

**EFFECTIVENESS OF CIVIL ENGINEERING PROGRAM, M
SULTAN TECHNIKON**

by

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ABSTRACT

The purpose of this research was to gather both qualitative and quantitative data, regarding program quality and effectiveness of the civil engineering discipline, offered by M L Sultan Technikon.

Seventy two students registered for the civil engineering program, participated in this study. Data was gathered by using questionnaires and documentation on the civil engineering program. The researcher's pragmatic framework has been greatly influenced by the view of Sackney (1986) and Edmonds (1982) and the Higher Education Quality Committee (2000) on quality assurance systems and effective programs in higher education.

Document analysis was carried out and descriptive statistics was used to analyse both the qualitative and the quantitative data. Some of the major findings of this research were :

The average throughput rate for the civil engineering program was 41% which was significantly higher than the average throughput rate for the entire technikon, which was 18%. It is interesting to note that funding from government is based on the throughput rate. The throughput rate is greatly influenced by the compulsory experiential training component of the program. If students cannot acquire in-service training, then this reduces the throughput rate.

The program has a mission statement and clearly stated goals. All the staff and 62% of the students who participated in the study were familiar with the goals of the program.

Incentives, rewards and sponsorships exist for students who produce exemplary results. Apart from the technikon rewards and incentives, there are also ECSA and CEITS awards available to students.

Staff, student and curriculum development programs, as well as a quality assurance program are in place. It is compulsory for all academic staff to participate in the staff development program and all staff are also involved in student and curriculum development and quality assurance, however, at varying levels of intensity.

The civil engineering program is evaluated once in every four years by both the Certification council for Technikon Education (SERTEC) and the Engineering Council of South Africa (ECSA)

All the academic staff are in possession of at least an M+4 vertical qualification in civil engineering and have both industrial and lecturing experience. Four staff members are registered in the professional category with ECSA. All the staff are practically and academically qualified to lecture on the civil engineering program.

Industry plays an imperative role in technikon education as outlined in cooperative education. Apart from having input in the curriculum, industry serves on both the SERTC and ECSA evaluation panels, provide experiential training for students and serve on the advisory committee.

DECLARATION

I hereby declare that this dissertation is my own original work, and has not been submitted previously for a degree at any other university.

Cherven Singh

ACRONYMS USED IN THE STUDY

The following acronyms were used in the study :-

BSc	Bachelor of Science
B.Tech	Bachelor of Technology
CE	Civil Engineering
CHELTA	Certificate in Higher Education, Learning, Teaching and Assessment
DTech	Doctor of Technology
ECSA	Engineering Council of South African
HG	Higher Grade
HOD	Head of Department
IPET	Institute of Professional Engineering Technologists
MDipTech	Master's Diploma in Technology
MTech	Master of Technology
NDip	National Diploma
NQF	National Qualifications Framework
PACE	Programme for Academic Course Evaluation
PCI	Portland Cement Institute
SAICE	South African Institute of Civil Engineers
SAQA	South African Qualifications Authority
SERTEC	Certification Council for Technikon Education
SG	Standard Grade
SWOT	Strengths, Weaknesses, Opportunities and Threats

DEFINITION OF TERMS USED IN THE STUDY

The following operational terms will be defined for the purposes of this study :-

Co-operative education

Is a training system which attempts to integrate classroom and laboratory instruction with practical in-service training in industry.

Experiential training

Is a compulsory component of the civil engineering program. Students are employed essentially in the civil engineering and building industry, but remain registered at the Technikon.

Program Effectiveness

Effectiveness is defined as being associated with high expectations, results and throughput rates, sharing a common mission and an emphasis on teaching and learning in any educational program.

Quality assurance

The maintaining and applying of academic and educational standards in the sense of specific expectations and requirements that should be complied with and these expectations may differ from context to context, partly depending on the specific purpose pursued.

Quality assurance mechanisms

Refers to systems, policies and mechanisms that are in place for an educational program. These mechanisms generally contribute to program effectiveness, for example, staff development, incentives and rewards for exemplary student performance and curriculum development.

Rationalisation

Refers to the sharing of resources for common instructional offerings / programs. This includes human, physical and material resources with the view to provide the primary customers (students) with the best possible education.

Re-curriculation

Refers to the process of periodically changing and updating the curriculum. This is necessary so as to make the curriculum compatible to the technological advances and demands of industry.

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CHAPTER 1

INTRODUCTION

1. Purpose of the study

Civil Engineering deals with the problems of tomorrow as well as the challenges of today. Since each engineering problem has novel characteristics, civil engineers work in cooperation with others in different fields to combine knowledge and creativity with the initiative to fulfill objectives, protect society and meet the construction and operating budgets of their projects. To meet the growing demands of our highly industrialised society, civil engineering graduates and diplomates need the technical expertise to develop cost effective techniques, materials and technologies that will advance construction, manufacturing and transportation while at the same time addressing the need to maintain and upgrade current infrastructure and facilities.

It is vital that the civil engineering curriculum offered by M L Sultan Technikon encompasses the principles mentioned above and is delivered to students in an effective manner. Also, the academic and practical training offered by the Technikon in civil engineering must adequately prepare students for registration with the Engineering Council of South Africa (ECSA) which is mandatory in order to practice civil engineering in South Africa. Therefore the purpose of this study is to evaluate the effectiveness of the civil engineering program offered by M L Sultan Technikon.

2. Critical Questions

- 2.1 What quality assurance mechanisms currently exist for the civil engineering program at M L Sultan Technikon that contribute to effectiveness?
- 2.2 How do students and employers perceive the quality and effectiveness of the civil engineering program?
- 2.3 What are the achievements and throughput rates and do they contribute to the effectiveness of the civil engineering program?

3. Civil Engineering Program Profile, Rationale and Methodology

3.1 Background of the Program

The civil engineering program is offered by the Department of Civil Engineering (CE) and is located in the Faculty of Engineering of M L Sultan Technikon. The Technikon is situated close to central Durban. The department has a staff compliment of 14 (Head of Department, 3 Senior Lecturers, 5 Lecturers, 1 Associate Lecturer, 3 Laboratory Assistants and 1 Secretary).

3.2 Instructional Programs

3.2.1 National Diploma : Engineering : Civil

This program was implemented in 1992 and replaced the National Diploma : Civil Engineering. This three year National Diploma is comprised of four semesters (S1-S4) of full time academic study and 1 year of experiential training, which is closely monitored and evaluated by the lecturers of the department. Ideally, the first and third years of this program should consist of full time academic study at the Technikon while the second year should be devoted to experiential training. However, due to the difficulty of placing students for experiential training in industry,

the department permits some flexibility in the program, i.e. at least six months of experiential training must be undertaken prior to registering for semester 4 (S4) and the remaining six months can be undertaken after completing S4.

3.2.2 Bachelor of Technology : Engineering : Civil (BTech)

This program is offered on a part time basis and the duration is 2 years. The program was implemented in 1995. To be able to register for this degree, students must be in possession of a National Diploma : Engineering : Civil or a National Higher Diploma : Civil Engineering. To satisfy the requirements for this degree, students must successfully complete eight instructional offerings in any one of six specialisation areas, viz. water, transport, structures, geotechnical, urban and management.

3.3 The Environment /Climate

The technikon buildings and surroundings are well maintained. However, there is an open space problem since the main campus is crowded with buildings. The computer laboratories, specialist drawing rooms, lecture theatres and library are well utilised and large enough to accommodate the students registered for the Civil program. Also, on campus there are amongst others a book shop, student counselling department and a financial aid bureau. According to Sackney (1986), a positive climate is one where affective development is facilitated; where students see themselves as able and responsible; and where students choose to learn and are invited to learn.

3.4 Rationale

The current programs, viz. the National Diploma : Engineering : Civil and the Bachelor of Technology : Civil Engineering, were implemented in 1992 and 1995 respectively. At both a self-evaluation meeting, held in March 2000, and the Certification Council for Technikon Education (SERTEC) evaluation committee meeting, held in May 2000, some employer representatives expressed their concerns that some of the civil engineering diplomates and experiential training students that are employed by their organisations, are deficient in certain areas of civil engineering, namely, design, surveying and drawing. Some of these employer representatives, represent major organisations that annually recruit students from amongst other institutions, M L Sultan Technikon. Also, there are a number of M L Sultan Technikon graduates, diplomates and students that are currently employed by these organisations.

On the other hand, the civil engineering students from M L Sultan Technikon have been recipients of a number of awards from the statutory body and other institutes for civil engineering in South Africa. These awards are highlighted in chapter 3. This was one of the reasons undertaking this research.

The Certification Council for Technikon Education (SERTEC) is a statutory body responsible for accrediting technikon programs in South Africa. The civil engineering program is evaluated by SERTEC once in every four years. Having served on these evaluation committees for the past three evaluation visits, in an allied field to civil engineering, I believe that SERTEC accreditation is not reflective of program effectiveness / ineffectiveness or high quality in teaching, learning and assessment. I view the two to three day accreditation visit by SERTEC as highly

insufficient to evaluate four years of work. This is a second reason for pursuing this research.

Rationalisation is an important consideration for tertiary institutions that offer civil engineering in Kwazulu-Natal. Resources, particularly in terms of technologically advanced equipment are scarce in some of the institutions and with the drastic cut in funding for higher education, rationalisation could play an imperative role. It is vital that students are empowered with the best possible teaching and learning experiences to meet the challenges of a developing country where the provision of infrastructure is of paramount importance. In this context rationalisation is viewed as a process of sharing resources (human expertise, physical and material) particularly where two institutions, that are in close proximity to each other are offering a common program. Technikon Natal and M L Sultan Technikon are approximately 400m apart and both institutions offer the same diploma program. However the institutions offer the BTech in different specialisations. It is possible to rationalise a number of instructional offerings and/or levels of the diploma program. This is another reason for undertaking this research.

3.5 Significance of the Study

The findings of this research could be useful to :

- the Department of Civil Engineering, M L Sultan Technikon in terms of identifying some of the strengths and weaknesses of the program and the provision of recommendations on how to transform the weaknesses into strengths.
- the management of M L Sultan Technikon in terms of highlighting the effectiveness of the various quality assurance mechanisms that exist at the

institution as well as zooming into the civil engineering program with the view of ascertaining whether it is effective or ineffective since the management is ultimately responsible for the effective and efficient delivery of the institutions programs.

- industry, who are partners in technikon education, which is cooperative in nature. This research could be useful to industry in terms of identifying the strengths and weaknesses of the experiential training component of the program which is provided by industry. Also, industry can benefit from the data collected and analysed from the students questionnaires in respect of experiential training.
- The Certification Council for Technikon Education (SERTEC) and the Engineering Council of South Africa (ECSA) who are responsible for the accreditation of technikon programs. This research could fill some of the gaps in the SERTEC quality assurance and the ECSA practical and laboratory work accreditation audits which are carried out once every four years.

Although there is an abundance of literature on effective educational programs and institutions, all relate to schools, colleges and universities. There is an absence of literature on effective programs at technikons, more in particular in civil engineering. This lack of literature on effective technikon programs is due to the uniqueness of technikon education which is cooperative in nature.

3.6 Methodological Approach

Questionnaires were used as an instrument to capture data from students and companies pertaining to their perceptions on the quality and effectiveness of the

civil engineering program. The total number of students that were registered for the diploma and degree was seventy two and therefore questionnaires were administered to all these students to capture data on the academic component of the program. Of the seventy two students that were registered for the program, twelve had completed the diploma and were studying towards the degree and eighteen had completed at least six months of experiential training. Therefore questionnaires were administered to thirty students to capture data on experiential training. All twelve students that were registered for the BTech degree have had at least 3 years post diploma work experience.

The company questionnaire was administered to six major organisations that employ more than sixty percent of the students either on a permanent basis (once they have completed the diploma) or as experiential training students. The researcher did envisage conducting interviews with companies but this proved to be a very costly and time consuming option since all these companies are located out of Kwazulu Natal. Furthermore the representatives of these companies are quite often involved in projects that are located in neighbouring countries to South Africa. The purpose of this questionnaire was to obtain employer perceptions on experiential training and academic preparedness of students for experiential training. The information gathered from these questionnaires provided valuable information on program quality and effectiveness.

The researcher spent approximately ten hours observing how teaching and learning took place. Attention was paid to the utilisation of laboratories and the teaching strategies employed by lecturers. The researcher conducted these observations in five two-hour sessions spread over five days so as to capture a variety of the

teaching and learning processes/activities that occur in the different instructional offerings in the program.

Official documentation on the civil engineering program was made available by the Secretary of the department (SERTEC documents, prospectus and other departmental and institutional policy documents).

A document analysis was carried out. The purpose of the document analysis was to gather information on a range of aspects pertaining to quality assurance. Some of the aspects associated with program effectiveness include the strategic plan, rewards and incentives, experiential training policy and staff development. Also some of the aspects (such as employer and student perceptions on experiential training, observation of some of the teaching and learning processes/activities and resources) for which data was collected and analysed from the questionnaires and from observation was also analysed from the documents. This served as a form of triangulation and contributed to the authenticity of the data.

Included in the self-evaluation document were SERTEC and ECSA accreditation reports for the past three visitations. Therefore it was not necessary to collect data from these statutory bodies. Furthermore, the accreditation committees of these bodies are formed on an ad hoc basis every four years and therefore there are no permanent committee members who could have been consulted to obtain perceptions on the civil engineering program.

The researcher decided to exclude staff perceptions of the quality and effectiveness of the civil engineering program since the inclusion of staff perceptions would have

led to a substantial degree of subjectivity. The researcher believes that the customers (students and companies) of any academic program, offered by a technikon provide valuable data on the quality and effectiveness of the program. Consequently, SERTEC and ECSA accreditation evaluations seem to concur with the researchers view in this respect.

3.7 Limitations of the Study

The study is based on the data for the period 1997 to 1999. In each of the years 1997, 1998 and 1999, the department offered exactly the same instructional offerings and made provision for a constant intake at each level of the program. Therefore data from previous years where there were two intakes of students per annum and optional instructional offerings were offered was excluded from this study.

The study uses secondary data (document analysis) to analyse the first critical question. It would have been a mammoth task to capture this data using other data collection instruments, for example, interviews and questionnaires.

There are a multitude of factors associated with program effectiveness as highlighted in chapter two of this study. Therefore this study is limited in that it evaluates the effectiveness of the civil engineering program within a defined conceptual framework which has been informed by the factors of effectiveness as postulated by Sackney (1986).

The researcher found it difficult to conduct interviews with students because at the time of data collection students were engaged in portfolio presentations and tests

in the various instructional offerings. The questionnaires were therefore administered by the subject lecturers immediately after the tests and portfolio presentations. Also, during this period, the researcher was committed to a workshop pertaining to his employment.

CHAPTER 2

LITERATURE REVIEW

2.1 Program Effectiveness

There is an abundance of literature on effective educational programs and achievement. However, much of this literature focuses on schools and colleges that are located in England and the United States of America (for example, Dunn, 1968; Edmonds, 1982; Purkey and Smith 1983).

In South Africa, there is a lack of literature on effective technikon programs and achievement. The bulk of the existing local literature focuses on secondary schooling (for example, Jansen, 1995).

The uniqueness of technikon education, particularly in engineering, differentiates it from other types of tertiary education in South Africa due to its cooperative nature. Cooperative education is a training system which attempts to integrate classroom and laboratory instruction with practical in-service training in industry MLST (2000).

Programs offered by technikons can be described, in terms of effectiveness, by reviewing and analysing existing related literature on effective programs (including literature on colleges, universities and schools) and achievement. The aim of this research is to evaluate whether the civil engineering program, offered by M L Sultan

Technikon, is effective or ineffective based on a selected framework of factors of effectiveness.

2.2 Towards a concept of an effective program

The body of literature on effective educational institutions, provides a plethora of conceptions of program effectiveness (as reviewed in this chapter). There are a range of indicators or factors of program effectiveness that one could use to ascertain whether a particular program is effective or ineffective. No single indicator can determine program effectiveness or ineffectiveness. However, some indicators may be more important than others, for example, results and throughput rates could be the most important considerations in determining program effectiveness at a technikon, since funding of higher educational institutions in South Africa is based on these. This is one of the critical aspects of this study in determining the effectiveness of the civil engineering program.

According to Johnson and Johnson (1989:13), "a clear cooperative structure is the first prerequisite of an effective educational institution". This implies that an educational program that is based on a cooperative structure will provide the culture necessary for helping educators to take responsibility for the learning of all their students. Successful programs are concerned, first, with reducing inequalities between students, both now and in their later life experiences (Fulcher, Semmens and Slee 1990).

There needs to be extensions of effective program initiatives beyond "simplistic five, seven or nine factor theories derived from educational program effectiveness research that is itself now over a decade in age" (Creemers, Peters and Reynolds

1989:8). Research into effective curriculum and pedagogy lags. Programs which are effective aim to produce a culture to improve the credentials of all students.

In an effective educational institution with quality classroom instruction, all students, irrespective of social class differences, can make more progress than all students in an effective educational institution with poor teaching methods (Stoll, 1991). According to Farell (1982), the more students learn in a given period of time, the more effective is the program or institution.

Interestingly, educational institutions serving poorer students are more effective than those serving the more privileged students in a nation, in spite of higher average scores in the elite private institutions (Scheifelbein and Farell 1973). In the poorer nations, one cannot consider the effectiveness of educational institutions in isolation but rather one must consider the effectiveness of various institutional or program alternatives in relation to their cost (Farell, 1982).

There is no single foolproof way to evaluate teaching. Each source of information or approach has its limitations; each can be biased or contaminated. What makes a program effective? Certain 'given' features provide an enabling environment in which to create an effective program. These are aspects over which teachers have little direct control such as class size, institution size and other policies implemented at national level. These 'given' characteristics, however, only contribute to effectiveness and do not by themselves ensure it. It is the characteristics within the control of the program leader and educators that are vital. These characteristics can change and provide a framework for program improvement efforts.

Research on effective schools (for example, Mortimore, Sammons, Stolls, Lewis and Ecob, 1988), indicates that approaches which maximise communication between educator and student rather than those which are heavily teacher-directed are associated with effective schools. Mortimore et al.(1988) have noted intellectually challenging teaching to be a factor in schools considered to be effective.

The huge body of research on effectiveness is competent only to provide indications of what factors are likely to produce greater effectiveness. Gray (1990) has pointed out that in about 30% of cases, programs seem to achieve “good” results without scoring particularly highly on all the “key” factors identified by researchers.

2.3 Characteristics of Effective Programs

The extensive research on effective educational programs and teaching provides a useful source of ideas as to the sorts of characteristics or features one should be seeking in order to determine whether a program is effective or ineffective. These rather general features have been confirmed by a host of other studies (for example, Bickel and Bickel, 1986; Lezotte, 1989; Purkey and Smith, 1983).

Edmonds (1982) identifies five characteristics attributable to effective educational programs :

- strong administrative leadership;
- institutional climate conducive to learning;
- high expectations for student’s achievement;
- clear instructional objectives for monitoring students performance; and

- emphasis on basic skills instruction.

But Ainscow and Muncey (1989) produced 6 characteristics, Porter and Brophy (1988) suggest 11 characteristics and Rutter, Maughan, Mortimore and Ouston (1979) link 10 factors with effectiveness while other studies (such as the 1980 Phi Delta Kappa study) generate different properties associated with effective programs. Similar observations have led Purkey and Smith (1983) to conclude that :

reviews do not always find the same features to be characteristic of effective programs, even when considering basically the same literature (p.429),

and continue that :

while all the reviews assume that effective programs can be differentiated from ineffectiveness, there is no consensus yet on just what the salient characteristics happen to be (p.430).

Apart from the number of factors associated with the different researchers mentioned above, there are other extensive effective program/institutional research that identify dozens of factors associated with effectiveness. Among other groupings of factors, are those provided by Sackney (1986).

I would argue that throughput rates, student achievements and greater input from students and employers, with respect to program quality, are of paramount importance to technicians and other higher educational institutions. The literature appears to be deficient in this respect. This study focuses extensively on these

components of program quality and effectiveness.

2.4 Conceptual Framework

The conceptual framework informing this study has been greatly influenced by Sackney (1986) and the Higher Education Quality Committee (2000).

The Higher Education Quality Committee (HEQC) in its Founding Document provides a basis for the need for a national quality assurance system for higher education in South Africa. This study focuses on quality assurance as a component of effectiveness.

According to Sackney (*ibid.*), there are a number of factors that are attributable to program effectiveness. Program effectiveness is dependent upon the existence and evaluation of all quality assurance mechanisms that exist for a program, in this instance the civil engineering program.

- **A Common Mission**

Bennis and Nanus (1985) describe a common mission as the articulation of 'a view of a realistic credible future, a condition that is better in some important ways than what now exists'. The mission reflects the shared vision of the educators, students, community and industry.

- **Clear Goals**

Clearly stated and agreed-upon goals give the program a sense of purpose, and hence its planning and implementation. These include the goals of every instructional offering and experiential training.

- **Frequent Monitoring of Student's Work**

According to Lezotte and Bancroft (1985), learning is seen as a primary purpose of any program. Regular and systematic monitoring of students' progress helps to identify strengths and weaknesses in learning and instruction. This is achieved by a variety of formal and informal assessments.

- **High Expectations, Pass Rates and Throughput Rates**

Educators in effective programs believe that all students can learn (Purkey and Novak, 1984) and set high but achievable learning standards. The head also communicates high expectations for staff in the promotion of student achievement. Pass rates and throughput rates are vital to program effectiveness. If a program is to sustain itself in the current climate of limited funding from government, not only good pass rates but high throughput rates are necessary since funding for tertiary programs are based on throughput rates.

- **Staff Development and Collegiality**

Students benefit academically when their educators share ideas, cooperate in activities and assist one another's intellectual growth. In more effective programs the emphasis is on educators as learners, as well as students as learners.

- **Recognition and Incentives**

All forms of reward, praise or appreciation have a positive impact on students. Effective programs have multiple opportunities for recognition.

- **Industry and Community Involvement and Support**

Industry is regarded as a partner in technikon education (cooperative education) and has significant input in the design and implementation of instructional programs and experiential training. There are also a wide variety of opportunities for the community to become constructively involved in the programs. Sackney (1986) provides a comprehensive framework of program indicators that researchers could use in understanding effective programs. These factors identified by Sackney form the main indicators of program effectiveness in this research.

2.5 Quality Assurance in Higher Education

Program quality in higher education is currently receiving much attention by many policy makers and researchers. The Council on Higher Education (CHE) via the Higher Education Quality Committee (HEQC) is presently engaged in establishing a quality assurance system for higher education. Quality assurance is often considered as a component of effectiveness, the relationship of which highlighted in the conceptual framework.

Quality assurance has been defined very broadly and there are multitudes of models currently available. According to Cox (1994:2), "quality assurance refers to those planned and systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality". Harvey and Green (1993) point out that quality assurance may be viewed as a benchmark, an absolute like "truth", that allows no compromise. Alternatively quality may be discussed in terms of thresholds of minimum performance that a "quality" education should exceed.

Quality assurance can also be defined in terms of the transformational experience of students (Moodie 1986:8). In this model, the aim is to create the conditions where students can experience a qualitative change that enhances them and empowers them as participants in education. However, the common aim of any quality assurance system, designed for higher education and training programs, must be responsive to the needs of learners, employers and society at large.

The development of a national quality assurance system for higher education in South Africa is a critical component of the restructuring of higher education which is currently underway. Inherent in program effectiveness is the concept of quality assurance, together with other principles such as democratisation, equity and redress and institutional autonomy. It is the effectiveness principle which is heavily dependent on quality assurance that this study is primarily concerned with.

2.6 Existing Quality Assurance System for Technikon Education (SERTEC)

The Certification Council for Technikon Education (SERTEC) was established as an autonomous statutory body, in terms of the Certification Council for Technikon Education Act, 1986 (Act 88 of 1986). Initially, SERTEC's function was to ensure that corresponding technikon certificates issued by the council would represent the same standard of education and examination. Its terms of reference were thus to ensure equal standards and to certify on that basis.

In 1988 SERTEC's main focus of activities changed to the monitoring of the quality of education in technikons. In 1993, by amendment to the Certification Council for

Technikon Education Act, SERTEC officially became an external accreditation body for technikons in South Africa and in 1996 SERTEC's methodology focused on self-evaluation which was influenced by and responded to the developing autonomy of technikons. SERTEC has significant powers to hold technikons accountable for quality at their institutions.

SERTEC establishes evaluation committees consisting of a member of SERTEC council, academic peers from other technikons, employer/industry representatives, students and representatives from professional bodies. All committees are coordinated by the executive director of SERTEC. The scope of the evaluations cover academic programs and other operational units such as resource centres, research, examinations and cooperative education. Evaluation committees visit technikons at least once in every four years to accredit programs, including civil engineering.

2.7 Strengths and Weaknesses of SERTEC

SERTEC, in discharging its statutory responsibilities has enhanced the status of technikons, increased their autonomy, enabled them to award degrees and provide greater opportunities for student mobility between individual technikons. SERTEC ensured accountability for the quality and standards of work in the technikons by subscribing to procedures which provided transparency and a strong professional/employer input.

Having pointed out all the positive aspects, in my view the methods adopted by SERTEC appear to be overly mechanistic and unlikely to encourage the development of strong and confident institutional quality management systems. The

SERTEC notion of self-evaluation is in fact a descriptive concept involving the collection of vast amounts of information. Little or no critical evaluation is required from the institutions nor provided by them. The somewhat cumbersome SERTEC manual encouraged this mechanistic approach to quality issues.

The SERTEC evaluation process provides guidelines that are generic, and areas of focus as well as the questions assume that all institutions are equal. They do not appear to recognise the highly differentiated higher education institutions that exist in South Africa. Institutions have consistently recorded problems in the interpretation and implementation of the procedures outlined by SERTEC. There is no common understanding and interpretation of the SERTEC guidelines within and between institutions, as well as between the internal and external evaluation teams.

Another criticism of the SERTEC process is the absence of performance indicators or acceptable minimum standards; appropriate elaboration of these and the vagueness surrounding them left them open to a wide range of interpretation. For instance, if it is not specified what 'good lecturer/student' ratios or 'adequate resources' for the library are, then the evaluation becomes highly subjective and generalised in nature, and ceases to be a useful feedback to the institution of the extent to which it is meeting minimum standards.

From the above discussion, it can be seen that in spite of the SERTEC quality assurance system being effective in a number of respects, it has many shortcomings. If the civil engineering programs aim to provide education and training that is nationally and internationally recognised, then a highly improved

quality assurance system is needed which consequently is a criterion for effectiveness.

CHAPTER 3

DATA COLLECTION AND ANALYSIS

3.1 Official Documentation on Civil Engineering Program (Document analysis)

Critical Question 1 : What quality assurance mechanisms currently exist for the civil engineering program that contribute to effectiveness?

A senior lecturer who is part of the management team of the department was approached and explained the purpose of the study. He immediately referred me to the secretary whom he made arrangements with to make available the documentation that was required for the study. The documents that were made available are :

- Prospectus : Civil Engineering
- Examination Manual
- Self-evaluation Manual : Civil Engineering
- Program for Academic Course Evaluation (PACE) Manual
- General Prospectus : M L Sultan Technikon
- Experiential Training Logbook

The researcher spent approximately three weeks analysing the documentation.

3.1.1 Admission Policy and Promotion

The minimum entrance criteria to the civil program is a senior certificate or equivalent with at least HG (D) or SG (C) symbol in Mathematics and Physical Science and at least E (HG) or D (SG) in English. However, students are usually subject to selection, due to the large number of applications for the limited number of places available. Selection is done on the basis of the quality of the matriculation results with greater weighting assigned to the subjects mentioned above.

For admission to the third year of study, students must have passed all first year subjects and must have completed at least six months of experiential training. To gain admission to the BTech, students must be in possession of the National Diploma : Engineering : Civil or a National Higher Diploma : Civil Engineering.

3.1.2 Fees, Sponsorships, Rewards and Incentives

The approximate fees per year of full time study is R 5500, excluding the cost of textbooks, drawing equipment and residence fees, for the diploma program and R 3200 for the BTech degree (part time). However, in the case of the BTech, the fees varies according to the subjects selected.

Some students are sponsored by employers in which case the employers are required to provide written undertakings that they will be responsible for the payment of the students fees.

Matriculants, with A aggregates get a full remission of fees for the first year of study at the technikon while matriculants with B aggregates get a 75% remission of fees. Also, if a student obtains an A aggregate in a level of study at the

technikon, he/she is entitled to a full remission of fees for the next level of study.

There are awards available for students who perform outstandingly well.

- the Engineering Council of South Africa (ECSA) award for the student with the highest overall average mark for the National Diploma : EGINEERING : CIVIL. This is a national award.
- The Institute of Professional Engineering Technologists (IPET) award for the student with the highest overall average mark at BTech level. This is a national award.
- The Portland Cement Institute (PCI) award for the student with the highest marks in concrete design 3 and construction 2.
- The South African Institute of Civil Engineers (SAICE) award for the student with the most number of distinctions from S1 to S4. This is also a national award.

The civil engineering students from M L Sultan Technikon have won the ECSA award four times, the PCI award four times, the IPET award once and the SAICE award four times, all in the past eight years. Also, the S3 and S4 students participate in the annual bridge building competition, which draws competitors from University of Natal, Technikon Mangosuthu, University of Durban-Westville and Technikon Natal.

3.1.3 Co-operative Education and Experiential Training

Co-operative education is a training system which attempts to integrate classroom and laboratory instruction with practical in-service training in industry. Co-ordination of theories and concepts with the practical application thereof in industry is

achieved by the alternating or integration of periods of technikon training with practical in-service training in industry. The one complements and supplements the other to effect better and more efficient training.

The three parties involved in co-operative education and which benefit from this system are the technikon, the employer and the student. By means of regular contact with employers, technikon personnel are able to get feedback in respect of contemporary work practices and new developments in industry. The technikon obtains valuable contributions from employers in compiling appropriate career-oriented courses.

Experiential (in-service) training is a compulsory component of the civil program. Students are employed essentially in the Civil Engineering and Building industry, but remain registered at the Technikon. There is no experiential training component for the BTech degree.

3.1.4 Evaluation and Assessment

Evaluation/assessment for each instructional offering in the civil program is either by continuous evaluation (non-examination) or examination at the end of the semester. In the case of examination subjects, fifty percent of the final mark constitutes the course mark and fifty percent constitutes the written examination. For continuous evaluation subjects, the weighted sum of all the projects, tests, assignments, etc. constitutes the final mark. Students who obtain between 45% and 49% are eligible to write the supplementary examination. There are no supplementary examinations for continuous evaluation subjects. All level three and above subjects are moderated externally. Sixty seven percent (67%) of the

instructional offerings are evaluated by continuous assessment. Scanning and remarking of examination scripts are permitted, however in order to apply for a remark, a student must have obtained at least 45% in the subject concerned. No remarking is permitted for continuous evaluation subjects.

3.1.5 Staff Development

The technikon has a staff development program in place where each department identifies two hours per week on its timetable for academic staff to attend discourses on professional development. It is compulsory for all academic staff to attend the staff development program. Each academic staff member is required to keep a professional development profile (log) to record their staff development activities. Workshops on program oriented integrated learning and teaching practice, assessment practices that are congruent with Outcomes-Based Education and research with respect to educational practice are arranged for staff to attend.

Program for Academic Course Evaluation (PACE) was implemented by the technikon in 1993 and currently exists and forms part of staff development. Basically, PACE provides academics with a range of student feedback and subject review options so as to improve their teaching practice. All academic staff must complete both a student feedback and subject review at least once a year.

Recently, the Certificate in Higher Education, Learning, Teaching and Assessment (CHELTA) was implemented by the technikon. This is an internally certificated program aimed primarily at newly recruited academic staff. Existing staff may also pursue this program should they wish to update their knowledge in teaching and

learning practice skills, modes of assessment and cooperative education.

3.1.6 Student Development

There exists a student development department which is responsible for implementing programs and initiatives which aim to help students individually and in groups to learn and study more effectively. An important feature of the student development is the tutorship program where final year students are put through a program so as to assist first and second year students who are experiencing difficulties in different instructional offerings, particularly in the mathematics and science related fields.

3.1.7 Curriculum Development

The curriculum development department is responsible for :

- developing curriculum practice to promote national goals for curriculum transformation.
- facilitating qualification specification and program design (including modularisation) to meet the requirements of the South African Qualifications Authority (SAQA) and the National Qualifications Framework (NQF).
- contributing to active development of outcome-based learning materials that embrace appropriate and effective use of technology.
- participating in national initiatives in curriculum development.
- initiating and participating in relevant research projects.

All academic staff are involved in curriculum development. Each department has a curriculum development coordinator.

3.1.8 SERTEC Evaluation

The Certification Council for Technikon Education (SERTEC), a statutory body, is responsible for accrediting technikon education in South Africa. SERTEC's function is to prescribe a minimum standard for all institutions included in its remit. These minimum standards would have to satisfy employers and professional bodies at all times. The evaluation of standards at technikons is based on the system of visiting evaluation committees. Visitations of evaluation committees takes place once every four years and the duration of each visit is two to three days.

3.1.9 Advisory committee and the role of students

An advisory committee consisting of academic staff (civil program) and industry representatives exists. The role of the advisory committee is :

- to provide a link and support between the technikon and industry.
- assistance with syllabus review.
- moderation of examination papers.
- assisting with placement of students and marketing of courses.
- training/compiling experiential training guidelines.

Students are represented at the Faculty Board, Senate, curriculum development workshops and the advisory committee meetings.

3.1.10 Staff Qualifications and Experience

All academic staff have qualifications in civil engineering. One staff has a Bachelor of Science (BSc), 1 has a Doctor of Technology (DTech), 4 have Master's Diploma in Technology (M Dip Tech), 3 have Bachelor of Technology (Btech) and 1 has a

National Diploma (N Dip). All academic staff have both industrial and lecturing experience. Industrial experience ranges from 3 years to 15 years while lecturing experience ranges from 2 years to 27 years. Four staff members are registered with the statutory body for civil engineering (ECSA) in the professional category.

All the academic support staff are in possession of a matriculation senior certificate and the industrial experience of these staff ranges from 11 to 15 years. Three academic staff members are pursuing studies towards the attainment of higher qualifications in civil engineering.

3.1.11 Objectives of Civil Engineering Program

The precise objectives of both the National Diploma and BTech in civil engineering are :

- to train students to become civil engineering technicians who will be competent in the application of technical tasks under remote supervision, by applying independent judgement in the identification and solution of civil engineering problems.
- to train students to become civil engineering technologists who will be competent in the application of specialist engineering tasks under minimal supervision, by applying independent judgement in the identification and solution of complex civil engineering tasks.

3.1.12 Mission Statement

The program has a mission statement which is parallel to the institutional mission statement. The mission statement of the civil program is :

To train and develop competent civil engineering technicians for employment in the survey, civil engineering and building industries.

and the institutional mission statement is :

In it's quest to train entrepreneurial leadership, M L Sultan strives for the transformation of higher education through sustainable quality teaching, learning, research and development programs in participation with industry and the wider community.

3.1.13 Community Projects

The staff and students involved in the civil engineering program engage in community projects for no remuneration. Most recent projects undertaken were the rehabilitation of a school, the survey of a temple site and the design of a mosque.

3.1.14 Monitoring of Experiential Training

A logbook for the recording of experiential training exists and is updated on a continual basis. All students who are registered for the civil program are required to register for experiential training in the second year of study which is undertaken at the work place. Staff from the department closely monitor students and visit them at their workplace and complete the "Monitoring of Experiential Training" form. This form contains information on compulsory aspects of in-service training and students are rated according to a scale on the type and nature of work undertaken. Employers are required to complete confidential reports on students. These reports include aspects such as relation with others, attitude, judgement, dependability, ability to learn and quality of work.

3.1.15 Strategic Plans

Strategic plans for the entire technikon exist. These plans cover a wide spectrum of aspects pertaining to the institution, some of which include the mission, goals and objectives, core values, student admission and access, curriculum development, cooperative education, community outreach, academic support services and image building. Every academic department, including civil engineering, is required to submit to the management of the technikon detailed long-term (5-year), medium-term (3-year) and short-term (1-year) strategic plans.

However, only two short-term strategic plans (i.e. 1998 and 1999) were available in the documentation that was made available. The goals and objectives are clearly set out in these plans. The student enrolment projections for the years 1999 and 2000, however, were not congruent with the actual enrolment figures. The enrolment figures were down by 38% and 36% respectively from the projected enrolments in the strategic plans. The department did manage to meet 70% of its targets for 1999, with the exception of the enrolment projection and the acquisition of additional academic staff to improve the lecturer-student ratio. All posts were apparently 'frozen' by the technikon management in 1999, due to the restructuring of academic departments.

Both the 1998 and 1999 strategic plans provide a detailed SWOT (strengths, weaknesses, opportunities and threats) analysis. The department has made successful efforts in attempting to accomplish its goals identified in the 1998 strategic plan, for example, the upgrading of the water, soils and survey laboratories. The department established partnerships with industry in order to transform these goals into reality.

The decline in the number of students enrolling for this program is not isolated from other programs and this is a national trend in higher education in recent years. Some of the reasons cited for this trend are students being unable to fund their studies, poor matriculation results, competition amongst tertiary institutions, including private colleges to attract students and cuts in the number of bursaries available for study at the institution. It was difficult to monitor the strategic plan projections and targets for the 1999 strategic plan since the majority of the target dates were towards the end of 2000 and the study was carried out in the first semester of 2000.

It is evident from the document analysis that there exists a plethora of quality assurance mechanisms for the civil engineering program which certainly contribute to program effectiveness.

Critical Question 2 : How do students and employers perceive the quality and effectiveness of the civil engineering program?

To answer this question, the student questionnaires and the employer questionnaires were analysed.

3.2 Student Perceptions : Academic Component of Program

Seventy two questionnaires were administered to students that are registered on a full-time basis for the civil program. All the questionnaires were returned.

Seventy four percent (74%) of the students were male while 26% were female. The average age of the students was 20 years. Approximately 35% of the students who

are registered for the Civil are not from kwazulu-Natal, but reside in the residences or other accomodation.

Sixty two percent (62%) of the students had a fairly reasonable idea of what the civil program involved. Twenty percent (20%) of the students had no idea of what the program involved while 18% did not respond to this question.

All the students had a high regard for the civil engineering program and rated it as "good". Seventy six percent (76%) of the students liked the good reputation of the technikon, 12% stated that the technikon was ideally located, 6% believe that the technikon has good facilities and 6% indicated that their parents sent them to the technikon.

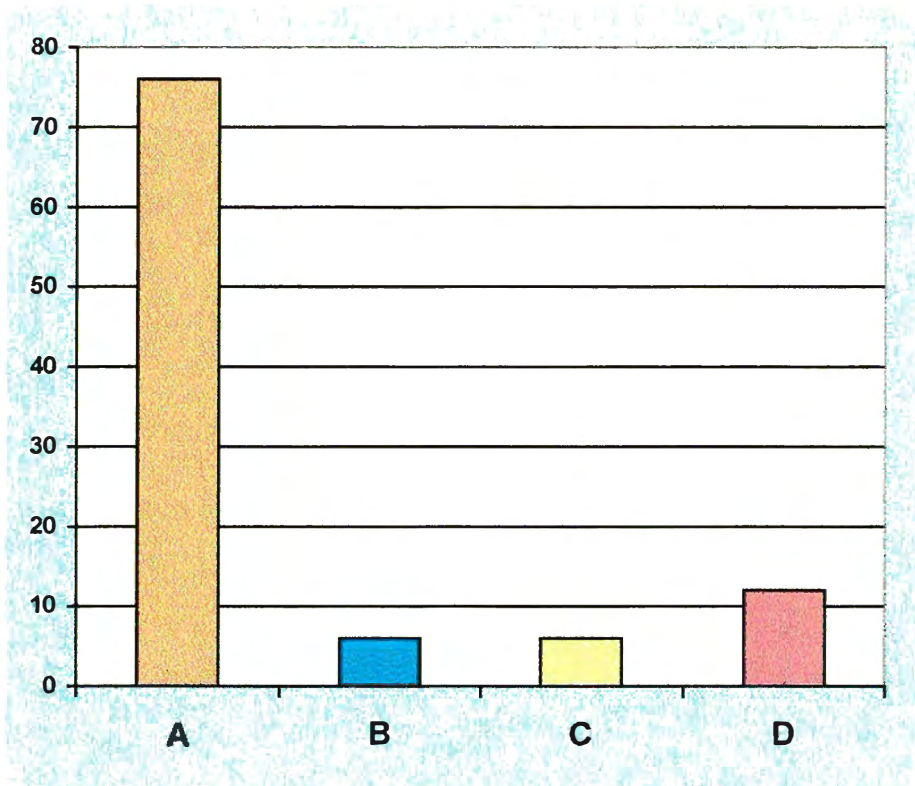
Graph, showing reasons for choosing the technikon according to students.

A = Good reputation

B = Good facilities

C = Parents sent

D = Ideally located



Ten percent (10%) of the students stated that their home language was English, while 90% indicated that their mother tongue and home language was an African language. However, 76% of the students stated that they prefer being taught in English and 24% indicated that they prefer being taught in their mother-tongue. Twenty six percent (26%) of the students were employed while 74% did not have jobs nor experiential training opportunities.

Progress reports are not issued to students (according to 100% of the students), unless requested by an employer.

Only seventy four percent (74%) of the students found their lectures in the various

subjects stimulating. Seventy eight percent (78%) of the students believe that their lecturers are knowledgeable in the subjects that they lecture while 22% do not believe so. Seventy two percent (72%) of the students stated that their lecturers are committed and dedicated in the teaching and learning process while 28% stated that lecturers are not committed and dedicated to their work.

Regarding the attitudes of lecturers towards students, 2% stated that it was "excellent", 22% rated it as " good", 76% rated it as "acceptable".

Fifty two percent (52%) of the students chose Mathematics and Surveying as their favourite subjects, while 42% reported that mathematics and Drawing are their worst subjects. Eight percent (8%) stated that they had no favourite or worst subjects.

The number of students that had difficulties in instructional offerings are as follows : mathematics (44%), applied mechanics (30%), structural analysis (12%) and the remainder of the students stated that they did not have any difficulties in any subjects.

Eighty four (84%) of the students stated that they had sufficient resources available to them, i.e. notes, study aids and drawing equipment, while 16% did not believe so. Seventy two percent (72%) of the students reported that the library is adequately equipped with books and other resources for the civil program, while 28% of the students stated that the library is under resourced, mainly due to insufficient copies of the relevant books being made available to students.

All the students (100%), stated that they received homework, tutorials, assignments and projects in each subject daily or after every lecture. Seventy eight percent (78%) of the students stated that their Lecturers put "theory into practice", especially in practical subjects, while 22% stated that very little or no theory is put into practice. Fifty two percent (52%) of the students reported that they never go on site visits while 48% indicated that they do go on visits.

All the students rated the standard of assessment as "high". Eighty six percent (86%) of the students were familiar with the rewards offered by the institution for outstanding performance while 14% were unfamiliar with these rewards. Sixty two percent (62%) of the students were familiar with the goals of the program while 18% did not know what the goals were and 20% did not respond to this question.

All the students were satisfied with the efficient marking and return of their tests, assignments, etc. by their lecturers. Regarding the leadership of the Head of department, 40% rated it as "good", 22% rated it as "poor" and 38% did not respond to this question.

Seventy percent (70%) of the students stated that they are not experiencing problems (eg. with respect to Lecturers, subjects and course content), while 30% reported that they are experiencing problems. Some of the problems experienced by students are :

- there is too much work in too little time.
- some lecturers do not supply students with the scheme of work for the semester (test dates, number of tests, assignments, projects, practicals, etc.)
- the content of some of the instructional offerings is too theoretical.

- some lecturers report for lectures late.
- not enough practicals and/or fieldwork are undertaken in some instructional offerings.
- Some lecturers favour certain students.

3.3 Student Perceptions : Experiential Training

Thirty (30) questionnaires were administered to students who completed the experiential training component of the program. All the questionnaires were returned.

Eighty one percent (81%) of the students rated the quality of training offered at companies as “good” (relevant to the academic program) while 15% of the students stated that the training is “unsatisfactory” (not relevant to the academic program) and 4% did not respond to this question.

Eighty five percent (85%) of the students rated the quality of academic and practical knowledge obtained from the Technikon as ‘good’ (relevant to ‘on the job training’). Seven percent (7%) rated this knowledge as “satisfactory” while 8% rated it as “unsatisfactory”.

Eighty five percent (85%) of the students rated the attitude of their employers as “good”, while 11% rated it as “satisfactory” and 4% were uncertain. Regarding the current state of technology in the civil engineering industry, 74% of the students stated that their employers are up to date, while 26% rated their employers’ use of technology as below the current state of technology.

Eighty one percent (81%) of the students reported that the current instructional material at the technikon is up to date with technology, while 15% stated that it was not and 4% were unsure.

Eighty five (85%) of the students stated that they are not adequately equipped to undergo experiential training in the second year of study, while 15% believe that they are. Fifty six percent (56%) of the students believe that experiential training should be offered after semester 4 , while 22% stated that it should be offered after semester 2 and 22% were uncertain about when experiential training should take place.

Thirty percent (30%) of the students said that they upgraded their knowledge with respect to technological advances at least once in every semester while 19% reported that they upgrade their knowledge once a year and 51% did not respond to this question. All the students indicated that lecturers visit their work places to monitor their training.

Some of the difficulties experienced by students are :

- many students are not given the opportunity to be actively involved in the handling of projects because of the limited knowledge that they possess.
- the methods of instruction in some of the major practical instructional offerings at the technikon is out of date.
- Students are not computer literate.

3.4 Employer Perceptions : Experiential Training

Questionnaires were administered to six organisations that offer experiential training (major employers of students). Five questionnaires were returned.

All the employers (100%) :

- were satisfied with the students' application of academic knowledge.
- stated that the students make a significant contribution to the value of their organisations.
- rated the students academic knowledge from the technikon as "good".

Sixty percent (60%) of the employers were satisfied with the students' practical knowledge obtained from the technikon while 40% found this knowledge to be very limited. Regarding the students' degree of responsibility, 80% of the employers rated it as "good" and 20% rated it as "satisfactory". All the companies reported that the students' degree of accountability was acceptable. Sixty percent (60%) of the employers stated that the students are not adequately equipped to undergo experiential training after completing S2 while 40% believe that the students are equipped. Twenty percent (20%) of the companies believe that experiential training should take place after completing S3 while 40% indicated that it should take place after completing S4.

Sixty percent (60%) of the employers stated that the lines of communication between the technikon and employers were "good", while 20% stated that they were "satisfactory" and 20% reported that they were "poor".

According to the employers, some of the difficulties experienced by students are :

- inability to relate theory to practice.
- inability to read plans and interpret drawings.
- unsure of the method of approach when taking off quantities.
- not all students are able to obtain a balance between site and office work.
- inability to carry out basic surveying tasks.
- some companies specialise in only one aspect of civil engineering, for

example, roads, and therefore students do not obtain a broad spectrum of training in civil engineering as required by the program.

- lack of communication skills poses a problem in industry.
- lack of computer skills, particularly with respect to civil engineering software packages.

3.5 Observation : Teaching and Learning

Through general observation, it was noticed that lecturing was very transmissive in nature with students sitting passively and the lecturer doing all the talking. All lecturers allocate a minimum of 5 periods per week for student consultation. In many of the first and second semester offerings, lecturers experience great difficulty in providing individualised attention to students since the class sizes are large (approx. 70 students). Also not all the lecture rooms are air-conditioned and this hinders the learning process since the heat is unbearable, particularly in the case of large groups of students.

Seventy five percent (75%) of the instructional offerings in the civil engineering program are evaluated by continuous evaluation. Each instructional offering has at least five assessments (including tests, assignments, projects, practicals and group work).

The civil engineering laboratories are well maintained and utilised and are equipped with up to date technology, particularly in water engineering and surveying. All laboratories have samples of students work displayed on the walls as well as models. The technikon library is spacious with more than sufficient study facilities and is equipped with the latest computerised technology for civil engineering students.

3.6 Enrolment and Results

Critical Question : What are the achievements and throughput rates and do they contribute to the effectiveness of the civil engineering program?

3.6.1 Enrolment

Shown below are statistics of the number of students that enrolled for the ND :Civil program, for the period 1997-1999.

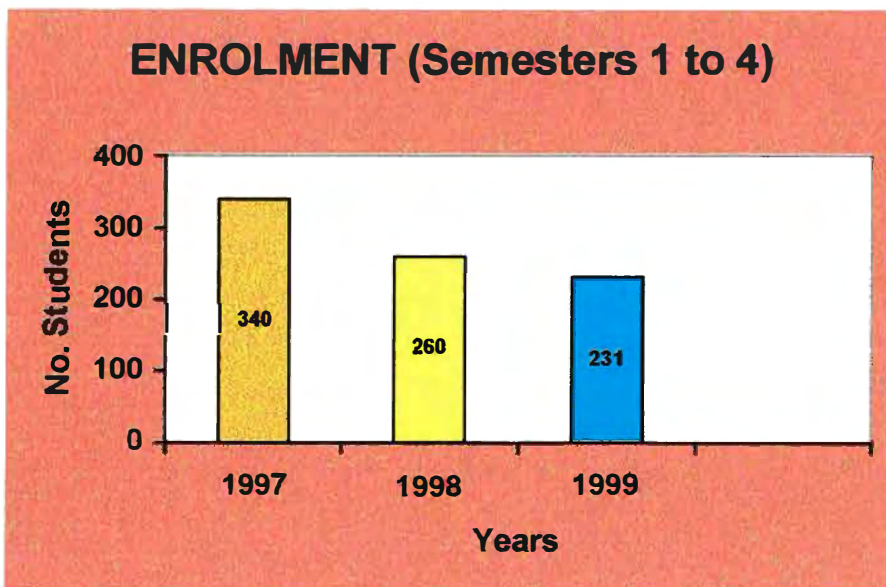


Figure 1

Figure1, above, shows the overall number of students that registered for each of the years 1997, 1998 and 1999. The number of students decreased from 340 in 1997 to 231 in 1999. The average enrolment per year is 277.

The number of students that registered for the BTech degree is indicated in Table 1, below.

Table 1

YEAR	1997	1998	1999
No. of Students	34	26	24

The highest number of students (34) registered in 1997 while the lowest (24) was in 1999. The average enrolment per year for the BTech is 28.

3.6.2 Results

Comprehensive statistical data and analysis of student achievements and throughput rates in the civil engineering programs are provided in this section.

Shown below, is a graph indicating the average first semester (S1) results for the period 1997 to 1999.

AVERAGE S1 PASS RATES (1997 TO 1999)

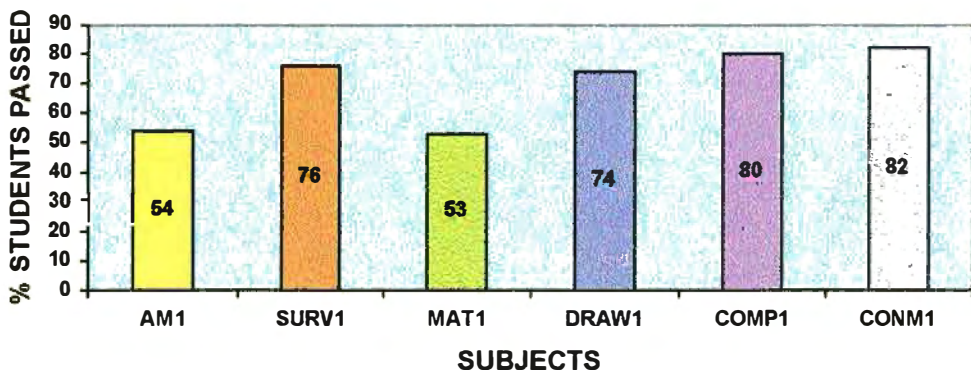


Figure 2

The subject codes represent the following subjects :

AM1 = Applied Mechanics 1

SURV1 = Surveying 1

MAT1 = Mathematics 1

DRAW1 = Drawing 1

COMP1 = Computer Skills 1

CONM1 = Construction Materials 1

Referring to Figure 2, COMP1 (82%) has the highest pass rate while MAT1 (53%) has the lowest pass rate.

Shown below, is a graphical representation of the average semester 2 (S2) results for the period 1997 to 1999.

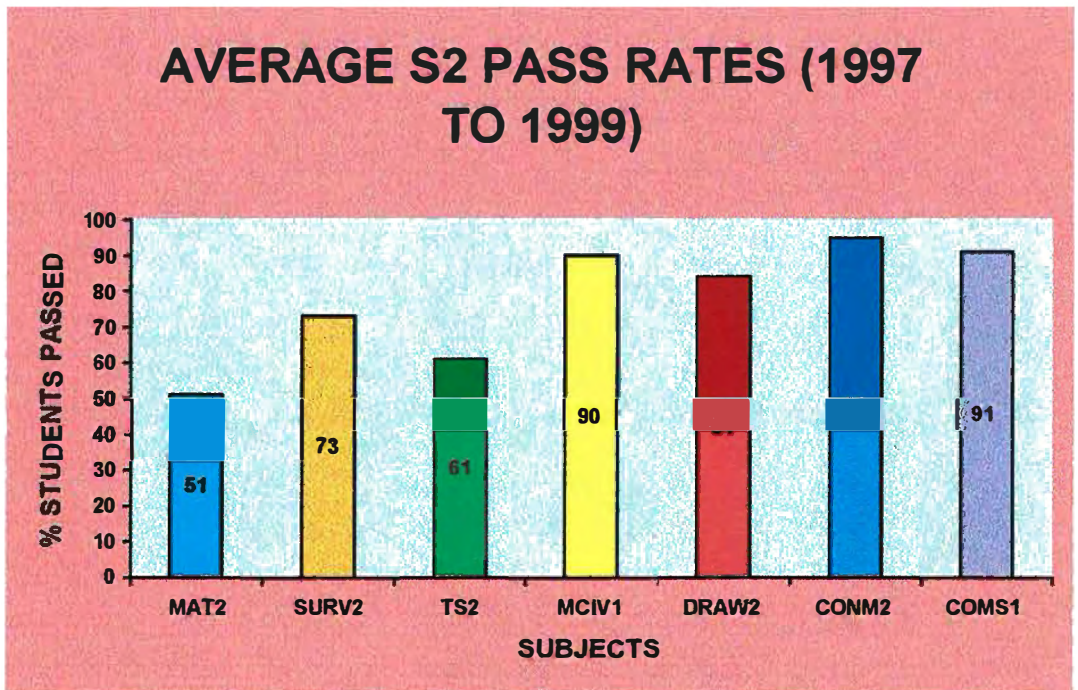


Figure 3

The subject codes in the chart above refer to the following subjects.

MAT2 = Mathematics 2

SURV2 = Surveying : Civil 2

TS2 = Theory of Structures 2

MCIV1 = Management : Civil 1

DRAW2 = Drawing 2

CONM2 = Construction methods 2

COMS1 = Communication Skills 1

Referring to Figure 3 , the highest pass rate was attained in CONM2 (95%) while MAT2 (51%) has the lowest pass rate.

The graphical representation, shown below, represents the average results in the third semester (S3) for the period 1997 to 1999.

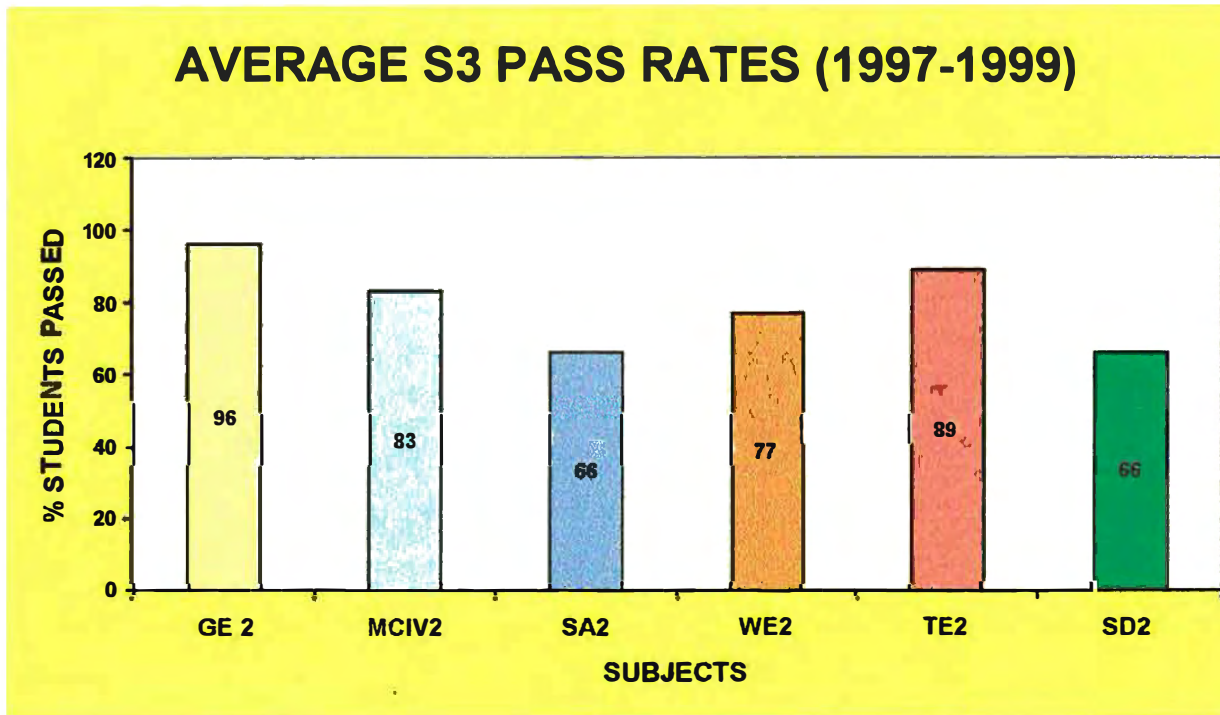


Figure 4

The subject codes in Figure 4 represent the following subjects :

GE2 = Geotechnical Engineering 2 MCIV2 = Management : Civil 2

SA2 = Structural Analysis 2 WE2 = Water Engineering 2

TE2 = Transportation Engineering 2 SD2 = Structural Design 2

Referring to Figure 4, GE2 (95%) has the highest pass rate while both SA2 and SD2 (66%) have the lowest pass rates.

The graphical representation, shown below, represents the average results in the fourth semester (S4) for the period 1997 to 1999.

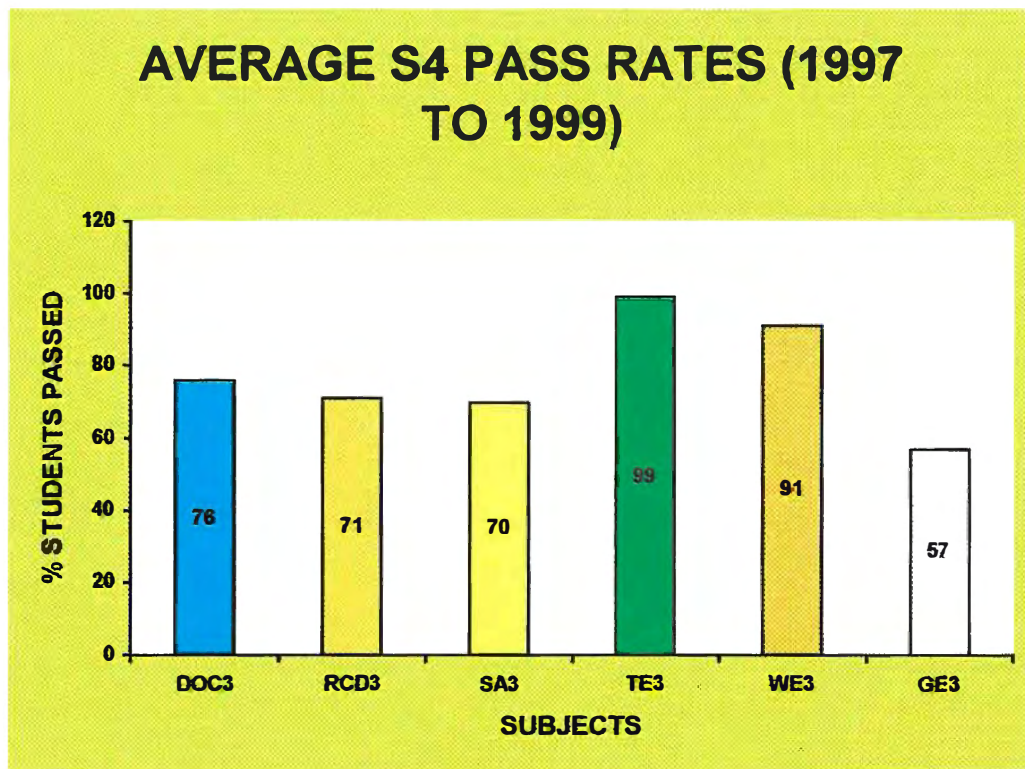


FIGURE 5

The subject codes in Figure 5 represent the following subjects :

- | | |
|-----------------------------|-------------------------------------|
| DOC3 = Documentation 3 | RCD3 = Reinforced Concrete Design 3 |
| SA3 = Structural Analysis 3 | TE3 = Transportation Engineering 3 |
| WE3 = Water Engineering 3 | GE3 = Geotechnical Engineering 3 |

Referring to Figure 5, TE3 (99%) has the highest pass rate while GE3 (57%) has the lowest pass rate.

The chart below represents the average pass rates for the BTech degree

for the period 1997 to 1999.

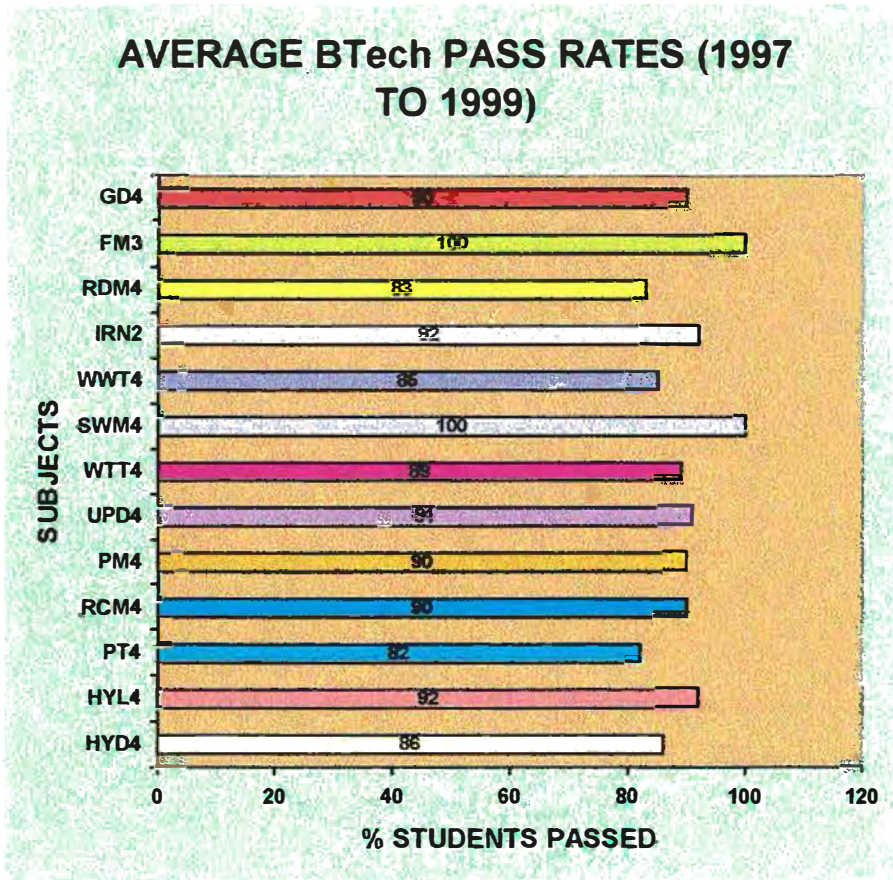


Figure 6

The subject codes indicated in the chart above represent the following subjects :

HYD4 = Hydrology 4

HYL4 = Hydraulics 4

PT4 = Pavement Technology 4

RCM4 = Reinforced conc. & Mas.
Design 4

PM4 = Project Management 4

UPD4 = Urban Planning & Design 4

WTT4 = Water Treatment Technology 4

GD4 = Geometric Design 4

SWM4 = Solid Waste Management 4

FM3 = Financial Management 3

WWT4 = Waste Water Treatment 4

IRN2 = Industrial Relations 2

RDM4 = Reticulation Design & Management 4

Referring to Figure 6, both SWM4 and FM3 (100%) have the highest pass rates while PT4 (82%) has the lowest pass rate.

The **overall pass rates per year** for the civil engineering program (Diploma) is indicated in Figure 7 below.

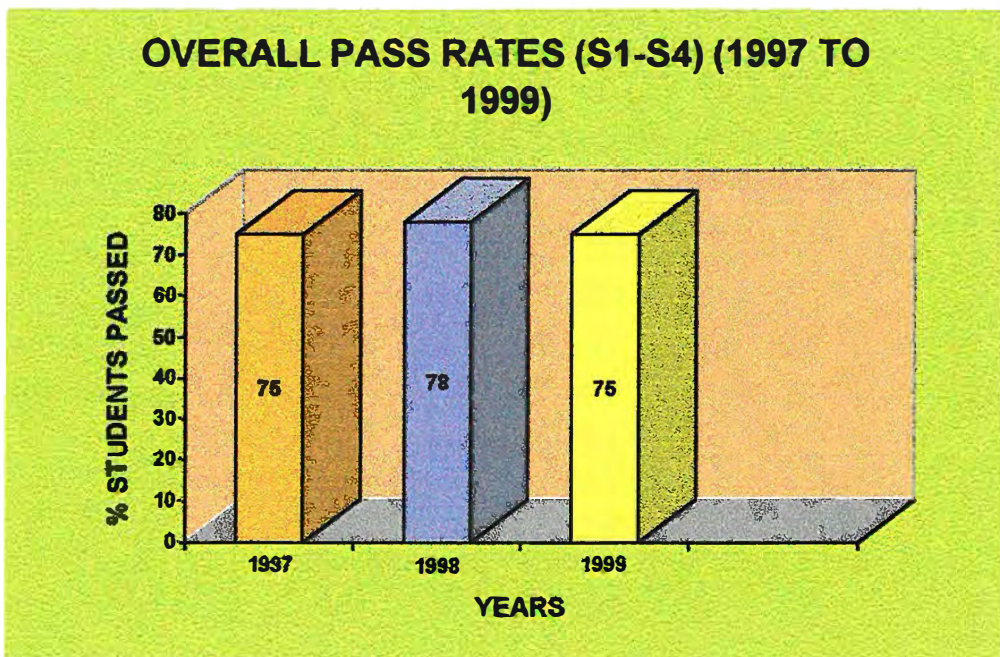


Figure 7

The highest overall pass rate was attained in 1998 (78%) and the lowest was in 1997 and 1999 (75%). The average overall pass rate over the three-year period is 76%.

The **overall pass rate** per year for the BTech is shown in Figure 8 below.

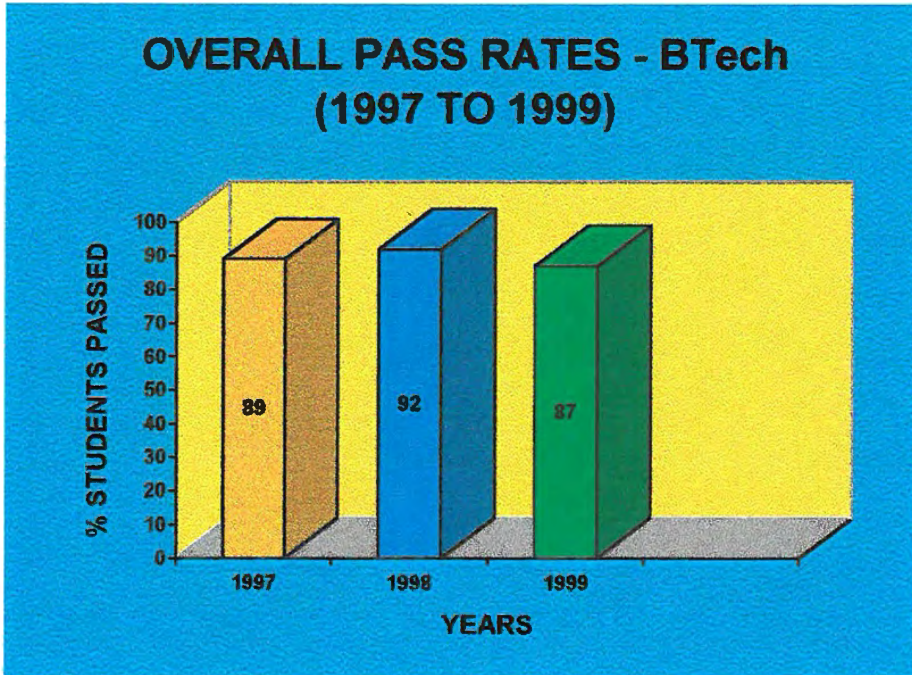


Figure 8

The highest pass rate for this post diploma degree was achieved in 1998 (92%) and the lowest pass rates was obtained in 1999. The average overall pass rate for the three-year period is 89%.

The **throughput rate**, for the period 1997 to 1999, is shown in the chart below.

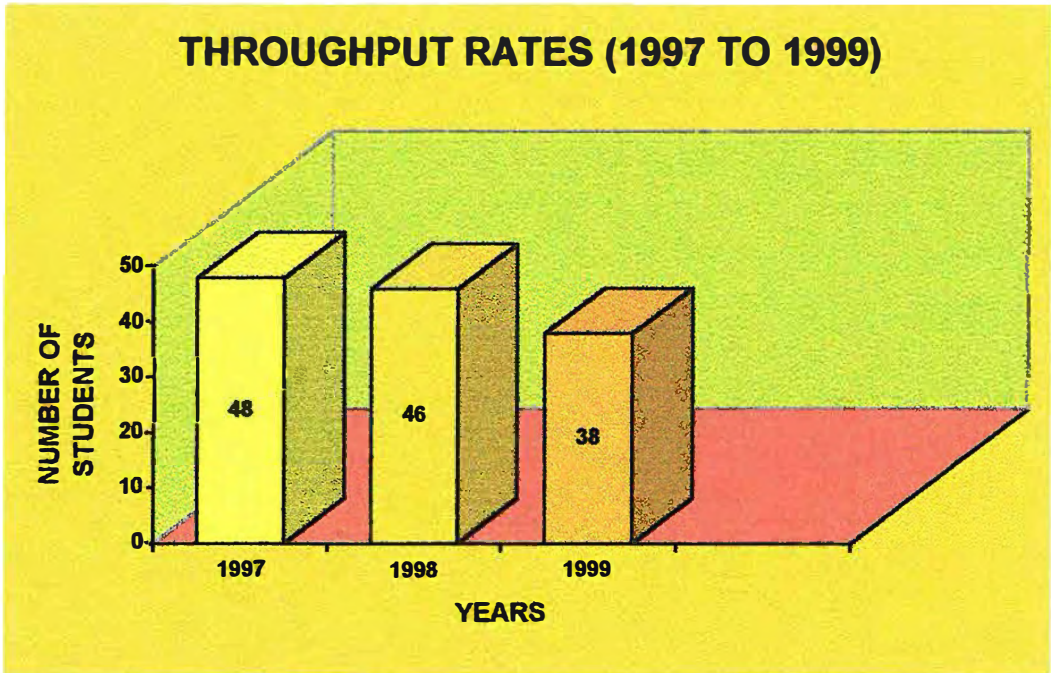


Figure 9

The throughput rates indicated above, includes the awards of National diplomas and BTech degrees. The highest throughput rate was attained in 1997 (48) and the lowest in 1999 (38). The average throughput rate for the three-year period is 41%.

3.6.2 Summary of Data Analysis (Enrolment and Results)

The enrolment figures, in terms of the data analysis appears to be on a decline. A possible reason for this is that the department has since 1997 subscribed to a policy of having a single intake of first year students per year as opposed to two intakes per year prior to 1997. Also the decline in student numbers appears to be a national phenomenon in higher education.

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The overall average pass rates per year of 76% and 89% for the diploma and degree respectively are extremely high (particularly an engineering discipline) by



any standards and fall into the category of distinction. These pass rates certainly are effective. The average overall throughput rate of 41% although relatively high in comparison to the 18% for the entire technikon is low. The throughput rate therefore appears to be effective at the institutional level. One possible reason for the low throughput rate is the decrease in the first year intake of students (i.e. one intake as opposed to two previously).

CHAPTER 4

FINDINGS, RECOMMENDATIONS AND CONCLUSION

The purpose of this study is to evaluate the quality and effectiveness of the civil engineering program, offered by M L Sultan Technikon. The framework of factors for program effectiveness as developed by Sackney (1986) has been used to a large extent.

4.1 Summary of Findings

- Approximately 38% of the students that are registered for the civil program are unfamiliar with what the program entails. Included in the 38% are first, second and third year students.
- The current program is being offered since 1992. Only subject codes and subject names have changed with the course content remaining unchanged.
- Students are not computer literate. The entire civil engineering program has only one introductory computer course in the first year of study. Also, students lack basic communication skills and this poses a problem in industry.
- Lecturing is transmittive in nature i.e. chalk and talk. From observation, it was noticed that there was very little or no student interaction in lectures, with the exception of the laboratory and practical work.
- The enrolment for the diploma decreased by 32% from 1997 to 1999 and the average enrolment per year was 277. The enrolment for the degree has also decreased by 29% from 1997 to 1999. The average enrolment per year was 28.
- The pass rates for mathematics 1 and 2 are relatively low when compared

with other instructional offerings in the first year of study. The overall average pass rates, for the diploma and degree were 76% and 89% respectively. These pass rates are significantly higher than the average pass rates in the Faculty of engineering which are approximately 58% and 68% for the diploma and degree respectively.

- The average throughput rate for the civil engineering program was 41% which is significantly higher than the average throughput rate of the entire technikon, which was 18%. It is interesting to note that funding from Government is based on the throughput rate. The throughput rate is greatly influenced by the compulsory experiential training component of the program. If students cannot acquire in-service training then this reduces the throughput rate.
- The program has a mission statement and clearly stated goals. Sixty two percent (62%) of the students were familiar with the goals of the program.
- Incentives, rewards and sponsorships exist for students who produce exemplary results. Besides the technikon rewards and incentives, there are also ECSA, SAICE and IPET awards available to students.
- Staff, student and curriculum development programs, as well as a quality assurance program is in place. It is compulsory for all academic staff to participate in the staff development program and all staff are also involved in student and curriculum development and quality assurance, however, at varying levels of intensity.
- Industry plays an imperative role in technikon education as outlined in cooperative education (chapter 3). Besides having input in the curriculum, industry serve on both the SERTEC and ECSA panels, provide experiential training for students and serve on the advisory committee of the faculty.
- All the staff are in possession of at least an M+4 vertical qualification in civil engineering and have had both industrial and lecturing experience. Four staff members are registered in the professional category with ECSA. All the staff

are both academically and practically qualified to lecture on the civil engineering program.

- Students receive assignments, projects and exercises from lecturers almost every week. All the students were satisfied with the efficient marking and return of these tasks.
- Sixty percent (69%) of the students were dissatisfied with the head 's management style, which was perceived to be autocratic in nature.
- Students are not well equipped to undergo experiential training in the second year of study, according to all the lecturers, 85% of the students and 60% of the employers.
- A logbook for experiential training does exist. However, it lacks detail on the compulsory training requirements in respect of experiential training.
- The civil engineering program is evaluated once in every four years by the both the Certification Council for Technikon (SERTEC) and the Engineering Council of South Africa (ECSA). Currently, SERTEC operates within the South African Qualifications Authority (SAQA) framework and is responsible for accrediting all technikon programs in South Africa.
- The laboratory facilities for the civil program are well maintained and equipped with modern technology.
- The majority of the subjects in the civil program are evaluated by continuous assessment (67%) which is in keeping with the philosophy of cooperative education.
- All the lecturers are in constant contact with the civil engineering industry since all lecturers are involved in the monitoring of experiential training.
- Some of the students enrolled for the program (30%) are experiencing problems (chapter 3, 3.2).
- There is a lack of field trips and site visits, according to 52% of the students.

Based on these findings, it is evident that the civil engineering program is ascending towards effectiveness, although there are some aspects of the program that needs to be addressed.

4.2 RECOMMENDATIONS

Flowing out of the findings and discussion, the following recommendations are made with the purpose of helping improve the degree of effectiveness of the civil engineering program.

- It is surprising to note that a large percentage of the students are not familiar with what the program that they are registered for entails. The department needs to amend it's marketing strategies in attracting students to this program.
- Civil engineering is a profession that continuously updates, especially with respect to technological advancement therefore re-curriculation needs to take place at short periods of time so as to satisfy the needs of industry.
- Additional computer courses need to be introduced in the program or every instructional offering in the program should have a computer component. Also the department should consider offering short courses in popular civil engineering software packages, for example Stardust, Allycad and Model Maker so that students can gain exposure to these packages prior to undergoing experiential training. Also, as mentioned above, re-curriculation needs to take place. The existing program is 8 years old.
- Students experience a host of problems with regard to communication skills. To overcome these problems, the following is recommended :
 - Involve students in lectures, group work, debates and presentations and allow them to express themselves.
 - Introduce additional communication modules in the program.

- Encourage students to attend workshops, seminars and inter-institutional meetings.
- Lecturing needs to be more learner centred rather than teacher centred as is the case in this program. Attention should be paid to group work, presentations and individual work.
- Mathematics, like in most science and engineering programs, is a problem subject for the majority of students registered for the civil program. The student development department should seriously consider appointing tutors in mathematics to assist students. Also, the introduction of foundation or bridging programs between matriculation and first year of technikon study in engineering should be considered. These foundation programs are known to improve the pass rate in mathematics quite considerably, for example, the pass rate in mathematics in surveying, offered by M L Sultan Technikon has improved by at least 30% since the introduction of the foundation program.
- There has been a significant decrease in the enrolment between 1997 and 1999. There could be numerous reasons for this decline in student numbers, some of which include, lack of finance to pay for studies, not satisfying the entrance criteria and poor marketing strategies by the institution in attracting prospective students. The department needs to investigate the decline in student numbers.
- The lack of experiential training stagnates the throughput rate. The department in conjunction with the advisory committee needs to devise ways of securing experiential training for its students. One suggestion is for the department to engage in consultancy work. The benefits are that students can be engaged in a multitude of projects (which would count towards their experiential training) under the supervision of the lecturers and the department can derive an income. Also, the throughput rate would be increased quite considerably since the overall pass rate for this program is 76% and it appears that the lack of experiential training contributes to the

41% throughput rate.

- The head of department needs to critically re-examine his management style and perhaps higher management intervention is needed here to resolve the problem as expressed by the students.
- It is recommended that the log book for experiential training be updated to include the compulsory categories of training required and the monitoring of in-service training form so that students know in advance what is expected of them and work towards achieving these outcomes.
- Students are experiencing a number of problems (see data analysis, chapter 3). It is recommended that all students be subjected to an orientation program, in order identify which department to approach when they experience problems.
- It is recommended that experiential training be undertaken after the completion of semester 4 (S4). This was the perception of 56% of the students and 60% of the staff.
- Although SERTEC and ECSA evaluates this program every four years, it is recommended that the advisory committee elect a panel to execute an evaluation of the program at least every two years. This exercise could be used to identify the weaknesses of the program and make the necessary rectification in preparation for the formal SERTC and ECSA visitations.

4.3 CONCLUSION

To ascertain whether a program is effective or ineffective is not a simplistic task since research on effective programs has provided a plethora of characteristics associated with effective schools, colleges and programs. An even more complex task is to evaluate a program or institution for quality in terms of the proposed quality assurance systems discussed in the literature review of this study. Depending on the framework selected and the factors of effectiveness associated with this framework, some researchers can deem a program to be effective and some can deem a program to be ineffective.

The civil engineering program has some deficits, particularly in terms of the leadership style prevalent in the department, the need to re-curriculate the program, the low pass rates in mathematics and the timing of experiential training. On the positive side the program has a mission and clearly stated goals (most of which it accomplished in 1999), committed lecturing staff, student and staff development structures in place, a climate conducive to learning, relatively high pass rates and throughput rates in comparison with other programs offered by the technikon, rewards and incentives for exemplary performance (students were recipients of numerous national awards) and strong industry involvement and support.

Evaluating both the deficits and strengths of these programs in terms of the frameworks of Sackney (1986) and the Higher Education Quality Committee (2000), which were used in this study, the civil engineering department is taking big strides in the direction of producing quality and effective programs.

4.4 Suggestions for Future Research

This study focused on a broad range of factors associated with effectiveness, using the models of Sackney (1986) and the Higher Education Quality Committee (2000).

- Future research could focus on the effectiveness of the matriculation examination in preparing students for tertiary studies in engineering at technikons.
- The effectiveness of a foundation studies program in improving the mathematics and science performances in the first year of study in engineering at technikons.
- Another study that could be carried out could focus on the factors of effectiveness that contribute to effective management of engineering programs at technikons.
- The effectiveness of a cooperative educational approach in engineering studies at tertiary institutions.
- The factors that contribute to maintaining quality in engineering programs at technikons.

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STUDENT QUESTIONNAIRE
(Academic Component of Programme)

The purpose of this questionnaire is to obtain student perceptions on the quality and effectiveness of teaching and learning in Civil Engineering, at ML Sultan Technikon.

This is not a test and there are no right or wrong answers. The information you provide is confidential

SECTION A : **BACKGROUND INFORMATION**

Please place a cross (x) in the correct section of the box, for 1 – 3.

1. GENDER:

Male	Female
<input type="checkbox"/>	<input type="checkbox"/>

2. AGE:

16 - 20	21 - 25	25 +
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. Why did you choose to study at this Technikon?

Good Reputation	<input type="checkbox"/>	Good Facilities	<input type="checkbox"/>
Parents Sent	<input type="checkbox"/>	Ideally Located	<input type="checkbox"/>

4. What is your home language?.....

5. What is your mother-tongue language?.....

6. What language medium do you prefer being taught in?.....

7. Are you employed, or have completed experiential training?

Yes No

SECTION B: **Programme Information**

1. What, in your opinion, is the Civil Engineering Programme about?

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

2. Do you find the lectures in the various subjects stimulating?

Yes No

3. Are the lecturers' knowledgeable to lecture the subjects that they are presenting?

Yes No

4. Are the lecturers' committed and dedicated to the teaching and learning process?

Yes No

5. How would rate the attitude of Lecturers towards students?

Excellent Good Accepted
Unaccepted

6. Which is/are your favourite subject/s?

.....
.....

Why?
.....

7. Which subject/s do you dislike?.....

.....

Why?
.....

8. Are there sufficient resources available (i.e. models, notes, study aids, computers, etc)?

Yes No

9. Do your Lecturers' put "theory in practice" in subjects that require practical work?

Yes No

10. Do you go on field strips. (e.g. construction sites).

Yes No

11. Do your Lecturers give you homework, tutorials, assignments, etc. ?

Yes No

If Yes, how often?

12. How would you rate the standard of assessment for this programme?

High Satisfactory

Fair Poor

13. Are you familiar with the rewards available for outstanding academic performance?

Yes No

14. Are you familiar with the goals of the Civil Engineering Programme, as framed by the department?

Yes No

15. How would you rate leadership of the programme by the Head of Department?

Excellent Good

Satisfactory Poor

16. Are you experiencing any problems (e.g. Lecturers, subjects, course content, etc.)?

Yes No

If Yes, list some of these problems.

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

THANK YOU FOR YOUR PRECIOUS TIME!

STUDENT QUESTIONNAIRE
(Experiential Training)

The purpose of this questionnaire is to obtain student perceptions on experiential training in Civil Engineering Programme, offered by ML Sultan Teknikon.

This is not a test and there are no right or wrong answers. The information you provide is confidential.

1. How would rate the quality of in-service training at companies (in terms of relevance to the academic programme)?

- | | |
|---------------------------------------|---|
| Very Good <input type="checkbox"/> | Good <input type="checkbox"/> |
| Satisfactory <input type="checkbox"/> | Unsatisfactory <input type="checkbox"/> |

2. How would you rate the quality of academic and practical knowledge that you obtained from the teknikon, in preparation for experiential training?

- | | |
|---|---------------------------------------|
| Good <input type="checkbox"/> | Satisfactory <input type="checkbox"/> |
| Unsatisfactory <input type="checkbox"/> | |

Other.....

3. How would you rate the attitude of your employer/s, who provide experiential training?

- | | |
|---|---------------------------------------|
| Good <input type="checkbox"/> | Satisfactory <input type="checkbox"/> |
| Unsatisfactory <input type="checkbox"/> | |

4. Are your employers up-to-date with the current state of technology in the Civil Engineering Industry?

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

5. Is the instructional material and equipment at the Teknikon up-to-date with the current state of technology in industry ?

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

6. Do you think that students are adequately equipped to undergo experiential training in the second year of the programme?

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

7. If the answer to question 6 is no, when in the programme do you think experiential training should take place?

After semester one

After semester three

After semester four

Other-----

8. How often do you upgrade your knowledge with respect to the latest technological advances in Civil Engineering?

Every month

Other

Every year

Every 6 months

9. What are some of the difficulties, if any, experienced by you as an in-service training student?

THANK YOU FOR YOUR PRECIOUS TIME!

COMPANY QUESTIONNAIRE
(Experiential Training)

The purpose of this questionnaire is to obtain employer perceptions on the experiential training component of the Civil Engineering Programme, offered by MLST.

The information you provide is confidential.

Rate on a scale of 1 to 4, questions 1 to 6.

Scale: 1 – Very Good
2 – Good
3 – Satisfactory
4 – Unsatisfactory

1. How well does the student display application of his/her academic knowledge?

1 2 3 4

2. Does the student make a significant contribution to the organization?

1 2 3 4

3. How would rate the students' academic knowledge in Civil Engineering (technikon study)?

1 2 3 4

4. How would you rate the students' level of responsibility (in terms of Civil Engineering Practice)?

1 2 3 4

5. How would you rate the students' level of accountability (in terms of Civil Engineering Practice)?

1 2 3 4

6. Do you think that the students are adequately equipped to undergo experiential training after completing two semesters of academic study at technikon?

Yes No

7. If your answer to question 6 is no, when in the programme, do you think experiential should take place?

After semester one

After semester three

After semester four

Other-----

8. How would you rate the "lines of communication" between the technician and employers?

Very Good

Good

Satisfactory

Unsatisfactory

9. What are some of the difficulties, if any, experienced by students in training?

THANK YOU FOR YOUR PRECIOUS TIME !

**FACULTY OF EDUCATION
RESOURCE CENTRE
UNIVERSITY OF DURBAN WESTVILLE
PRIVATE BAG X54001
DURBAN, 4000**
