | Research results and conclusions | 75 |
| 4.5 | Most indicative findings from the research results | 83 |
| 4.6 | Guidelines for teaching mathematics at public colleges for further education and training through an outcomes-based approach | 84 |

**CHAPTER 5: OVERVIEW, CONCLUSIONS AND RECOMMENDATIONS**

| | | |
|---|---|---|
| 5.1 | Overview | 88 |
| 5.2 | Conclusions | 90 |

| | | |
|---|---|---|
| 5.3 | Recommendations based on the most indicative findings | 92 |
| 5.3.1 | Recommendation 1 | 92 |
| 5.3.2 | Recommendation 2 | 92 |
| 5.3.3 | Recommendation 3 | 93 |
| 5.3.4 | Recommendation 4 | 93 |

List of sources 94

Annexure A

Annexure B

Annexure C

## CHAPTER ONE

## GENERAL ORIENTATION

### 1.1 Introduction

South Africa is faced with the challenge of reconstruction and social recovery having held its first democratic elections in 1994. Education was central to the discursive process of racial and cultural segregation (Baxen & Soudien 1999: 131). After the 1994 elections the whole education dispensation in South Africa was bound to change dramatically. This is a logical deduction since new role players will always have a new vision, in order to spell out the new roads to be embarked upon. Jansen (1999:145) puts it as follows: "...OBE as primarily a political response to apartheid schooling rather than one which is concerned with the modalities of change at classroom level".



A multitude of changes have taken place in the interim. One of the major changes was legislation that provided for the establishment of SAQA (South African Qualifications Authority). The Act was promulgated in 1996, Act 58 of 1996. The main objective of SAQA is to provide for the development and implementation of the NQF (National Qualifications Framework). The NQF brought about a new structure regarding bands of education and levels of qualifications within the said bands. (Refer to diagram 1). According to Pretorius (1998:4) the framework of the NQF makes provision for life-long learning opportunities and levels of qualifications nationally agreed upon.

The NQF makes provision for three bands of education. The three bands of education are divided into different levels (1-8) of qualifications. If one takes a closer look at traditional technical colleges, one can see from the outset that these institutions are faced with huge challenges. The learning areas currently

offered at technical colleges span across two bands of the NQF. The first band is the Further Education and Training band, NQF levels 2-4. The second band is the Higher Education band levels, NQF levels 5-8. Technical colleges offer qualifications in the HE band, focused mainly on level 5 of the NQF.

<table>
<tr><th>NQF Level</th><th>Band</th><th colspan="2">Types of Qualifications And Certificates</th><th colspan="3">Locations of Learning. For units and qualifications</th></tr>
<tr><td>8</td><td rowspan="4">Higher Education And Training</td><td colspan="2">Doctorates<br>Further Research Degrees</td><td colspan="3">Tertiary / Research<br>Professional instructions</td></tr>
<tr><td>7</td><td colspan="2">Higher Degrees<br>Professional Qualifications</td><td colspan="3">Tertiary / Research/<br>Professional instructions</td></tr>
<tr><td>6</td><td colspan="2">First Degrees<br>Higher Diplomas</td><td colspan="3">Universities / Technikons<br>Colleges / Private / Professional<br>Institutions / Workplace, etc.</td></tr>
<tr><td>5</td><td colspan="2">Diplomas.<br>Occupational Certificates</td><td colspan="3">Universities / Technikons /<br>Colleges / Private / Professional<br>Institutions / Workplace, etc.</td></tr>
<tr><td colspan="7">Further Education and Training Certificate</td></tr>
<tr><td>4</td><td rowspan="3">Further Education And Training</td><td colspan="2">School/College/Trade certificates<br>Mix of units from all</td><td rowspan="3">Formal High schools/ Private/ State schools</td><td rowspan="3">Technical/ Community/ Police/ Nursing/ Private Colleges</td><td rowspan="3">RDP and Labour Market schemes/ Industry Training Boards/ Unions/ Workplace, etc.</td></tr>
<tr><td>3</td><td colspan="2">School/College/Trade certificates<br>Mix of units from all</td></tr>
<tr><td>2</td><td colspan="2">School/College/Trade certificates<br>Mix of units from all</td></tr>
<tr><td colspan="7">General Education and Training Certificate</td></tr>
<tr><td rowspan="5">1</td><td rowspan="5">General Education And Training</td><td>Senior Phase</td><td>ABET level 4</td><td rowspan="5">Formal schools<br>(Urban/ Rural/ Farm/ Special)</td><td rowspan="5">Occupation/ Work-based Training/ RDP/ Labour Market Schemes/ Upliftment Community Programmes</td><td rowspan="5">NGOs/ Churches/ Night Schools/ ABET Programmes/ Private Providers/ Industry Training Boards/ Unions/ Workplace, Etc.</td></tr>
<tr><td>Intermediate Phase</td><td>ABET level 3</td></tr>
<tr><td>Foundation Phase</td><td>ABET level 2</td></tr>
<tr><td>Preschool</td><td>ABET level 1</td></tr>
</table>

Table 1.1: Structure of the NQF (Isaacman, 1996:24).

According to Mothata (1998:18) the structure of the NQF is designed to improve the quality of education in South Africa. The whole structure of the NQF makes provision for an approach to education called OBE (Outcomes-based Education). OBE is learner-centred as opposed to the teacher-centred method prior to 1994. OBE sees the applicable outcomes demonstrated as competencies to be achieved by the learner as key to the process of education and training. The implementation of OBE has already been in use since 1998. Much research has been done and many books/articles have since been published mentioning the positive and negative aspects of this approach.

The following will illustrate that although OBE in South Africa has been implemented primarily in the General Education and Training band, views are still largely divided between pro- and anti- OBE. Although some of the authors had negative experiences regarding OBE they still see the positive influences brought about by OBE.



Jansen (1999:150) argues that the majority of teachers do not have access to the information on OBE. Mzolo (1999: 38) says: "In order to fight against resistance, teachers must be properly trained, guided and shown the way of how to deal with subjects in our OBE style". Singh (1999: 55-56) states that the Department of Education should supply teachers with parallel starter packs and to consider setting up networks to assist the teacher. Geyser (2000:23) is of the opinion that in order to implement OBE successfully in South Africa, parents, teachers and all other stakeholders need to be properly informed regarding the possible advantages and disadvantages of OBE.

It is however the opinion of the author that OBE is driven by the Minister of Education. It is a political drive to break away from the pre-1994 education dispensation. Jansen (1998:330) says that OBE is an attempt by the Ministry of Education to push forward something innovative into schools to reclaim political

credibility. The road would thus be walked reflectively and changes made as and when needed. To get OBE in place seemed more important than to do proper training of teachers. This is underpinned by the opinions of other authors expressed in this chapter. The principles of and general information about OBE will be alluded to in following chapters.

The technical college sector has a rather chequered past. The technical college sector is in the view of the author, until recently, the most neglected sector of education in South Africa. Admittedly OBE needed to be implemented from the lowest level possible. Hence most intervening actions by the Department of Education was aimed at the General Education and Training band NQF level 1. Many policy documents were aimed at curriculum reform focussed on schools.

Jansen (1999:145) says that since the 1994 elections, the Ministry of Education has introduced three curriculum reforms aimed at schools. Jansen continues by saying that the most ambitious curriculum policy of the Government of National Unity is referred to as Outcomes Based Education (OBE). No major drives specifically aimed at reforming the curriculum at technical colleges have been undertaken by the National Department of Education. The current programmes offered at technical colleges have only been registered in the interim at SAQA until June 2003. The Department of Education via the Directorate: National Examinations and Assessment put forward the criteria to affect a pass percentage in nationally written examinations.

The final mark obtained by a student was no longer only the mark obtained by writing a final summative examination. In future the mark would be made up as follows (Department of Education, 1998:2)

Promotion mark (100%) = 60% Exam mark + **40%** Trimester mark
Trimester mark (**40%**) = 70% Theory + 30% Application of theory

In the interim, the National Business Initiative (NBI) has undertaken formal assessment of Technical colleges and of programmes offered at Technical colleges. The Colleges Collaboration Fund (CCF) also came into being. "The NBI... is responsible for the design and implementation of the CCF, a project funded by the Business Trust to help build world class Further Education and Training colleges." (Colleges Collaboration Fund, 2001: 2). A Further Education and Training (FET) convention, hosted by the CCF, aimed at placing FET colleges on the National map. Prof. Kader Asmal, the National Minister of Education, wrote in his message in the first publication of Colleges Collaboration Fund (2001:i) that the business community who created the CCF, was to transform technical colleges into dynamic providers of technical education and training.

It would seem based on the previous paragraph that technical colleges would have to play a pivotal role in the FET band for providing technical education and training. The sector is currently undergoing major changes. Legislation has been promulgated i.e. the FET Act, Act 98 of 98 as well as the Gauteng College Education and Training Act, Act 13 of 98. Traditional technical colleges must be declared as Further Education and Training colleges. A very crucial change still to be made is the merging of technical colleges. In his keynote address to the FET convention in October 2000, Prof. Kader Asmal said: "There are 152 technical colleges in South Africa". Later in the same address he said: "I have previously gone on record as saying we need a system of perhaps 50 or 60 FET colleges nationally, ....." (Colleges Collaboration Fund, 2001:5-6). From a governance point of view it is clear that, in the interim, pertinent issues are going to be addressed. The aim of the Department of Education is to build a FET College sector, which is vibrant and can contribute meaningfully towards growth and development in South Africa.

In the written media there is no information available regarding OBE in Engineering Studies at the current traditional technical colleges. Judged by the preceding chapter OBE will have to be implemented at technical colleges.

The research will focus on Engineering Studies at technical colleges and more specifically on Mathematics N4. At technical colleges offering Engineering Studies, the academic year is divided into three trimesters. The learning area Mathematics N4 is presented over a period of 11 weeks, three times per year. It will be impossible to transform only the curriculum for Mathematics N4 to OBE. All the qualifications for technical colleges have been registered on the NQF on an interim basis. The question of 120 credits per qualification also needs to be addressed, specifically for engineering studies at technical colleges.

Under the current circumstances the following issues are of concern:

- Training periods of only 10 - 11 weeks per trimester (7.5 hours per subject per week)
- No current documentation regarding OBE for Engineering Studies at technical colleges exists
- No current training of lecturers to prepare them for OBE and assessment techniques is offered by the GDE.
- No Unit Standards are available for the different learning areas from the Manufacturing and Engineering Sector Education and Training Authority (MER Seta).

Since the focus of OBE transfers the previously lecturer-centred learning activities to student-centred learning activities, time constraints might cause serious problems. Developing learning support materials in an OBE style for the whole of the learning area of Mathematics N4 could be problematic due to the mentioned time constraints. Group work in whichever form should be one of the

cornerstones to enable all students to participate in the learning activities. Group work, if not properly controlled, can also be very time consuming. The topics in the Mathematics N4 curriculum do not always have practical applications. Some of the students might be enrolled for a specific vocational qualification where the specific mathematical knowledge is not applicable.

## 1.2 Problem statement

To what extend is Mathematics at Public Colleges for Further Education and Training, being taught through an OBE approach?

## 1.3 Aim of the research

The aim of the research is to determine whether mathematics at Public Colleges for Further Education and Training, is taught through an OBE approach. If it is not the case, guidelines will be developed in order to achieve the adoption of an OBE approach for teaching mathematics at Public Colleges for Further Education and Training.

## 1.4 The research method

The method of investigation would be the use of a questionnaire to determine:

1.4.1 Mathematics lecturer's general application of OBE methods
1.4.2 Mathematics lecturer's general training regarding OBE
1.4.3 Mathematics lecturer's application of group teaching methods
1.4.4 Mathematics lecturer's problems with respect to OBE
1.4.5 Mathematics lecturer's application of OBE assessment methods
1.4.6 Mathematics lecturer's problems with respect to assessment

## 1.5 Programme of study

Chapter 1 serves the purpose of a general orientation. The attitudes towards OBE are sketched as well as some of the changes, which have taken place at technical colleges, illuminated. The aim of the research is stated as well as the research plan.

In chapter 2, a thorough situation analysis is done regarding:

- The current technical colleges (to be referred to as Further Education and Training Institutions)
- The student profile at technical colleges
- Programmes offered at technical colleges for engineering studies
- Qualifications obtained at technical colleges for engineering studies
- Careers learners are prepared for at technical colleges for engineering studies
- The progression of learners at technical colleges for engineering studies to institutions of higher education
- Current teaching methods applied at technical colleges for engineering studies

In chapter 3 different teaching strategies are discussed, why OBE should be continued with as well as assessment and assessment techniques.

Chapter 4 consists of the research method and the results thereof. Some conclusions will be drawn and guidelines given to teach mathematics at public colleges for further education and training through an outcomes-based approach.

In Chapter 5 an overview is given of this study, conclusions are drawn and recommendations are made.

## CHAPTER TWO

## THE TECHNICAL COLLEGE: A SITUATIONAL ANALYSIS

### 2.1 Introduction

In chapter 1, changes that have taken place in the education dispensation, after the 1994 elections are discussed. New acts were promulgated of which the SAQA Act and the FET Act had the biggest influence on the technical college sector. The NQF made provision for levels of qualifications and for bands of education. The structure of the NQF also provided for the transition to OBE. Mention is also made of positive and negative views regarding OBE.

Various documents referred to show that technical colleges would have to play a bigger role in the whole new education dispensation in South Africa. At technical colleges for engineering studies, no formal documentation on the implementation of OBE are available.



Chapter 2 will describe the changes that occurred in the college sector since 1994. The changes will reflect changes at national and at institutional level. The student profile, programmes and qualifications offered at technical colleges will be discussed. Reference on how learners can continue with their studies at institutions for higher education will also be made.

### 2.2 Technical colleges

Technical colleges are currently in a state of transformation. In order to fully understand the transformation that has taken place, one needs to also look at the period prior to the 1994 elections.

During 1981 the Act on Technical colleges was promulgated. The Act provided for the establishment, maintenance, management and control of technical colleges and for incidental matters (South Africa (Republic), Act 104 of 1981). Act 104 was applicable to the then White state-aided technical colleges. According to the Act a technical college is an institution providing post school education. The act defines post school education as instruction and training –

- provided with a view to the pursuance of a vocation or the development of a social or recreational skill; and
- primarily intended for persons who are not subject to compulsory school attendance in terms of the provision of any law or who were exempted from such a provision

but also excludes the correspondence mode of delivery.

From the above it is clear that these technical colleges focussed primarily on vocational education and training since its inception. During 1989 the technical colleges amendment Act (House of Assembly), Act 44 of 1989 was promulgated. The then so-called Indian, Black and Coloured technical colleges were governed by different acts. The Indian technical colleges were politically represented by the then house of Delegates, and were governed by the Indians Education Act, Act 61 of 1965. The House of Representatives politically represented the Coloured technical colleges and were governed by the Coloured Persons Education Act, Act 47 of 1963. The Indian and Coloured technical colleges were in a category between state and state-aided technical colleges. These colleges were slowly developed into state-aided technical colleges. The Education and Training Act, Act 90 of 1979 governed the black technical colleges. These technical colleges were also referred to as state technical colleges.

At state-aided technical colleges, the then Department of Education and Culture made financial provision for these technical colleges by means of:

- providing subsidies for those technical colleges with a Full Time Equivalent (FTE) count of up to and including 750 as well as the funding of the staff establishment provided by the Department.
- providing for those technical colleges with a FTE count of higher than 750 for the funding of the staff establishment only as provided by the Department of Education.

"State-aided colleges have control over their budgets, expenditure and investments and operate their own bank accounts, with the principal as the accounting officer" (Department of Education, 2001:9). The College Councils of these technical colleges determine their own class fees and make use of the generated income for their operational and capital budgets. The College Council of the technical college governed state-aided technical colleges (South Africa (Republic), Act 104 of 1981:5). The College Councils of state-aided technical colleges are fully constituted governing bodies, with legal capacity and the right to own property (Department of Education, 2001:9).



At state technical colleges the state is responsible for all operating costs, provides all accommodation and equipment, prescribes class fees, control the budget and prescribes financial policy (ibid.). These colleges were also subsidised according to FTE's but with no maximum as a cut-off value for FTE's as for the state-aided technical colleges. State colleges have limited financial authority. The college council of state colleges only have advisory functions and the right to own property is vested in the state.

Since 1994 the whole education dispensation has changed. A plethora of documentation saw the light, specifically regarding the transformation of technical colleges.

The very first indication of the imminent change was the formation of the TFTC (Transitional Forum for Technical colleges). The main aim of the TFTC was to include all the major stakeholders from all the technical colleges (state and state-aided) regarding the transformation of all the technical colleges. The new bill that was to be promulgated on the governing of all newly transformed technical colleges was a major point of debate. The TFTC in Gauteng made many proposals regarding the Gauteng College Education and Training Bill. This Bill was soon to be promulgated and stipulated how all technical colleges in Gauteng was to be governed. The Gauteng College Education and Training Act was promulgated on 18 January 1999, Act 13 of 1998. The Gauteng TFTC also forwarded many proposals to the National TFTC regarding the Further Education and Training Bill stipulating how the Further Education and Training Colleges were to be governed.

Act 104 of 1981 made provision for the Committee of Technical College Principals (CTCP). The CTCP was exclusively for the former white state-aided technical colleges. The CTCP was formed during 1981 and functioned until 1994. Since 1990 informal co-operation was undertaken by the CTCP and principals of the other technical colleges not governed by Act 104 of 1981. From 1994 until 2000 the CTCP included all principals of all technical colleges. During 2000 the CTCP was transformed into AFETISA (Association of Further Education and Training Institutions of South Africa).

During August of 1998, Education White Paper 4, a programme for the transformation of Further Education and Training (FET) was published by the National Department of Education (DoE). In his foreword, Professor Bengu, National Minister of Education, said that FET will include learning programmes registered on the NQF from levels 2 to 4. These programmes would include grades 10 to 12 in the school system and N1 to N3 in the technical college system. According to Professor Bengu: "A successful FET system will provide

diversified programmes offering knowledge, skills, attitudes and values South Africans require as individuals and citizens, as life-long learners and as economically productive members of society." (Department of Education, 1998:iii)

Prior to 1994, education and training were viewed as separate entities. After 1994 FET is also seen as the crux of integrating the education and training systems. White paper 4 clearly spells out that the FET system lies at the cross-roads between General Education and Training (GET), Higher Education (HE) and the world of work (Department of Education, 1998:6). The White Paper views technical colleges as generally performing poorly, being overly academic, theoretical and out of touch with the needs of the labour market. Technical colleges also lack public recognition because of the above and also because of the public preferring academic rather than vocational education (Department of Education, 1998:14).



During October 1998 a situational analysis of the technical college sector in Gauteng was done and the report made available to the MEC of Education in Gauteng (National Business Initiative, 1998). The situational analysis was done by the NBI. Although there are 153 technical colleges in South Africa, the report only deals with the 33 technical colleges in Gauteng. One of the 33 colleges in Gauteng is a distance education college.

The report made a total of 50 recommendations regarding the transformation of technical colleges in Gauteng. The following recommendations are mentioned to indicate the proposals made on transformational issues (National Business Initiative, 1998:71-93):

The Gauteng Department of Education (GDE) should initiate a process of transforming the technical colleges into fewer, larger FET institutions (Merging of technical colleges).

- Provision should be made for the appointment of senior college principals to provide high-level management for the new institutions.
- Colleges should accelerate the introduction OBE to programmes and curricula.
- Urgent attention should be given to the inclusion of work-based training in college curricula.
- Urgent attention should be given to the introduction of learnerships in colleges.
- Assessment practices at colleges should change
- Colleges should take a positive view of transformation and be prepared to take a lead in the process.
- Restructured colleges should pay immediate attention to the appointment of inclusive and representative councils.



During November 1998, the act on Further Education and Training, Act 98 of 1998 was promulgated. The FET Act made it possible for the Minister of Education to merge public FET institutions. The new Further Education and Training landscape will look significantly different with only 50 colleges as compared to the previous 152 nationally (Department of Education, 2001:9).

According to the National Strategy Document, one of the initiatives to be introduced during 1999, was to set up the governance structures of colleges in terms of the FET Act. In this document the Department of Education outlines the goal and the strategic objectives for 3 years, which started during 1999. The overall goal is stated as follows: "to establish the foundation for building capacity and systems across all levels of FET in order to effect the desired programmatic,

institutional and cultural changes that are necessary to achieve a flexible and responsive FET system" (Department of Education, 1999:7). Four strategic objectives are then stated. These strategic objectives are (ibid.):

- Organisational development
- Learning and teaching
- Resourcing FET
- Planning, monitoring and evaluation

These objectives would be achieved by means of activities planned for over a 3-year period. Only some of the activities for the strategic objective Organisational Development are mentioned to form a picture of the transformation preceding the current circumstances at Public FET colleges. The planned activities were (Department of Education, 1999:8):

| Objective | 1999 | 2000 | 2001 |
|---|---|---|---|
| **Organisational Development** | • Development of regulations and provincial acts<br>• Development of criteria for the development of FET institutions | • FET advocacy<br>• Declaration and registration of FET institutions | • Evaluation of public response to the new FET system<br>• Declaration and registration of FET institutions |

Table 2.1: Activities: Organisational objectives

During August 2001 all technical colleges in Gauteng were declared public FET institutions. The MEC for Education in Gauteng also declared his intention to

merge public FET institutions in Gauteng by means of a notice in a Government Gazette. Eight clusters to be merged were identified. An Interim Single Council (ISC) was elected for each cluster of institutions to be merged. Eight working groups for each cluster were also elected. These working groups are:

- Governance and management
- Facilities and infrastructure
- Programmes
- Finances
- Administration and Business systems
- Learner affairs and support
- Human resource development
- Marketing and communication

Facilitators were appointed by the GDE to facilitate the pre-merging process. A template for planning was also made available by the GDE according to which the 8 identified clusters had to draw up merging plans under the guidance of the facilitator. A chairperson was appointed for each working group. All the working groups of each cluster had to submit their planning for the merging process of their cluster to the facilitator. The facilitators had to combine the plans for merging of the respective working groups into one merger plan for the respective clusters. The facilitators had to submit their merger plans to the Provincial Merger Team (PMT).

During January 2002 the members of the permanent College Councils of the public FET Colleges were elected. During March 2002 the new posts for College Principals for the 8 clusters in Gauteng were advertised in the national press. During June 2002 the elected permanent FET College Councils received feedback from the GDE regarding the submitted merger plans.

## 2.3 The student profile at technical colleges

Act 104 of 1981 stipulated that technical colleges were providing vocational education and specifically separated it from education in schools where learners were of compulsory school-going age. Since the various training boards regulated vocational education, most of the learners were apprentices. The system evolved in such a way that apprentices could do theoretical training at the technical college for 3 months, and practical training at their employers for 9 months. The system thus made provision for alternating periods of theoretical education and practical training of apprentices. Due to various reasons the artisan training started to decline. Many unemployed or so-called private learners started to enrol for theoretical training provided at technical colleges.

Admission requirements for engineering studies programmes offered at technical colleges are:



- Standard seven (now grade 9) pass with Mathematics and Science (Department of Education, 1997:19)
- Not of compulsory school going age (South Africa (Republic), Act 104 of 1981:3)

As alluded to earlier, many changes were implemented in the education sector after the 1994 elections. Technical colleges were identified as institutions differing from schools with a very specific target population. The deputy director of FET said in an interview (Colleges Collaboration Fund, 2001:13) that:

- in order to raise the standard of the college sector, colleges have to be separated from schools and need to be treated and governed differently.
- older learners must be accommodated at technical colleges, which provide education in a more adult environment.

It is clear that the FET band would include a wide range of learners. These learners would include school-going youth, out of school youth, young adults and the larger adult population. It would therefore be fair to assume, based on what the deputy FET director said, that the technical college target population would be out of school youth, young adults and the larger adult population. FET colleges could then offer a second chance to out of school youth and young adults. The FET college sector would thus offer vocational education as an option to out of school youth and unemployed young adults.

The following statistics were published regarding the student population at technical colleges during 1998 (Powell & Hall, 2000:20-42):

- 302 550 learners were enrolled for technical college studies.
- 29% of these learners were enrolled at technical colleges in Gauteng.
- 96% of the learners belong to the age cohort 15 – 35 years of age.
- 73% of the learners are youth aged between 15 and 24 years.
- The two most popular programmes enrolled for by students at technical colleges in South Africa are business studies (49,6%) and engineering sciences (36,7%) of total enrolments.
- Learners enrolled in the FET band (N1 – N3) were predominantly engineering studies (54,4%) and business studies (30,0%).
- Learners enrolled for in the HE band (N4 – N6) were predominantly business studies (71,9%) and engineering studies (16,5%).
- Of all learners enrolled at technical colleges the percentages were as follows: 71% Black, 18% White, 9% Coloured, 1,5% Indian and other 0,5%.
- Of all learners enrolled at technical colleges, 56% were male and 44% were female.
- Of all learners enrolled at technical colleges for Engineering studies, 87% were male and 13% were female.

The Department of Education published the following statistics, reflecting relevant figures during 1999, (Department of Education, 2001:13).

- Of the 13 759 731 learners in all the sectors of education 2% were enrolled at technical colleges.
- 271 900 learners were enrolled at 153 technical colleges.

## 2.4 Programmes and qualifications offered at technical colleges for engineering studies

### 2.4.1 Programmes offered at technical colleges for engineering studies

According to Powell & Hall (2000:24), the following are the main programmes offered at technical colleges:



- Art / Music
- Business Studies
- Engineering Sciences
- Educare / Social services
- General Studies
- Utility Industries

Since this study focuses on Mathematics offered at engineering studies colleges, no further mention will be made regarding the other above-mentioned programmes.

Engineering studies programmes are offered from an introductory level and then progress from N1 through to N6. The introductory course is on level 1 of the NQF. The programmes offered on N1 through to N3 is part of the FET band on

the NQF and therefore coincides with bands 2 to 4 on the NQF. Grades 10 to 12 of the secondary school system also falls into NQF levels 2 to 4. Programmes offered at technical colleges from N4 to N6, are regarded as post school education and forms part of the higher education band of the NQF. Currently a big debate is raging on the phasing out of these programmes offered at technical colleges. The level on the NQF should be level 5 (Naptosa, 2002:16).

The programmes offered at technical colleges for engineering studies are largely divided as follows:

- Civil / Construction engineering
- Electrical engineering
- Mechanical engineering

Mathematics is a compulsory subject for all programmes offered from introductory to N3. Mathematics N4 is a compulsory subject for the Government Certificate of Competency for Engineers. The Government Certificate of Competency for Engineers will be referred to in the section discussing the qualifications that can be obtained at technical colleges.

### 2.4.2 Qualifications obtained at technical colleges for engineering studies

National Technical Certificates are issued upon the successful completion of each level, introductory to N6, at technical colleges. Learners successfully completing N3 with four technical subjects can also apply for a senior certificate provided that they also comply with the two compulsory languages. (Department of Education, 2000:15-17).

A National N Diploma, with twelve subjects, is also issued to learners upon the successful completion of a National Technical Certificate N6 and two years compulsory and appropriate practical experience (Department of Education, 1997:325). A second National N Diploma is also issued to learners after successfully passing another 6 subjects on levels N4 to N6.

To qualify as an artisan a learner needs to pass the relevant trade theory on N2. An employer usually employs these learners by means of an apprenticeship contract managed by the relevant training board. After the apprentice completes a compulsory and relevant two-year practical training period, he may write a trade test. Upon the successful completion of a formal trade test the apprentice is then certified as a qualified artisan (South Africa (Republic), Act 56 of 1991).

A Government Certificate of Competency for Engineers can also be obtained after the successful completion of a National N Diploma. The certificate of competency is issued to Mechanical or Electrical Engineers.



Mechanical and Electrical engineers can obtain the Certificate of Competency (Factories) issued by the Department of Labour (Department of Labour, 2002:1). Mechanical and Electrical engineers can also obtain the Certificate of Competency (Mines and Works) issued by the Department of Minerals and Energy (Department of Minerals and Energy, 2002:1). To qualify for these Certificates of Competency candidates must pass the relevant prescribed subjects with a minimum of 50% for each subject.

When a candidate follows the technical college route the following will apply (Department of Labour, 2002:2-3), (Department of Minerals and Energy, 2002:3):

- The Commission of Examiners must first accept an intended candidate as a candidate to write the exams.
- A National N Diploma (Mechanical or Electrical) obtained at a technical college.
- All subjects to be passed with at least 50%.
- A minimum age of 23 years.
- A served apprenticeship in an appropriate trade.
- Experience gained in the maintenance of mechanical or electrical machinery.
- Post apprenticeship experience of between 2 to 4 years

A candidate has to pass the following two subjects before a Certificate of Competency is issued:

- Plant Engineering applicable to factories or mines and works.
- Legal knowledge: Mining or Occupational Health and Safety.



### 2.4.3 Careers learners are prepared for at technical colleges for engineering studies

Learners studying engineering at technical colleges are prepared for various careers. These careers are not limited to the following: Engineering technicians, automotive engineers, Electro-mechanical engineers, Industrial and Maintenance engineers. Apprentices employed by means of an apprenticeship contracts to qualify as Artisans also do their theoretical education at technical colleges. Qualified Artisans include, Motor mechanics, Fitters, Fitters and turners, Plumbers, Electricians, Instrument Technicians and Radio and Television technicians.

With the introduction of the Skills Development Act, Act 97 of 1998 apprenticeships were replaced by learnerships. The regulations giving effect to

the Skills Development Act define a learnership as: "Consisting of a structured learning component and practical work experience of a specified nature and duration, and culminating in a qualification registered with SAQA." (Department of Labour, Regulation No. R. 69 of 1999). Technical colleges have only recently embarked on offering learnership programmes. The Skills Development Act also introduced skills programs. A skills program is defined as: "A programme that is occupationally based; that utilises training providers and when completed, will constitute a credit towards a qualification registered in terms of the NQF." (ibid.). Technical colleges are also embarking on offering skills programs to commerce and industry, which must address needs in the labour market.

### 2.4.4 Progression of learners at technical colleges for engineering studies to institutions of higher education

Prior to the restructuring to take place at institutions of higher education, the progression to these institutions of higher education were not the same. All institutions had different admission requirements due to their autonomy.

To enrol at a Technicon a completed National N3 certificate with four technical subjects, provided that the learners comply with the compulsory language requirements, is needed. Learners who have completed a National N6 certificate qualify for subject exemptions at Technicon when enrolling for a National Diploma: Engineering: Electrical. The learner must have achieved a 50% pass mark for all subjects to be considered for exemption. If a learner passed Mathematics N4, N5 and N6 at a technical college, the learner will be exempted from Mathematics I and II at technicon level. A completed National N6 certificate will give the learner a maximum of 8 subject exemptions, depending on the subjects reflected on the National N6 certificate. (Wits Technicon, 2002:1)

Universities prefer a completed N5 certificate before enrolling for pre-graduate studies, provided that the learners comply with the compulsory languages. A completed National N Diploma is acceptable to allow learners to enrol for a Higher Diploma in Education for technical subjects, provided that the learners comply with the compulsory languages.

### 2.4.5 Current teaching methods applied at technical colleges for engineering studies

As referred to in Chapter 1, one of the issues of concern at technical colleges is the training periods of 10 – 11 weeks only. During the training period a complete syllabus must be covered, learners must be evaluated, obtain a trimester mark and be prepared to write a National exam. At the culmination of this period the learner writes a National exam.

From the above it is quite clear that lecturers at technical colleges are under immense pressure to get everything in place in order for the learner to be able to write National exams. The above presupposes that teaching strategies will be primarily expository of nature. Direct instruction that is teacher-centred and aimed at preparing the learner for the exam is prevalent throughout technical colleges for engineering studies. It must also be taken into consideration that the majority of these lecturers were trained during the pre-1994 elections era. Lecturers may be appointed on post level 1 without a teacher's diploma when teaching technical subjects at a technical college for engineering studies. Lecturers are thus appointed to include lecturers with much practical experience from industry.

According to Clark & Starr (1996:172) the direct teacher-centred methods are used when teaching highly structured basic subject matter. Teaching methods

currently applied at technical colleges for engineering studies are therefore mainly:

### 2.4.5.1 Lecture method

In a formal lecture the teacher presents the information to learners by what amounts to a speech. The lecture is one-way communication from the teacher to the learner. According to Clark & Starr (1996:176) lectures have been used with success in the past. Lectures as a method of teaching will continue to be used in the future since it is valuable when:

- introducing activities
- the teacher summarises content
- explaining difficult points
- proposing theories



### 2.4.5.2 Textbook method

Considerable negative critique has been levelled against this method specifically when teachers only use the textbook to read from during presentations. Due to the above, the value of the use of a textbook is often underestimated. Fraser et al. (1990:143). Textbooks for Mathematics usually contain many exercises, which serve as assignments (ibid.).

### 2.4.5.3 Review-Teach-Practise

This is one of the most familiar forms of mathematics lessons, but may also be one of the least effective (Reys et al. 2001:37). The most common form is where teachers review problems, which were worked on during a previous lesson. They then move on to introducing a new topic followed by demonstrating by means of

worked examples. Teachers then assign exercises similar to what was just demonstrated. The learners then practise on their own while the teachers assist individual learners (ibid.).

#### 2.4.5.4 Explanations

Glatthorn (1993:207) says that explaining is a process of telling. Teachers explain concepts, processes, causes of events and other aspects of subjects. He continues by saying that in actual fact, explanations make up most of teacher talk.

#### 2.4.5.5 Demonstrations

According to Fraser et al. (1990:145) the aim of demonstrations is to allow learners to master skills, capabilities and knowledge through observation. Since equipment to teach subjects which are very technical in nature is very expensive, many lecturers revert to demonstrations as a method of teaching.

#### 2.4.5.6 Questions and answers

Fraser et al. (1990:142) say that the teacher plays a dominant role when this method is used. When using this method the teacher sets the question in such a manner that the learner's learning is directed to the specific objectives of the lesson.

### 2.5 Summary

Technical colleges have undergone many changes over the past years. These institutions developed from colleges offering exclusive theoretical education to artisans, to institutions offering theoretical education to learners of not

compulsory school-going age. These developments took place prior to the 1994 elections when technical colleges were still largely divided along racial lines.

After the 1994 elections, all technical colleges (state and state-aided) were united under one act, Act 98 of 1998, the Further Education and Training Act. This act gave the national minister of Education the power to merge public FET institutions. During 2001 the process was initiated whereby the 153 technical colleges were to be merged into 50 public FET colleges.

Learners at the previous technical colleges were primarily of the age group 18 to 35. These learners were not of compulsory school-going age. It is however clear from the above that the new FET colleges are to provide education and training to learners in a more adult environment.

Qualifications offered at technical colleges for engineering studies consist of National Technical Certificates and National N Diplomas. Learnerships and skills programmes are new options to obtain qualifications at technical colleges.

Technical colleges offer a wide variety of programmes on the NQF levels 1 to 4. Currently the debate still centralises around the possible phasing out of programmes offered at technical colleges on levels N4 to N6, NQF level 5.

Progression through to institutions of higher education varies from institution to institution. Co-operation agreements between these institutions and technical colleges made provision for progression to these institutions.

Current teaching methods used are mostly direct instructional of nature and include amongst others:

- The lecturing method
- The textbook method
- The demonstration method
- The explanation method
- The review-teach-practise method
- The question and answer method

## CHAPTER THREE

## TEACHING STRATEGIES

### 3.1 Introduction

In chapter 2, the changes that took place in the technical college sector are discussed. The student profile at these institutions is alluded to as well. The various programmes offered at technical colleges are discussed but more specifically programmes offered in the engineering field of study. Qualifications, that can be obtained through studies at technical colleges are mentioned. The progression of technical college students to institutions of higher education is also stated. Current teaching methods applied by lecturers at technical colleges for engineering studies are looked at.

Chapter 3 will describe what a teaching strategy is and which various strategies can be used. A constructivist approach will be briefly discussed as well as how a constructivist approach leads to OBE.

Aspects of OBE and why it is important to continue with an OBE approach will be dealt with. Since assessment is a very important aspect of an OBE approach, different forms of assessment will be discussed very briefly.

### 3.2 Teaching strategies

Mahaye (2000:210) defines a teaching strategy as: "a broad plan of action for teaching and learning activities with a view to achieve one or more specific outcomes." According to Mahaye and supported by Fraser et al. (1990:137), two of the most well known teaching strategies are the inductive and deductive

strategies. Van der Horst & McDonald (1997:125-126) define the deductive and inductive strategies as approaches used to achieve outcomes as follows:

- Deductive strategy

The teacher gives a general rule and continues by applying it to specific cases. The learner participation is therefore limited to applying the general rule to various examples. The deductive strategy is used extensively in Mathematics. According to Cangelosi (1996:157) deductive reasoning is a cognitive process. People determine with the aid of this process whether what they know about a concept is applicable to some unique situation.

- Inductive strategy

The strategy is used in lessons where the learners need to discover for themselves. In the deductive strategy individual examples are used to reveal the general underlying principles.



Mahaye (2000:210) elaborates by saying that in a teaching strategy there are teaching methods. Teaching methods are therefore applied to successfully carry out a teaching strategy. Kramer (1999:91) defines a teaching strategy as the approach that educators will take to manage learning activities. Fraser et al. (1990:137) define a teaching strategy as a broad plan of action for teaching activities with the aim of achieving a specific objective.

Clark & Starr (1996:7) define a teaching method as the means a teacher uses to bring about the desired learning. Methods are made up of strategies, tactics and techniques. A strategy is a plan of attack (ibid.). Various teaching methods can be used to present a unit. Teachers should be flexible in their approach in order to apply different teaching methods. The latter is supported by Clark (1995:5),

when he says that there are many forms instruction can take. He continues by saying that the experienced teacher has a whole repertoire of different forms of instruction. These teachers can then in any given teaching situation mix and match these different forms of instruction, to answer to the needs and demands of the situation.

Mahaye further distinguishes between two main teaching methods. The first method is the participatory method where the learner plays a central role in the teaching-learning activities. Participatory methods lead to productive interaction between the teacher, learners and amongst learners (Mahaye, 2000:211). The second method is the expository method. Expository methods are methods where the teacher plays a central role in the teaching-learning activities (Mahaye, 2000:236).

Expository methods in essence are teacher-centred. The teacher is responsible for all the learning activities. Communication is from the teacher to the learner and therefore is one directional. According to Hewit & Whittier (1997:281), with the expository approach the focus is on the teacher and the success of this approach depends on the teacher's ability to communicate information to the students. The expository approach is an excellent strategy when the teacher has to explain facts, rules and procedures (Hewit & Whittier, 1997:283)

Frazee & Rudnitski (1995:203) say that instructional strategies form a continuum from direct instruction (teacher-centred) to indirect instruction (learner-centred). Kramer (1999:91) further elaborates by saying that when choosing a teaching approach there are three elements teachers need to take cognisance of. Each strategic choice lies along one of three continuums. Refer to figure 3.1. The first continuum describes the educator versus learner-centred approaches. The second continuum lies between independent and group strategies. The third continuum lies between reception and discovery learning.

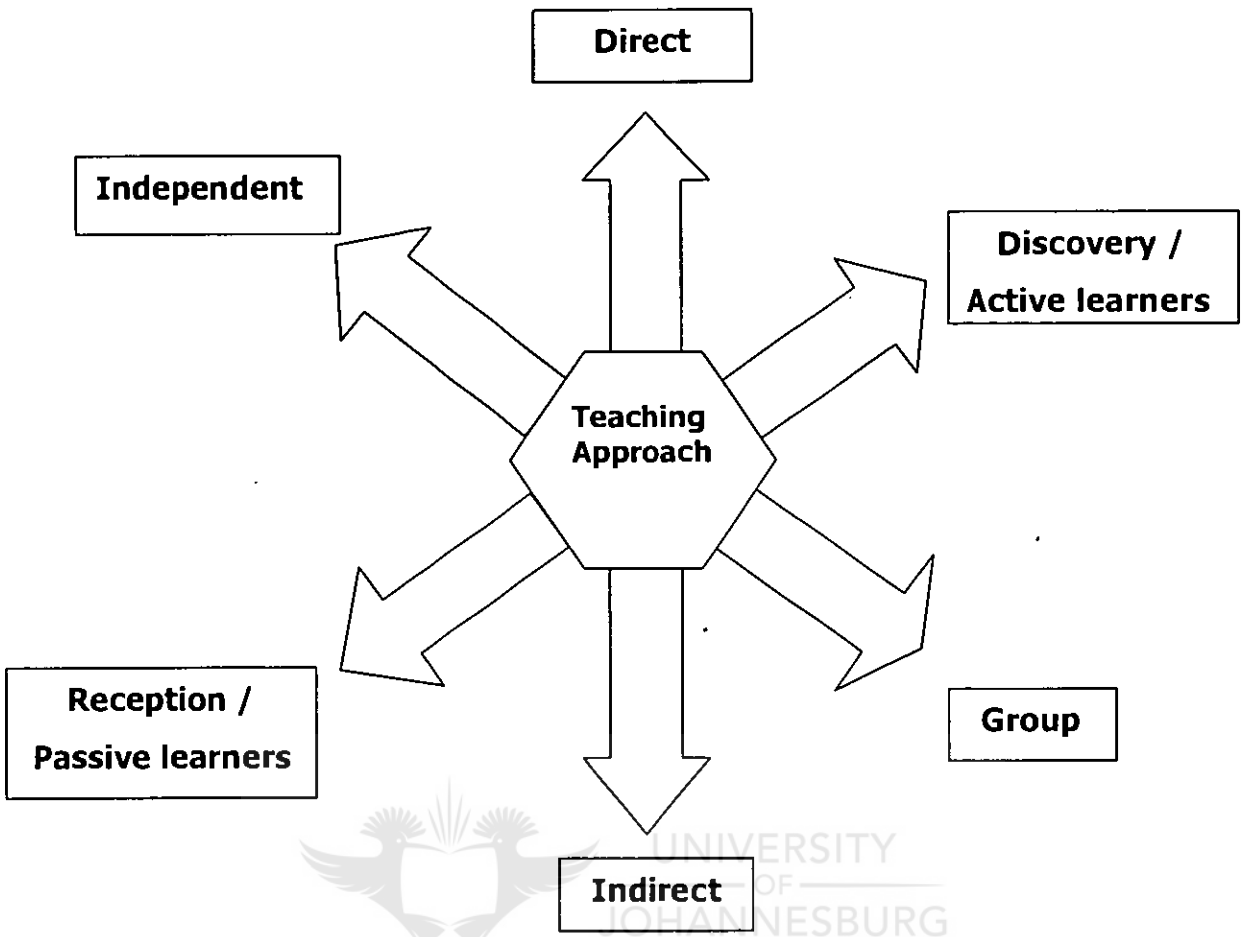




Figure 3.1: Methods of teaching and learning (Adapted from Kramer 1999:92).

Kramer (1999:92-100) continues then by saying that the teacher basically has, based on the above continuums, three strategic choices to make.

### 3.2.1 Choice 1: Direct versus indirect instruction

#### 3.2.1.1 Direct instruction

Direct instruction is seen as educator-based. The educators do not only have all the knowledge, but they also decide what and how it is going to be learnt. According to Reys et al. (2001:36) the teacher plays the central role with direct

instruction and the lesson has a tighter focus. The teaching methods are seen as expository actions or transmission only from the educator to the learner. The teaching methods only encompass one-way communication. Peters & Armstrong (1998:78) defines direct instruction as teaching by transmission and learning by reception. Communication is one-directional from the teacher to the learner and the teacher is the sole source of information. Direct instruction only allows the learners to be passive recipients of knowledge. The educator absolutely controls the teaching and learning process as well as the whole class atmosphere. Direct instruction is a deductive process whereby concepts are presented followed by the illustration thereof by well-selected examples.

Killen (2000:2) says that there are several approaches to teaching, which are methods of direct instruction. Mostly the term refers to instruction of a whole class, which is explicitly expository of nature. The approach is highly teacher-centred whereby an educator delivers academic content. The academic content is delivered in a structured format whilst simultaneously directing the activities of the learners with a focus on academic achievement. The educator has maximum control over what, when and how learners learn.

Frazee & Rudnitski (1995:205) say that whole class instruction is usually direct instruction and the teacher is the provider of information. Reys et al. (2001:36) say that with direct instruction lessons the teacher plays a central role in directing the lessons.

Killen (2000:2) says that sometimes it is better for teachers to explain and demonstrate concepts directly rather than leaving learners by themselves to discover. As highlighted by Killen and supported by other writers, learners cannot construct scientific evidence which took humanity ages to develop. Constructivist approaches are herewith not excluded but under certain circumstances learners need careful guidance. Ideas sometimes need to be laid

out in order for learners to see the inter-relationship between it, before they can reflect critically on it. Killen distinguishes between the two most commonly used methods of direct instruction namely lectures and demonstrations.

Kramer (1999:93) says that direct instruction is a vital component of teaching and learning but should be part of a holistic approach rather than the only approach. Reys et al. (2001:36-44) see the following as methods of direct instruction:

- Review-teach-practise
- Textbook-based lessons
- Drill and practise

Frazee & Rudnitski (1995:207) say that the two most common direct teaching strategies are:



- Lecture and
- Modelling (Demonstration) and add to these two strategies
- Textbooks – to support instruction
- Seatwork – to be used in moderation to provide practise and to indicate the level of understanding

Frazer et al. (1990:139-144) and Malan & du Toit (1991: 81-83) identify the following methods of direct instruction.

| | |
|---|---|
| The narrative method<br>• Group discussions<br>• Stories<br>• Panel discussions<br>• Guest speakers<br>• Teaching by pears<br>• Oral reports | One person makes information available to another through speech |
| The question and answer method | Teacher sets questions to direct the learning of learners |
| The textbook method | The textbook is used by the teacher to ensure effective learning |
| The demonstration method | The teacher demonstrates and learners observe |
| The drill method | When rote learning of facts is required. What is to be learnt is repeated |



Table 3.1: Methods of direct instruction

Cangelosi (1996:283-284) says that when asking questions two types of questions can be asked.

- Memory-level questions

These questions can be answered by remembering a previous response. Mahaye (2000:224) refers to these types of questions as reproductive questions.

- Reasoning-level questions

These questions are answered by making use of reasoning and making judgements. Mahaye (2000:224) refers to these types of questions as productive questions.

According to Kramer the following direct instruction strategies are most commonly used.

| STRATEGY | METHOD |
|---|---|
| Lectures | Educator presents talk with visual aids |
| Dictation | Educator reads or speaks. Learners write exactly what is said. |
| Presentation | Educator leads discussion with oral presentation, raising issues. |
| Drill & practice | Educator presents examples. Learners then do problem-solving exercises. |
| Guided worksheets | Educator guides, class works through worksheets step by step |
| Video, film, tape or radio presentations | Class view presentation, taking notes. |
| Didactic questioning | Educator leads learners using questions, moving from lower to higher order questions. (This is also called Scaffolding). |
| Demonstrations | Educator shows or illustrates skill or principles |
| Guided writing, reading or listening | Educator uses structured format to lead learners towards specific learning outcomes |
| Team teaching | Educators work together, to illustrate debates, different perspectives or approaches to learners. |
| Visitor presentations | Presentations by visitors from World-of-Work, community, parents, ex-learners from the school, etc. |

Table 3.2: Methods of direct instruction (Kramer, 1999:93).

Glatthorn et al. (1993:207-217) discusses the following methods of direct instruction.

| | |
|---|---|
| Explaining | Explaining is a process of telling. Telling who, what, when, where and how. |
| Modelling | Serving in the sense of an example |
| Demonstrating | To show a person how to do something by performing what is to be learnt |

Table 3.2: Methods of direct instruction

### 3.2.1.2 Indirect instruction

With indirect instruction the focus moves away from the educator to the learner. Reys et al. (2001:35) say that investigative lessons revolve around ideas that the learners generate through their investigation of the task at hand. Indirect instruction is learner-centred with a very high degree of involvement of the learner. Mahaye (2000:211) views the above as participatory methods. Mahaye continues by saying that participatory methods are those methods where the learners play a central role in the teaching and learning activities.

The learner has to accept responsibility for how learning is going to take place and for obtaining knowledge and not simply receiving knowledge from the educator. Learners create their own understanding of concepts. The learners analysing the data gathered through their learning activities, create the understanding. Indirect instruction places the responsibility on the learner to gain information not only from the educator, but also from any other possible source. Questions asked by the educator ensure that learners are pointed in the right direction. The learners must also through their own enquiries, seek to understand.

Clark & Starr (1996:200) say that indirect methods of teaching are most effective when teaching loosely structured subject matter and when trying to develop

higher level cognitive learning. Indirect instruction therefore allows for different learners with different learning styles to understand through their own efforts and at their own pace. Some educators may feel uncomfortable with the approach since it does not allow for them to have full control over all activities in the classroom. Indirect instruction also takes a lot of planning and preparation on the part of the educator. Indirect instruction is not very successful when complex concepts have to be learnt which need a step-by-step approach to facilitate understanding (Kramer, 1999:94). Indirect teaching strategies are numerous and include the following:

| STRATEGY | METHOD |
|---|---|
| Oral presentations | Learners prepare a fixed time presentation for class |
| Concept maps | Learners create topic based mind maps |
| Case studies | Learners study a given real or fictitious situation in order to understand concepts, facts & principles |
| Delivering lessons | Learners act as educators in planning & delivering a lesson |
| Theme posters & collages | Learners create an educational poster or collage to illustrate issues relating to the topic |
| Role plays & simulations | Learners prepare and simulate situations & characters. |
| Design and make activities | Learners plan and construct products or performances. |
| Group projects | Groups of learners collaborate on various projects |
| Research articles | Learners use different research techniques to complete essays or original research presentations |
| Field trips & and site visits | Visits to authentic sites are used as a basis for learning topics / themes from the curriculum |
| Investigations & Experiments | Learners undertake discipline based procedures to learn principles and concepts (e.g. for science or other areas) |
| Debates | Learners research and build logical arguments to support a particular perspective in a debate. |
| Interviews | Learners have the task of gathering data from other people and specialists on various topics |
| Surveys or draw | Learners gather data about topics in order to make predictions and draw conclusions |

Table 3.3: Methods of indirect instruction (Kramer 1999:95).

Mahaye (2000:211-235) records the following teaching methods as participatory methods:

- Discussion – The teacher uses this method as a co-operative method where the discourse between to or more people has a definite purpose in mind.
- Question and answer method – Through the use of questions the teacher leads the learner to the discovery of knowledge. This method is very demanding on the teacher and the learner.
- Projects – Learners are required to participate in projects. Teachers can design projects or the project can originate from amongst the learners.
- Role-play – This method is the acting out of make-belief situations.
- Problem solving – According to Mahaye (2000:235) it is also known as the heuristic method. Learners learn through self-activity and engage in problem solving. Teachers must however guide learners to problems, which are part of the learning outcomes. Forsten (1992:40) says that the following are strategies that can be used to help students find solutions when engaging in problem solving:

    - Locate keywords to operations
    - Guess and check
    - Make a table or an organised list
    - Draw a picture or use real objects
    - Work backwards or make it simpler
    - Find a pattern
    - Use logic

- Experiments – The method allows learners to experience reality and learn things themselves.

Curzon (1990:287-295) identifies learner-centred strategies as the following:

- Discussion in a group, which can be a structured discussion or take the form of a seminar where a thesis is lectured and then followed by a semi-structured discussion.
- Tutorial – Takes place between a teacher and a student where face to face teaching takes place.
- Case study group – The group analyses a simulated problem in order to allow for general principles that might emerge.

### 3.2.2 Choice 2: Independent versus co-operative strategies

#### 3.2.2.1 Independent strategies

The choice to be made is whether learners will work as individuals or in groups. A common misconception in the classroom is that individual work is always either better or worse than group work. Both approaches play a pivotal role and the approach will be determined by what the purpose of the learning is. (Kramer 1999:96).

With independent learning the role of the educator is similar to the mediator. The mediator (teacher) guides, assists, challenges and supports learners to master new knowledge (ibid.). According to Kramer the advantages of independent learning are:

- It allows for differences in learning styles.
- It allows for differences in pace of learning.
- The same time limit does not have to be set for the whole class.
- Allow individual learners to work at home or outside the boundaries of the class.

- Suits tasks to be completed by learners such as interviews with other people or tasks associated with assessment.

Kramer (1999:96-97) identifies the following techniques as independent learning techniques.

| STRATEGY | METHOD |
|---|---|
| Homework | Work outside of regular class or school time. |
| Research projects | Information on a topic is collected, collated and presented independently for analysis in class. |
| Report projects | Project done completely outside of class. Includes purpose, definition of terms, data, analysis, and references. |
| Interview tasks | Learners identify and conduct interviews with role models and present results in class. |
| Assigned questions | Educator prepares questions that learner works through. Used to recall prior learning or to reinforce new learning. |
| Equipment assisted learning | Learners use computers, scientific or other equipment for learning. Ensures individual practice of skills. |
| One-on-one debates | Learners prepare own notes before discussing with a partner. |
| Learning centres | Special space created in the classroom for learners to find and use resources for special tasks. |
| Writing assignments | Essays, paragraphs or sentences done individually |
| Self assessment | Learners assess themselves and their own work using various techniques, guided by educator. |
| Worksheets | Learners work through worksheets, at their own pace. |
| Crossword puzzles | Educators prepare crossword puzzles for learners to complete by researching answers from books or notes. |

Table 3.4: Independent learning strategies (Kramer, 1999:97).

Cangelosi (1996:301-303) sees homework as an opportunity for learners to work alone, at their own pace. Homework provides a learning opportunity, which is complementary to classroom activities as:

- Preparation for classroom activities

Instead learners only working from textbooks or on data provided by the teacher, learners should occasionally be given the opportunity to collect data or information, which will be used for classroom activities.

- The extension of classroom activities

Homework can relieve pressure from trying to squeeze all activities into class periods.

- Follow-up for classroom activities

Homework is assigned as a formative test of the objective of the day. The results of the homework are used to reinforce what was learnt and to identify areas for remedial work.



### 3.2.2.2 Cooperative strategies

Sanders & Meloth state that: "One highly regarded instructional strategy that has proven to meet the needs of a great many and diverse student populations is cooperative learning". According to Artzt & Newman (1990:448) cooperative learning is a teaching strategy that holds the promise by which the mathematical skills and attitudes of learners can be improved.

Buys (1998:133) makes a clear distinction between co-operative learning and group work. Buys also stipulates that co-operative learning is a group work strategy. Therefore co-operative learning is not equal to group work. Group work is the overarching concept. Group work allows for learners to work together in a group in order to achieve the stipulated learning outcome (Kramer

1999:97). Andrews and Hatch (1999:210) say that the research results of the statistical study with general acceptability attached to it indicate that group work is an essential part of the mathematics teachers' repertoire.

According to Gawe (2000:190) co-operative learning is a way of teaching that ensures that learners work together in groups. All the members of the group must see to it that all other group members have learnt the same content (ibid.). Gawe continues by saying that through learning co-operatively, learners are responsible for their own learning and to help their fellow learners in the group to learn and practise skills. Slavin (1985:179) says through making use of cooperative learning, students who understand the lesson can assist students who have problems to keep up with the pace of the class.

Artzt & Newman (1990:448) are of the opinion that cooperative learning is an approach where learners work together in small groups as a team to solve problems, complete tasks or to accomplish a common goal. They continue by saying that the group must share the success and failure of the group. To achieve the common goal learners must talk to and assist one another (ibid.). "Pupils thus provide assistance and support to each other" (Reynolds & Muijs, 1999: 282). A strong emphasis must be placed on interdependence and co-operation. Individual learning is however still stressed (Gawe, 2000:190). Sutton (1992:66) states that: "Individual accountability is maintained through testing. The group members encourage one another and help each other prepare for tests, but each student takes his on test with no assistance".

Cangelosi (1996:291-293) says that co-operative learning activities in which learners learn from one another have proved successful. Cangelosi continues by saying for learners to engage in co-operative learning activities small task groups are particularly well suited for students to teach one another. He also states that

a variety of intra class task group patterns are often used to facilitate co-operative learning. These include the following:

- Peer instruction groups

In peer instruction groups, one student or a group of students teach each other by presenting a brief lesson, tutoring or providing help with certain tasks. Learners who help or assist others are usually more advanced in achieving an objective than those who are being helped or assisted.

- Practise groups

In practise groups, learners work together in small groups to answer memory-level questions or to review information. One learner asks questions whilst the others answer questions and give feedback. The role of the questioner rotates.



- Interest and achievement groups

Small intra class groups are organised according to interests or achievements of learners. Feedback from these groups in then used in larger group sessions.

- Problem solving groups

Small task groups in a class work simultaneously on a variety of problems. Feedback from these groups in then used in larger group sessions.

A group can be as few as two learners or the whole class working together on an assigned project. According to Artzt & Newman (1990:449) experience shows that groups of 3 to 5 work well. Artzt & Newman continue by saying that working in pairs are often advantageous but it leaves the group vulnerable since

interaction is limited and the absence of one member leaves the group dysfunctional. All cooperative groups should however be heterogeneous in ability and characteristics. It should however be remembered that students work well together if they feel happy in their groups (ibid.). Learners learn and practise important skills by working together in groups, e.g. as how to work together with other people in an organised manner.

According to Buys (1998:116) there is no definite relation between the interaction taking place between learners in a group and the size of the group. Kramer (1999:98) says that the general rule of thumb for group sizes is between 4-6 depending on the task at hand. Kramer also warns against groups being too large since the shyer learner might be excluded.

Gawe (2000:201-201) says that the following are the most commonly used co-operative learning methods:



- Student teams achievement division (STAD)

Four or five members in a group, work on a worksheet after the presentation of a lesson by the teacher. Groups are heterogeneous. Scores are given to teams based on e.g. individual quizzes about the lesson presented by the teacher.

- Team game tournament (TGT)

This method is similar to STAD but instead of quizzes, learners play academic games to show that they have mastered the learning material.

- Jigsaw 1

Learners are assigned to six-member groups. Each group is given unique information about a topic. The learners read and discuss the information in the "expert" groups. Learners in the "expert" groups then return to their groups to teach their group mates. Quizzes are then given to each learner.

- Jigsaw 2

This method is similar to Jigsaw 1. Quizzes are given to each learner. The scores are then rearranged into group scores.

- Learning together

Learners work together in small groups to complete a single worksheet. The group then receive recognition for the work done.

Many group-learning techniques are available. Kramer (1999:98) provides the following examples.



| STRATEGY | METHOD |
|---|---|
| Group assignments | Learners complete projects in groups, with different tasks given to each member. Each person contributes towards the final product, e.g. Producing a class magazine. |
| Simulations & role playing | Each group member assumes the role of a character and plays that role in addressing an issue, e.g. Deciding on anti-smoking law. (Roles: doctor, smoker, tobacco merchant, politician, cigarette factory worker, etc....) |
| Brainstorming | Learners generate different ideas to solve problems or for discussion on a topic. |
| Jigsaw | Each learner belongs to a "home" team and an "expert" team. The "home" teams are briefed on a topic and decide on important questions. Learners then join their "expert" team. Each "expert" discusses a sub-topic in depth and the members take notes. The sub-topic is an issue, idea, question or theme related to the main topic. Each learner then returns to his or her "home" team. Each member then |

| | |
|---|---|
| | shares with the whole group what s/he has discussed in his or her "expert" teams.<br>The "home" group them completes work on the main topic. |
| Peer teaching | Members of "expert" groups learn and become competent in a new skill or knowledge. They then return and teach this to their "home" group members. |
| Team presentations | Group members prepare individual contributions to a joint presentation on a topic. Members work independently, in class or at home, before convening to work together. |
| Fishbowls | One group sits in a circle facing each other to discuss one issue related to a topic. The rest of the class sits in an outer circle, taking notes and watching. Different groups discuss different issues in turn. Members then return to a "home" group to write up their report. |
| Round Table (Written) or Round Robin (oral) | Groups use a single pen and piece of paper to answer a question. Each member writes down one line before passing the paper and pen to the next member, who writes the next line and passes it on. Learners may pass without writing. |
| Buddy System | Learners are assigned a partner to discuss issues with. Partners discuss questions or check each other's work or share ideas. The buddies need not work on the same questions. |
| Peer Assessment | Learners are divided into groups or pairs to assess each other's work prior to handing in to the educator. |
| Train questions | Groups sit in lines, one member behind the other. The educator or other groups pose questions. The first member answers or passes it on to the next person. If the question reaches the end of the line without being answered, the team loses a point. |
| Telstar techniques | Each group elects a spokesman to address the issue. All spokespersons sit in an inner circle to debate. Members of the groups may pass notes, suggestions or ideas on to the spokesperson from outside of the circle. |

Table 3.5: Group learning strategies (Kramer, 1999:99).

### 3.2.3 Choice 3: Rote versus discovery learning

### 3.2.3.1 Rote learning

What is to be learnt by the learners is given by means of direct instruction. This is followed by rote learning on the part of the learner.

- Teachers teach (transmit) and learners learn (receive).

### 3.2.3.2 Discovery learning

What is going to be leant by the learners, by means of discovery through their own experiences?

- According to Bennett et al. (1996:34) in adult education especially there has been a move away from dissemination. This involves learning by doing, through experimentation and problem solving rather than just listening to an expert.
- Hewit and Whittier (1997:311) say that the underlying principle of discovery learning is the belief that children learn best by doing and not by either sitting or watching.
- Learners can learn by means of the teacher guiding them to the learning topics to be discovered (guided discovery).
- Independent discovery is when learners are left to themselves to discover the topics that were set as learning outcomes in some or other way (Kramer 1999:100-101).

The above-mentioned teaching approach or strategy, learning by means of discovery, links directly with constructivism.

## 3.3 Constructivism

The constructivist view of learning is based on the work of the psychologist Jean Piaget that asserts that children build their own knowledge. According to Huetinck & Munshin (2000:50) constructivism is a cognitive learning theory, which stems from both the social cognitive theory and the information learning theory. Constructivists put the view forward that children do not learn by memorising facts or processes that are isolated from reality. Children must participate in the discovery of their own learning (Troutman & Lichtenberg, 1995:25).

Cognitive theorists depict learning as a process in which learners become actively involved. Learners draw on their personal experiences and interact with others to construct new understanding and new knowledge (Brown, 1998:6). According to von Glasersfeld (1991:xiii) the common belief is that knowledge cannot simply be transferred from the teacher to the student, but it has to be actively built up in the mind of each learner. According to Fensham et al. (1994:5) the fundamental principle of constructivism is that learners construct their own meanings for experiences and from whatever they are told.

Gericke & Smit (1999:7) state that: "Constructivist learning occurs where learners reflect critically (on issues and their own assumptions), change their views and paradigms as a result of such reflection, and imaginatively inquire into issues with the aim of demonstrating their solutions to problems. Von Glasersfeld (1991:xiv) puts it as follows: "The notion that knowledge is the result of a learner's activity rather than the reception of information or instruction, goes back to Socrates and is today embraced by all who call themselves "constructivists"".

Constructivism is a theory about how people learn. People construct knowledge through interpretive interactions and experiences in their social environment (ibid.). Constructivism is not a theory about teaching. It is a theory about knowledge and learning (Brooks & Brooks, 1993:vii). According to Jaworski (1994:14) constructivism is a philosophical perspective on knowledge and learning. Jaworski continues by saying that constructivism is internationally recognised as having much to offer to mathematics education.

Reys et al. (2001:11) say that constructivism for Mathematics rests on three basic principles:

- Knowledge is not passively received by students, it is actively created or invented by students
- Students create new Mathematical knowledge by reflecting on their mental and physical actions
- Students do not only create knowledge on their own but also by discussing it with others as well as teachers and by describing their relationships, explaining the procedures they have used and defending processes they have followed.

According to Henson (1996:13) constructivism maintains that individuals understand new information by connecting it to previously acquired understanding. Henson (1996:14-15) continues by saying that constructivism is a set of:

- Philosophical beliefs
    - Schools should promote creativity
    - Schools should improve the learners' present and future life
    - Schools should produce better thinkers

- The depth of understanding is important

- Psychological beliefs

  - Learning is not only about the acquiring of knowledge but of creating new understanding
  - New insights are produced because newly acquired information is used to shape existing understanding
  - Knowledge is viewed as temporary since learning creates new insights and new understanding

According to Brooks & Brooks (1993:4-5) teachers should invite learners to participate, ask their own questions and look for their own answers and challenge them to understand the complexities of the world. Schools must be structured in such a way that it honours and facilitate the construction of knowledge. Schools can therefore become institutions where teachers can invite learners to search for understanding. According to Troutman & Lichtenberg, (1995:25) constructivism makes it possible to a organise learning dynamically in the classroom. They continue by saying that if one subscribes to a constructivist view of learning, one will also subscribe to:

- Interdisciplinary learning

Interdisciplinary learning means that learning must take place in realistic settings and curriculum must be concerned with developing activities to integrate subject areas

- Cooperative learning strategies

Learners work together in groups to allow them to refine each other's ideas. According to Peters & Armstrong (1998:76): "The group learning experience is more than the sum of the individual experiences because of the interactive nature of the knowledge construction process".

One will consider the following when deciding on learning activities since the learners must integrate their newly constructed knowledge into existing schemata:

- learners' cultural and social backgrounds and
- their level of development.

In Constructivism the focus of teaching must be on the empowerment of the learner. The teacher must involve the learners in discovering knowledge. Teachers must give learners opportunities to reflect on knowledge and to test theories by means of real life applications. " The constructivist approach to teaching and learning moves learners away from rote memorisation to metacognition and self-evaluation." (Brown, 1998:8)
According to Troutman & Lichtenberg, (1995:26) the following roles need to be acquired by the teacher if a constructivist approach is followed:

- the teacher becomes a guide
- the teacher becomes a companion. Teachers observe, ask questions and give feedback at critical times
- the teacher must ensure that the emphasis of the lesson is on seeing, understanding and doing before learners embark on reading, writing and manipulation of symbols
- learners must work together with peers to allow them to refine ideas

- evaluation must be based on many different assessment strategies
- the teachers must apply a holistic approach
- teachers must allow learners to learn at their own pace

Henson (1996:17) sees the role of the teacher with a constructivist approach as the teacher who:

- invites students to discover information
- invites students to identify additional contents that interest them
- helps students to discover information
- arranges for discontinuity
- encourages students to create learning
- strives to help students to achieve a deeper level of understanding of fewer topics



In accordance with a constructivist point of view, the essential role of vocational education is to: "facilitate construction of knowledge through experiential, contextual and social methods in real-world environments. The end product is self-directed learners who make connections to workplaces and other environments based on personal and social experiences." (Lynch, 1997; as quoted by Brown, 1998:27).

With a constructivist approach the learning environment that can be developed is that of learner-centred teaching (Brown, 1998:27). According to Buys (1998:68) a constructivist approach is learner-centred. It centres on the learner's active involvement and formulation of ideas. The premise of constructivism is that learners construct their knowledge of their world from their perceptions and experiences rather than receiving and reflecting what they are told or what they read (Njisane, 1992:60). Jansen van Rensburg (1994:9) sees constructivism as

the approach that emphasises the active involvement of the learner in the creation of knowledge. Radical constructivism is based on two principles. (Von Glaserfeldt, 1987(a); as quoted by Jaworski, 1994:16). Jaworski understands these two principles as follows:

- We all construct knowledge; we don't simply passively receive it from our environment.
- An individual learns through adaptation. What we therefore know is the accumulation of all our experiences so far.

## 3.4 Outcomes-based education

Clarke (1994:3) says that OBE seems to have its roots in the negative opinions expressed about public schools during the Bush and Reagan years of administration. American people were warned about the rising tide of mediocrity (ibid.). According to Manno (1994:4) the key problem was weak academic achievement.



According to Killen (2001:4) Outcomes-based Education (OBE) has its roots in earlier work on:

- Educational objectives
- Competency-based education
- Mastery learning and
- Criterion-referenced assessment

Killen continues by saying that OBE has synthesized but also extended all of these ideas. "The central point of outcomes-based education is an unambiguous statement of what students are to learn" (ibid.). "OBE can be described as a global educational curriculum reform phenomenon..." (Cross et al., 2002:176).

OBE views itself as a drastic break from current educational practises, which provides for the educational success of all learners. (Capper & Jamison, 1993:427). According to Spady (1994:1) OBE means to: "...clearly focus everything in an educational system around what is essential for all students to be able to do successfully at the end of the learning experience".

Spady (1994:9) says that OBE has two purposes:

- "Ensuring that all students are equipped with the knowledge, competence, and qualities needed to be successful after they exit the educational system".
- "Structuring and operating schools so that those outcomes can be achieved and maximised for all students".

These two purposes are based and three premises (ibid.):

- All students can learn and succeed but not at the same time and in a similar way.
- Successful learners promote even more successful learning.
- Schools control the conditions that directly affect successful learning in the school.

Manno (1994:2) says that OBE is defining learning results that all students will master. Clarke (1994:6) says that OBE when used as an instructional technique refers to teaching towards outcomes rather than objectives. Zitterkopf (1994:76) says that outcomes-based schools produce results which relate primarily to pre-determined curriculum and instruction. According to Bedeker (1999:20) OBE is learner-centred.

Claassen (1998:34) says that OBE is a transformational perspective on the curriculum. Learners therefore accept responsibility for their own beliefs and actions and the teacher becomes a facilitator. Pro-OBE exponents say that OBE is based on what students should understand, be able to do and value as a result of coming to school. According to the Department of Education (1999:11), OBE is based on four important principles. Two of these principles are:

- We need to be very sure of what it is we want learners to learn and whether they have learnt it
- OBE focuses more on what learners do and learn than on what educators do

McGhan (1994:70) says that OBE proponents call for students to demonstrate what they have learnt over variable periods of time. According to Renyi (1993:23) OBE defines the characteristics learners must possess in terms of knowledge and ability. She continues by saying that learners will demonstrate these characteristics and the end of a schooling period and at major moments of transition from childhood to young adulthood.

"Education that is outcomes-based is a learner-centred, results-oriented system founded on the belief that all learners can learn" (Towers, 1996 as quoted by Lorenzen, 2002:1). Killen (2001:7) says that the most important feature of OBE is that all learners are expected to be successful. Spady (1994:8) says that the paradigm of OBE that shapes decision-making is that: "... what and whether students learn successfully is more important than when and how students have learnt".

According to Professor Bengu (Bengu, 1997:1) there is a concern about current teaching and training methods, which are still largely content-based. The curriculum in future would therefore be focussed in terms of learning outcomes. " It will cut across traditional divisions of skills and knowledge, with the emphasis

on what learners should know and can do....." (ibid.). The Department of Education describes an OBE and training system as requiring a shift from a teacher input compelled system to focussing on the outcomes of the learning process (Department of Education, 1997:15). Denver (1995:1) says that content outcomes tell students what they should know and be able to do in specific learning areas.

## 3.5 Concepts of OBE

### 3.5.1 Introduction

In a content-based approach students must learn content by obtaining information from teachers, trainers, textbooks and notes. When evaluated, the students must regurgitate what they have learnt. The evaluator therefore only marks what was taught to and what is reflected by students (Olivier, 1998:21). The converse of a content-based approach is an outcomes-based approach.



An outcomes-based approach focuses on outcomes and the mastering of knowledge and skills in order to achieve the outcome (Ibid). The role of the teacher in OBE is that of a facilitator of the development of the skills of learners as they focus on the outcomes of learning and the application of the knowledge the learners have learnt (Mason, 2000:344). Janse van Rensburg (1998a:27) says that the focus of outcomes-based teaching and learning is about what the learners have learnt and can do at the end of the learning experience.

According to Mahomed (1996:27) competence-based curricula measures learning in terms of the achievement of certain outcomes. Halcyon Online (2002:1) puts it as follows: "At its most basic, OBE is simply the establishment of expected goals or outcomes for different levels of elementary-secondary education, and a

commitment to ensuring that every student achieves at least those minimum proficiencies before being allowed to graduate."

### 3.5.2 Outcomes

Spady (1994:1-2) says that the keys to having an outcome-based system are:

- A clear set of learning outcomes are to be developed around which all the components of the system can be focussed.
- Conditions and opportunities must be established within the system in order to enable and encourage all students to achieve those essential outcomes.

"A crucial issue in outcomes-based learning it the attainment of certain outcomes which have been made explicit" (DoE, 1996:20). OBE focuses primarily on the end results of learning processes. These designed end results are outcomes of learning. Manno (1994:3) puts it as follows; "The only way to gauge educational quality and effectiveness is to focus on outputs: goals ad ends, products and results, outcomes and effects". Janse van Rensburg (1998a:27) says: "These results refer to knowledge, skills, attitudes and values which learners must acquire and not merely to be prescribed content". According to Killen (2001:4) outcomes are statements of intention, which are written in terms of student learning. Killen (2001:1) says that there are two basic types of outcomes in any education system:

- Performance indicators like test results and
- Outcomes expressed in terms of what students know, what they are able to do or what they are like as a result of their education.

The focus of OBE is thus also on learners demonstrating successfully that they have attained these outcomes. This implies that learners will have to be

continuously assessed to determine whether they are making progress. There is a very important further implication for teachers regarding outcomes in an OBE approach. The learning outcomes are the focus when they make instructional decisions and plan lessons. The process of learning and teaching is guided by outcomes (Janse van Rensburg, 1998a:27).

McNeir (1993:1) says: "In contrast to a content and time-based method, OBE specifies the outcomes students should be able to demonstrate upon leaving the system. These outcomes are derived from a community vision of the skills and knowledge students need in order to be effective adults. OBE focuses educational practice on ensuring that students master those outcomes, and it asserts that all students can succeed."

Olivier (1998:24-25) sees the achievement of an outcome as:

- The result of a learning process
- The result of a series of performances
- Supported by underpinning knowledge
- Supported by competencies
- Supported by learning processes
- A clearly defined product, service or decision which is achieved, demonstrating that the trainee was exposed to a variety of learning experiences where knowledge, skills and processes were mastered.
- A terminal performance objective.

The intended results of education and training are described in very broad terms and are linked to national aims and goals. These outcomes are called macro or overarching outcomes (Olivier, 1998:22).

The following critical outcomes are cross-curricular. Olivier (1998:22) puts it as follows: "Achievement of critical outcomes will ensure that learners gain the knowledge, skills and values that will allow them to contribute to their own successes ..... and the nation as a whole". These critical outcomes put forward by SAQA (South African Qaulifications Authority, Regulation No. R 452 of 1998) apply to all learning areas. They are the ability to:

- communicate effectively using visual, mathematical and/or language skills in the modes of oral and/or written presentation.
- identify and solve the problems by using creative and critical thinking.
- organise and manage themselves and their activities responsibly and effectively.
- work effectively with others in a team, group, organisation and community.
- collect, analyse, organise and critically evaluate information.
- use science and technology effectively and critically, showing responsibility towards the environment and the health of others.
- understand that the world is a set of related systems. This means that problem-solving contexts do not exist in isolation.
- show awareness of the importance of effective learning strategies, responsible citizenship, cultural sensitivity, education and career opportunities and entrepreneurial abilities.

## 3.6 Why forward with an OBE approach?

Fritz (1994:81) says that if we allow the pendulum to swing back to input-compelled schooling, students and teachers will be harmed and we shall lose out on the worthwhile reforms included in OBE.

Van der Horst & McDonald (1997:7) reiterates that OBE is learner-and-results orientated approach. OBE is based on the following underlying principles:

- Learners and teachers must have high expectations for successful learning on the part of learners irrespective of background, race, age, gender, and previous achievements, etcetera.
- Every learner must be allowed to succeed. Not all learners will achieve exactly the same outcomes, but learners must be allowed to reach their full potential.
- The class atmosphere must encourage active learning and promote a culture of learning.
- All the relevant stakeholders share in the responsibility for learning. The stakeholders must work together, be co-operating partners in both the development of curriculum and the implementation thereof.

Van der Horst & McDonald (1997:16) states that one should not view OBE as a magical cure for all the wrongs, present and past, in education. They continue by saying that there is no one approach that is perfect for all educational scenarios at all times. OBE has its limitations but most definitely have advantages. The following limitations of OBE are highlighted: (Van der Horst & McDonald, 1997:16-19)

- Outcomes are vaguely worded and are largely associated with emotions.
- When government prescribe outcomes, which include values, parents must be allowed to choose between a wide variety of schooling options.
- When institutions adopt an OBE approach critics believe that standards will be dropped to the least common denominator since not all students have the same potential to achieve.
- Implementation of OBE is highly expensive.

Advocates of OBE believe that there are more advantages than disadvantages in their approach. Vermeulen (1997:35) says that OBE is: ".....collaborative,

flexible, trans-disciplinary, outcomes-based schooling system that is oriented towards empowering learners".

Malan (2000:22-28) says the following about OBE:

- OBE is favoured internally in order to promote educational renewal.
- "At best OBE may be described as an eclectic philosophy, which takes the best from several past educational approaches and incorporates them into a new system that is appropriate to the needs and demands of a new democratic South Africa."
- OBE offers a dialogue between the learner and the curriculum. The learner interacts with the various sources of knowledge, reconstruct knowledge and also accept responsibility for their own learning.
- Instead of teachers acting as sources of information whereby content is transferred to learners they are now in an OBE approach to fulfil the role of facilitator.



Pro-OBE advocates see the following merits / advantages of OBE:

Malcolm (1999:80) says:

- Breaking the nexus between input and outcome raises exciting possibilities. Teachers can acknowledge inputs to learning from sources other than themselves and their texts – students everyday experiences, families, books, television programmes, imaginations, other young people".
- "Teachers can design activities especially to facilitate differences".
- "Instead of a situation where governments prescribe inputs (through syllabuses and recommended texts) they prescribe outcomes and leave the design and selection of inputs to teachers.

- Baxen & Soudien (1999:141) says that there is definitely merit in the way young people are being made literate in the characteristics of a modern lifestyle by means of OBE.
- Jansen (1999:146) says that the following sound reasons would justify that a curriculum policy be modelled on OBE:

    - Outcomes would move away from emphasising content to be covered.
    - Outcomes would make explicit what learners should attend to.
    - Outcomes would direct and focus assessment towards specified goals.
    - Outcomes would indicate what is worth learning in a content-heavy curriculum.

In his conclusion (Malan, 2000: 28) says that there are many positive sides to OBE:



- It creates a national focus on education as a means to an end and not an end it itself.
- It negates a laissez-fair approach to educational planning, management and teaching practices.
- It introduces strategic educational planning aimed at achieving results.
- Learners must accept greater responsibility for their learning whilst actively engaging in the learning process.
- The above will hopefully restore a culture of learning in many schools.

## 3.7 Assessment

### 3.7.1 Introduction

It is important to distinguish between assessment and evaluation. Assessment is the gathering of data in order to evaluate. Evaluation assigns a value.

Evaluation is deductions made based on gathered data. (Van der Watt, 1999:46). Van der Horst & McDonald (1997:169) say that evaluation is judgment made about a learner's knowledge, behavior, performance, values or attitudes. The aforementioned judgment is made about the learner based on information gained from formal or informal assessment. Malan (2001:96) states that assessment consists of the following components: Collecting, recording and reporting evidence. Van der Watt (1999:42) continues by saying that the formulation of an assessment theory for Mathematics is needed due to the specific nature of the subject and the different classroom practice of Mathematics.

Malan (1997:24) states that there are two views regarding assessment. One trail of thought is the approaches of pass one, pass all. They claim that a learner cannot experience subject teaching for a year without learning something. Therefore experience allows promotion. The other view is that of those opposing the previous approach. This group claims that there is no evidence that learning has taken place unless the learner was exposed to some form of assessment. Malan (1997:25) however states that assessment for the sake of assessment is useless. Assessment has to be functional, valid and reliable.

### 3.7.2 Why should assessment take place?

Malan (1997:25) states the following reasons why institutions of learning and teachers make use of assessment:

- Learners are assisted to make subject and career choices.
- To determine whether learners have mastered the required knowledge or skills and have grasped the concepts or processes they were supposed to.
- To evaluate the effectiveness of a learning programme or a process.
- For learner placement in groups or grades.

- To compare the results of a learner/group to that of another learner/group.
- To inform learners about their individual progress and development.

### 3.7.3 Types of assessment

According to Van der Horst & McDonald (1999:171-172) supported by Clark & Starr (1996:381) teachers mainly use the following types of assessment:

#### 3.7.3.1 Diagnostic assessment

Diagnostic assessment can be done formally by means of a pre-test or informally by asking questions. If diagnostic assessment is done before a lesson it provides the teacher with planning information.

#### 3.7.3.2 Formative assessment



Formative assessment can be done formally by means of a test or informally by asking questions. Formative assessment helps teachers to adapt their teaching strategies during lessons in order for them to effect greater understanding of what is to be learnt. Formative assessment therefore has a "teaching" function. According to Kotzé (1999:32) formative assessment is pro-active. "It is also obvious that information and judgement resulting from formative assessment serve as feedback for improvement rather than for purposes of grading." (ibid.)

#### 3.7.3.3 Summative assessment

Summative assessment is done at the culmination of a lesson, unit or course. It is a final measure of what was learnt like a final examination.

### 3.7.4 The aim of assessment in Mathematics

According to Van der Watt (1999:47) assessment has a multi-purpose aim because:

- It measures the Mathematics knowledge of the learner.
- It shows the teaching success of the teacher and where to adjust or improve.
- It shows the effectiveness of a programme to subject specialists.
- It shows academic achievements to parents and the community.

### 3.7.5 Continuous assessment

Marneweck & Rouhani (2000:279) state that OBE changed many curriculum aspects including that of assessment. A whole new approach, namely continuous assessment is being implemented. Sieborger & MacIntosh, (1998:25) puts it as follows: "Continuous assessment simply means assessment which takes place on and throughout a course or period of learning."

Malan (1997:26) says that continuous assessment takes place whilst learners are busy with class work. Continuous assessment monitors learning progress and diagnoses learning problems. It occurs under the following circumstances:

- When learners are reflecting on their own work.
- When a learner's peers reflect of what the learner has said/done.
- When teachers are reflecting on what a learner has said/done or has not done.

The Department of Education (1997:17) say that continuous assessment will underpin all assessment across all levels and bands of education. "Thus the paradigm shift from promotion decisions based on the results of a single test or examination (summative evaluation) will be replaced by the ongoing formative assessment of the learner" (ibid.)

### 3.7.6 Advantages of continuous assessment

According to Marnewick & Rouhani (1999:282-283) continuous assessment has many advantages. These advantages are to the benefit of both the teacher and the learner. Amongst other, advantages of continuous assessment are:

- The awareness of a learner's progress is not limited to one or two tests per year.
- Learners know how they are progressing in their learning.
- Since learners are assessed continuously, they can't be disadvantaged because of missing a test due to for example illness.
- Continuous assessment negates the use of only tests and exams as assessment strategies.
- It enables learners to correct their weaknesses as learning takes place. Continuous assessment is thus both formative and summative.
- It motivates learners.

### 3.7.7 Outcomes-based assessment

Janse van Rensburg (1998b:82) says that in order to give effect to an outcomes-based approach for teaching and learning, a shift must occur. The shift must be a movement away from emphasising summative assessment, which is a once off event, to assessment, which is continuous and developmental of nature. In OBE the assessment must be of the same format. Learners must be given many

opportunities to show what they know and what they can do. It is up to learners to demonstrate their knowledge, ability or competence and up to teachers to judge the quality of such a demonstration (Malan, 1999:30). Assessment can either be norm-referenced or criterion-referenced.

- Norm-referenced assessment - A pre-determined norm is the standard. A learner's performance is compared to that of other learners (Letsoalo, 2000:8).
- Criterion–referenced assessment – According to Luckett & Sutherland (2000:105) in order to implement outcomes-based or criterion–referenced assessment the following should be made very clear to everybody concerned:

    - The criteria against which judgements will be made.
    - What evidence is needed to indicate that the criteria are met?



The Department of Education (1997:17-18) says that a formative assessment model will include the following methods:

- Continuous formative assessment
- Diagnostic assessment
- Achievement-based assessment
- Self assessment
- Peer assessment
- Portfolio assessment
- Performance assessment
- Observation sheets
- Journals
- Teacher made tests
- Assessment of prior learning

According to Janse van Rensburg (1998b:83) assessment should be:

- Continuous
- Formative and summative
- Diagnostic
- Criterion referenced
- Performance driven and
- Authentic

### 3.7.8 Assessment strategies that support OBE

#### 3.7.8.1 Self-assessment

According to Killen (1998:24) there is a limit to what could be left to the responsibility of the learners for their own assessment. Teacher must make sure that the learners completely understand the criteria against which they must evaluate their achievement. According to Marnewick & Rouhani (Jacobs et al., 1999:284) self-assessment encourages learners to accept more responsibility for their own work. The teacher must still control how effective the learners evaluate themselves and how learning is progressing (Bedeker, 1999:37). Kusnic & Finley (1993:11) say that self-evaluation is a means of assisting the development of the student as a whole person. They continue by saying that through paying attention to students' self-evaluations their learning and development can be guided appropriately.

#### 3.7.8.2 Peer assessment

Peer assessment allows learners to share and contribute towards the efforts of fellow learners in the class (Malan, 1997:59). Learners must compare the work to specified standards and not give personal opinions.

### 3.7.8.3 Assessment of projects

By allowing learners to work on projects the creativity of a learner can be assessed.

### 3.7.8.4 Assessment by means of portfolios

According to van der Watt (1999:63) a portfolio is a permanent record of a learner's demonstration of their understanding and progression at different stages of their school career. A portfolio is a file, which keeps record of the learner's projects, tests, assessment forms and homework assignments. By looking at the portfolio of a leaner the teacher is able to assess what the learner has achieved and if progress was made (Bedeker, 1999:39).

### 3.7.8.5 Group assessment



Assessment must also reflect the interaction of learners in a group. It is difficult to assess the contribution of an individual learner in a group. The aim of group assessment is to determine what learners have learnt and not what they have not yet learnt. Therefore learners learn to co-operate and not to compete with each other (Bedeker, 1999:40).

## 3.8 Summary

When discussing teaching based on whichever approach as a point of departure, one has to encounter teaching strategies to be applied with one's approach. One can distinguish between two main methods of teaching. These methods are those that are participatory of nature and those that are expository of nature. Various teaching strategies can be used to give effect to either of the methods. Many choices need to be made based on what the intended outcome must be.

When learners learn by means of discovery, it allows learners to construct their own knowledge. This leads to a constructivist approach of learning. Constructivism places the learner centrally in the learning process. Since OBE is learner-centred, the conclusion can be drawn that constructivism was one of the building blocks that led to an OBE approach.

Central to an OBE approach is the achievement of learning outcomes by learners. Various writers support the perpetuation of an OBE and training system. The achievement of learning outcomes by learners is of paramount importance. Learners must demonstrate these achievements to show that learning has taken place. Whether an outcome has been achieved must therefore be assessed. The importance of assessment is highlighted. Continuous assessment and its advantages are pointed out. Assessment strategies relating to OBE are also mentioned.

## CHAPTER 4

## RESEARCH METHOD, RESULTS, CONCLUSIONS AND GUIDELINES

### 4.1 Introduction

From the literature review as discussed in the chapters 1 to 3 the following is very clear:

- Technical colleges are in a period of transition.
- Technical colleges have been merged.
- The merged groups are known as Public Colleges for Further Education and Training.
- Previous technical colleges are now referred to as campuses of Public Colleges for Further Education and Training.
- Lecturers at campuses for engineering studies seem not to have had any meaningful exposure to outcomes-based education.
- Teaching methods at the above-mentioned campuses seem to be mainly expository of nature.
- Changes effected at Public Colleges for Further Education and Training are focussed on governance and governance structures.
- No curriculum changes were made at Public Colleges for Further Education and Training for engineering studies.

- Engineering studies programmes are the second most popular programmes enrolled for at Public Colleges for Further Education and Training.

- Mathematics is a compulsory subject for all programmes offered at Public Colleges for Further Education and Training in engineering studies up to N4 level.

- Mathematics N4 is a compulsory subject to obtain the Government Certificate of Competency for mechanical or electrical engineers.

- Tuition periods at Public Colleges for Further Education and Training for engineering studies are only 10 – 11 weeks with a maximum of 7.5 hours per subject per week.

## 4.2 Research method



### 4.2.1 Experimental group

The experimental group is lecturers at Public Colleges for Further Education and Training for engineering studies. The group is also limited to those lecturers who teach mathematics. Some of these lecturers only teach mathematics. Some of these lecturers teach mathematics as well as other technical subjects.

### 4.2.2 Collection of data

Eight campuses of Public Colleges for Further Education and Training in Gauteng were decided upon. These campuses include former state as well as state-aided colleges in order to ensure that respondents are from various socio-economic groups. All lecturers as identified in the target group, were requested to complete the questionnaire.

The questionnaires, included as Annexure A, were handed to a member of management on all the campuses. The manager had to distribute the questionnaires to the lecturers. The lecturers teaching mathematics N4 to N6 regularly were asked to indicate it on the questionnaire. The lecturers had to complete the questionnaires the same day and return it to the same manager on the campus.

A total of 52 questionnaires were distributed. Lecturers regularly teaching mathematics N4 to N6 completed 17 Questionnaires. Lecturers teaching mathematics as well as other technical subject completed 35 questionnaires.

## 4.3 Drafting of questionnaire

The questionnaire was drafted with respect to the literature review discussed in chapters 2 and 3. The aim of the questionnaire is to elicit data from the indicated target group of mathematics lecturers. The questionnaire is divided into two sections:



- Section A: 11 questions eliciting biographical data.
- Section B: 31 questions eliciting data on:

    - OBE teaching methods / strategies applied by the lecturers
    - Lecturers' training with respect to OBE
    - Lecturers' application of group teaching methods
    - The problems lecturers experience with OBE
    - Assessment methods for OBE applied by lecturers
    - The problems lecturers experience with assessment

## 4.4 Research results and conclusions

Annexure B contains the research results on section A of the questionnaire, the biographical data. The lecturers who have completed the questionnaire are divided into two groups:

Group 1 – Lecturers who mainly teach mathematics N4 to N6. These lecturers also specialise in teaching mathematics at Public Colleges for Further Education and Training.
Group 2 – Lecturers who mainly teach mathematics Introductory to N3. These lecturers assist in teaching mathematics but they specialise in teaching other technical subjects at Public Colleges for Further Education and Training.

The following deductions can be made:

- Question 1 – An average of 64% all the lecturers belonging to group 1 and 2 are male. This phenomenon can be attributed to the engineering environment traditionally being a male environment. The same phenomenon is perpetuated to lecturers at Public Colleges for Further Education and Training, for engineering studies.

- Question 3 – The total percentage for lecturers of group 2 adds up to only 86%. This can be attributed to the requirements for appointment of lecturers teaching technical subjects at Public Colleges for Further Education and Training. These lecturers do not need a teachers' diploma to be appointed on post level 1 at Public Colleges for Further Education and Training.

- Questions 4, 5 and 6 – The average teaching experience decreases as the questions narrow the option down from general teaching experience to specifically teaching mathematics at Public Colleges for Further Education

and Training. This indicates that lecturers have also previously been employed at other educational institutions. It also shows that some lecturers' area of specialisation lies within other technical subjects. These lecturers then start teaching mathematics after they have gained more experience.

- Questions 7 – 35% of all lecturers belonging to group 1 have a qualification containing a third year university mathematics component. Only 22% of the lecturers belonging to group 2 have a qualification containing a third year university mathematics component. This can be attributed to only the better theoretically qualified lecturers usually being asked to teach the more senior learners.

- Question 9 – 59% of the classes taught by lecturers belonging to group 1 are larger than 30 learners as opposed to 39% of lecturers belonging to group 2. This can be attributed to fewer available lecturers to teach the senior mathematics classes. It also indicates that the more experienced lecturers of group 1 can cope easier with larger class groups.

- Question 11 – 36% of lecturers belonging to group 1 previously specialised in teaching other technical subjects. 44% of lecturers belonging to group 2 actually specialise in teaching other technical subjects. This can be attributed to lecturers of technical subjects being asked to assist with the teaching of mathematics to help carry the workload. It must be remembered that mathematics is a compulsory subject for all programmes at least to the level of N4. Traditionally these learners are more in number than the senior learners and more lecturers are needed to teach them.

Annexure C contains the research results on section B of the questionnaire. The following deductions can be made:

- Question 1 – The majority of lecturers of both groups 1 and 2 apply the explanation of topics method closely followed by the teach-practise-review method. This can be attributed to 69% of all the lecturers of groups 1 and 2 not having undergone any OBE training during their initial teachers' training (refer to the results of question 6). The results of question 8 further underpins the above since 79% of all lecturers of groups 1 and 2 are not being trained in OBE at their campuses either (refer to the results of question 8). Question 9 further shows that only 18% of lecturers in group 1 are being trained for OBE at their campuses as opposed to 23% of lecturers in group 2 (refer to the results of question 9).

- Question 2 – Lecturers of both groups 1 and 2 prefer instructional activities such as lecturing and teacher-learner conversations. This indicates that the instructional activities are mainly expository of nature. It also coincides with the traditional teaching methods of talk-and-chalk.

- Question 3 – 90% of lecturers of group 1 indicated that class size and time limited them from exploring other teaching methods as opposed to 78% of the lecturers of group 2. In chapter 1 one of the concerns alluded to, was the tuition time of 10 to 11 weeks with a maximum of 7.5 hours tuition time per subject per week. Lecturers must complete a whole syllabus, do revision and prepare learners for the national exams during this period. Lecturers therefore feel that they must be in control, direct the activities in class and stick to the strict timeframes.

- Question 4 – 65% of lecturers of groups 1 and 2 indicated that 60% or less of the learners actively participate in the lessons they present. The results of questions 1 and 2 indicate that methods of instruction are expository of nature. These methods allow learners to passively receive knowledge from the teacher who is the source of knowledge. Application of these methods

does not challenge learners to become actively involved because they can rely on the teacher to make all the information available.

- Question 10 – For the lecturers of group 1, the longest training for OBE was 1 week. For the lecturers of group two, specified under other, it was a three-day workshop and training done once a week by the principal. It must be indicated that this training was done after the initial teachers training. Very limited training is done at short workshops. Only basic principles could be passed on to these lecturers. The absolute minority of lecturers of both groups participated in the training (refer to the results of question 8). This type of training can only be introductory of nature and can therefore not have a meaningful impact on the teaching practices of these lecturers. The results of question 11 underpins the above since an average of 79% of lecturers of groups 1 and 2 have not implemented any OBE teaching methods at their campuses.



- Question 12 – Lecturers of group 2 could only mention practical work in groups and peer teaching. Lecturers of group 1 mentioned open discussions. This is indicative of the total lack of OBE training the lecturers have been exposed to.

- Question 13 – An average of 33% of both groups of lecturers do not apply indirect teaching approaches. An average of 37% of lecturers of both groups allow learners to collaborate in groups on projects. Since learners have to obtain a trimester mark that forms part of the final pass percentage obtained by learners, it could be the reason for allowing learners to work together on assignments in order to obtain an assignment mark. The assignment mark forms part of the trimester mark that must be obtained by all learners at Public Colleges for Further Education and Training.

- Questions 14 – 53% of lecturers of group 1 do not use group work as opposed to 40% of lecturers of group 2. The response to question 3 where time was mention as a limiting factor impacts here as well. Lecturers generally view group work as time consuming.

- Questions 15 – 63% of group 1 and 52% of group 2 prefer direct instruction followed by rote learning to ensure that learners achieve specified outcomes. This can be attributed to the initial teachers training done by lecturers, no meaningful exposure to OBE training and the mentioned time constraints.

- Question 16 – Lecturers from group 1 primarily work on the chalkboard (45%) and from textbooks (26%). Lecturers from group 1 indicated similar percentages of respectively 44% and 31%. This again is indicative of primarily expository teaching methods being applied.

- Question 17 – Lecturers of groups 1 and 2 identified the following

  - Group 1 for group work – Difficult concept where learners explain to each other, practical application of theory, revision where advanced learners assist learners who battle.
  - Group 2 for group work – Homework assignments, discussing problems, review of old exam papers, to share ideas on a new topic.
  - Group 1 for individual work – Worksheets, seatwork or when new topics are introduced.
  - Group 2 for individual work – Seatwork, open book tests, and individual homework assignments.

The results for questions 13 and 14 show why these lecturers have very limited application of group work strategies. Question 18 however indicates that

lecturers from both groups (average of 97%) think that group work can improve results.

- Questions 20 – 71% of the lecturers of group 1 indicate that they don't use team teaching as a strategy for group work. These lecturers are on average older and more experienced when compared to the lecturers of group 2. Their exposure to OBE training is also less than that of group 2. This can be attributed to older lecturers being more set in their way of doing and when teaching senior learners the time constraint becomes an even bigger factor because of longer and more detailed syllabi. The lecturers of group 2 indicated that 87% of them (question 11) did not implement OBE teaching methods at their campuses. The result of this question for group 2 however indicates that 48% of these lecturers make use of team teaching. This is contradictory because lecturers could have interpreted it as collaborative teaching.



- Question 21 - 59% of the lecturers in group 1 give learners very limited options to do work in small groups as opposed to 49% of the lecturers of group 2. This once again indicate that these lecturers prefer direct instruction and the fact that they are not trained to teach in an outcomes-based approach which calls upon learners to be active participants in a learner-centred setting. The results of question for further substantiate the above.

- Question 22 – An average of 41% all lecturers of group 1 and 2 indicated that groups are arranged according to the learners' abilities and personalities. From the other questions it was clear that the lecturers do not favour group work. This could have been interpreted by most of the lecturers as to what they will do should the opportunity be available.

- Question 23 – 75% of the lecturers of group 1 give learners very limited opportunities to work in small groups outside of formal class time as opposed to 77% of the lecturers of group 2. This again indicates the largely traditional methods of teaching being applied.

- Questions 24 – 65% of the lecturers of group 1 indicate limited use of group work as opposed to 53% of the lecturers of group 2. Lecturers of group 2 might be confusing whole class groups with smaller group activities.
- Question 25 – The two groups identified the following problems:
  - Group 1 – Time is a major constraint mention by most of them, lecturers are not properly trained, they do not know how to implement OBE teaching methods, the role of the learner is nor clear, dedicated students do all the work, older student are very lazy to adapt to new methods and average class sizes (question 9 section A – 59% of classes larger than 30 learners) makes it very difficult to control groups.
  - Group 2 – Outdated syllabi, time, learning support material not readily available, classes to large (question 9 section A – 39% of classes larger than 30 learners), they are still in a process of being trained, learners don't want to adapt they are used to the old way old doing and not all the learners want to participate.

- Question 26 – An average of 55% of all lecturers of both groups primarily depend on summative assessment. All learners write a national examination at the end of each trimester. This is still largely perceived as the final assessment to be promoted to the next level. Although the trimester mark has been introduced to move away from only a once off final summative assessment the final exam still accounts for 60% of the promotion mark. Lecturers therefore still do not apply continuous assessment, which is formative in nature.

- Question 27 – 81 % of group 1 and 67% of group 2 applies criteria-referenced assessment. The criterion used is however the pass rate obtained by learners upon writing the national summative examination.

- Question 28 – The assessment strategies used are largely divided between the options given. This indicates that the lecturers of groups 1 and 2 are well trained in assessment methods. This deduction is not possible since limited training in OBE implies limited training in methods of assessment.

- Question 29 – The majority of the lecturers of both groups indicated that checklists are used as well as assessing only samples of the learners' work. This indicates that traditionally lecturers check that homework is done and thereafter they only mark one or two or the most difficult "problems". This once again reiterates the limited training in OBE the lecturers were exposed to.



- Question 30 – 88% of group 1 and 83% in group 2 responded by saying yes. The 17% of the lecturers in group 2 saying no might be because 87% (question 6 section A) of these lecturers have 5 years or less teaching experience in mathematics at Public Colleges for Further Education and Training.

- Question 31 – The groups responded as follows:

  - Group 1 – Individuals disappear in the group, it takes too much time, the good learner is restricted, it is too complicated for learners who battle, class sizes prevent continuous assessment, it is confusing, it is too subjective.
  - Group 2 – Large class groups makes individual attention impossible, fairness towards all learners, time, learners not at the same stage of

completion of assignments, too much administration, we only do summative assessment.

## 4.5 Most indicative findings from the research results

- 87% of lecturers in group 2 have 5 years or less teaching experience in teaching mathematics at Public Colleges for Further Education and Training.

- An average of 54% of all lecturers teaching mathematics have mathematics N6 as their highest mathematics qualification.

- 59% of all lecturers teaching mathematics initially specialised or currently specialise in teaching other technical subjects.

- 90 % of lecturers in group 1 and 78% of lecturers in group 2 indicate that class size and time limit them from exploring other teaching methods.



- 49% of all lecturers indicate that class sizes are in excess of 30 learners per class.

- 57% of all lecturers still prefer direct instruction followed by rote learning.

- 69% of all lecturers have not undergone any OBE training during their initial teachers training.

- 79% of all lecturers have not undergone any OBE training at their respective campuses.

- 79% of all lecturers have not implemented any OBE teaching methods at their respective campuses.

- 55% of all lecturers still use summative assessment as the only method of assessment.

## 4.6 Guidelines for teaching mathematics at public colleges for further education and training through an outcomes-based approach

- The attitude of the lecturers towards OBE is of paramount importance. They must always portrait a positive attitude.

- The intended outcomes of learning must be made very clear and be available to all learners.

- Lecturers should work collaboratively with other lecturers to develop lesson plans for an OBE approach.



- Lecturers should work collaboratively with other lecturers to determine the best teaching and learning activities in order for learners to accomplish the intended outcomes of learning.

- Lecturers should work collaboratively with other lecturers to develop learning support material in order to encourage co-ownership of resources. Learning support material must encompass the widest possible variety.

- Lecturers must ensure that the learning support material to be used by the learners is of good quality and sufficient for the number of learners and available at the time such recourses are needed.

- A media centre should be available to all learners to make other resources available instead of just one textbook.

- An OBE approach is learner-centred. Planned class activities must ensure the involvement of all the learners.

- Planning should be done meticulously in order to ensure the smooth flow of learning activities.

- Lecturers must act as facilitators. They must give hints and be available for consultation when needed. Learners must however be allowed to complete assignments or solve problems in their groups or as individuals.

- Learners should be given many opportunities to demonstrate that they have mastered the intended outcomes.

- Lecturers must make detailed notes on what worked well and what should be changed.

- Time constraints as identified by the questionnaire should be taken into consideration. As to be recommended in Chapter 5, only some modules of the current curriculum should be identified to teach through an OBE approach.

- Assignments given by lecturers must force learners to make use of other resources as well.

- One or two tests during a trimester are not sufficient to assess the learners. Different forms of assessment as discussed in Chapter 3 should be applied to determine a more realistic trimester mark as prescribed by the current examination instruction.

- Criteria against which learners are going to be assessed must be made clear to all learners in advance.

- Assessment is very important and learners should be assessed continuously and in the presence of other learners.

- Learners need to see all forms of assessment as important and the lecturer should therefore spend the appropriate time on assessment.

- All assignments must be assessed.

- When assisting groups lecturers should make notes to assist them with their assessment of different groups.

- Lecturers should put a lot of emphasis on group work and making groups responsible for completion of assignments or solving of problems.



- Lecturers must also assist groups as a facilitator and should not leave them to continue by themselves at all times.

- Assignments given to learners must be linked to the world they live in. Applications in their respective technical subjects can be of great help.

- The lecturer must determine the formation of the groups, where they sit and what they have to do.

- The instructions to groups must be made explicitly clear as well as the responsibility of learners in the group.

- Learners in the group must not be allowed to compete against each other but rather to assist one another.

- All learners in the group must know that any individual can be asked to report back, explain or to demonstrate the solution of the group in order to obtain a mark for the group.

- Lecturers should when possible be available after college hours to assist learners or groups of learners as a facilitator and not to do the assignment for them.

- Lecturers must stick to deadlines given to groups on assignments. The time schedule must be made available to all learners.

# CHAPTER 5

# OVERVIEW, CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Overview

After the completion of the first democratic elections in South Africa during 1994, the whole education dispensation has changed. Legislation provided for the establishment of SAQA. The main aim of SAQA is to see to the development and implementation of the NQF. The NQF makes provision for the principle of life long learning, eight levels of nationally recognised qualifications and three bands of education.

The structure of the NQF makes provision for the new approach to education namely that of OBE. During 1998 OBE has been implemented in all grade 1 classes in South Africa. This approach is currently being phased in, in further education and training schools.



Technical colleges currently known as public further education and training colleges offer programmes in the FET band of the NQF. No meaningful inputs from the Gauteng Department of Education have been received at these colleges yet. It is however the opinion of the author that OBE will also be implemented at these colleges as well.

This study therefore endeavours to determine to what extend the existing mathematics curriculum is taught through an OBE approach. If the mathematics curriculum is not taught through an OBE approach, guidelines will be given to lecturers in order to assist them to do it.

In the study a situational analysis is made of the previous technical colleges by looking at the following:

- The history of technical colleges and the changes that are taking place at these institutions.
- The profile of the students.
- Programmes offered and qualifications that can be obtained at technical colleges for engineering studies.
- Careers learners are prepared for at technical colleges for engineering studies.
- Progression of learners at technical colleges for engineering studies to institutions of higher learning.
- Current teaching methods applied at technical colleges for engineering studies.



Teaching and learning methods are discussed by looking at three continuums, namely:

- Direct versus indirect strategies
- Independent versus cooperative strategies
- Rote versus discovery learning

A constructivist learning approach is discussed and the follow through to OBE. Aspects of OBE is then discussed and why there should be continued with an OBE approach. OBE also has a big and a direct influence on evaluation and assessment. Evaluation and assessment is then discussed as well as the different forms of assessment.

A questionnaire was compiled that was completed by mathematics lecturers of eight campuses of public colleges for FET. The questionnaire elicited biographical data of lecturers as well as data regarding the following:

- Current teaching methods
- Application of OBE-methods
- Problems lecturers experience regarding OBE
- Assessment
- Problems lecturers experience regarding assessment

## 5.2 Conclusions

Mathematics lecturers at public colleges for FET (engineering studies campuses) have not been adequately prepared for the transition to an OBE approach. The results from the questionnaire indicate that only 31% of all mathematics lecturers at public colleges for FET were initially trained with respect to an OBE approach. 79% of these lecturers did not implement any OBE teaching methods.

Teaching methods currently applied by mathematics lecturers at public colleges for FET (engineering studies campuses) are indicated in section 2.4.5 as well as the results from the questionnaire to be primarily expository of nature. The lecturer is therefore still seen as the primary source of knowledge. Lecturers transmit information and learners passively receive knowledge by means of rote learning.

An OBE approach has been introduced in South Africa in mainstream education since 1998. All lecturers at public colleges for FET will in future have to adapt to an OBE teaching approach as indicated earlier in this study. Numerous authors as referred to in Chapters 3 say that an OBE teaching approach is learner-centred. Group work will therefore be imperative to get learners involved in and

responsible for their own learning. In section 3.6 motivations are put forward why lecturers should continue with an OBE teaching approach.

The following suggestions are therefore made from the literature review and research results:

- Lecturers should not be introduced to OBE by means of short 1 or 2 day workshops. The results from the questionnaire show that these lecturers barely apply what was taught.

- Programmes presented to train lecturers must at all cost also be presented through an OBE approach to give these lecturers hands on experience of OBE teaching methods.

- To adapt to an OBE approach lecturers need to become facilitators and to move away from direct instruction.



- Learners need to be assessed in various ways in order for them to demonstrate that they are competent based on pre-determined criteria. Lecturers will have to move away from the traditional way of only assessing by means of summative assessment.

- Lecturers should be trained on how to make use of group work strategies to involve learners.

- A lot of extra paperwork should not be generated to overburden lecturers. The research results indicate that these lecturers have time constraints because of the short tuition periods.

## 5.3 Recommendations based on the most indicative findings

### 5.3.1 Recommendation 1

As alluded to in chapter 1, time was mentioned as a concern. The aim of the study is to determine whether mathematics at Public Colleges for Further Education and Training, is taught through an OBE approach. If it is not the case, guidelines will be developed in order to achieve the adoption of an OBE approach for teaching mathematics at Public Colleges for Further Education and Training.

Since time is identified as a major constraint, it is recommended that modules of the current curriculum must be identified to teach through an OBE approach on each level. The modules to be identified should be only those modules that are perpetuated at the next level of instruction. Furthermore these modules should be limited to not more than the three of the most important modules of the curriculum needed as prerequisite knowledge for the next level.



### 5.3.2 Recommendation 2

The lecturers of groups 1 and 2 indicate class size, as a limiting factor to explore other teaching methods.

It is recommended that group work be used extensively. Cooperative group work where all learners of the group are made responsible for each other's learning can be applied fruitfully. Variations of group work as explained in chapter 3 should be applied.

### 5.3.3 Recommendation 3

It is clear from the research results that the majority of the current lecturers are not trained in applying an OBE teaching approach and they don't apply OBE teaching methods.

It is recommended that the mathematics subject committees at the respective campuses accept the responsibility to train these lecturers to adapt to an OBE approach. Instead of having meetings that are mostly administrative of nature, these meetings can be adapted to do this very important and much needed in-service training.

Lecturers should be gradually introduced to OBE that is learner-centred. This will be a major paradigm shift for most of the mathematics lecturers as indicated in the results of the questionnaire, who are still favouring teacher-centred, expository approaches.



### 5.3.4 Recommendation 4

As indicated in the results of the questionnaire lecturers still mainly use summative assessment. Learners still write a final summative exam that determines 60% of the eventual grading received by the student. The compilation of a term mark is a step in the right direction as stipulated by the Department of National Exams and Assessment.

The recommendation is that subject committees once again train lecturers in the application of assessment methods for OBE as discussed in chapter 3.

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**Respond by completing the data in the space provided or by marking your answer by means of an "X" in the space provided**

**Examples.**

What is your age in completed years?

| 2 | 5 |
|---|---|

How many subjects do you teach?

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| | | X | |

**Questions – Section A**

1. What is your gender?

| M | F |
|---|---|
| | |

2. How old are you in completed years?

| | |
|---|---|
| | |

3. How many years' teachers training have you completed?

| 1 year | 2 years | 3 years | 4 years | >4 years |
|---|---|---|---|---|
| | | | | |

4. How many years' teaching experience do you have in completed years?

| 0-5 years | 6-10 years | 11-15 years | 16-20 years | >20 years |
|---|---|---|---|---|
| | | | | |

5. How many years' teaching experience do you have at a technical college in completed years?

| 0-5 years | 6-10 years | 11-15 years | 16-20 years | >20 years |
|---|---|---|---|---|
| | | | | |

6. How many years' teaching experience do you have in teaching Mathematics at technical colleges in completed years?

| 0-5 years | 6-10 years | 11-15 years | 16-20 years | >20 years |
|---|---|---|---|---|
| | | | | |

7. What is your highest qualification in Mathematics?

| | |
|---|---|
| Grade 12 | |
| Mathematics N4 | |
| Mathematics N5 | |
| Mathematics N6 | |
| Technicon first year | |
| Technicon second year | |
| Technicon third year | |
| University first year | |
| University second year | |
| University third year | |
| Honours degree | |
| Masters degree | |
| Other | |

8. How would you best describe your College?

| | |
|---|---|
| Inner city | |
| Suburban | |
| Township | |
| Other (Please specify) | |

9. How many learners do you have on average in your Mathematics class?

| 11-20 | 21-30 | 31-40 | > 40 |
|---|---|---|---|
| | | | |

10. How can your position at the College be described as?

| | |
|---|---|
| Lecturer on post level 1 | |
| Senior lecturer on post level 2 | |
| Head of division or Deputy principal on post level 3 | |
| Vice rector or Senior Deputy Principal on post level 4 | |



11. What is your academic field of specialisation at the College?

| | |
|---|---|
| Engineering Science | |
| Electrical | |
| Mechanical | |
| Mathematics | |

## Questions – Section B

1. Which teaching methods do you apply most often when teaching Mathematics? (You may mark more than one option)

| | |
|---|---|
| Drill and practise method | |
| Explanation of topics method | |
| Handbook method | |
| Question and answer method | |
| Teach-practise-review method | |
| Completion of worksheets method | |
| Others (Please specify) | |

2. Which of the following instructional activities do you apply most often? (You may mark more than one option)



| | |
|---|---|
| Demonstrations | |
| Lecturing | |
| Teacher-learner conversation | |
| Learner group discussions | |

3. Which factors do you feel limit you to explore other teaching methods? (You may mark more than one option)

| | |
|---|---|
| Class size | |
| Financial constraints | |
| Teachers training | |
| Time | |
| Others (Please specify) | |

4. How many of the learners in your class really actively participate in every lesson you present?

| 0 – 20 % | 21 – 40 % | 41 – 60 % | 61 – 80 % | 81 – 99 % |
|---|---|---|---|---|
| | | | | |

5. Are you aware of the introduction of curriculum 2005 at schools?

| Y | N |
|---|---|
| | |

6. Have you undergone any OBE training during your initial teachers training?

| Y | N |
|---|---|
| | |

7. Are you a trained assessor?

| Y | N |
|---|---|
| | |



8. Have you undergone any OBE training at your College?

| Y | N |
|---|---|
| | |

9. If yes, whom have you been trained by?

| | |
|---|---|
| Gauteng Department of Education | |
| Principal | |
| Vice Principal | |
| HOD | |
| Senior Lecturer | |
| Private training provider | |

10. What was the duration of the training?

| | |
|---|---|
| 1 day workshop | |
| 2 day workshop | |
| 1 week | |
| Others (Please specify) | |

11. Have you implemented any OBE teaching methods at your College?

| Y | N |
|---|---|
| | |

12. If yes, please specify the methods you are using.

| |
|---|
| |
| |
| |
| |
| |



13. When making use of an indirect teaching approach, which of the following do you apply most often?

| | |
|---|---|
| Learners collaborate in groups on projects | |
| Learners gather data about topics to make predictions | |
| Oral presentations by learners | |
| Theme posters created by learners | |
| I do not make use of an indirect teaching approach | |

14. Which of the following group learning strategies to you apply most often?

| | |
|---|---|
| Group assignments where learners complete a project with different tasks for each learner | |
| Jigsaws with "home" and "expert" teams | |
| Peer assessment of individuals' work prior to handing it in to the lecturer | |
| Team presentations with individual contributions of learners as part of a team | |
| I do not use group work | |

15. When learners need to achieve specified outcomes, which method do you prefer to ensure that learning will take place?

| | |
|---|---|
| Direct instruction followed by rote learning | |
| Guided or independent discovery by learners of what is to be learnt | |



16. With which types of equipment do you normally work?

| | |
|---|---|
| Chalkboard | |
| Computer | |
| Overhead projector | |
| Text book | |
| Others (Please specify) | |

17. Describe for which type of activities in your class you prefer learners to work together in groups or work as individuals?

| |
|---|
| |
| |
| |
| |

18. Do you think that learners working together in groups can improve results or enhance their understanding of concepts?

| Y | N |
|---|---|
| | |

19. Should learners be guided to explore and discover objectives of your lesson by themselves or in groups?



| Y | N |
|---|---|
| | |

20. Do you use team teaching as a method of group work?

| Y | N |
|---|---|
| | |

21. Do you give learners opportunities to solve problems or do assignments by working together in small groups?

| Never | Rarely | Sometimes | Very often |
|---|---|---|---|
| | | | |

22. If you are using group work in your lesson, how do you arrange your learners in the groups?

| | |
|---|---|
| According to their abilities | |
| According to their personalities | |
| According to their abilities and personalities | |
| I do not use group work | |

23. When you allow learners to work together in small groups do you give them assignments to do, not forming part of the formal class time?

| I do not use group work | Never | Rarely | Sometimes | Very often |
|---|---|---|---|---|
| | | | | |



24. To determine whether learners are doing their work in the groups, do you assess all learners by asking questions, observing them and encouraging them by listening to their plans?

| I do not use group work | Never | Rarely | Sometimes | Very often |
|---|---|---|---|---|
| | | | | |

25. Write down any problems you experience with respect to OBE?

| |
|---|
| |
| |
| |
| |
| |

26. Which forms of assessment do you apply most often when assessing your learners?

| | |
|---|---|
| Diagnostic: To use as planning information | |
| Formative: Assessment whilst learners are doing their work to be used as feedback to learners and lecturers | |
| Summative: A final measure of what a learner has learnt | |

27. When assessing your learners do you make use of the following types of assessment?



| | |
|---|---|
| Criteria referenced assessment: The norm is the ability of a learners to demonstrate what they have learnt | |
| Norm referenced assessment: A learner's competence is assessed and compared to that of other learners (the norm). | |

28. When assessing your learners, do you make use of the following methods?

| | |
|---|---|
| Peer assessment | |
| Portfolio assessment | |
| Self assessment by learners | |

29. When assessing your learners, do you make use of the following methods?

| | |
|---|---|
| Checklists: Homework done, note book up to date etc. | |
| Observing learners to judge behaviour and progress | |
| Ranking: Rating learners' skills or accomplishments in rank-order from best to worse | |
| Rating scales: Judging as for example Fair, Good, Excellent | |
| Work samples: Assessing only samples of the learners' work | |

30. When you are going to assess your learners, do they know exactly what is going to be assessed and which criteria will apply?

| Y | N |
|---|---|
| | |

31. Write down any problems you experience with respect to assessment for OBE.

| |
|---|
| |
| |
| |
| |
| |

| Question and options | | Lecturers N4 – N6 | Lecturers Intro – N3 |
|---|---|---|---|
| 1 | Male | 65% | 63% |
| | Female | 35% | 37% |
| 2 | 20-30 | 24% | 32% |
| | 31-40 | 48% | 44% |
| | 41-50 | 18% | 6% |
| | 51-60 | 12% | 18% |
| 3 | 1 | 13% | 14% |
| | 2 | 6% | 0% |
| | 3 | 19% | 17% |
| | 4 | 25% | 49% |
| | >4 | 37% | 6% |
| 4 | 0-5 | 29% | 46% |
| | 6-10 | 7% | 29% |
| | 11-15 | 29% | 11% |
| | 16-20 | 29% | 9% |
| | >20 | 6% | 5% |
| 5 | 0-5 | 47% | 63% |
| | 6-10 | 11% | 26% |
| | 11-15 | 18% | 9% |
| | 16-20 | 18% | 2% |
| | >20 | 6% | 0% |
| 6 | 0-5 | 52% | 87% |
| | 6-10 | 24% | 10% |
| | 11-15 | 12% | 3% |
| | 16-20 | 6% | 0% |
| | >20 | 6% | 0% |

| | | | |
|---|---|---|---|
| 7 | Grade 12 | 0% | 0% |
| | Mathematics N4 | 6% | 0% |
| | Mathematics N5 | 0% | 3% |
| | Mathematics N6 | 35% | 39% |
| | Technicon first year | 0% | 3% |
| | Technicon second year | 0% | 0% |
| | Technicon third year | 12% | 12% |
| | University first year | 0% | 3% |
| | University second year | 6% | 6% |
| | University third year | 35% | 22% |
| | Honours degree | 0% | 0% |
| | Masters degree | 0% | 0% |
| | Other | 6% | 12% |
| 8 | Inner City | 35% | 53% |
| | Suburban | 35% | 28% |
| | Township | 30% | 19% |
| | Other | 0% | 0% |
| 9 | 11-20 | 12% | 7% |
| | 21-30 | 6% | 50% |
| | 31-40 | 59% | 39% |
| | >40 | 23% | 4% |
| 10 | Lecturer | 73% | 91% |
| | Senior lecturer | 20% | 6% |
| | HOD / Deputy Principal | 7% | 3% |
| | Vice Rector / Senior Deputy Principal | 0% | 0% |
| 11 | Eng Science | 24% | 15% |
| | Electrical | 18% | 32% |
| | Mechanical | 18% | 12% |

| | | | |
|---|---|---|---|
| | Mathematics | 40% | 41% |

| | Question and options | Lecturers N4 – N6 | Lecturers Intro – N3 |
|---|---|---|---|
| 1 | Drill and practise method | 17% | 18% |
| | Explanation of topics method | 26% | 23% |
| | Handbook method | 10% | 6% |
| | Question and answer method | 17% | 18% |
| | Teach-practise-review method | 21% | 25% |
| | Completion of worksheets method | 7% | 9% |
| | Others (Please specify) | 2% | 0% |
| 2 | Demonstrations | 9% | 16% |
| | Lecturing | 34% | 32% |
| | Teacher-learner conversation | 44% | 31% |
| | Learner group discussions | 13% | 21% |
| 3 | Class size | 40% | 41% |
| | Financial constraints | 7% | 15% |
| | Teachers training | 3% | 7% |
| | Time | 50% | 37% |
| | Others (Please specify) | 0% | 0% |
| 4 | 0 – 20% | 6% | 9% |
| | 21 – 40% | 18% | 29% |
| | 41 – 60% | 41% | 26% |
| | 61 – 80% | 35% | 35% |
| | 81 – 99% | 0% | 0% |
| 5 | Yes | 100% | 94% |
| | No | 0% | 6% |
| 6 | Yes | 29% | 32% |
| | No | 71% | 68% |
| 7 | Yes | 18% | 32% |
| | No | 82% | 68% |
| 8 | Yes | 18% | 23% |
| | No | 82% | 77% |
| 9 | Gauteng Department of Education | 6% | 3% |
| | Principal | 0% | 6% |
| | Vice Principal | 0% | 0% |
| | HOD | 0% | 0% |
| | Senior Lecturer | 0% | 0% |

| | | | |
|---|---|---|---|
| | Private training provider | 12% | 14% |
| 10 | 1 day workshop | 0% | 13% |
| | 2 day workshop | 33% | 38% |
| | 1 week | 34% | 13% |
| | Others (Please specify) | 33% | 38% |
| 11 | Yes | 29% | 13% |
| | No | 71% | 87% |
| 13 | Learners collaborate in groups on projects | 39% | 36% |
| | Learners gather data about topics to make predictions | 11% | 13% |
| | Oral presentations by learners | 17% | 10% |
| | Theme posters created by learners | 6% | 3% |
| | I do not make use of an indirect teaching | 28% | 38% |
| 14 | Group assignments where learners complete a project with different tasks for each learner | 12% | 26% |
| | Jigsaws with "home" and "expert" teams | 6% | 3% |
| | Peer assessment of individuals' work prior to handing it in to the lecturer | 24% | 17% |
| | Team presentations with individual contributions of learners as part of a team | 6% | 17% |
| | I do not use group work | 53% | 40% |
| 15 | Direct instruction followed by rote learning | 63% | 52% |
| | Guided or independent discovery by learners of what is to be learnt | 37% | 48% |
| 16 | Chalkboard | 45% | 44% |
| | Computer | 3% | 3% |
| | Overhead projector | 24% | 20% |
| | Text book | 26% | 31% |
| | Others (Please specify) | 3% | 3% |
| 18 | Yes | 100% | 94% |
| | No | 0% | 6% |
| 19 | Yes | 71% | 91% |
| | No | 29% | 9% |
| 20 | Yes | 29% | 48% |
| | No | 71% | 52% |
| 21 | Never | 18% | 3% |

| | | | |
|---|---|---|---|
| | Rarely | 6% | 9% |
| | Sometimes | 35% | 40% |
| | Very often | 41% | 49% |
| 22 | According to their abilities | 24% | 12% |
| | According to their personalities | 6% | 15% |
| | According to their abilities and personalities | 41% | 42% |
| | I do not use group work | 29% | 30% |
| 23 | Never | 21% | 3% |
| | Rarely | 21% | 17% |
| | Sometimes | 21% | 31% |
| | Very often | 25% | 23% |
| | I do not use group work | 13% | 26% |
| 24 | Never | 12% | 0% |
| | Rarely | 6% | 11% |
| | Sometimes | 29% | 19% |
| | Very often | 35% | 47% |
| | I do not use group work | 18% | 22% |
| 26 | Diagnostic: To use as planning information | 0% | 7% |
| | Formative: Assessment whilst learners are doing their work to be used as feedback to learners and lecturers | 45% | 37% |
| | Summative: A final measure of what a learner has learnt | 55% | 56% |
| 27 | Criteria referenced assessment: The norm is the ability of a learners to demonstrate what they have learnt | 81% | 67% |
| | Norm referenced assessment: A learner's competence is assessed and compared to that of other learners (the norm). | 19% | 33% |
| 28 | Peer assessment | 30% | 29% |
| | Portfolio assessment | 35% | 29% |
| | Self assessment by learners | 35% | 43% |
| 29 | Checklists: Homework done, note book up to date etc. | 32% | 48% |

| | | | |
|---|---|---|---|
| | Observing learners to judge behaviour and progress | 32% | 18% |
| | Ranking: Rating learners' skills or accomplishments in rank-order from best to worse | 4% | 10% |
| | Rating scales: Judging as for example Fair, Good, Excellent | 8% | 10% |
| | Work samples: Assessing only samples of the learners' work | 24% | 14% |
| 30 | Yes | 88% | 83% |
| | No | 12% | 17% |