MEDICAL LABORATORY TECHNOLOGY

IN THE REPUBLIC OF SOUTH AFRICA

- BEYOND 2000

A literature study and study of attitudes about the factors influencing the direction of Medical Technology

by

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Corrected dissertation is approved

Dissertation submitted in compliance with the Master's Diploma in Technology in the Department of Medical Technology at Technikon Natal.

I, CAROLYN MARGARET WINCHESTER, declare that this dissertation represents my own work, both in conception and execution.

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ABSTRACT

The arena for medical technologists is continually changing with the result that educational directive must change accordingly. A number of big issues have changed the role of the medical technologist. Cognisance of the identified issues is essential if the profession is to survive the year 2000. The future directions of medical technology are analysed in this disseration in order to identify the knowledge and skills that the professional medical technologist will require for the 21st century. The factors which have up to now introduced dramatic changes in clinical pathology laboratories will also present certain opportunities for laboratory professionals but taking cognisance of the necessity for change and professional ability. This study was thus conducted to explore the educational requirements necessary for the professional future of medical laboratory technologists in the Republic of South Africa.

A theoretical sub-structure lays the foundation for the study. The literature review in Chapter 2 outlines medical technology eduction both in the Republic of South Africa and in certain other countries. The necessity for change in the education of medical laboratory technologists is addressed here. Chapter 3 examines the factors (gleaned from the literature) which are producing a need for such dramatic change for the century ahead. It also examines the role of the technikons and the roles of the technikons with regard to the training of medical technologists and the influence of academic drift.

The methodology in Chapter 4 explains the structuring and administration of a questionnaire used to capture data from registered medical laboratory technologists in the Republic of South Africa. The processed data results are discussed in Chapter 5. Tables are presented at the conclusion of certain groups of major issues. Chapter 6 concludes with the findings

of the questionnaire, supported by the literature review. Medical technologists' attitudes towards their professional future is reported in detail. The results indicated that the majority of medical laboratory technologists in the Republic of South Africa are despondent about the future and realise that the present educational system does not fulfil the requirements for future needs.

Medical laboratory technologists must support their profession now to understand, accept and exploit the new realities resulting from rapid change in health care. The study revealed information that could be used to improve the shortcomings of the existing training of medical laboratory technologists and help ensure the best possible solution to these problems. The end result must be the best trained medical technologist possible and this must be kept in mind by both the technikons and these responsible for experiential training.

UITTREKSEL

Die arena vir die mediese laboratorium-tegnoloog is gedurig aan die verander met die gevolg dat die opvoedkundige opset dienoor-eenkomstig sal moet verander. 'n Aantal belangrike strydvrae het die rol van die mediese tegnikus verander. Die inagneming van hierdie kwelpunte is noodsaaklik indien die beroep die jaar 2000 wil oorleef. Die toekomstige rigting van mediese tegnologie word in hierdie dissertasie ontleed om die kennis en vaardighede wat professionele mediese tegnici in die 21st eeu sal benodig te identifiseer. Die faktore wat sulke dramatiese veranderings in kliniese patologie laboratoria teweegbring, sal sekere geleenthede vir tegnici meebring, maar kennis moet geneem word van die noodsaaklikheid vir verandering en vir professionele vaardigheid. Hierdie studie was gevolglik onderneem om die opvoedkundige geleenthede wat noodsaaklik is vir die professionele toekoms van mediese laboratorium-tegnoloe in die Republiek van Suid-Afrika te ondersoek.

'n Teoretiese sub-struktuur is die hoeksteen van die studie. Die hersiening van die literatuur in Hoofstuk 2 som die mediese tegnologiese opvoeding in beide die Republiek van Suid-Afriak en in sekere andere lande op. Die noodsaaklikheid vir verandering in die opvoeding van mediese laboratorium-tegnoloog word hier aangespreek. Hoofstuk 3 ondersoek die faktore (soos dit uit die literatuur blyk) wat die noodsaaklikheid vir so 'n dramatiese verandering vir die volgende eeu teweegbring. Dit ondersoek die rol van die tegnikons en spesifiek die rol van tegnikons met betrekking tot die opvoeding van mediese tegnoloog en die invloed van akademiese strominge.

Die metodologie in Hoofstuk 4 verduidelik die struktuur en administrasie van 'n vraelys was gebruik is om inligting te bekom van geregistreerde mediese laboratorium-tegnoloog in die Republiek van Suid-Afrika. Die gevolgtrekkings wat met behulp van die verwerkte inligting gemaak kan word, word in

Hoofstuk 5 bespreek. Uiteensettings van sekere groepe van die mees belangrike aspekte word ten slotte in die vorm van tabelle weergegee. Hoofstuk 6 sluit af met die bevindings wat op grond van die vraelys gemaak is, soos gesteun deur die oorsig van die literatuur. Die houding van mediese tegnoloog ten opsigte van hulle professionele toekoms word in besonderhede weergegee. Die uitslae toon aan dat die meerderheid van mediese laboratorium-tegnoloog in die Republiek van Suid-Afrika swartgallig is oor die toekoms en van mening is dat die huidige opvoedkundige stelsel nie die eise van die toekoms bevredig nie.

Mediese laboratorium-tegnoloog moet hulle professie nou ondersteun om die nuwe realiteite wat voortspruit uit die snelle veranderings in gesondheidsdienste te verstaan, aanvaar en ontgin. Die studie het inligting blootgele wat gebruik kan word om die tekortkominge van die huidige opleiding van mediese laboratorium-tegnoloog te verbeter en die beste oplossing vir hierdie probleme te verseker. Die eindresultaat moet altyd 'n goed opgeleide mediese tegnikus wees, en hierdie doel moet deur beide die tegnikon en daardie persone verantwoordelik vir die opdoen van ondervinding in die proses van opleiding in die oog gehou word.

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CHAPTER ONE

PROBLEM DEVELOPMENT

1.1 GENERAL INTRODUCTION

In the decade ahead, significant and corresponding challenges will be facing the medical technologist (Ehrmeyer, 1990b:129). Critical issues are: .

* The political future of the Republic of South Africa will have implications for the direction of laboratory services. With the re-organisation of health services, community based primary health care laboratories will become increasingly important. Laboratory services, which were previously only available to a minority of the population will now becoming accessible to all. (Health Policy Forum S.A. Medical Journal 1993:562);

* A burgeoning new technology (McKenzie,1992:221) allows unqualified personnel to assume the role of the medical technologist at one end of the technological spectrum whilst increased level of sophistication will be demanded from medical technologists who use it at the other.

* The depressed economy demands the necessity of cost containment, not only in the provision of laboratory services but also in providing an adequate number of personnel to fill its ranks.

All these factors are coming together to demand resolutions to questions that have been festering for years. The medical technologist of the future will need to operate much differently because of technologic and sociologic changes whilst education will have to span the difference between the needs of both First and Third worlds. A new medical technologist must emerge to meet the challenges that lie ahead.

The literature reviewed indicates that issues relating to (a) quality assurance, (b) the image of the medical laboratory technologist, (c) new professional opportunities brought about by alternate testing sites, (d) private practice, (e) ethical problems and (g) growth in the pathology knowledge base are all beginning to converge. (McKenzie, 1992:221; Raichle, 1992:227; Lacroix, 1993:37). The result is that laboratory staff face too many key issues that demand direct answers.

Based on the above assumptions this study is the final product of an investigation and evaluation to clarify what changes are occurring, their direction and velocity. The goal and objectives of this project were developed in line with past history, the present conditions, and projections for future needs of the medical laboratory technology profession.
Chapter One consists of the background and motivation for the study, the delimitations, assumptions and conceptual clarification relating to the problem. The investigation was completed over a period of three years.

1.2. BACKGROUND TO THE STUDY

The format for the education of medical technologists has undergone several changes since its inception approximately forty years ago. The skills required of laboratory workers were at first largely confined to performing simple tests. As the science of pathology developed, new highly sophisticated tests were designed. These developments required that medical technologists possess a broad science base to understand the theory and principles of testing and their application (McKenzie, 1992:221).

Several aspects of the current structure of educational programmes for medical technologists require an alternative approach (Zane, 1988:285). Foremost among these is that clinical laboratory science is broader in scope than medical technology alone. The status of medical technoligists cannot be maintained, still less improved, unless the professional courses are given a greater educational emphasis (Karni, 1986:101).

With the political emergence of the new South Africa laboratory services will have to be offered on two different fronts. There will be a need for both first and third world practitioners and for the first time medical technologists will have to learn to function outside the central hospital laboratory. The 1980 National Plan For Health Services documented a plan to shift an emphasis from secondary and tertiary care to primary care (Pillay, 1993:606).

South Africa combines a very fragmented health authority structure with a centralized and bureaucratic tradition. The system emphasizes curative care, which, in general is not effective in improving the health of the whole population (South African Medical Journal, 1993:562).

Some of the above problems can be compounded by resource constraints resulting from the world recession and this country's own particular economic problems. An important aspect in respect of cost containment, is the emergence in laboratories, outside the Republic of South Africa, of multi-competent personnel. Muli-skilled personnel are able to complete tasks that cut across two or more traditional paramedical specialities (Starrs, 1989:204) and could thus be of enormous benefit and a mainstay of rural health care. By capitalising on the expanded roles afforded by change the medical technologist could be recognised as a vital esteemed member of the health care team.

In recent years medical technologists have drawn attention to the lack of educational content in the courses and syllabi and the inadequate recognition for academic purposes (Baker, 1990: 237).

In the United Kingdom, medical technology education has recently undergone considerable changes with the main move/emphasis on/towards a degree compared to/rather than diploma qualification. This move in the United Kingdom has come about through an expansion of (a) knowledge base in the profession, (b) the professionalism process and (c) through academic entrepreneurship supported by academic drift (Jones, 1987:69). This is in accordance with both the United States of America and Japan, where medical technology is offered as a four year Bachelor degree (Kitano, 1980:73). It seems therefore inevitable that medical technology in the Republic of South Africa may follow the same route.

The education of medical technologists in the United States of America gives medical technology students the opportunity to progress to graduate programmes. According to Beck (1990a:49) the various roles medical technologists will have to assume in the future will require training/education at a degree rather than diploma level.

Educational curricula must therefore be evaluated to determine their efficacy in producing employable medical technologists (Beck, 1990b:393) that can fulfill the many and divergent roles required in the future. A new curriculum must be cleared of all unnecessary or redundant content but the needs, however, of the society in which the educational programme exists should be addressed. In developing a new course structure to prepare students for future roles, we need to ascertain whether we are in fact simply perpetuating outdated aims and methods and attempting to inflate that which should be abolished.

The education of medical technologists is expensive in terms of time and money and it would be reassuring to have reliable tools of prognostication in order to ensure that to-day's student will be able to function in tomorrow's reality. The answer is perhaps to devise a flexible course which can accommodate change as and when this is required. The future will depend on new accomplishments.

1.3. PROBLEM STATEMENT AND OBJECTIVES OF THE RESEARCH

The purpose of this study was to investigate the attitudes and perceptions of medical technologists in the Republic of South Africa towards their profession to obtain information necessary in the formulation of objectives for a more challenging course structure for the year 2000. The study consists of a comprehensive literature review and a survey conducted by postal questionnaires. The literature review was undertaken to:

* Document a need for additional research on the efficacy of the educational requirements for medical technology

and how it relates to continuing education. (Continuing education is based on the need for additional learning to remain current with changing techniques and information);

* Review the educational and professional strategies in other parts of the world in order to gain an international perspective of medical technology that enables South Africa not repeat mistakes of the past.

The philosophy of existing technikon strategy, as well as the various articles reviewed relating to the future of the profession and the education of medical laboratory technologists have assisted the author in clearly defining educational activities.

The survey intended to:

* Provide data to identify the specific problems that the profession is presently encountering;
* Identify and clarify what changes are occurring and their direction;

The results were then integrated to recommend guidelines for a challenging new course structure (curriculum) in order to keep medical technology as a viable and professional profession.

It is believed that this study has indicated the new direction that medical laboratory technology education should take for the 21st century. The future of the profession depends on its ability to respond to the opportunities and responsibilities afforded by change.

1.4. MOTIVATION FOR THE STUDY

A consensus for change in the education of medical technologists has emerged in South Africa. New developments require medical technologists to undertake new roles (Gregg, 1990:32), multi-skilled workers have become an economic reality and skill-coupling, adding additional skills to traditional laboratory skills has become a necessity. Increasing interaction and collaboration with other health-care personnel are required to enhance medical efficiency whilst cost-effectiveness of patient care warrants the correct concept regarding test utilisation. Problem solving, clinical correlation and the need for developing technical inter-personal and conceptual skills are issues that must also be addressed.

The rapidly changing laboratory arena is forcing laboratory professionals to re-evaluate their present positions. Clinical laboratory personnel need to recognise current realities, maximise their opportunities and strengthen and expand the scope of their clinical practice (Flanagin, 1988:6). Individuals must identify the knowledge and skills (and how to apply them) that the profession demands. The content of courses poses important questions for the educators of medical technologists (Beck, 1990b:393). Changes within the entire field of health care demands a realistic look at both the quality and quantity of medical technologists. The motivation for this study stems from increasing concerns about the future of Medical Laboratory Technology in the Republic of South and the impact that changes in the profession could inspire.

In planning a new course structure, the fundamental re-evaluation in terms of the subjects taught, the organisation of the courses and the teaching methods used is required. A variety of educational approaches should be made available. The profession could also benefit from a better public understanding of the function of its members and the economy could benefit from the potential containment of hospital costs through developing and utilizing professional capabilities to the fullest. For example, many rural hospitals could utilize multi-skilled workers to either fill critical gaps in a scanty workforce or to avoid under use of precious human resources.

Analysis of the data received from the questionnaires could lead to the recommendation of several education and job related suggestions in the belief that implementing one or more of them could improve the future prospects of medical laboratory technology in the Republic of South Africa. Information contained in this study can enhance our knowledge and understanding of traditional medical technology practice and will allow medical laboratory technologists to achieve a position of leadership in their quest for delivering the best health-care possible - and this they can only do through superb education.

1.5. THE DELIMITATIONS

* The research will be limited to approximately 1000 registered medical technologists at the appropriate laboratories. Medical technologists in education will also be approached.
* The study is not based on an educational strategy, but rather on factors contributing towards the formulation of objectives appropriate for the year 2000.
* This study will not attempt to address the problems encountered with the development of new curricula, nor will it predict the success of such curricula.
* The study considers but does not recommend selection criteria for potential students for the profession.
* Finally, the study is not explanatory, but of an exploratory and descriptive nature and will only investigate factors that may influence the direction of the profession. It will not elaborate on political events presently occurring, or predict their outcome. Any such assumption may be invalidated.

1.6 ASSUMPTIONS

The following underlying assumptions have been accepted as a basis for this study.

* The need for medical technologists will continue
* The academic standard required for registered medical technologists will not be lowered
* There is a need to formulate objectives for a strategy

for the professional education of medical technologists.

* The recipients of the questionnaire answer the latter honestly.
* The recipients of the questionnaire be a representative sample of registered medical technologists in the Republic of South Africa.
* That all literature reviewed is indicative of the problems encountered by the profession and should give a clear perspective in this regard.

1.7 DIRECTIONAL HYPOTHESES

The hypotheses addressed by this research are:

Hypothesis One:

The profession does not reflect a positive future for medical technologists in the Republic of South Africa.

Hypothesis Two:

The present course structure and training of medical technologists is deficient for the knowledge and skills required for a professional career in medical technology for the year 2000.

Hypotheses Three:

The profession could be graded into three tiers eg. Medical Technician, Medical Technologists, and a Medical Laboratory Scientist.

11.8. CONCEPTUAL CLARIFICATION

The function of a technikon can be stated as being to train people to function as technicians and technologists (Pittendrigh, 1990:315).

* The Technician

The technician who has acquired detailed knowledge and skills in one specialist field, or knowledge and skills to a lesser degree in one or more specialist fields, is required to exercise judgement, in the sense of both diagnosis and appraisal and initiative in his work; is frequently called upon to supervise the work of others; is normally engaged for more than 40% of the time in intellectual work rather than in tasks requiring skills; and has an appreciation of the environment beyond the limit of his duty (Pittendrigh, 1990:315).

* The Technologist

A technologist is competent by virtue of his fundamental education and training to apply scientific methods to the analysis and solution of technological problems. He should be capable of closely and continuously following the progress of his discipline or occupation by consulting and assimilating newly published information and applying it independently. He should thus be able to make contributions on his own account to the advancement of the technology of his discipline. His work is predominantly intellectual and varied, requires the exercise of original thought and judgment. It involves both personal responsibility for innovation, design, research, development and related matters and also includes the supervision of the technical and administrative work of others (Pittendrigh, 1990:315).

The above two definitions have very important implications for course design and didactics, states Pittendrigh.

* The Medical Technologist

A medical technologist is a professional who is employed in clinical laboratories and whose task is to perform tests which are used in the diagnosis, treatment and control of disease.

Medical Technology is a complex field embracing a number of different disciplines. Medical technologists fill many niches, the main fields are, however, in Chemical Pathology, Haematology, Cellular Pathology and Microbiology.

* The Pathology Laboratory

The pathology laboratory forms an integral part of a nation's health service. It provides accurate scientific information by means of a vast array of laboratory procedures, each of which has its specific usefulness. The information thus obtained is used in the diagnosis, treatment and monitoring of disease. The increased demands on the laboratory have inevitably resulted in the introduction of more specialised and sophisticated procedures including automation data processing and computerisation. To keep abreast with technologist development it has become necessary for students entering the profession to have a more academic background (Baker, 1985: ix). The degree to which a pathology laboratory service performs its important functions and contributes to a higher standard of health care and the prevention of disease, depends on how well its service is recognised and how well it functions with the other components of the health service.

* A Profession

A profession may be defined as an occupation based upon specialised intellectual study and training, the purpose of which is to supply skilled service or advice to others for a definite fee or salary (Jarvis, 1984:21). In a society that is becoming ever more specialised, there are an increasing number of occupations that are claiming professional status. When an occupation receives recognition as a profession through a law, this brings advantages for the occupation as well as for the public, who are now better protected.

Many professions have sought and obtained legislation that disqualifies untrained and unregistered personnel from practising. This has resulted in many occupations issuing a code of ethics of professional practice so that the public know the standard and commitment that they should receive from a registered practitioner. It is an essential element that professionals must be competent. Competence relates to knowledge, skills and attitudes (Jarvis, 1984:35).

* Professional

The term professional applies to one who receives emoluments for the performance of his occupational tasks (Jarvis, 1984:71). He is also one who practices a profession and one who is regarded as an expert since he has mastery of a specific branch of learning that the professional occupation claims to control. Not all practitioners actually master new developments in the area of learning upon which their professional occupation is founded. Jarvis suggests that the professional is one who continually seeks the mastery of the branch of learning. The practitioner finds it is essential to continue his learning after initial education. Continuing education, voluntary or mandatory, is a requirement likely to become universal for professionals within the next decade (Williams, 1979:44).

* Professionalisation

It may be seen that the process of professionalisation involves changes in the occupational structure, so that it reflects whatever professional model the elite of the occupation espouse (Jarvis, 1984:25).

A number of commentators have sought to isolate and describe this pilgrimage towards professional status. The first stage suggested is the establishment of a professional association, this is followed by a change in occupational title, for example, undertaker to a funeral director. Thirdly, a code of ethics is published which portrays the social utility of the occupation, followed by legislation restricting specific practices to the occupations. Concurrently with this goes the development of training facilities and the control of admission to training, qualification and entry into the profession. Thus the occupation controls every aspect of training and practice through various sub-committees of its professional association (Jarvis, 1984:27).

* Licensure

Licensure of individual persons for any purpose is, by definition, a governmental activity generally undertaken on behalf of the public to protect them from potential harm (Davis, 1990:250). Such protection usually occurs at the state government level and is deemed necessary by lawmakers when the public does not have the expertise to judge the quality of the services they receive from individuals. Advocates of licensure for personnel providing clinical laboratory services believe that licensure is necessary because the public is unable to judge the quality of laboratory services they receive, and the public would suffer great harm if incompetent persons provided such services (Davis, 1990:250).

* Academic Drift

Academic drift is a process of change within a non-university institution whereby it aspires ultimately to become a university. It appears to be a process operating in education institutions which causes them to aspire towards becoming institutions which are imagined to be on the next rung of a hierarchical ladder. Having moved out of the role for which they were established, they tend to create a vacuum into which other institutions, imagining themselves to be on a lower hierarchical rung, are sucked in order to perpetuate the process of academic drift. On the hierarchical ladder universities are seen to be at the apex (Pittendrigh, 1990:55).

1.9 STRUCTURING OF THE STUDY

This study consists of a theoretical foundation based on a related literature review and an empirical investigation. Chapter One deals with problem development and the second and third chapters consist of a review of the related literature and critical evaluation of facts concerning past events revealing trends that could be used to forecast present parameters. A comparison was undertaken between South Africa and various countries of the world.

In Chapter One the background to the problems facing the medical technology profession in the Republic of South Africa and the motivation for the study are addressed.

Chapter Two looks at the current status of the medical technology educational process by reviewing the changes that have occurred in its history. Histories of the profession were reviewed and correlated with the literature concerning developments in education in medical technology.

In Chapter Three the theoretical basis for the study, namely examination of the various foci which constitute the arena of laboratory practice, is discussed together with the role of the Technikon.

In Chapter Four the research methodology, questionnaire design and data evaluation methods is discussed.

Chapter 5 is the discussion on the findings (results) from the questionnaire. Descriptive statistics were used to analyse the data so as to elicit conclusive discussion and answers.

Chapter 6 concludes the study with a summary, conclusions and recommendations based on both the issues identified in the literature review and the findings from the emperical study.

1.10 SUMMARY OF CHAPTER 1

The study was undertaken in order to investigate the present situation of medical technologists in the Republic of South Africa in order to identify key attributes in respect of knowledge and skill requirements to be used in the formulation of objectives for a more challenging course structure. This chapter outlines the problem statement objectives, hypotheses background to and the importance of the study.

CHAPTER TWO

THE EDUCATION OF MEDICAL TECHNOLOGISTS

2.1. GENERAL INTRODUCTION

In the previous chapter the motivation for, problem statement and objectives of the study were outlined. This chapter is a discussion on the forces urging for changes in the education of medical technologists by reviewing the evolution that have occurred in the profession and how programmes have developed around the world to accomodate change.

The countries discussed here include the United States of America, the United Kingdom, Australia and various developing countries. The United States of America has been the Republic of South Africa's traditional role model. Australia has been included for three reasons. She shares a geographical position in the Southern Hemisphere, covers a vast area not unlike our own and also has the United Kingdom as a role model due to her involvement with the British Commonwealth. All of these countries are considered western and belong to the First world.

The developing countries represent the Third world and help to demonstrate the Republic of South Africa's unique link in sharing similarities with both sides of society. As with any historical study, the information gained helps us better understand the profession so as to plan for the future without repeating mistakes of the past (McKenzie, 1992:221).

Chapter 2 concludes by disclosing the educational differences between the system in the Republic of South Africa and in other parts of the world.

2.2. THE DEVELOPMENT OF MEDICAL TECHNOLOGY AS A PROFESSION

The occupation may probably be first recognised from about 1870 (Bailey, 1986:19). The few pathology laboratories at that time were situated in universities and teaching hospitals. There was no training scheme or certification and the work was performed by medically qualified pathologists aided by "laboratory assistants" (Jones, 1986:3). Pathology laboratories were established around 1900 following the development of a particular interest in biological science by some doctors. With the increase in knowledge in the medical laboratory sciences between about 1890 and 1920, the number of hospital laboratories and laboratory assistants increased (Bailey, 1986:9).

In 1911 the precursor of the present institute of Medical Laboratory Sciences was formed in Great Britain and in 1921 a system of examinations and certification was created (Jones, 1986:3). There were no formal systems of study for these qualifications and over the years syllabi were altered several times and new subjects introduced and obsolete disciplines abandoned. The only areas where the pathologists invariably maintained direct contact with the work of the department was in histology and cytology (Bailey, 1986:9).

The clinical laboratory played a major role in medicine as a formidable array of laboratory procedures became available. (Ravel, 1984:Preface). Medical technologists progressed from laboratory assistants who obtained knowledge and experience through on-the-job training, to the formal system where their training is now being controlled by tertiary institutions. The quest for higher qualifications has thus been a characteristic of the profession for many years.

In the United States of America and the United Kingdom, curricula have been developed with the purpose to accept less highly trained personnel (laboratory technicians) to perform the day-to-day laboratory testing whilst clinical laboratory scientists require education at the graduate level. The number of graduates who are entering the profession has increased so rapidly that it appears a logical step that medical technology world-wide should become an all-graduate profession (Jones, 1986:3).

2.3. THE ROLE OF THE MEDICAL TECHNOLOGIST

The role of the medical technologist is to assist in the diagnosis, treatment and control of disease by the use of certain accepted laboratory methods. It is not a vocation to be taken up lightly, and even after qualifying, the technologist will still have to keep abreast with modern developments and trends. The profession of a medical laboratory technologist is a highly responsible one. Those who practise it have a duty to exercise a proper degree of professional skill and care, to take all reasonable precautions to avoid mistakes which may cause injury to patients or others and to respect professional confidences. In order to fill their demanding role, the medical technologist must be a particular type of person, skilled, intelligent and dedicated to the ideals of the profession.

The clinical laboratory is an exacting work environment. It demands extremely high levels of accuracy, precision and efficiency (Karni, 1989:355). Medical technologists frequently work under severe time pressures, such as requests in emergency procedures. The consequences of an error may virtually always be serious and sometimes fatal and the very nature of the tasks performed and the work environment ensures that the laboratory is a stressful place (Jeter, 1989:362). One study mentioned by Jeter, showed that in the United States of America laboratory professionals ranked seventh highest in stress out of 130 different occupations.

There are three main areas of work in a medical laboratory, namely diagnostic work, research work and the preparation of serum and vaccines. Diagnostic work remains the chief function of the medical technologist. Because of the very nature of their work, medical technologists need to have scientific orientation and an interest in research (Careers Guide, 1981:82). A problem of the profession has been an introverted focus. It is one of the few professions that was not controlled by the people in the profession, ie. pathologists dictated to the profession since its inception. Until 1990 medical technologists were not able to function privately without the direction of a pathologist. This was despite the fact that 239 out of 293 laboratories in the Republic of South Africa functioned without the direction of a pathologist (correspondence of the Natal Coastal Branch of the Society of Medical Laboratory Technologists, 1989).

2.4. NECESSITY FOR CHANGE

Although change has always been a part of the practice of laboratory medicine more change occurred during the 1980's than during the previous thirty years (Ehrmeyer, 1990b:29). Technological developments in health care, automation and computers have brought changes to the work pattern of every medical technologist throughout the world (Snyder, 1990:242). In the decade ahead, significant changes will face both the clinical laboratory and the technologists who work in them.

Critical issues, such as cost containment, a widening gap between manpower needs and the labour pool available and a burgeoning technology that demands an increased level of sophistication from those who use it, present enormous challenges (Podell, 1990:10). The profession must change its agenda for the year 2000 (Beck, 1990b:393). The educational programmes that are required must adjust to the changing market place, accommodate advances and respond to the needs of the increasing centres of biotechnical research (Mendelson, 1988:331).

2.5 Social Factors

The use of new technology is transforming the way in which clinical testing is performed (Snyder, 1990:242). Recent discoveries in measurement techniques and procedures are revolutionizing instrumentation and changing the physical structure as well as the staffing needs of the laboratory. Major breakthroughs are expected in the understanding of the human immune system and genetics. Transplants, both in terms of numbers and types of organ will dramatically increase. Each new discovery development will demand new laboratory techniques.

Limited funds will compel laboratories to change by cutting costs and maximising efficiency. The current economic climate indicates that laboratories should deliver services as cost-efficient as possible. Hence laboratory workloads can be reduced by restricting profile ordering. Excessive use of laboratory tests by doctors is an accepted phenomenon. Greenland (1980:863-869) found discrepancies between knowledge and use of laboratory tests ordered by doctors.

The employment arena for medical technologists has been changing steadily (Gregg, 1990:32). Creatively applying their skills and knowledge, medical technologists can pursue diverse pathways in meeting their own personal needs and goals. Numerous factors are producing the breakneck rate of change the profession is experiencing: legislation, new technology, health-care foci (e.g. ageing population) and alternate test sites (Ehrmeyer, 1990b:29).

Although the increasing sophistication of technology has significant implications for the way in which laboratory service is delivered, what is now in question is whether we are producing a medical technologist who is responsive to these changing needs. Medical technologists will have to adjust, not only to a changing market place, but should also be able to accommodate the new technological advances. Having the appropriate educational foundation will give medical technologists greater credibility in dealing with other professionals, in overcoming external opposition to both private practice and advancement and lastly in assuming responsibility for the future of the profession.

2.5.1 Educational Factors

The trend in other countries to address these problems has been to upgrade the educational requirements of medical technologists. The American Society for Medical Technologists defines the Bachelor degree as the benchmark for Clinical Laboratory Science (Pailet, 1990a:133). A benchmark is a standard by which others may be measured. In 1987, the American Society for Medical Technology (ASMT) influenced the future direction of graduate education in clinical laboratory science by proposing that the doctorate be the terminal degree by the year 2000 (Mendelson, 1988:329). According to the American Society for Medical Technologists, "...the curriculum and surrounding educational environment must immediately come to terms with the fact that the medical technologist is now and increasingly will be a broad-based professional" (Harmening-Pittiglio, 1988a:12).

With the increased complexity of medical laboratory science and the increased demands of the occupation in the United Kingdom (aided by social and other educational changes) it became apparent that medical laboratory science was an appropriate area for the development of degree courses (Jones, 1986b:3). As a result, education programmes in medical laboratory sciences in the United Kingdom instituted degree courses, the first graduates from Portsmouth Polytechnic qualifying in 1976-77 (Jones, 1986b:3). The creation of these new degrees has been welcomed by the profession, employers and students alike. Entrants entering the profession in the United Kingdom generally possess a relevant university degree at Bachelor level (Baker, 1985:IX). Post-basic education is seen as being required to provide the greater specialization needed for more senior positions. (Jones, 1987a:5). A masters degree is seen as the most likely appropriate level for post-basic education (Jones, 1986:3).

All involved in the education of medical technologists should have serious concerns as to whether they are providing curricula designed to meet the anticipated needs of entry-level professionals (Matuscak, 1988:34). They must provide the curricula necessary to prepare future medical technologists to meet the demands of a changing health-care market. The technical demands of the profession can only be attained if the course is structured in such a way that medical technologists can adjust to the changing needs. If cognisance of these facts can be taken and the profession is to keep abreast with the times, it must be assumed that the present traditional training programme is now inadequate (Zane, 1988:32).

2.5.1.2 Selection Criteria

Both Primary health care and political developments have necessitated the need to address the training of black medical technologists. This results in particular difficulties in the selection of students from deprived communities (Editorial, Medical Education, 1988:2). The poverty of primary and secondary education characterises and affects students from these areas. Lack of general knowledge, qualified science teachers, inadequate science laboratories and a generally poor command of the English/Afrikaans languages is detrimental to students from these areas.

Identification of the particular problems resulting from the poverty of education, rote - learning, unquestioning academic attitudes, no problem solving experience, offers some solutions on the basis of insights gained from the literature reviewed. To remedy the educational gap which exists between the secondary schooling system and the tertiary systems should be a priority. One needs first to quantify the problem before looking for solutions. The solution will depend on the size of the problem, i.e. the size of the gap and the numbers of students involved (Booysen, 1990:120).

2.5.1.3 Laboratory Technicians

Pressures existed to shorten the preparation time for medical technology as far back as 1976, but in the light of the then current trends, it was not accepted as the optimal manner in which to proceed (Day, 1976:36). As the necessary need for accountability in the laboratory grows, so should the same accountability be expected of those involved in education at all levels of training. A four or five year course which teaches basic understanding and competence in four distinct areas of clinical laboratory technology - haematology, microbiology, chemical pathology and cellular pathology - will probably not meet the demands of tomorrow. As technology continues to advance rapidly, more sophisticated automation may be needed to enable less highly trained technical personnel to perform laboratory analyses. Day (1976:36-37) also suggested that because of economics and automation, lesser trained individuals could be made to do the simpler chores, whilst continuing education programmes can be expanded to prepare medical technologists for extended roles. If these speculations are correct then the sub-baccalaureate level clinical laboratory professional will be in great demand (Matuscak, 1988:33). Within the same context, as far back as 1975, Louis Matheson (1975:6-10) proposed higher level training for medical technologists, far above that of a laboratory technician.

2.5.2 Professional Factors

New technology is transforming how and where clinical testing is performed. With the diversity of testing locations predicted, the traditional hospital laboratory will take on new roles. Testing for the future will focus on health problems stemming from the ageing population, environmental causes, new diseases and new treatments, etc. (Ehrmeyer, 1990b:29).

Success in medical laboratory technology demands competence in 3 domains of learning; cognitive, psychomotor and affective. There has always been an emphasis on theoretical knowledge and technical skills in developing competency in a clinical laboratory course structure. Elements of the affective domain such as attitudes, values, feelings and emotions have been over-looked. There is thus a need to address the affected domain and thereby develop a professional attitude (Jarvis, 1984:35). Medical laboratory technologists will have to possess not only the requisite knowledge of facts and theory, but also the necessary skills and appropriate professional attitudes and behaviours (Laudicina, 1986:620). In contemporary society, self-presentation has assumed a level of importance and significance so that the image the practitioner presents may be no more than a reflection of techniques employed (Jarvis, 1984:125).

Schweitzer (1985:251-253) has found that the task of educating laboratory professionals to perform competently both now and in the future is an enormous task. Since professional practice is constantly undergoing change as a result of new knowlege being introduced and new techniques being adopted, curricula must change in relation to innovation in practice (Jarvis, 1984:55). The technology of today and of the future will have to be incorporated into the educational course structure if a future generation of technologists is to continue.

If improving the desire to learn is to be a major goal, Kirsch (1987:145-148) expresses that we will have to examine the learning process and the factors affecting it. Of fundamental importance is our acceptance that in encouraging students to learn we will have to spell out very carefully what skills, attitudes and knowledge we want them to acquire.

2.6. MEDICAL TECHNOLOGY IN THE UNITED STATES OF AMERICA

2.6.1 Historical Development

Training programmes were founded in the early 1920's but the profession of medical technology, called clinical laboratory science (CLS) was only established in the United States of America in 1928 (Vittetoe, 1990:25). Historically, educational programmes in medical technology have been hospital-based (Mendelson, 1988:326).

Many countries have moved towards a basic qualification at bachelor degree level and this has been the case in the United States of America (Jones, 1986:5). Medical technology in the United States of America is offered as a four-year baccalaureate degree, B.Med.Tech. These programmes are not, however, uniform throughout the States and two main patterns have emerged (Baker, 1990:241).

1. The Traditional Approach which comprises a 3 or 4 year general science degree plus a further year of clinical training in a hospital laboratory leading to a Baccalaureate degree in medical technology.
2. The Integrated Approach which combines the academic and clinical aspects of the course in a continuum instead of two separate segments. This was found to be effective in facili-

tating an ongoing dialogue between the two training institutions, the hospital and the University. It was felt that students were able to associate and integrate both the practical and academic aspects of their career at an early stage which increased their insight and comprehension.

2.6.2 Present Educational Strategies

2.6.2.1 Selection Criteria

Educators attempting to identify predictors of success for students in medical technology programmes have focused on academic measures, aptitude and interest characteristics and various combinations of academic and non-academic factors (Jeff, 1988:51). While the importance of identifying predictors of success in medical technology programmes has not changed, the rationale for doing so has. In the past, there were more applicants than available positions. In facing the restricted pool of applicants, attempts were made to identify measures which would predict the success of applicants in order to select the ones with the greatest potential for success (Jeff, 1988:51).

Medical technology is not only expensive in terms of time and money, but with an international shortage of medical technologists, it is imperative that those who qualify remain in the profession. Jeff's investigation attempted to identify specific indicator courses that had a high predictive value for success in specific professional phase medical technology and overall success in the programme. The specific pre-requisite courses which showed the greatest incidence of correlation with specific professional phase courses were microbiology, mammalian physiology and genetics. Those showing the lowest correlation were survey of calculus, general and analytical chemistry, organic chemistry, computer science and physics.

Traditionally medical technology programmes have emphasized biology and chemistry pre-requisites. The result of Jeff's study show the importance of pre-requisite biology courses as indicated by the high correlations observed between a microbiology, mammalian physiology and genetics. Information obtained from Jeff's study could be used as a guide in making changes in medical technology curriculum and in formulating student selection criteria.

The difficulty in defining suitable selection criteria has led to a study of the interaction of interpersonal values with perceived job satisfaction in an attempt to delineate value sets of those satisfied and those dissatisfied with clinical laboratory jobs (Douglas, 1985:409). The latter study was unable to significantly correlate interpersonal values with job satisfaction for the total sample. It did, however, show that professional group workers valued independence but because of the formal rules and regulations of laboratory practice, are seldom able to achieve this state.

2.6.2.2. Student Evaluation

Faced with the difficulties inherent in evaluating clinical courses, some proponents of competency-based education advocate the use of a satisfactory/unsatisfactory reporting system rather than the traditional letter grade (Snyder, 1985b:659). Difficulties in assigning a letter grade to reflect student performance have been widely discussed by educators in the health-care profession. The assignment of grades to performance is a major source of tension, frustration and uncertainty for both students and faculty.

According to Snyder (1985b:659), performance of a given task includes elements of knowledge about how the procedure is performed, demonstration of necessary psychomotor skills and professional attitude exhibited in task completion. Clinical evaluators point to the difficulty in evaluating overlapping domains and reducing this assessment to a letter grade. They prefer the letter grade approach for the laboratory component of professional courses and adoption of a letter grade for the theoretical component.

As a result of the difficulties in assigning a letter grade (A,B,C,D,E) to reflect student performance some institutions in the United States of America have adopted a Satisfactory/ Unsatisfactory approach. This has presented some problems. The students favoured the Satisfactory/Unsatisfactory system because it decreased anxiety and competition but educators feel it does away with motivation and those students who do well have no reward. He also states that future employers have no guide-lines as to an applicant's ability.

2.6.2.3 Clinical Laboratory Science Programmes

Clinical Laboratory Science programmes in the United States of America are generally not totally integrated throughout the four years of college curriculum (i.e. theory and practice). Clinical courses are introduced to the last two years (2+2 programme) or the final year of study (3+1 programme), but with proficiency in the basic clinical areas of the laboratory expected upon graduation (Harmening, 1990:391). Cytopathology and histopathology courses are not in the general clinical laboratory science curriculum but are in the domain of a separate accredited programme.

Programmes in the United States follow a generalised approach. This concept allows for greater flexibility, allowing students to have several majors and gain certification in more than one speciality. The benefit of a broad-based education in laboratory science is the extensiveness of training. The clinical laboratory scientist in the United States is trained to understand the holistic viewpoint of the disease process and to use the full range of clinical laboratory parameters (Harmening, 1990:392). The clinical laboratory scientist can interpret chemistry, haematology, immunology, microbiology and coagulation data on a particular disease process.

2.6.2.4 Medical Technology Technicians

In the late 1960's and early 1970's increased medical knowledge, advanced technology and public pressure for better health-care resulted in the delegation of simple tasks to technician-type workers. The routine repetitive analyses of the medical laboratory were to be performed by the medical laboratory technician (Floyd, 1988:109).

In 1985, the medical technology programme at Daemen College expanded its curriculum to provide opportunities for technicians to earn a Bachelor of Science degree. Since most technicians cannot relinquish their full-time jobs to continue studies, the curriculum had to be re-designed to cater for their needs. Since technicians already possess basic skills in Clinical Laboratory Science, their clinical practicums focus on more advanced learning experiences (Kotlarz, 1990:84).

Lectures have been videotaped and are updated as needed. Giving students the opportunity to view these videotaped lectures and meet periodically with instructors to hear supplemental lectures, ask questions, receive handouts and take examinations. Student evaluation is based on a written examination administered at the end of each departmental rotation and on a final comprehensive practical examination.

During the practical examination students receive specimens and a list of test to perform. The examination consists of a brief explanation of abnormal results, justifying repeat testing, and calculating the approximate cost of tests they have performed. This curriculum has been successful in meeting the demands of technicians who aspire to a higher qualification (Kotlarz, 1990:93).

2.6.3 Future Perspectives

Challenges which are facing the profession are coming from many directions: new regulations and technologies, the relocation and restructuring of the laboratory workplace, economic pressures and the need for continued education (Harmening-Pittiglio, 1988:83). The long term effects of these are just starting to surface and its imperative that the profession continues to enhance itself and determine its own destiny.

Three elements are critical to this basic approach:

1. Education.
2. Social factors affecting the profession.
3. Professional elements.

2.6.3.1. Education of Medical Laboratory Technologists

The literature reviewed also revealed that there are certain aspects which have been approached in the United States of America which could be potentially relevant to medical laboratory technologists in the Republic of South Africa.

These are:

* a new model for educating clinical laboratory scientists
* clinimetrics - a new discipline
* laboratory management
* the impact of technological sophistication
* graduate education

Several aspects of the current structure of education programmes for clinical laboratory scientists warrant an alternative approach (Zane, 1988:285). Foremost among these is that clinical laboratory science is broader in scope than medical technology alone, encompassing such specialisations as cytotechnology, cytogenetics and toxicology, to name but a few. The trend in the United States has been to shift from the department of medical technology to departments of clinical laboratory science. This reflects the advancement that laboratory science is broader in scope than medical technology alone. There is thus a broad education base for medical technology in the United States of America.

*** Clinimetrics - a new discipline**

Feinstein (1983:843) used the term clinimetrics in 1983 to express the quantification of holistic patient outcomes. Clinimetrics in this context denotes the application of scientific and epidemiologic principles to the design, development, operation and management of clinical measurement processes. The Ph.D. programme in clinimetrics now being developed at the University of Wisconsin-Madison is in the proposal stage and is expected to take at least two years before implementation.

The Wisconsin Faculty wanted to define a curriculum that would encompass and apply to all specialities and yet maintain the broad application of clinical laboratory science. The graduate in clinimetrics would not be a specialist in any single area. The most compelling reason for developing clinimetrics is the emergence of a unique body of knowledge and a theoretical framework that provides clinical laboratory science with its own sound basis for practice and research (Feinstein, 1983:843).

☆ Laboratory Management

To meet the increasing demands for more effective management in laboratories Florane (1985:453-457) found that programmes have emerged in the United States of America to expand the supervisory skills of medical technologists. Laboratories are staffed by and often managed by medical technologists who possess technical knowledge and skill but relatively little or no training or education in administrative and supervisory skills. As the demand for more effective management increases, programmes that provide administrative and supervisory skills seem to be of considerable potential value. Karni (1988:298) states that even though 70,000 medical technologists in the United States of America are currently in management positions, education in the fields of management and administration remains a controversial issue.

In attempting to identify what clinical laboratory managers perceive as important management skills, Karni reported that communication was the management skill selected as most important. Other skills regarded as essential included resume writing, understanding one's place in the institution, managing data, using a quality assurance programme, participating in continuing education and methods of evaluation.

* **The impact of technological sophistication**

The laboratory is experiencing a rapid increase in technological sophistication (Matuscak, 1988:32). With the increase in complexity of information there is evidence that computers will become even more indispensable (Galen, 1979:40). He predicted that in the 1990's the computer will serve as the most important piece of equipment in the laboratory. Computers will be used by medical technologists both in a technical and managerial capacity. Since large data bases will exist, facts will be as accessible as the nearest computer, ultimately changing the types of skills that will be needed by future laboratory professionals.

The training of medical laboratory technologists is not geared for automated computerised instrumentation (Roberts, 1981: 886). A new breed of medical laboratory technologists capable of understanding computerised instruments, trouble shooting and more importantly knowing the principle of the test performed, are needed (Roberts, 1981:886). Curriculum prepared three decades ago is inadequate to meet the present and future requirements. A considerable amount of time for the teaching of instrumentation, electronics, computer science and quality assurance should be incorporated in the curriculum.

With declining resources, increasing complexity of information provided by the laboratory, increasing sophistication and automation of laboratory instruments and methodologies, clinical laboratory scientists may be faced with major role changes (Baumberg, 1981:259). According to a recent survey (Matuscak, 1988:33) directors of programmes in clinical laboratory science predict that technicians will perform the bulk of laboratory testing while clinical laboratory scientists will need greater sophistication.

Changes have occurred in both job responsibilities and the laboratory work environment. In the first case, laboratory managers report changes in job stratification and the recognition of levels of practice. This has resulted in the use of clinical laboratory scientists for more management-orientated and technologically sophisticated jobs. Clinical laboratory technicians tended to be involved in more repetitive laboratory procedures and to handle fewer of the management responsibilities. Laboratory managers' perceptions are that they are facing more turnover among experienced personnel, more absenteeism and more overtime in 1989 than they.did in 1983. Consistent with this they are reporting a greater actual workload.

* Graduate Education

The education of clinical laboratory science students allows them to progress to graduate programmes and in the future the roles that they assume will require preparation at the graduate level. For example, positions as laboratory managers may require a masters degree in administration (MBA) and clinical laboratory scientists in roles as laboratory directors and researchers may require masters or doctoral degrees (Beck, 1990a:49). In 1987 the American Society for Medical Technology influenced the future direction of graduate education by proposing that the terminal degree be the doctorate by the year 2000 (Mendelson, 1988:328). The usual rout to the doctoral degree in clinical laboratory is to major in a traditional speciality, sich as clinical chemistry, microbiology or clinical pathology.

Only two doctorate programmes in clinical laboratory science exist in the United States. One at Catholic University in Washington DC and the other at Northeastern University in Boston (Mendelson, 1988:328). The programme at Catholic University integrates the basic and clinical laboratory sciences, preparing the doctoral student to assume an academic teaching position. 56 credits of course work, a comprehensive examination and a dissertation are required. The student selects a major (32-35 credits in Chemistry or Microbiology) and a minor (12-15 credits in Chemistry, Microbiology, Haematology/Immunology/Immunohaematology or Computer Science and takes 9-12 credits in Education).

The Northeastern University degree demands a minimum of 40 quarter credits plus comprehensive examination and a thesis are required. Course requirements include 13 core credits, 10 credits in laboratory medicine sciences and 9 credits in a speciality concentration (Immunology, Clinical Chemistry, Clinical Immunology or Haematology) (Mendelson, 1988:328). According to Karni, (Ph.D. Department of Laboratory Medicine, University of Minnesota) as cited in Mendelson (1988:330) the American Society for Medical Technology (ASMT) is preparing a document on planning doctoral programmes.

A 1986 survey by the Society of Allied Health Professions of 37 of their institutional members found that 18% of clinical laboratory scientists held baccalaureate degrees, 60% master's and 21% doctorate. Karni believes the profession needs the doctoral degree if the profession is to achieve recognition, power and esteem (Mendelson, 1988:329). Medical technologists need to compete successfully with colleagues, in medicine and in the basic and applied sciences, who hold doctorates.

One of the signs of a profession is the hierarchy of baccalaureate degree, master's degree and doctorate. Almost all self-sufficient and self-actualizing professions hold the doctorate at terminal degree (Mendelson, 1988:329). As in any profession, individuals motivated to assume leadership roles will establish the goal of an advanced degree for themselves (Mendelson, 1988:329).

2.6.3.2 Social Factors

A number of social factors have influenced the future direction of clinical laboratory science in the United States of America. The factors relevant to the direction of medical technologists in the Republic of South Africa are discussed in more detail in Chapter 3.

: federal regulations (Pailet, 1990:227; Sanchez,1990:372; Gore, 1990:358; McNair, 1991:26)

: Auto-immune deficiency syndrome (Simonson, 1989:262; Feeney, 1989:142)

: cost containment (Friedman, 1991:30)

: alternate test sites (Blanchard,1987:131;Flanagin,1988:6)

* **Federal regulations**

Recent trends in federal regulations indicate that increasing attention will be directed toward assessing and certifying many aspects of the health care delivery system - including laboratories, laboratory professionals, laboratory information systems and other entities that contribute to delivery of laboratory services (McNair, 1991:26). These regulations are aimed primarily at ensuring the accuracy, appropriateness and cost-effectiveness of pathology and laboratory medicine services.

* **Cost Containment**

The health care industry is growing more competitive as a result of demands for lower cost and increased quality of services. Clinical laboratory professionals in hospitals will not be insulated from these pressures (Friedman, 1991:30). Serious strains in the health-care system are raising the frustrations of all who participate in it. Hospitals find it increasingly difficult to cope with pressures for cost-containment (Pisaneschi, 1990:21). Such strains in the health-care system will be exacerbated by the rapid aging population, the AIDS epidemic and the continuing technology explosion, which Pisaneschi states, spawns more and more treatments that, although often beneficial, are too costly.

The cost and use of equipment must be considered carefully since there is considerable pressure by sales representatives (Bills, 1988:36).

* **Alternate test sites**

Technological advances such as improved analytic instruments and more sophisticated laboratory information systems provides both the technical means and the financial incentives to shift hospital laboratory testing to commercial reference laboratories. The weakening of the centralised hospital laboratory model also encourages the migration of laboratory testing to remote hospital sites such as the patient's bedside, the operating rooms and the emergency department (Ehrmeyer, 1990b:29).

To summarize, changes in governmental regulations and increased competition in the health-care system have led to substantial changes in the management of laboratory tests and personnel in the United States of America. The role of the clinical laboratory scientist in the new health care environment is now changing from that of one who performs day-to-day laboratory tests to that of one who monitors laboratory testing in a highly automated setting (Floyd, 1988:109). Floyd predicts that less highly trained individuals will perform most the laboratory work in the future with the clinical laboratory scientists becoming involved in supervision, technical trouble shooting and management of information.

To prepare clinical laboratory scientist students for future roles, curriculum changes that would place a greater emphasis on skills in management, research communication and computer use are recommended (Beck, 1990a:49).

* AIDS

The human immunodeficiency virus (HIV) epidemic has had a far reaching impact upon the health care delivery system in the

United States of America (Walker, 1991:33). One of the consequences of the epidemic has been a fear among health care workers of exposure to HIV at the worksite. One of the ways to alleviate the fears of prospective students and assure their safety while enrolled in health profession educational programmes, is to document the use of universal precautions which are to be used in studen laboratories.

Documentation of safety precautions against HIV and other blood borne infec-tions will be required for laboratories where students are taught (Walker, 1991:34). These guidelines reinforce procedures long mandated to ensure safety in the laboratory (Buescher, 1988:287). With regard to the safety precautions to be taken in the workplace, employers must provide for compliance with the regulations by all employees who may have contact with body fluids. This is in relation to the United States Department of Labour Issuing Instructions in January of 1988 enforcing procedures for occupational exposure to Hepatitis B virus and HIV in health care facilities.

2.6.3.3. Professional Issues

*** Job Satisfaction**

Professional studies in the work situation have shown a lack of job satisfaction among medical technologists. Rosland, (1985:127) suggests a need to find specific feasible job enrichment features. Technologists cited a lack of job motivation in their work environment. Karni, (1986:101) investigated the attitudes of medical technologists at three leading universities in the United States of America towards their profession. In contrast to Baker's study (1989:243) in the Republic of South Africa, Karni's study showed that 72% of medical technologists maintained they were receiving a good education, 25% rated it as average while only 30% declared their education poor.

* Personnel Shortage

Several key arguments are being made to support claims of an emerging personnel shortage. The crux of the personnel problem in most laboratories is turnover, making employee retention the most important problem in clinical laboratory management (Gardner, 1990:382).

* Professional Image

Both laboratory managers and educators agree that a re-examination of the issues of education and training in the clinical laboratory sciences is required to improve the profession's image (Flanagin, 1988:10). According to the American Society of Medical Technology, the profession must redefine competence so that educational programmes can focus on producing competent practitioners.

2.7. Medical Technology Education in the United Kingdom

2.7.1. Historical Developments

In the United Kingdom medical technologists are known as medical laboratory scientific officers and they work in clinical chemistry, haematology, blood transfusion, cellular pathology, immunology and medical micro-biology laboratories. The majority are employed in National Health Service hospital laboratories. The first formal qualifications in medical laboratory technology in the United Kingdom date from 1921. Prior to this there was only unstructured "on the job" training. There were no official classes of instruction for these examinations, but various local laboratories began to arrange informal courses in the evenings, taught by laboratory staff (Jones, 1986b:3).

There was a major revision in 1942 and a preliminary examination (the "Intermediate") was introduced. This examined technologists, after 3 years training, in all aspects of pathology at a relatively low level. Subsequently the syllabi and examination arrangements were changed several times and in 1947 Government Local Education Authorities assumed responsibility for these courses which were then arranged as evening classes and held in the hospital laboratories (Jones, 1986:3). A further two years study of a single discipline led to the final examination (associate member of the institute) ; a further two years study of a different discipline led to the Fellowship of the Institute (Total 7 years).

Since 1960 it has been a legal requirement for medical laboratory scientific officers working in the United Kingdom national health service to be registered with the Council of Professions Supplementary to Medicine. A second validating body is often involved when a course is offered in a polytechnic or an institution of higher education (Jarvis, 1984:50). Various qualifications, together with successful completion of a training programme in an approved laboratory are accepted for such registration (Jones, 1986:3).

Rapid developments in the medical laboratory sciences made it necessary to acquire a deeper understanding than previously and syllabi were expanded to give more scope to basic sciences. In 1962 day-release courses for Institute examinations were subsumed into the Government National and Higher National Certificate system. It was then realised that the Institute examination system was too specialised. However, excellent as a measure of technical competence for vocational purposes, it did not necessarily have the educational content to justify the academic equivalence sought, nor to allow for further study and qualifications leading to the highest academic status (Jones, 1986:3).

Therefore between 1967 and 1975, the Institute's qualifications at at the basic level were phased out and transferred to the National Certificate system. These examinations are held at two levels, the ordinary National Certificate and the

Higher National Certificate. They were available in a wide range of subjects and could lead to full professional status. The courses were widely accepted both as giving entry to further courses and as a qualification in their own right. The Higher National Certificate was commonly regarded as being somewhat below the academic standard of a British Bachelor degree states Jones (1986:4).

The first Higher National Certificate in medical laboratory subjects was examined in 1968/9 and success led to Associateship and State-registration. Students followed a core course, usually of chemistry, bio-chemistry, molecular and cell biology and physiology, cellular pathology or medical microbiology.

Following success in the Higher National Certificate, students continue their studies for Fellowship of the Institute. The examination follows advanced study in one of the medical laboratory disciplines and is set and marked by the Institute. This course was altered and extended in 1987. The length of part-time study was extended to 3 years and the academic level upgraded.

The relationship between the professions and the institutions of higher education in the United Kingdom is complex (Jarvis, 1984:61). The content of the curriculum, agreed or stipulated by the profession, has to then be completed by those who teach. As a result mutual trust should emerge between the profession and the institutes of higher education.

2.7.2 Present Educational Strategies

The minimum entry level to hospital laboratories requires four General Certificate of Education Ordinary Level passes. Junior medical laboratory scientific officers follow a two year part-time course of a minimum of 600 hours tuition leading to the National Certificate in Medical Laboratory Sciences. There is also a full-time version leading to a diploma. These courses give entry to the Higher National Certificate. There is currently hardly any recruitment at this level (Jones,1986:2).

About 50% of the entry to the profession is recruited with two Advanced level subject passes, usually in Chemistry and Biology. The employment grade is Junior "B" medical laboratory scientific officer. These students follow a two-year part-time course of day-release studies at college leading to the Higher National Certificate in Science. Concurrently students follow an on-the-job training scheme lasting a total of three years. This is assessed by the Council of Professions Supplementary to Medicine by means of a viva examination (Jones,1986:72).

With the increased complexity of medical laboratory sciences and the increased demands of the occupation it had become apparent that medical laboratory science was an appropriate area for the development of degree courses. The first such course was at Portsmouth Polytechnic, its first graduates of 1976-1977 being closely followed by those of the University of Bradford 1977-1978. Each of these programmes has been developed independently and the similarities in the course indicate a near consensus in the academic world as to what the basic education syllabi for medical laboratory scientific officers and other biomedical scientists should contain (Jones, 1986:3).

About 50% of the entry to the Junior "B" grade are graduates of whom about 11% have specialist degrees in medical laboratory sciences (Jones, 1987b:3). Entrants with these qualifications are required to follow a one year on-the-job training programme before their oral examination for State registration.

There are two main approaches to these curricula, a generalist approach covering all of the traditional disciplines of the medical laboratory sciences and a more specific route where there is considerable emphasis on one of the disciplines. As well as the academic validation, the degrees have to be accredited by the Institute for professional purposes and by the Council of Professions Supplementary to Medicine for State-registration purposes. In a few cases the undergraduate programmes incorporate the period of on-the-job training required for State-registration, otherwise one-year post graduate training is needed.

In the 10 year period (1976-1986) 8 degrees in medical laboratory sciences/biomedical sciences were established (Jones, 1987b:3). The creation of these degrees has been welcomed by the profession and the number of graduates entering has been rapidly increasing over the last few years so that according to Jones (1987b:3), it seems logical and probably an inevitable step that medical technology in the United Kingdom becomes an all-graduate profession states Jones. According to Jones (1987a:72), only about 60% of the graduates of these specialist degrees take jobs as medical laboratory scientific officers (Jones, 1987a:72). The remainder follow a wide variety of occupations indicating that these new vocational degrees have gained a wide acceptance as academically equivalent to other life-science degrees.

The introduction of degrees in medical laboratory sciences has been very successful in the United Kingdom and many people are looking to this as the model for development of medical laboratory science education in their own country (Jones, 1987a:72). The tasks undertaken in hospital and similar laboratories are no less intellectually, scientifically and technically demanding than many jobs for which graduate qualifications are required.

Presently in the United Kingdom a tendency exists to upgrade courses and to abandon low-level work. This well-documented phenomenon, known as academic drift, enables individual academic entrepreneurs to occupy higher status niches and this individual enterprise has been a major force in establishing biomedical science degrees in the United Kingdom (Jones, 1987a:72).

2.8. Medical Technology in Australia

2.8.1 Historical Development

In 1912 the Pathological and Bacteriological Association of Great Britain was formed, with a branch in Australia in 1914 (Bailey, 1986:9). As pathology developed, the tests became more routine, with the result that the level of intelligence and education increased for latest working in the laboratory. In those days, medical technologists were just laboratory assistants to the pathologist but with the advent of time the pathologists withdrew to a position as consultant to the hospital concerned. Here they were concerned mainly with the interpretation of the data produced by the laboratory.

Seven Institutes of Technology are located in Australia's states and territories. The institutes grant the degree of Bachelor of Applied Sciences after students successfully complete three years of study. The medical laboratory science curricula differ among the various institutes, depending on the type of practitioner needed in each state or territory.

The first two years are generally completed on a full-time basis, while the third and final year is completed on a part-time basis over a period of two years (Harmening, 1990:389).

Post-secondary education in Australia is conducted at three levels: The Universities, the Institutes of Technology and the Colleges of Advanced Education. Universities conduct the traditional programmes at baccalaureate degree and graduate degree levels and grant Bachelor of Science degrees. The Institutes of Technology grant Bachelor of Applied Science degrees in keeping with their more applied teaching and research roles. The Institutes maintain a close working relationship with industry, the source of much of their research and development funding. The Institutes and the Colleges of Advanced Education conduct diploma degree programmes with an applied focus.

2.8.2 Present Educational Strategies

A high academic standard has been cultivated for its Institutes of Technology, where individuals are prepared to meet the growing needs of a society with a high standard of living and health care. The Royal Melbourne Institute of Technology is the country's largest Institute of Technology. Here classes are limited to 24 hours of contact per week. The academic programme is conducted in two 14 week semesters; the first from March to mid-June. The second from mid-July to the end of October. Over the 3 year programme students will have approximately 2,000 hours of formal class contact with a balance of 1:2 in favour of laboratory instruction.

The first year of the programme for medical laboratory scientists provides an extensive foundation in the physical and biological sciences (Harmening, 1990:389). Most of the first year is spent in basic science departments: physics, chemistry and mathematics. "Introduction to Laboratory Techniques" presents basic principles and laboratory procedures in haematology, hystopathology, microbiology and bio-chemistry. At the start of this programme, full-time students are assigned to individual faculty members in an organised mentor system. In the second year, the clinical areas are introduced in some detail, including general pathology, genetics (Integrated with other subjects), immunology and bio-chemistry, which serve as the foundation for later specialty courses.

In the third and final year, the student specialises in one of the six clinical subjects listed above. In addition, all students are required to take a course in special pathology, synthesizing all areas of Medical Laboratory Science. Students are also required to select two courses from the field of specialty electives: immunology, virology, parasitology, medical mycology, electron microscopy, medical photography, computers in clinical pathology, introduction to toxicology, human genetics, gynaecologic cytopathology and blood banking.

All courses in the advanced education area must include four subjects from what is termed "Context Curriculum", similar to the United States' concept of "core curriculum". Topics from the Context Curriculum comprise multi-disciplinary studies of contemporary cultural, social, scientific and technologic issues. These courses can be completed in the classroom or by correspondence.

The major difference between laboratory science education in Australia and the United States (Harmening,1990:389) is the degree of specialisation. In Australian Medical Laboratory Science programmes general courses in all clinical areas are taken in the first two years of the curriculum, including histophathology and general pathology.

Specialisation, however, must be determined by the third year. Degree of specialisation varies across programmes according to the state market served by each Institute. Queenland's scattered laboratories require a broader based training than the full-staff facilities of Victoria. A Medical Laboratory Science student, therefore, may not necessarily have been trained in the five major clinical areas, haematology, blood bank, clinical chemistry, microbiology and immunology. The Australian Medical laboratory Science student could thus specialise in microbiology with only limited exposure to immuno-haematology.

2.8.3 Future Perspectives

Guidelines for medical laboratory science programmes are set by the Australian Institute of Medical Laboratory Scientists. Scientific staff working in pathology laboratories in Australia, including medical laboratory scientists do not, at present, require either registration or certification to practice (Harmening-Pittiglio, 1990:390). It has only been in the last three years that accreditation of pathology laboratories has been in effect.

It is thus apparent that in Australia, programmes do not stress a generalist approach but rather a specialisation orientation. This concept does not allow for greater flexibility in the educational process since Medical Laboratory Science students cannot obtain several majors or gain certification in more than one speciality. Over the past two decades automation has become established in all branches of laboratory technology without significantly affecting the staffing of laboratories. The next decade is likely to see a re-appraisal of staffing patterns (Bailey, 1986:11). Educators of Medical Laboratory Scientist, (Harmening-Pittiglio, 1990:390) should take note of these changes to the profession and make appropriate adjustments. Training of students, as it is currently performed, may no longer be useful, especially if it is expected that professionals will be more involved in specialised or research work. There is more than a single route to success and effectiveness.

Learning other ways to educate students is the key to the growing sophistication and widening vision of clinical laboratory science (Harmening-Pittiglio, 1990:392).

2.9. MEDICAL TECHNOLOGY IN THE REPUBLIC OF SOUTH AFRICA

2.9.1 Historical Development

Medical technology in the Republic of South Africa is a relatively young profession and the education and training of its students has undergone several radical training changes over the years (Baker, 1989:237). In 1949 when the first regulations affecting the training and registration of medical technologists was published, the profession, as we know it, did not exist, instead, Pathology laboratory technicians, laboratory assistants and a variety of other individuals existed. Wikeley, (1985:5) writes that the above published regulations were a call to arms and almost immediately societies were formed in Natal, Transvaal and in Cape Town. In 1951 the societies amalgamated to form the present body, i.e. the Society of Medical Laboratory Technologists of South Africa. Prior to 1949 there was no recognised training course. Young (1989;3) helped towards instigating the first courses in physics and chemistry which counted towards the intermediate qualification.

* Educational Inauguration

Post 1960 saw the inauguration of a theoretical course for medical technology in South Africa consisting of four intermediate subjects which were studied on a part-time basis at the then Technical College. Subjects taken at that level were Physics, Chemistry, Anatomy and Physiology and Laboratory Technique. The Intermediate exam was completed after 2 years. A final theoretical and practical examination was written after 24 to 30 months of laboratory experience (Baker, 1989:237). This could be written in Clinical Pathology, which included Haematology, Microbiology and Chemical Pathology, or in a single specified subject within the pathology discipline. Student medical technologists were released by their employing authorities to attend classes during the day.

The main tendency was for the basic sciences (Physics v Chemistry) to be taught by College staff during the day and for part-time teachers from the laboratories to teach both Laboratory Technique and the specialist subjects (which encompassed the Diploma in Clinical Pathology) in the evening. These evening lectures were normally undertaken in the pathological institution in which one worked (generally Government controlled laboratories and/or The South African Institute for Medical Research). This training scheme had the advantage that students were able to have a great deal of "hands on" experience whilst undertaking their studies. According to Baker (1989a:237), this proved a great advantage, since the medical technologist who qualified at the completion of the Diploma was academically and practically competent. The drawback was that in the absence of the student, whilst attending Physics and Chemistry lectures, bench work accumulated and this caused disruption in the laboratory.

Students completed their studies after 4 years and were then eligible for registration with the South African Medical and Dental Council as medical technologists in whichever category the Diploma was issued e.g. Clinical Pathology (which encompassed Microbiology, Haematology and Chemical Pathology) or for those who only studied one discipline a diploma in the category of either Microbiology, Haematology, Chemical Pathology or Cellular Pathology.

This system of education was phased out in 1978 with the introduction of a full-time course at a technikon. The old medical technology course was upgraded and the new course now consists of 18 months full-time study at a technikon in applied aspects of eleven scientific and medically oriented subjects (Chemistry, Physics, Anatomy and Physiology, Calculations and Statistics, Chemical Pathology, Histopathology, Blood Transfusion, Laboratory Practice, Microbiology, Haematology and Pathophysiology).

A final national theoretical and practical examination co-ordinated by the Department of National Education was written .

after a minimum of 12 months laboratory experience. If successful the candidate was awarded the National Diploma of Medical Laboratory Technology in the specific category of study. However, registration of this qualification with the South African Medical and Dental Council was only permissable after completion of four years of theoretical and practical training (Baker, 1989a:237). The year 1980 saw the Society acting as host to the congress of the International Association of Medical Laboratory Technologists (Smith, 1988:115). The South African Society of Medical Laboratory Technologists were later expelled from this same body due to the Republic of South Africa's political stance (Medical Technology International, 1988:8).

*** The Advent of the Professional Board**

The advent of the Professional Board for Medical Technology was announced by the Registrar of the South African Medical and Dental Council at the 1972 congress. This was a recognition of the professional status of the medical technologist and, although compulsory registration was only to follow many years later, this was an important milestone in the history of medical technology.

2.9.2 Present Educational Strategies

In 1985 another educational system was introduced (Baker, 1989a:237). Students entering the profession had to have passed at least one of a number of subjects in their senior certificate or any other recognised equivalent examination in order to register with the technikon as a student, namely; Biology, Physiology, General Science, Geography and Mathematics (Standard or Higher Grade). Under this educational structure, students studied at the technikon for 18 months of full-time study. In the third semester (Level III) students study Microbiology III, Haematology III, Cellular Pathology III and Chemical Pathology III. Examinations were set on an internal and not a national basis.

The successful completion of examination at the technikon was followed by a period of experiential training for a period of eighteen months in an approved, registered training laboratory. The most important aspect of the experiential training is performing and completing the practical exercises as laid down in the in-service training manual. The manual system is unique to South Africa and covers standard diagnostic procedures pertaining to each of the disciplines. Only after the manual, which is supervised by senior medical laboratory technologists and monitored by the technikon concerned, has been satisfactorily completed, is a Diploma awarded. There was no final examination at the end of this 3 year period. On receiving a diploma, a student required a further year before registration with the South African Medical and Dental Council as a medical technologist.

Lack of co-ordination between technikons and employment bodies is causing technikons to take on students that the market cannot accommodate says de Benedictus,(1988:139). de Benedictus also states that technikons are also telling the profession what their needs are and not vice-versa, thus setting a precedent for the profession, which he feels is not a healthy state of affairs and that perhaps an alternative system should be sought with the Society controlling qualification of medical technologists.

* Post-Basic Qualifications

The increased demands in the laboratory have resulted in the introduction of more specialised and sophisticated procedures. As a result, further qualifications are now offered at certain technikons in South Africa:

* Level IV Higher National Diploma in Medical Technology. This is a one-year full-time or two-year part-time theoretical course which is being equated to a B.Sc. (Hons.) degree.
* Level V Masters Diploma in Technology. A thesis of M.Sc. standard is required.
* Level VI Laureatus. A thesis of Ph.D. standard is required (Baker, 1989:237).

Some medical technologists, wishing to further their studies, enrol for part-time degree courses. Certain universities, such as the University of Witwatersrand and the University of Cape Town have granted medical technologist diplomates degrees in Medical Science. This has been done on an individual basis only for the outstanding candidates (Baker, 1989a:238).

To conclude, it is interesting to note that the statutes of the Medical Universities of Southern Africa,(MEDUNSA), were amended in 1986 and diplomates may now apply to write a BSc status examination. Baker, (1989:237) states that successful candidates may then study towards an Honours degree in Medical Science.

2.9.3 Future Educational Perspectives

The introduction of the three year course in January 1993 means that syllabi and curricula had to be drastically overhauled and, where necessary, updated (McKenna, 1990:255). The new course comprises 5 semesters and involves experiential training. At the successful completion of this in-service training students are to be awarded a diploma in Bio-medical science. The National Diploma will not be known, as elsewhere in the world, as a diploma in medical technology. The professional Board of Medical Technology will not permit the title of diploma in medical technology (as per conversation with Mr. Truter, Cape Technikon, September 1993). The Cape Technikon is the convener for the new course.

Research into the educational process has helped to generate a body of knowledge about education (Jarvis, 1984:75). Recruits into a profession are expected to have learned professional knowledge before they enter practice (Jarvis,1984:75) so that the parameters of the concept provide some guidelines to the content of the professional curriculum. Registration as a medical technologist can only take place at the end of the fourth year after students have successfully completed an examination set by the Society of Medical Technology.

The first step in developing a long-range plan is to identify those issues perceived to be important by educators (Lacroix, 1993:38). There seems to have been some confusion over the category of registration as a medical technologist in the new course and the Society Medical Laboratory Technologists of South Africa were unable to answer the question regarding registration in Clinical Pathology. Advisory committees of certain technikons and particularly the representatives of employing bodies were dissatisfied with the answer received to the question of the category of registration that the Medical Technologist would be entitled on successful completion of the 4th year of training.

It was not known whether a student would be able to qualify in Clinical Pathology as an alternative to one of the specialist subjects. The need for a general diploma such as Clinical Pathology cannot be over-emphasized and it would be a tradgedy to see it's demise. (Minutes of Advisory Committee Meeting, Mangosuthu Technikon: September,1993). Generalists, not specialists, are required in the workplace and particularly in smaller laboratories (Starrs, 1989:140).

The Educational Committee has now provided the following information:

* The Educational Committee is busy compiling a study guide for Clinical Pathology subjects.
* The duration of experiential training will be one year.
* Examinations will be written in Microbiology, Haematology and Chemical Pathology although the length of each examination has not yet been determined.

As the necessary need for accountability in the laboratory grows, so should the same accountability be expected of educators at all levels of training. One consequence of the process of professionalisation has been that the majority of professionals have placed much of their education and training in institutions of higher education. With notable exceptions, the educators of professionals are actually employed as teachers of their dicipline rather than the practitioners of it (Jarvis, 1984:113). Since professional knowledge cannot be regarded as a static phenomenon, the teacher of professionals should also keep abreast with all new knowledge that appears within his profession.

Baker (1989:243) suggested improvements for education. Firstly, revising the present system by raising the standards and improving aspects of the practical and theoretical training and secondly, a restructuring of the programme by introducing a Baccalaureate degree in Medical Technology. In the survey undertaken by Baker (Baker, 1989:237) amongst qualified medical technologists at Garankuwa Hospital, Medunsa indicated that the majority of the respondents felt that the educational course for medical technologists needed to be improved or re-structured. It should be presented as a continuum with theory and practice being taught together in the same institution and extending over the whole of the student's training period. The need for greater career mobility and professional recognition was also expressed in Baker's survey.

All final examinations should be set at a national level with external assessment and overseas accreditation. MacFarlane (1989:255) also stated that she had studied three Higher National Diploma papers from three different centres in 1988 and there were obvious discrepancies in content and standard. No simple method exists for assessing students (Jarvis, 1984:102). Even when two examiners, an internal and an external, agree on grades this merely reflects that the two examiners have roughly the same standards in relation to the piece of work being assessed and that this standard may be harsh or lenient (Jarvis, 1984:102).

* **Apartheid education.**

The impact of political change on South Africa will have its own impact on the medical technology profession. The direction and force of this change is outside the limitations of this dissertation. As a result of apartheid education the basic skills that students bring to the Technikon is deficient in a number of ways. The result is a high failure rate. If educators want to meet their commitment to affirmative action then a systematic identification of the specific skills needed by students is called for (Motala, 1993:11). Technikons will experience increased pressure for admission of larger numbers of students from disadvantaged communities (Stumpf, 1993:1).

In addition to institutional and administrative reasons for determing resource requirements and costs of educational programmes, there are state needs for cost figures. Identifying the costs associated with providing educational programmes (full-time or long-distance) is important for determining minimum and maximum enrollment, cost-effective curricula and appropriate numbers of academic staff (Karni, 1990:333). Given the monumental challenge of building good quality basic education and secondary schooling opportunities in townships and rural areas, tertiary education will have to be content with current levels of state subsidation. Expansion and improvements must come from greater cost efficiency (Donaldson, 1993:15). One can thus according to Donaldson disperse with the possibility that substantially increased public resources might be available for assisting technikons to adapt.

* **Degree Courses in Medical Technology**

The degree course in medical technology has been discussed over the past few years by the Medical Laboratory Technology Council but it was felt that with the introduction of the higher levels of qualifications (National Higher Diploma, Masters and Laureates) a degree course would not benefit the profession but possibly fragment it (Education Committee Report for Council, 1986). To summarise briefly, the reasons why such a course was not considered feasible.

a) The Advisory Council of Universities and Technikons in documents SAPSI 115 and 114 have defined the course which each will offer, the length of period of the offering, and the subjects which will be offered.

b) Medical Technology is a practical science and universities cannot offer this practical component to full-time students, that is why UNISA would not consider medical technology as a degree course.

c) In future all "Paramedical" degree courses must be done over 4 years full-time study.

The Education Committee for Medical Technology did not originally support the idea of a degree course as they felt that any presentations by the Society of Medical Laboratory Technologists had no chance in succeeding. (This matter falls outside the function of the Professional Board of Medical Technology).

The degree programme was eventually approved at the meeting in

Cape Town on 27 July 1993. The Higher National Diploma will be phased out and the degree programme implemented in January 1995. Some of the subject matter in the HND had shifted to the new diploma course and some has been placed in the degree programme and had been upgraded to a more advanced level. Students complete a course in intergrated pathophysiology (lectured only by a pathologist) as part of their degree.

The new curricula proposes that the degree programme will follow the awarding of a national diploma and it is possible that it could be undertaken either on a one year full-time basis or a two year part-time basis. This degree will be conducted by the technikons. It is not expected that every student who obtains a diploma in Biomedical Technology will continue with the degree programme and not by the universities. A pre-determined level of achievement will have to be attained in order to progress to the degree programme.

The justification in progressing from diploma to degree without experiential training in between is a question that must be raised to. It is suggested that a diplomate be required to complete the experiential training prior to undertaking the degree. The rationale behind this is that the student, on completing the diploma, is not a recognised medical technologist and will only be recognised after the successful completion of the experiential training.

2.9.4 Medical Technology Technicians

The Council of the Society of Medical Laboratory Technologists of South Africa accepted a proposed protocol for the training of medical technicians in 1989. The proposal was that technikons be approached to conduct a two-year, after hours part-time course. This will serve as a bridging course for technicians who wish to enter the second year of the course for the National Diploma in Medical Technology (Medical Technology South Africa, 1990:315). At present there is no technikon training for medical technology technicians and at the time of writing this dissertation there was no evidence that the technikons have been approached to conduct such a course.

2.9.5 Clinical Competence for the Future

Continued professional development comes into effect in July 1994 (see Annexure G - Elements of Professional Compentency).
A two-year internship in a recognised laboratory for medical technology is presently required by the South African Medical & Dental Council for those medical technologists who wish to enter private practice (Conradie, 1990:315). Accreditation will be a requirement of all laboratories in the future concludes Conradie. The ongoing monitoring of medical technology in private practice will also be a requirement of the South African Medical & Dental Council. The Professional Board for Medical Technology in collaboration with medical technologists will now have the opportunity to expand their

knowledge as accreditation comes into effect. The Professional Board for Medical Technology in collaboration with the Society has formulated a list of investigations which may be performed by medical technologists in private practice (see Annexure L).

As the role of medical technology continues to change, so too must the education of medical technologists. An area that the new syllabus does not address are the regional needs pertaining to pathology services. For example, Natal/Kwa Zulu is more affected by the advance of HIV/Aids than any other area in the rest of South Africa and and indication of the problem is the doubling of HIV prevelence in rural Natal/ Kwazulu from 1.2% in November 1990, to 2.5% by June 1991. This was one of the points under discussion at a workshop in Durban on 4 September 1993 (Epidemiological Comments, Vol.20(9), November, 1993:161).

The advent both of primary health care and HIV will have a tremendous impact on the functions and activities of laboratories in the Republic of South Africa. The profession has a responsibility for assuring safe and effective use of laboratory testing in clinical medicine and medical technologists must concern themselves with new, emerging sites for such tests. They are presented with a threat, possible usurpation of their professional roles by less-trained personnel.

A four or five year course teaching basic understanding and competence in four distinct areas of clinical laboratory technology, namely, haematology, micro-biology, chemical pathology and cellular pathology - will probably not meet the demands of tomorrow. As technology continues to advance rapidly, more sophisticated automation may be needed to enable less highly trained personnel to perform laboratory analyses. If these speculations are correct then the sub-baccalaureate level clinical laboratory professional will be in great demand (Matuscak, 1988:33).

Education is a dynamic force which must keep pace with the times. The education committee of the South African Society of Medical Laboratory Technologists (with the assistance of the technikons) are tying to improve the system. They will soon have firm proposals to take the profession into the 1990's (de Benedictus in the Society Newsletter No. 60, Medical Technology News, 1989:4). This came to fruition in January 1993 with the emergence of the new course for Medical Technology. The education standard in any profession is the cornerstone of the profession and for this reason members much be vigilant that it is never found wanting.

2.10 DEVELOPING COUNTRIES

A brief synopsis of medical technology in countries considered belonging to the third world is presented. There appears to be very little literature emerging from these developing countries or otherwise it is just not made easily available to the Republic of South Africa.

South Africa's unique role as both a first and third world entity allowed comparision with developing countries which have problems similar to our own. Haiti, Panama and Malaysia were chosen as being representative of the northern hemisphere. Zambia, Uganda and Zaire are not only in the southern hemisphere but share with South Africa, the continent of Africa. The general impression of medical technology in developing countries is that economic realities dictate the level of health services and therefore the academic standard of the profession. (A point which could be developed in the South African context).

2.10.1 Medical Technology in Haiti

The Republic of Haiti is located on the western third of the island of Hispaniola in the Carribean. It has an estimated population of six million people. Estimates indicate that 50% of the total population is under 16 years of age. Haiti is ranked as the poorest country in the western hemisphere (Fredriksen, 1988:118). Fewer than half the school-age children attend schools and even fewer progress beyond primary school.

The status of health-care in Haiti is reflected in an average life expectancy of 45 years and an infant mortality rate of 130 deaths per 1,000 births. The country has identified seven priority health problems. Diarrhoea, which kills by dehydration, causes 40% of child deaths and is a major contributor to malnutrition. Pneumonia causes another 25% of child deaths. Immunizable diseases, notably tetanus, polio and measles, are also causative agents in many child deaths. Diseases primarily affecting adults include malaria (5% of the population and tuberculosis 2-3% of the population). High fertility weakens the maternal health and is a prime cause of low birth weight; and malnutrition, is a contributing factor to most of the diseases of infants and children. Although not specifically cited as a priority health problem, lack of sanitation is a major contributing factor to disease.

The Haiti State University Hospital is a state owned and operated institution with approximately 700 beds. The main laboratory was decentralised and satellite laboratories were established during a re-building phase. The clinical laboratories in state hospitals provide services for approximately 4,000 out-patient visits per week, in addition to in-patient needs. Observations at the onset of Project HOPE's programme in early 1985 reflect the minimal services offered. The laboratory is staffed by 38 technicians and nine support personnel. While the laboratory is open 16 hours a day, minimal services (WBC, haematocrit, malaria smear, and urinalysis) are offered after the day shift (8am to 1pm). At the beginning of the Project HOPE intervention effort, very little capital equipment was present.

Medical technologists in Haiti have various backgrounds and experience (Fredriksen, 1988:118). The medical technology programme is undertaken at the State University of Haiti in Port-au-Prince. The medical technology faculty is part of the medical school faculty. According to Fredriksen, many of the lecturers have medical practices or operate laboratories or have other professional commitments and thus their preparation time is limited and the quality of the lectures varied. At the State University of Haiti, the professor's lecture is dictated from notes and copied verbatim by students. The medical technology students then memorize the notes and are examined on them twice a year. The final course mark is derived from the average of these two examinations. If an overall grade of 65% for all courses is not attained, the courses must be repeated; if 65% is still not attained the student is dropped from the programme.

Students entering the programme have completed the equivalent of two years of college pre-requisite course, such as mathematics and chemistry. The curriculum consists of two years (six quarters) of course work in which each subject is taught once a week in lecture format only. Students in the first and second years of the professional programme are assigned to observe in the clinical laboratory when they are not attending lectures. After successfully completing two years of course work, the students must complete two years of residency in approved laboratories to receive their diploma. During this time, students observe and practice under supervision of laboratory personnel. After the two year residency, they are eligible for employment in government or private laboratories. Many of the graduates of the University school migrate to other countries. A few then return to Haiti to start their own laboratories. There is no certification or licensure for medical technologists, nor is accreditation required for the many private laboratories. Technologists are attempting to form a professional organisation for standardisation of practice as well as for professionalisation.

2.10.2 Medical Technology in Panama

Panama is the isthmus between Central and South America. The population is 2,1 million with a literacy rate reported at 85%. (Frederiksen, 1988:121). The University of Panama is the only major university in the country. The professional association of Medical Technology numbers about 800 persons. Persons must hold a baccalaureate degree to be members. The great majority of medical laboratory technologists (90 - 95%) are employed in the public sector. Many technologists hold second positions, either working a 16 hour day or week-ends and holidays. Others have their own private laboratories.

Panama does not require a separate certification or licensure examination. Applicants, instead, must submit their credentials to an independent agency, which evaluates the credentials and then provides a license to those considered qualified to practice. A surprisingly large number of Panamanian medical laboratory technologists have advanced degrees in immunology, microbiology and clinical chemistry. Panamanian laboratories also employ laboratory assistants who are trained on the job and whose work consists of making reagents, staining materials and washing glassware (Fredriksen, 1988:121).

The professional association of Medical Laboratory Technologists has been the primary force for attempting to re-establish the medical laboratory technology programme at the University of Panama. The goal and objective of a project undertaken by Fredriksen (1988:121) was to evaluate whether a medical laboratory technology programme should be re-established. The project consisted of needs assessment, evaluation of proposed curricula and recommending an organisational structure for the programme. As a result it was recommended that a school of medical laboratory technology should be established in the Faculty of Medicine. The initial four semesters would be taught in a science faculty and the five final semesters would be taught at the School of Medical

Technology.

The final curriculum in medical technology resulted in a requirement of 156 semester hours, including management and instrumentation. This compares to that found in an academic health centre in the United States of America. The final 5 semesters should be offered immediately to selected 3rd and 4th year biology students and graduates. This would supply medical laboratory technologists to the market more quickly. The programme is designed to graduate 20-25 students per year according to demand projected every two years.

Panama is probably one of the most advanced countries of Central and South America. Officials are very responsive to the overall needs of the country. Organised groups of health-care professionals in Panama are strong, cohesive and powerful. These groups are legally recognised by the Government (Frederiksen, 1988:121).

2.10.3 Medical Technology in Malaysia

Medical laboratory technology in Malaysia can be traced as far back as 1990 with the founding of the Institute for Medical Research (IMR) in Kuala Lumpur. Since 1901 the training of medical laboratory technologists has been reported in various publications of the Ministry of Health of Malaysia. Several methods of training have been tried out, but it was only in 1960 that formal courses in medical laboratory technology were introduced. In 1966 the Ministry of Health of Malaysia and the University of Malaya Medical Centre started regular courses for medical laboratory technologists simultaneously. In the Ministry of Health it is a 3 year full-time course conducted at the School of Medical and Health Laboratory Technology situated at the Institute for Medical Research. Trainees are recruited on bursary and employed as medical laboratory technologists after the completion and passing of the 3 year course.

The course conducted at the University of Malaya Medical Centre is a 5 year in-service course. As this is an in-service course, trainees are paid a salary on the trainees scheme. They work in a particular Department and are absorbed into the programme of medical laboratory technologists upon passing the examination.

The President of the Malaysian Society of Medical Laboratory Technologists raised the question as to whether a university education for medical laboratory technologists was a solution to the problems facing the profession. He felt that adopting a university or university equivalent degree would overcome many of the problems currently facing the training and future of medical laboratory technologists. The benefits would include uniformity in their training, i.e. worldwide, universities all have the resources to teach computer science, electronics, develop curricula, experiment in new teaching methodologies and innovations (Saminathan, 1987:17).

Furthermore, Saminathan (1987:17) is of the opinion that the need for continuing education has been stressed time and again and the acceptance of university or university equivalent education as a route of qualification is essential. Though it is generally accepted that university education will be a solution to many of Malaysia's problems, it must be approached with caution since third world countries would find it difficult to embark on university instruction for medical laboratory technologists - graduate medical laboratory technologists will be a misfit in small low-budgeted rural hospitals, yet larger hospitals and centres would greatly benefit from graduates. Whether it is a developing or developed country he states there is a need for 3 or 4 categories of laboratory workers depending on the situation and needs of the laboratory service. A number of category medical laboratory technologists can exist but it is essential there is opportunity for allowing individuals to move vertically to the highest level of their capabilities in the profession.

The prospects of being employed in Malaysia are good as there are only +/-2000 medical laboratory technologists throughout the country for a population of 15,000 people.

2.10.4 Health Care in Uganda

Uganda is a tropical land-locked country astride the equator in East Africa. It has a population of 17 million people, 90% of them living in rural areas and 10% of them living in urban areas. Uganda has a typical developing country population structure with about 50% of the population below 15 years of age (Konde-Zule, 1993:3). Although most of the population stay in rural areas, most medical facilities are located in urban areas and the rural areas where transportation and other facilities are most difficult have the lowest level of health care. The result is that the public access to health care is limited.

The Uganda government has adopted the Primary Health Care strategy to be the official policy of the Ministry of Health. Community based health programs in which all people are participating fully, however, remain a goal that is yet to be attained. With barely 1,000 doctors in the country, the doctor to population ration stands at about 1:20,000 , but more than one half of these are located in Kampala, the capital city, and most of the others are distributed in other towns. The doctor to population ration in the rural areas is therefore much worse than the overall average.

With the prevailing scarcity of skilled manpower it is often necessary to utilize semi-skilled personnel more extensively than is conventional. The need thus for inter-disciplinary orientation among all health professionals is a necessity (Konde-Zule, 1993:3). There does not appear to be a formal educational policy for the training of medical technologists in Uganda and laboratory facilities are therefore scarce.

2.10.5 Health Care in Zambia

Zambia has a population of some 8.5 million and is one of the most urbanised countries in Africa, with over half the population living in the urban areas. The economy in Zambia has been in decline for two decades with the result that the World Bank has re-classified the country from "lower middle income" to "lower income".

In 1991 Zambia became one of the first African countries to change government through the ballot box. Since then there have been significant improvements in both health and education, but unfortunately economic difficulties of the past decade and the solutions imposed, have resulted in major cutbacks in capital and recurrent expenditure. The result is declining standards of service and there is generally a shortage of testing kits for diagnostic purposes (Whiteside, 1993:1).

2.11 AN INTERNATIONAL PERSPECTIVE

The range of scientific disciplines encompassed by medical laboratory technology or medical laboratory sciences throughout the world are: (see Annexure I for tests required by

World Health Organisation)

* Blood Banking
* Clinical Chemistry
* Cytopathology
* Haematology
* Histopathology, also called cellular pathology
* Immunology
* Medical Microbiology incorporating bacteriology, virology, parasitology and mycology
* Clinical Physiology and Nuclear Medicine (Jones, 1987a:5).

These disciplines, like all sciences, are advancing at a remarkable rate but at the same time, because instrumentation is becoming much simpler, there has been some de-skilling of the occupation. Tasks and fields of work, which traditionally have been essential, are now of less importance and can be handled by untrained people. New areas and new disciplines are likely to be created. Medical laboratory sciences are practised not only in clinical, hospital or public health laboratories but also in other organisations and increased legislation and environmental concerns are likely to create a demand outside the traditional area.

It is recognised that not all countries will have reached the same point on this continuum or evolution of practice. In developing countries, what appears to be needed are training programmes which give people competence in performing basic skills not necessarily requiring much science back-ground. However, any course provided for this purpose should be structured so that students are also prepared for progress to further qualifications similar to those suggested for the industrialised societies (Jones, 1987a:5).

Skill coupling, adding necessary skills to the traditional laboratory skills, is essential for the clinical laboratory scientist to maintain a valuable position in the health-care market. Skill coupling will give greater confidence and greater professional flexibility. It will also give greater value to his or her current employer and to the profession in general.

A list of individual subjects are thus recommended for clinical laboratory scientists:

* Computer operation
* Computer Software Design
* Marketing/marketing research
* Consulting
* Accountancy
* Management
* Sales
* Foreign languages
* Journalism
* (Health-care) MBA

(Adapted from the American Society for Medical Technology, 1987), (Matuscak, 1988:12).

Medical laboratory technology education in various countries throughout the world was reviewed with the purpose of attaining a direction for future perspectives of the profession. Medical laboratory technology and its educational provision is based in specific national, political, organisational and management circumstances and is therefore inevitably nationally circumscribed (Jones, 1987:5). By reviewing the literature pertaining to the education of medical laboratory technology world wide, the future direction of the profession in the Republic of South Africa could be compared, giving as a clear idea where education in medical technology is heading!

2.12 SUMMARY OF CHAPTER 2

In this chapter the accent is placed on the international evolution of the profession, its education and training. An overview of the historical development, present and future educational strategies, is given. The need for additional skills was assessed and highlighted. The necessity of developing programmes to provide medical laboratory technology students with the ability to perform in the laboratory of the future is acentuated. The most important findings indicate that economic, legislative, technologic and medically related changes taking place will ultimately affect the practice and future direction of the profession.

CHAPTER THREE

FUTURE DIRECTIONS OF MEDICAL TECHNOLOGY

3.1. INTRODUCTION

A related literatuare review exploring the factors influencing the practice and future direction of the profession revealed three main areas of concern:

* Social Factors
* The Technikon
* Professional Dilemmas.

These are shown in detail in annexure J. A Considerable body of professional literature has already championed curriculum reform to meet the changing job duties of the medical technologist (Raichle, 1992:227).

The factors that have produced these dramatic changes whilst uncertain in their degree and extent will provide opportunities for laboratory professionals. New directives are needed which will allow the profession the ability and the mechanism to help solve the problems and face the challenges that lie ahead.

3.2. SOCIAL FACTORS

Many important issues were identified but the influence of the social factors is no better seen than with the advent of primary health care. The advancement of technology and the diverse opportunities which they present will also greatly influence the profession.

The economic situation in the Republic of South Africa, coupled to a political transition will have enormous impli-cations for the shape of laboratory practice.

To ensure that the curricula meets the demands of the profession objectives were to:

* Profile primary health care,
* Describe and assess new technology,
* Identify cost containment formats,

to answer the important question as to whether the course curricula instituted in January 1994 reflects the new demands being made on the profession.

3.2.1. RURAL LABORATORIES

Health-care in many third world countries, like the Republic of South Africa, is derived from home treatment, eg. witch-doctors and herbalists. Doctors are usually not consulted until all other treatments have failed (Fredrikson, 1988:118). The use of laboratory tests is usually unavailable in rural areas because of shortage of funds to establish laboratories.

In selecting a curriculum for training medical laboratory technologists in developing countries, cognisance must be taken that about 80% of the health problems in developing countries are due to malnutrition and infectious diseases such as malaria, trypanosomiasis, leishmaniasis, hookworm, schistosomiasis, filariasis, leprosy, tuberculos, pneumonia, diarrhoeal and dysenteric diseases, measles, hepatitis and sexually transmitted diseases. It is therefore essential that all laboratory curricula reflect the importance of techniques to investigate infectious diseases and provide information about the transmission, control and prevention of these diseases (Cheesebrough, 1987:3).

☼ Primary Health Care

South African Society finds itself in a period of transition due to the demise of apartheid. Medical education needs to align itself with the process of social change (Editorial, Medical Education 1980). Health care has become a political issue in the emergent South Africa and although laboratory medicine is perhaps only a small part of this vast issue, it is important, that from the relatively sheltered environment of their laboratory, technologists appreciate the broader social and ethical problems of their profession. In February 1989, the South African Health Policy Council endorsed the objectives of the World Health Organisation (WHO) with special reference to the need for Primary Health Care (PHC) for all the inhabitants of South Africa (Epidemiological Comments, 1993:140).

The Government regards it as its mission to bring health services to everybody in the Republic of South Africa through primary health care (Zwi, 1994:226). To succeed with this mission endeavours must be made to move as closely as possible to the guidelines of the World Health Organisation. (Declaration of

Alma-Ata, Annexure C).

Primary health care is essential health care based on methods and technologies that are practically and scientifically justified and socially acceptable. Health care should generally be accessible to individuals and families in the community at a price that can be afforded by the community and country, in a spirit of self-responsibility. It is the first level of contact with the health system and makes health care readily available to all the inhabitants of the country (WHO Alma-Ata, 1978:34).

Many people in developed nations believe that the level of health care they enjoy should be made easily available to all (Snyder, 1987:180). Since there is a great disparity in health care services between developed and developing countries, the question on how to raise the standard of health care must be cautiously planned. One of the goals of the medical technology programme is to provide the community and surrounding area with competent laboratory practitioners. To accomplish this goal it is necessary to be aware of the needs of the community and to recognise significant trends in health-care delivery (McKenzie, 1985:570).

To succeed with this mission, endeavours must be made to move as closely as possible to the guidelines of the World Health Organisation. The new Government has committed itself to the fact that it is only through primary health care than an affordable health service can be rendered to all the inhabitants of the Republic of South Africa (Zwi, 1994:226). Based on the principle of partnership between the private sector and health authorities on different levels, an affordable health service can become available to all the inhabitants of the country. Close liaison with the local community and optimal involvement are essential pre-requisites for effective primary health care services.

¤ Resources: Equipment

Laboratory workers need to be trained to work economically since resources are often extremely limited in developing countries. In peripheral laboratories the workload is usually high hence medical laboratory technologists working in rural laboratories must therefore be trained to work responsibly with a high degree of organisation and co-ordination. Cheesebrough (1987:3) states that as laboratories are often in remote places, curricula for medical laboratory technologists must include the principles of operation, care and preventive maintenance and servicing of essential laboratory equipment. A reliable referral back-up system is also required to provide as full a laboratory service as possible to patients and to operate a cost-effective service. Curricula should therefore also include training in the collection, packing and despatching of specimens safely and how to keep reliable records of specimens sent and results received.

With rapid changes in technology, many laboratories have usable but not state-of-the-art equipment that can be salvaged. This can be donated to a rural laboratory. The appropriate level of sophistication is another area of concern. Most of the equipment of the last decade, now outdated, required more knowledge to operate than current models. The majority of the current instrumentation can be operated by lesser trained individuals and in many cases repaired more easily.

Questions related to the donation of salvaged equipment include whether the piece of equipment is complete, is there an operator's manual and are any spare parts available that could be included (Snyder, 1987:181). Donations to rural laboratories of new equipment is not without special considerations. Expendable supplies necessary for operation may be difficult or impossible to obtain. Availability of repair and maintenance services for equipment is a problem that limits the use of some technology in developing countries says Snyder. An objective of two American medical laboratory technologists in visiting African laboratories, was to compare their laboratory practices with those in South Africa (Heinsohn, 1985:119). In every country they visited, the "technician" seemed to be well trained but the difficulty they encountered in obtaining reagents and maintaining equipment often resulted in their having to rely on basic methods.

* Multiple skilled Workers

Multi-skilled practitioners have been a mainstay of rural health care for several decades (Starrs, 1989:207). Over the past five years, a variety of forces have coalesced to fuel an organised multi-skilled movement with both academic and professional proponents. Much of the impetus for an organised multi-skill movement in health care has come from two sources. The first source is the special needs of providers in rural areas which has given rise to a large somewhat ad-hoc work force of multi-skilled medical assistants. Their former education has been supplemented with on-the-job training to meet specialised needs of rural health-care practices.

The second force driving the multi-skilled movement is the growing trend toward the delivery of health care in non-traditional settings such as health maintenance organisations, primary care clinics, urgicentres, outpatient diagnostic facilities and day-surgery centres. Such non-traditional facilities have a high demand for multi-skilled personnel who can, for example, operate a variety of different types of diagnostic imaging equipment (such as radiography and ultrasound) (Starrs, 1989:207).

There are two basic models for multi-skilled practitioner training in the United States of America. The first model is the medical assistant/generalist. Personnel are trained for settings such as urgicentres, clinics and other non-traditionnal health care delivery sites on either urban or rural settings.

The second model type of multi-competency skills training is known as the "combined fields" method. Developed in response to the rapidly growing need for trained, multi-skilled workers in some of the more technically allied-health disciplines. The use of health care personnel with multiple skills is a strategy to contain costs, to promote greater flexibility and efficiency in managing personnel. They would also assist in accommodating manpower shortages. This approach has been pursued for at least three decades by rural hospitals (Bamberg, 1990:254).

Despite the need for specialists in large hospital settings, the need for generalists and persons with multi-skills remain in small hospitals, both in rural and urban settings, in clinics, in physician office laboratories and in outpatient facilities.

Several studies have been conducted to date to assess the current and perceived use and skill combinations of multi-skilled health professionals. In 1980, 70% of the small rural hospitals used multi-skilled personnel acknowledges Bamberg (1990:254). Some educational programmes combine areas such as medical technology and perfusion. More than 90% of the programmes in the United States of America combine skills from two or more clinical/technical areas as opposed to clinical or management areas.

Decentralisation of health care services may well have been major factors behind the recent granting of licensure to medical technologists. The needs of the country may be such that the demands for a single medical technologist with a sound knowledge of several laboratory disciplines and a greater appreciation of pathology will increase. This would open further career options in terms of primary health care in rural areas (MacFarlane, 1989:255).

* Laboratory Service Network

Cheesebrough (1987) suggests that the structuring of a laboratory service in a developing country should consist of a network which includes community-based primary health-care laboratories, District hospital laboratories, Provincial and Public Health laboratories. (Refer to ANNEXURE D).

The various activities of these laboratories need to be clearly defined and carefully co-ordinated. Good channels of communication and effective back-up referral systems between laboratories are essential. The network needs to be operated reliably and cost-effectively with resources been distributed according to the needs of the entire network. The work of the community-based primary health laboratory is to support primary health care in investigating, controlling and preventing major diseases in the community.

Without laboratory support for primary health care, diseases are often misdiagnosed or remain undiagnosed until they are advanced and accompanied by serious complications. The staff in a primary health care laboratory should be a medical technologist and/or a medical technician, trained to examine specimens microscopically, perform appropriate screening and diagnostic tests, collect and refer specimens for specialist tests and participate in health-care education.

The district hospital laboratory, comments Cheesebrough, plays an important role in supervising the work of the peripheral community based laboratories. Whereas the main role of the provincial laboratories is to assist and supervise the district laboratories, to test referred specimens and to perform a range of specialist and other tests as required by the work of the provincial hospital.

The public health laboratory would be responsible for the planning, expenditure and co-ordination of the national laboratory service. It has equally important roles in ensuring the reliability of the service, the appropriateness of its technology, training and motivation of its work force and ensuring that the laboratory services extend to as many people as possible. The public health laboratory would also be responsible for the prompt laboratory investigation of epidemics and outbreaks of serious illnesses among communities.

* Education

The training programme for all laboratory personnel should be consistent with the work to be undertaken, working situation and responsibilities to be assumed. Training programmes must be task orientated (competency-based) (Cheesbrough, 1987:6). The theory and practice parts of the programme must be carefully integrated and follow a logical sequence. Unnecessary knowledge must be avoided.

Clinical laboratory scientists currently working in rural communities who want to develop new knowledge and skills are often prohibited because of their remote geographic location, family obligations and finances. A distance learning programme that provides opportunities for laboratory professionals to pursue their education with minimum time spent on the campus was developed in the United States of America (Wayne Bruce, 1990:17). Several distinct advantages accrue from this type of programme. By bringing many of the courses to students, the distance learning programme has enable recruitment of motivated students who otherwise would not be able to enrol in the programme.

* Project HOPE

Health personnel in the developing world are taught modern techniques by Project HOPE (Health Opportunities for People Everywhere). Project HOPE has been in existence for 27 years and in that time has assisted many countries in health care education. Project HOPE's visual strategy is to raise the level of health care by training the countries' health care team so that they in turn can train their own (Snyder, 1987c:180). The goals and objectives of Project HOPE in Haiti were to plan for the expansion of clinical laboratory services in conjunction with overall plans for developing health-care in Haiti (Fredriksen, 1988:119). Most of the technicians in the Haitian laboratory have an educational level comparable to a clinical laboratory assistant. Specifically, the plan called for the further development of the medical technology programme.

Needs assessments, evaluations of present pedagogical practices and assessment of curriculum content and resources were conducted. Since no survey firms existed, a task test was developed and later validated by physicians and technicians in varied settings. From this task list a performance evaluation form was designed to assist in designing curricula reflecting important health needs.

The clinical laboratory, with its rapidly changing technology, requires that for primary health care in the Republic of South Africa to maximise its effect, an in-depth analysis of needs must be completed. The present poor economic climate necessitates a minimum cost per test. Obtaining very sypecific answers through sophisticated laboratory testing is often a poor use of scarce resources. For example, if a strong programme to treat and prevent tuberculosis is not in place, the expense for properly culturing and identifying tuberculosis is not justified. An option is to have a good quality screening test, states Snyder, 1987c:180).

* **The Role of Medical Technologists in Primary Health Care in the Republic of South Africa.**

Three main areas of health care were identified as providing scope for the utilisation of medical technologists, as reported in the Natal Coastal Branch Newsletter, Society of Medical Technology, (February 1992). These are:

1. Provision of safe water
2. Mother and child health services
3. Prevention and control of endemic disease

(See Annexure K for details)

Developments in new technology will change medical laboratory practice in the next decade (Starrs,1989:64). An impact on laboratory practice is to be achieved with the introduction of new, internationally accepted health policies which seek to develop primary health care as a major priority (Zwi, 1994:2226). These policies will actively address the health problems in the community with a renewed emphasis on promotive and preventive medicine. (Refer to Annexure I - The contents of the Manual of Basic Techniques for a Health Laboratory, WHO:1980:1-479). Curative and rehabilitative medicine, along with their supporting technologies will be subject to rigorous "Technology

Assessment" so that resources can be re-allocated to health promotion and disease prevention (Pillay, 1992:606). The resources currently allocated to laboratory technology, a technology which is for the most part, related to curative medicine, will be the subject of intense scrutiny and extensive re-allocation.

The delimination of tests described in annexure J indicates that training of suitable personnel for provision of pathology services will include both technicians and technologists. The district health system will be staffed by nurses for any years to come. Trained in clinical diagnosis and treatment, nurses will become an increasingly prominent professional in the health-care team (Health Policy Forum, South African Medical Journal, August 1993:564).

3.2.2 NEW TECHNOLOGY

Another change that has reshaped the future for clinical laboratory scientists is the advance of the technology. The laboratory is presently undergoing a rapid increase in technological sophistication. The use of new technology is transforming how and where clinical testing is performed. Simpler technology has made the whole office testing world possible and these tests can be operated by less-trained and less-skilled personnel (Gore, 1991:361).

While it is clear that technologic change is influencing clinical laboratory practice, the effect of such a change on manpower is more difficult to determine (Snyder, 1990:242). Technological change alters some very fundamental manpower characteristics such as the perceptions of what medical technologists do versus the reality of task complexity in the work setting. It will also affect the demand for educationally prepared personnel, both in numbers and skill levels required. Curriculum directors responsible for the education of clinical laboratory personnel and managers responsible for such practice must accommodate the impact of changing technology maintains Snyder.

Podell (1990:14) states that many people erroneously believe the advent of new technology spells the end of certain jobs and responsibilities traditionally performed by individuals. Biotechnology will, however, require a more sophisticated and more highly trained individual performing the test, analysing the data and assessing the results.

* Computers in the Clinical Laboratory

It is predicted that by the year 2000 the computer will serve as the most important piece of equipment in the clinical laboratory (Matuscak, 1988:33).

Prior to computerisation a totally manual system was used with about thirteen different laboratory request data. Computers will thus be used by clinical laboratory scientists in both a technical and managerial capacity states Matuscak (1988:33). These professionals will need a basic understanding of computer science and many educational institutions are not adequately preparing their students to assume these roles. Medical technology training programmes do not routinely include computer programming as a required course. Thus, the laboratory computer specialist has developed expertise from practical experience on the job and possibly a few night courses in computer programming thrown in for good measure (Butch, 1991:21).

* Automation

Automation and computerisation have completely changed the character of work in medical laboratories. Previously there was a limited number of manual examinations performed in a small section and with a substantial amount of patient con-tact. Now there are large departments processing hundreds of specimens each day with little or no patient contact (Bailey, 1986:9). A frequent argument in favour of automation is that it performs the large volume of repetitive work with precision and which staff find so mundane and unsatisfying. The staff released from this work can therefore be used for work more appropriate to their level of education states Bailey.

It is already apparent that automation has been a decisive factor in determining roles of those lesser trained individuals who will push the buttons of increasingly sophisticated laboratory instruments (Day, 1990:36). Thus there exists a push from the bench to separate the technologist from the secure function of performing tests and relegating this function to others acknowledges Day.

The major advantage of automation is its capacity to perform repetitive tasks with precision. This capacity has significantly improved quality control of most routine analyses for two major reasons. A machine performing mechanical tasks is inherently precise, a group of technologists performing the same mechanical task is not. Automation has made it possible to greatly decrease the time taken to obtain a result from the laboratory. Increasing simplification in the operation of instruments has enabled their operation by non-laboratory staff prompting the expansion of "bedside" or "offsite" pathology.

The combination of specialised medical staff and sophisticated technology is allowing clinicians to demand almost instant patient monitoring. This has been achieved by siting analysers in the wards. The further the instrument is sited from the laboratory the less likely it is that rigorous quality control and maintenance procedures will be enforced
(Flynn, 1990:379).

Current trends are for instruments to be sited in the doctors' surgeries and group practices. The patient may benefit from more appropriate treatment by a reduction in medication or the elimination of the need for referral to a larger centre. On the spot pathology may also reduce pathology costs by the performance of single assay rather than a range of assays as a profile (Lehman, 1988:305).

It is automation and simplification of pathology testing, combined with the growth of expert systems that is threatening the careers of medical laboratories (Snyder, 1990:242). One of the more obvious and significant effects of the "technological revolution" has been the introduction of sophisticated instrumentation into all into branches of health care. The field of laboratory medicine continues to expand rapidly, and with it the speciality of clinical chemistry. Chemistry is one area in which changes are occurring most rapidly (Linne, 1993:155). In many cases this has made it possible to obtain information previously unobtainable, enabling early diagnosis of potentially fatal conditions. Other technologies have improved the ability to monitor the physiological state of the patient more accurately so that appropriate treatment can be given in the correct quantity and at the correct time.

To summarise, new technology coupled with other factors, will increase the importance of generalised as opposed to specialised knowledge, the need for computer literacy and the ability to function outside the hospital setting (Snyder, 1990:242). The effects of technological changes in manpower for the clinical laboratory have not been adequately researched, despite the fact that three questions demand urgent answers. These are:

1. The impact of technologic change as it affects the public perception (image) of laboratory practice.
2. The impact of technology on the nature of work and demand.
3. How changing technology is influencing education.

3.2.3 COST CONTAINMENT

One of the major issues facing health-care facilities to-day is cost containment. The current economic climate in which hospitals operate necessitates that all departments in the hospital deliver services as cost-efficiently as possible (Bissonette, 1988:283). Cost are best controlled at the level where they are incurred, so decentralised departmental control is very important (Johnson, 1985a:561).

The "district", an organizing, planning and administrative concept, is widely recognized as a key element in the development of comprehensive health systems (Tollman, 1993:565). With fifteen years of experience since the Alma-Ata Declaration (see Annexure K) on primary health care, the "district" is increasingly viewed as indispensable to the effective implementation of primary health care and its limited resources (Tollman, 1993: 565). There is a need to separate the financing channels of the district health care system from those of the referral and academic medicine health care providers (South African Medical Journal, Health Policy Forum, 1994:563).

The proportions of the health crisis in South Africa are enormous (Whiteside, 1990:16). Tuberculosis, measles, malaria, typhoid are major killers. Cholera, polio, trachoma and hepatitis have also taken their their toll. Now AIDS is a burgeoning threat which will have a considerable economic impact (Whiteside, 1990: 16). Despite the above, the budget allocation for health, under an ANC government would remain the same as present (about 12% of the national budget) (Editorial, South African Medical Journal, 1994:55).

* Limitation of Profile and Test Ordering

The clinical laboratory plays a major role in modern medicine. A bewildering array of laboratory procedures is available, each of which has its special usefulness and its intrinsic problems, advantages and disadvantages. It seems strange, therefore, that medical education has so often failed to grant laboratory medicine the same prominence and concern that are allotted to other subjects (Ravel, 1984:9). In ordering any laboratory procedure, several things should, acording to Ravel, be known about the test, including:

* The conditions in which the test is diagnostic and situations in which the test does provide information without being diagnostic.
* Commonly available tests that can give similar information and when one should be used in preference to others.
* The disadvantages of the test and what are the possibilities of error or false results.

The fact that this type of information is not adequately disseminated is quickly brought home to a clinical laboratory scientist. It becomes evident in two ways. The continually rising number of laboratory procedure requests and even a casual inspection of patients' hospital charts. Unnecessary tests represent severe financial and personal inconvenience to the patient. Inappropriate tests or tests done under improper conditions means wasted time or misleading information.
Interpretation of laboratory test results is much more complicated than simply comparing the test result against a reference range. There are certain basic considerations which underline interpretation of any test result and which often are crucial when one decides whether a diagnosis can be with a reasonable certainty or whether a laboratory value should alter therapy. Besides inherent error, there is the possibility of human mistake in obtaining the specimen, performing the test or transcribing the results (Kaplan, 1987:5).

For many laboratories, the assessment of cost-containment strategies has focused on reducing the high volume of routine tests. These tests are those included in most profiles and make up more than 60% of tests performed in a chemistry laboratory. These profiles generally consist of electrolyte, enzyme, total protein, albumin, glucose and kidney function tests (Lehman, 1988:305). The primary reason for the attempt to reduce the number of routine tests is the belief that physicians overuse and rely too heavily on routine laboratory tests (Lehman, 1988:305).

The results of an investigation undertaken by Lehman, which implemented a new laboratory protocol restricting the number of tests a physician could order, found that the laboratory reduced the total number of tests by more than 50%.

Excessive use of laboratory tests by practising physicians and housemen in patient diagnosis and management is a generally accepted phenomena (Greenland, 1980:863). Another commonly stated hypothesis centres on the lack of education of medical students and residents concerning the costs and proper use of laboratory tests. Data from Greenland's study indicated that internal medicine residents in the first postgraduate year rely most heavily on the laboratory for screening whilst of particular interest was the discrepancy observed between physician's knowledge of the efficacy of individual diagnostic procedures and the routine use of such procedures. The result of such studies may be important in the design of future strategies for cost containment in the arena of patient diagnosis and management.

It's been clear for some time that physicians, primarily because of malpractice fears, have excessively ordered clinical laboratory tests. It is also true that the current fee-for-service system offers no real incentive for the physician to attempt to order laboratory tests judiciously. Therefore, the number of tests ordered and the associated costs have escalated. Tests offered on small chemistry analysers are there only because the technology is available, not because physicians need them

(Billo, 1988:36). Redundant, repetitive tests aren't necessarily resulting in improved clinical outcomes.

The laboratory professional will have to take a greater responsibility in ensuring that the tests selected are appropriate and meaningful in terms of clinical impact. No longer can we afford the over-utilisation and the mis-utilisation that comes from relying on doctors to order the tests he/she thinks might answer the clinical question. Medical laboratory technologists will have to enhance their ability to help determine the minimum test volume that will help deliver improved health care (Oliver, 1988: 35). Economics is demanding a plan of action from the laboratory and this plan should be orientated to patient disease status.

As hospitals face increasing pressures to contain costs, pressures may be taken to control the amount of unnecessary testing performed through better use of available laboratory services. A worst-case scenario would be a future of decline and stagnation for clinical laboratories. This would mean an increased work-load, decreased equipment expenditures, declining number of employees and levels of salary and the use of hospital laboratories for emergency facilities only (Matuscak, 1988:32).

In their efforts to reduce unnecessary spending, hospitals are reviewing the economic efficiency of the clinical laboratory. In response to this, hospitals are seeking new management strategies. Hospitals in the United States of America are already arranging contractual agreements, investments and joint ventures with commercial laboratories (Matuscak, 1988:33).

* Professional Resources

The economy could benefit from the potential containment of hospital costs through developing and utilising professional resources to the fullest (Rosland, 1985:130). In the late 1960's and early 1970's increased medical knowledge, advancing technology and public pressure for better health care resulted in federal funding that encouraged health professionals to delegate simple tasks to assistants/technicians-type workers. Within the medical technology field, the category of medical laboratory technician (MLT) was added (Floyd, 1988:109). The routine repetitive analysis of the medical laboratory were to be performed by the medical laboratory technician, thus allowing the medical technologist to take the responsibilities of non-routine procedures and supervision.

As a result of development in medical technology, there is a need for more highly skilled personnel on the one hand and for workers carrying out menial and repetitive tasks on the other. Medical laboratory technologists are often doing routine tasks that could be performed by less well-educated technicians (McKenzie, 1992: 221). It is in the interests of the profession and health services that medical technologists should occupy a higher status and technicians a lower stratum. In the 1980's there was no apparent difference in the responsibilities of medical technicians and medical technologists, states McKenzie, but advances in technology advocated the emphasis of a graduate degree.

Laboratory determinations and salaries of laboratory personnel represent a cost to hospitals and must be minimised as resources tighten (Matuscak, 1988:32). Many of the tasks being performed by medical laboratory technologists give them no opportunity to extend themselves or use their expensively acquired education. Medical laboratory technologists should be directed towards tasks which need their level of expertise and education and leave the purely technical tasks to the technician (Bailey, 1986:9).

Management of human resources is an important process and employee turnover has potentially serious consequences. Employee replacement is reported to increase administrative and training costs each time a new employee is hired. In a 1988 report it was estimated that costs of $10,000 - $28,000 are incurred to pay for overtime, advertising, personnel and management time to hire one medical technologist (Bissonette, 1988:283). In an atmosphere of cost containment, impending shortages of clinical laboratory personnel and increasing rates of turnover, effective management of the resources of the clinical laboratory depends on effective matching of the employee and the job (with well defined occupational roles).

* Laboratory Managers

Laboratory managers need a good understanding of the financial and clinical changes associated with the payment system (Medical Aid) and other cost-containment policies. They will also need to judiciously evaluate the pressures for cost containment to strike a balance between supply and demand without losing sight of the patient's wellbeing (Flanagin, 1988:6). As medical laboratory technologists assume more managerial positions and perform less bench work they will need expertise in the following areas; budgeting, wage and salary administration, performance measurement, work scheduling, personnel selection and a knowledge of equipment (Matuscak, 1988:33).

The next challenge is to manage quality so as to ensure an appropriate delivery of care at the lowest possible costs. This can be done in one of two ways: reduction of the costs per unit of service or reduction of the number of units of service provided (Hartzell, 1988:114). Management in this cost conscious environment requires a major commitment to issues of quality. If all services are carried out skillfully in the right quantity and at the right time, then the highest level of care is achieved at the lowest cost. Additional money does not necessarily buy quality.

Laboratory management is becoming more concerned with productivity improvement, with the objective of achieving efficient utilisation of human resources and pay roll minimisation (Pang, 1985:459). To arrive at reliable figures for the prediction of work volume and staffing needs, the laboratory manager must be able to accurately translate units of work into the number of employees required to perform the work. Once a productivity monitoring system has been established, the manager can make use of it in numerous ways to help manage human resources in the laboratory.

* **Multi-skilled Workers**

Practitioners who can do two or more types of work are in considerable demand in health care. Multi-skilled personnel have become a survival strategy for health-care institutions in the current era of cost containment (Starrs, 1989:204).

* **Medical Laboratory Technology Training**

Medical laboratory technology training (both at the Technikon and expriential) is expensive in terms of time and money. Determining costs of educational programmes in medical laboratory technology is important for two reasons:

Firstly, to identify ways to make programmes cost-effective and to forecast the effects of increasing enrolments.

Secondly, to calculate costs of individual programmes (e.g. Higher National Diploma, Masters, Laureates) and to determine the number of staff required to teach the curriculum (Karni, 1990:333).

Karni identified the costs with providing education and found that they could be reduced by providing didactic instruction and some laboratory experience prior to and outside of the clinical (laboratory) setting; using as larger group sizes as possible; using student laboratories for group instruction rather than one-on-one in the service setting; articulating with clinical laboratory technician programmes; and not assigning academic faculty to supervise students in clinical areas.

The minimum class size for a medical laboratory technology professional programme should be eight students (Karni, 1990:339). In the light of declining enrolment in the United States, it was imperative that programme officials examined the curricula carefully so as to offer the most cost-effective classes and laboratory practical sessions.

The current era of cost-containment requires innovative and creative thinking to survive financially, while still offering quality health care. The use of multi-skilled health practitioners has proven to be a successful strategy for many hospitals and other health-care institutions (Bamberg, 1990:257). It is a labour application worthy of intensified consideration. Overuse of clinical laboratory tests is a serious problem and one that should be addressed in this cost-conscious time.

3.3. THE TECHNIKON

The technikon is a tertiary educational institution whose main educational task is to provide education and training in order to supply the labour market with people who possess particular skills and adequate technical and practical knowledge. This ensures that they practice their occupations effectively and productively.

Together and parallel with the University, the Technikon is responsible for supplying high level manpower to the South African labour market. Although technikons are in a sense like universities in that they strive towards the development of knowledge at a tertiary level i.e. after senior certificate - they are really unique institutions directed towards the application of knowledge in the practical, real-life situation. Flexibility to adapt to changes in educational needs is a hallmark of technikon education (Philosophy of Technikon Education, 1988:21).

The function of the technikon is thus to prepare its students for occupations. Courses that are offered do not differ in level or degree of difficulty from the courses at university (National Educational Policy, 1988:18); they do, however, differ from them in terms of aims. The function of a technikon must be seen as being clearly different from that of the university and consequently every programme offered by a technikon should be vocational in nature (Pittendrigh, 1988:313).

3.3.1 Professional Education

If the aims of professional education are elaborate and if they are to be achieved, it is necessary that the content of what is to be taught or learned must be in accord with them (Jarvis, 1984:50). Jarvis states that it is necessary to draw a distinction between what the designers of the curriculum, or the syllabus, intend the learning outcomes to be and what is actually taught.

Curricula for professional education are constructed either by the professional body itself, in which case there is usually a specified minimum syllabus or by the staff of the academic institution who are teaching the course (Jarvis, 1984:50). In South Africa the new course in Medical Technology started in January 1994, was developed under the auspices of the Cape Technikon, (which acted as the convener Technikon) with input from both the professional body and educators of the profession. Examinations are internal and certain courses are pre-requisites to enable entry into the next semester.

3.3.2 Technikon Autonomy

The state's realisation of the desperate need for high-level vocationally trained manpower in South Africa - especially in the field of technology - is highlighted by legislation that gave Councils of Technikons the autonomy necessary to pursue their educational role. There are, however, certain disadvantages, one being the apparent disregard for the number of students entering the profession. There is presently an oversupply of both medical technologists and students requesting experiential posts. The Professional Board of Medical Technology and SERTEC have requested the Technikons to limit student intake to 30 per year (Society of Medical Laboratory Technology Newsletter, March, 1994).

The Technikons also have a duty to cover the content stipulated in the syllabus. This duty may not entail that everything is covered in equal depth on every subject, but it does mean that the lecturers have been employed to teach a specific course (Jarvis, 1984:60). Unless the students are able to satisfy the profession by satisfactorily negotiating the examinations set by it, they will never be able to enter the profession, states Jarvis. Technikon autonomy has permitted another disadvantage with contrast in the responsibility towards the stipulated content of the syllabus and lecturers may incorporate other aspects of knowledge, skills and attitudes, that from their own professional awareness, they think ought to be learnt.

3.3.3 Technikon Microsystem - The Future Path

A leading role for technikons in a shake-up of post school, tertiary and adult career education was proposed by the Academic Vice-rector of the Technikon Natal (Tertiary Development News, 1990:4). Technikons, with their clearly defined role as career education institutions, with standards and levels accepted country-wide, ought to become the principle accrediting bodies for the plethora of non-formal courses, experiential training, technical and teacher education courses offered in South Africa. Apart from the advantage of bringing some coherence to a fragmented system, the new initiative would offer post school education and training to the increasing number of black matriculants. The present system, burdened by fragmentation into various departments and a lack of horizontal and vertical mobility, is also patently wasteful, with the present limited resources not effectively utilised.

Du Preez, (Tertiary Development News, November, 1990:4) sees technikons as acting as regional co-ordinators of career education through a system of satellite campuses, with various types of colleges (e.g. community colleges) forming the basis of a feeder system. Accredited technikons would themselves offer research education up to Masters and Doctoral levels through "Graduate Schools" which would issue degrees rather than diplomas (Tertiary Development News, November:1990).

Degrees in Medical Technology will in January 1995 at certain Technikons which have the necessary academic staff structure. Only students who have obtained an aggregate of 60% or more will be eligible for enrollment (Society of Medical Laboratory Technology Newsletter, March,1994). The information reviewed leads to the conclusion that technological education is a dynamic system with potential for change initiated by many sources. The potential for change should not be ignored by accepting old parameters as applicable to the present population.

3.3.4 Technikon and University

The relationship between the technikon and the university must each have its own distinct functions and objectives if their co-existence as separate institutions is to be justified.

According to the Van Wyk de Vries Commission (Philosophy of Technikon Education, 1988:40), the 2 types of institutions, namely the university and the technikon, should not be in a hierarchical order, but should stand side by side. The relationship, therefore, between technikon and university should not be one of sub-ordination. (This remains a postulate which it would be difficulty to confirm or refute on purely educational grounds). Provisions for cross-flow mechanisms at the advanced academic level should be possible, although two-way bridges should not necessarily be limited to the highest levels (Philosophy of Technikon Education, 1988:40). Skilled manpower is at a premium in the Republic of South African and if we are to make full use of it, all that is required is for everyone to adopt a realistic and responsible attitude (MacFarlane, 1989:255).

3.3.5 The Problems of Educational Mobility

The problem of mobility for the university is two-fold: firstly the joint statutes of the University only permit the transfer of credits to the university equal to half of the total number of courses for a particular degree; secondly, the problem for the university is an additional one. Professor le Roux's (1990:172) perception is that university staff are suspicious of courses conducted at other tertiary institutions and display a marked lack of enthusiasm for mobility of students from other institutions. Transfer could be effected more readily if those concerned deliberately concentrated more on a process approach, but there will have to be an additional change on the part of the university.

Among the advantages of college-university co-operation was the hope that college courses would be validated by the university and that mobility for students between the institutions would occur (le Roux, 1990:172). Medical technologists who wish to pursue graduate education encounter many difficulties in acceptance at universities. Credits are not recognised and the graduate path is not accessible to most.

3.3.6 Co-operative Education

Co-operative education is the joint representation of the technikon and the industry for which the qualification is designed. The two partners in the training are equal but the technikon bears the final responsibility for the academic ability of the student (Philosophy of Technical Education, 1988:49). In many of the careers for which a technikon prepares its students, the work situation is found to involve equipment, materials, processes, technologies and pressures of time, money and personalities which cannot be simulated in an educational situation. In all such cases the technikons develop co-operative educational programmes which include periods of planned and meaningful in-service experience (Pittendrigh, 1990:314).

Optimum structuring ensures that the internal and the experimental aspects of instructional programmes will have a mutually re-enforcing effect. The interaction (between profession-students-technikon) may take the form of short, consecutive periods of interaction or of no longer periods of exposure to each facet (known as thick and thin sandwich courses). The choice of a specific interval structure should be determined by the nature of the technology and not by the wishes of the participants. The duration of the intervals should at all times be short enough for the relevance of formal instruction and practice not to be allowed to fade during one of the components.

In the Republic of South Africa, technikons have traditionally been associated with co-operative education. Co-operative education is firmly established in other countries as well. In the United States of America 80% of the top fifty companies (ranked in Fortune magazine) are known co-operative education employers. Co-operative models are adapted according to the individual needs of each career. The most successful system is the so-called "sandwich system" in which the student alternatively spends 6/12 months at the technikon followed by 6/12 months of in-service training until they complete their diploma.

Unfortunately, this system has not been favourably received by most employers. An employers' absence from work for a period of six months creates a temporary void in the company and thus interferes with the smooth running of the organisation (Goodes, 1989:3). Employers prefer the so-called "day release" system as an acceptable alternative. Under the latter system the student, while in full-time employment, attends a technikon for one day per week from 08h00 to 19h00. The diploma can be completed in a minimum period of 4 years as against a period of 3 years by the "sandwich" system (Goodes, 1989:3).

From the students' point of view the day release system has the advantages that they earn a full salary while studying, and here the opportunity of effectively applying and realising the importance and relevance of their technikon education to the work situation on a daily basis. This is in keeping with the underlying principles of co-operative education.

From the employers' point of view there is little or no disruption caused by the student's absence from work one day per week. Goodes states that the day-release system has some significant disadvantages. Firstly the student and the lecturer meet only once a week which causes a break in continuity. This can lead to unnecessary recapitalization hence a waste of time. Secondly, the student spends an eleven hour day at the technikon. After the first few hours the student begins to show signs of mental exhaustion.

Another popular arrangement is for full-time students to first complete all the theory at the technikon and then be employed while completing the experiential training. It is most unfortunate that this system is becoming increasingly popular states Goodes (1990), since it goes against the very principles of co-operative education. Complicating this system is that students face the real problem of having to find a facility where they can do their experiential training. As this is an exploratory and not an explanatory study, the reasons for the implementation of this format is outside the scope set down in the delimitations.

The student pursuing a course in Medical Technology will generally only gain experience in one method or at best a limited number of methods, for any particular analysis (Georges, 1988: 141). Educational institutes have to operate on tight budgets which limit the availability of methods requiring specialist instrumentation or expensive materials states Georges (1988:141). With this background the newly- qualified technologist is frequently ill-equipped to perform many functions in the laboratory. This highlights the importance of co-operative education.

Medical technology is a co-operative educational venture in the Republic of South Africa. Students presently complete 18 months study full-time at the technikon and then 18 months experiential training at an approved laboratory. A major problem for medical technologists seems to be the integration of theory with practice. This integration may not be achievedby merely lengthening the course (Baker, 1989:243). It was suggested in Baker's study that the education of medical technologists needs to be restructured and presented as a continuum. Theory and practice need to be taught together in the same institution and extending over the whole of the student's training period.

3.3.7 Continued Education

Part-time study is becoming an increasingly significant feature of the landscape of higher education (Editorial, Studies in Higher Education, 1987:125). Part-time higher education takes many forms; correspondence courses, distance learning, re-training schemes and post-graduate research. Institutions of higher education have little scope to carry out market research individually to establish the nature and extent of local demand for part-time courses. Anticipated demand for part-time higher education is affected by economic, social and political developments and national policies (Trotman-Dickensen, 1987:187).

*** The Need for Continuing Education**

As a tertiary educational institution, the technikon, like the university, is never rid of the responsibility of broadly educating it's clients (Klopper, 1989:20).

Graduates/diplomates who decide to enter employment rather than proceed to further studies may soon find themselves faced with the need to take further courses of study in one form or another. This may be prompted by the need for a further quali-fication in order to compete with better qualified colleagues in their chance of promotion. In most cases it is the desire to keep up with technological advances in their chosen field of work that plays an important part in their decision to re-enter higher education (Roweth, 1987:66). The choices open to most will lie between in-house training courses, short courses in special topics arranged either by professional bodies or educational institutions, or enrolling for a further course of formal study.

During preliminary discussions of Roweth's project most of the people consulted seemed to be of the opinion that part-time student's main motivation for taking further studies was career advancement and higher salary prospects. While some did indeed take this view, the final response showed that there was also a large group who were clearly not motivated primarily by financial considerations or their prospect of promotion. They were furthering their studies because they felt the need for further knowledge in order to continue to do their jobs well or for personal intellectual satisfaction.

The majority of students appeared to view their courses as a step towards increased specialisation or consultancy work in the field in which they were currently employed. Beyond certification, which provides the individual with his/her entry ticket into the profession, one must be assured that the individual continues to learn, grow or adapt to the change in science. This is embodied in the concept on continuing education and re-certification (Zabrinsky, 1978:25). Zabrinsky has been a recent president of the ASMT in the United States of America.

3.4 PROFESSIONAL DILEMMAS

A médical technologist must not only know the tools of his field, but also be able to perform the tasks skillfully and professionally (Teshima, 1992a:68). Professional education according to Bloom (1956:4) is the acquisition and integration of

* knowledge (the cognitive domain);
* skills (the psychomotor domain);
* attitudes (the effective domain).

All three areas are essential in preparing students for the complex role of health profession and each of the areas related to in this chapter have been considered major issues affecting the profession as gleaned from the literature and pertaining to the three interdependent learning domains.

In recent years increasing attention has been paid to the continuous need to improve quality in health care (Peddecord, 1993:110). Definitions of quality laboratory performance continue to evolve, states Peddecord, understanding patient needs and defining quality on that basis are increasingly important to health care services.

3.4.1 Licensure and Certification Issues

To protect the public, states invariably license health workers such as physicians, physical therapists, nurses and pharmacists to name only a few. To obtain a license of any sort, individuals must meet specified qualifications relevant to their competence and must provide the service in a manner consistent with public safety and welfare. Clinical laboratory personnel, however, have generally been excluded from mandatory state licensure requirements (Davis, 1990:250).

Advocates of licensure for personnel providing clinical laboratory services believe that licensure is necessary because the public is unable to judge the quality of laboratory services they receive, and the public would suffer great harm if incompetent persons provided such services.

Licensure of personnel is often contrasted with certification, which is a private sector activity. A major difference between the two concerns the consequences of engaging in practice without them. If a licence is required for the practice of a profession or occupation, it is unlawful to engage in such work without one, and the consequences of doing so are potentially quite serious. On the other hand, the absence of a particular type of certification might make it more difficult to obtain work but it is not unlawful to work, states Davis.

Licensure of laboratory personnel has been viewed negatively with respect to manpower issues, but the facts appear to indicate otherwise, states Davis (1990:250). Personnel licensure, in recognising that the services provided by competent laboratory workers are both important and crucial, can play a part in establishing an environment that values such workers' contribution to the health and well being of others. As a professional issue, personnel licensure, rather than contributing to manpower shortages, might serve as a signal to prospective students and others that clinical laboratory science is indeed a valued profession. Removing or rejecting requirements for competence of individual practitioners (licensure) is not the answer to the current crisis in laboratory manpower. Licensure doesn't hurt - it might even help (Davis, 1990:252). The authority to revoke a license should allow the government to protect the public from a licensee who blatantly violates the conditions of licensure; this authority is distinctly different from that of certification agencies (Bigler, 1990:24).

Clinical laboratory scientists in the United States of America have grappled with the issue of licensure and certification within the profession. No one solution agreeable to everyone has emerged but the American Society of Medical Technology maintains that individual state licensure of clinical laboratory science personnel will ensure the professionalisation of the field and provide an important foundation from which clinical laboratory science can build (Podell, 1990:13). It is no accident that three individual states in the United States of America managed to have licensure legislation approved.

Grass-roots movements on the part of clinical laboratory scientists have been to define the profession and to secure their positions within the health-care community.

The American Society for Medical Technology recognises that licensure is perhaps the single most critical professional issue that medical technology now faces (Podell, 1990:13). Whether credentialling by certification or licensure, each profession must define its own standards for practice and entry to that practice. Unless clinical laboratories are in control of their own certification or licensure processes, they will be viewed by colleagues in nursing, occupational therapy, physical therapy, pharmacy, medicine and the like, as less than equal. It is important that these legislators and agency officials respect us as a profession. As we start the 1990's it is time for us to accept the responsibility to design our own future and to influence those who will follow us (Karni, 1990:243).

3.4.2 Professional Image of the Medical Technologist

The affective domain (attitudes) of professional education is a well documented phenomenon and the medical technology profession could benefit from a better public understanding of the function of its members (Rosland, 1985:130). The need for professional recognition was also expressed in a survey undertaken at Garankuwa Hospital and Medunsa (Baker, 1989:243).

It is extremely important for medical technology as a profession to sell itself and its members to the community (Roberts, 1988:5). Of the several factors frequently cited as contributing to the manpower shortage in the United States of America negative perceptions about clinical laboratory science as a career, held by prospective students and by current and former practitioners are among the more troubling (Davis, 1990:252). A common practice among young people making career decisions is to seek advice and encouragement from those already working in a given field. When they do in clinical laboratory science, they are likely to encounter substantial numbers of dissatisfied laboratory workers.

In reviewing research findings about medical technologists' job satisfaction from 1970 through to 1985, Karni identified lack of professional recognition and respect as among the most frequently cited dissatisfiers (Davis, 1990:252). Under these circumstances merely improving the quality and quantity of various aspects is not enough. Jobs in the clinical laboratory must be perceived in a more serious light, both by practitioners and those outside the profession. For this to occur, the professional working environment in clinical laboratories must improve to the point where job satisfiers far outweigh dissatisfiers.

The apparent exodus of experienced technologists from the profession has caused alarm. Among the most often cited problems causing professional attrition are wage and salary scales that are not appropriate to the level of training, extremely limited career mobility, lack of professional autonomy and independence, negative work environment which is aggravated by hostile clinical staff, lack of professional recognition and acceptance by physicians, nurses, general public and patients (Summers, 1990:247).

Despite the large base of related articles and editorials, considerable controversy and uncertainty remain about the actual severity and scope of the medical technologist shortage, the cause of the problem and the best approaches and strategies for mitigating the crisis (Summers, 1990:245). Leaders in the field of medical technology are thus faced with a problem whose scope, cause and solutions remain incompletely defined. Organisations charged with leadership in this field should accept that responsibility and devise thoughtful strategies for addressing the problems. A number of professional groups have suggested a need to strengthen the image and visibility of the profession through marketing and public relations efforts.

*** Public Image**

The patients for whom we exist, are unaware that the person in the white laboratory coat is a medical technologist rather than a laboratory technician, a doctor or a nurse. The public has no idea of what is required to become a medical technologist. Even doctors and other allied health professionals need to be educated to this fact (Roberts, 1988a;5). A conscious effort must be made to publicise and upgrade the image of clinical laboratory professionals. This effort must be directed both at other members of the health-care team and the general public (Schwabbauer, 1990b:109).

Although medical technology as a profession is now more than 50 years old, its public image is still weak (Vittetoe, 1985:537). Medical technology is an under-appreciated, misunderstood profession. It is demeaned, dismissed and ignored by the public, the government and even the health care community. Medical technologists have never stood up before the rest of the health care community to assert the importance of their role (Creeden, 1990:71). Most are unaware of the role medical technologists play in providing for the proper diagnosis of medical conditions and appropriate treatment of medical problems.

A series of strategies to improve the professional image of the clinical laboratory scientist have been undertaken by the American Association Society of Medical Technologists. They plan to create an image for the profession based on two factors; The first strategy involves educating the public about clinical laboratory services through state and local fairs and educating parents and teachers about careers in clinical laboratory science. The second strategy is that clinical laboratory science is patient-connected and is the scientific basis underlying the practice of medicine (Flanagin, 1988:10).

Growing dissatisfaction on the part of clinical laboratory scientists regarding their professional status, recognition and re-imbursement has led to diminished recruitment on the part of existing medical technologists. More attractive career opportunities for women in other areas of allied health care and in other unrelated fields has led to the malaise that has gripped recruitment efforts (Podell, 1990:12). This is coupled to a growing distrust of allied health professionals on the part of the public as well as a somewhat non-existent public image of the clinical laboratory scientist.

*** Strategies for Professional Improvement.**

Clinical laboratory scientists can become the equals of other professionals in the health-delivery system by demonstrating leadership abilities in research, education, administration and clinical practice. Having the appropriate educational foundation will give the profession greater credibility in dealing with other professionals. Laboratory professionals must attain the status their competence warrants and achieve the prestige owed the profession (Mendelson, 1988:331).

In Indiana a hospital laboratory found a way to improve its image. They produce a video-tape featuring procedures, instruments and employees. The goal was to inform both the public and the hospital staff that the laboratory is more than just a place to go for a blood test. Another documentary video-tape was shown on local public television. This explores the vital role the medical technologists and cytotechnologists play on the medical team and emphasises the critical shortage of these professionals.

* Professional Complaisance

Any lack of recognition, self-esteem or remuneration that has been suffered has been self-imposed by inaction on the part of medical technologists (Editorial, Journal of Medical Technology, 1985:144). Any intimidation or unfair restraint by pathologists and other employers should be legally challenged. The professional body of medical technology is urged to launch a national public relations campaign and to issue statements on health related issues like other professional organisations do. Any organisation or individual making a statement demeaning or derogatory to medical technologists or indicating ignorance of their role, work and responsibilities should be deluged by letters and calls setting them straight (Editorial, Journal of Medical Technology, 1985:144).

Practising medical technologists must start exerting themselves. They must begin to break the bondage of their cocoon, they must be active in professional organisations, read professional journals and be educated sufficiently to engage in one-to-one educational sessions with colleagues, clinicians, pathologists and other health personnel. Summer concludes that critical to the education, training, recruiting and retention aspects is the total image of the profession. It must get involved and explore new ways of letting others know of its abilities and contributors. Together the emergence of the generalist, manager and consultants will enhance the image of clinical laboratory scientists (Flanagin, 1988:13). If they just vaguely hope for the best or accept the position to which they have relegated, they may never arise from their somnolence.

The new challenges and opportunities depend on a professional reawakening of the medical technologist. The technologists need to begin to create their own identities within the health care team. The profession can no longer afford to be lethargic and allow opportunities to pass them by (Podell, 1990:14). Nurses and other health practitioners are recognised for their efforts because of their visibility and their one-to-one contact with patients. One-to-one direct contact with patients will do as much as any public relations to enhance the image of the medical technologist in the eyes of the public, states Podell. The profession must be marketed as a career and not just as a job (Barr, 1990:7).

3.4.3 Ethics

Ethics is the term used to identify the theoretical or systematic study of moral action or conduct. It is the study of right and wrong conduct for the purpose of establishing principles or guidelines that we can call upon to guide our moral choices

(Pisaneschi, 1990:22). In ethics, for example, we would attempt to define and substantiate the principle of confidentiality and to determine when or under what circumstances this principle is not applicable. In addition, the word "ethics" is used in relation to codes of conduct that have promulgated by some formal body or organisation (Pisaneschi, 1990:22).

Medical laboratory technology practice is affected by a broad range of ethical issues pertaining to national, professional, institutional, personal and patient obligations. With the increasing complexity of health care, all practitioners are faced with even more difficult challenges in these spheres. Therefore, it is important that medical laboratory technologists and students be educated about the importance of their participation in ethical decision making and policy development (Vittetoe, 1990:26).

* Professional Code

The oldest professional code and its interpretation is attributed to Hippocrates in Greek around 500B.C. (Vittetoe, 1990:25). That code had a moral perspective and, if broken, carried serious penalties. Today, professional codes of ethics provide broad statements of expected ethical behaviour and professional values appropriate to its practitioners.

For example, the American Society of Medical Technologists (ASMT) Code of Ethics (see Annexure E) states:

* "Being fully cognisant of my responsibilities in the practice of medical technology I affirm my willingness to discharge my duties with accuracy, thoughtfulness and care.
* Realising that the knowledge obtained concerning patients in the course of my work must be treated as confidential. I hold inviolate the confidence placed in my by patients and physicians.
* Recognising that my integrity and that of my profession must be pledged to the absolute reliability of my work. I will conduct myself at all times in a manner appropriate to the dignity of my profession."

The code addresses responsibility, confidentiality, integrity and commitment as professional values for clinical laboratory scientists (CLSs). The code of ethics adopted by the American Society for Medical Technology (ASMT) House of Delegates in June 1988 sets forth the principles and standards by which clinical laboratory professionals practice their profession. This code is divided into two parts addressing the duty to the patient and the duty to colleagues and the profession.

1. Duty to the Patient

Clinical laboratory professionals are accountable for the quality and integrity of the laboratory services they provide. Included here is that clinical laboratory professionals perform their services for the individual, respecting his or her right to confidentiality, the uniqueness of his or her needs and his or her right to timely access to needed services.

2. Duty to Colleagues and the Profession

Clinical laboratory professionals accept responsibility to individually contribute to the advancement of the profession through a variety of activities. Also stated is that these same professionals actively strive to establish co-operative and insightful working relationships with other health professionals.

Because of rapid technologic and societal changes, clinical laboratory scientists are faced with many new and complex situations not addressed by the code (Vittetoe, 1990:26). Therefore, health professionals as well as students must be educated about the importance of their participation in ethical decision making and policy development. Some of the many pressing and difficult ethical issues the profession have to address are:

- Rationing of health-care for the elderly and the terminally ill.
- The provision of equitable access to care for the poor and the those without medical insurance.
- Cost aspects regarding abortions.

These questions and others, should not and cannot be answered by medical technologists or by health professionals alone. They must seek the answers to them with other professionals and citizens within society (Vittetoe, 1990:26).

South African medical laboratory technologists do not yet have a professional code of conduct. A code will ensure that a person works to a recognised standard which those using the laboratory service can expect to receive. A code can motivate medical technologists in reminding us that the profession is primarily dedicated to the service of the sick and the promotion of good health care (Cheesebrough, 1987:5). A suggested code of professional conduct for medical laboratory technologists is shown in annexure E. The code includes those attitudes and practices which characterise a responsible laboratory worker.

*** The AIDS Patient and the Laboratory**

The AIDS virus is transmitted through blood and body fluids. As a result, laboratory personnel may perceive themselves to be at high risk, since their very livelihood depends upon the handling of such specimens, as well as the manipulation of sharp objects contaminated with those fluids (Wyatt, 1987:108). It is suggested that a simple non-specific bio-hazard label on specimens from AIDS patients can provide sufficient precautionary information while maintaining patient confidentiality, states Wyatt.

Employees are bound, under a legal concept of duty in the United States of America, to care for persons who are admitted for treatment. If any employee refuses to care for a patient, the facility has the right to fire that employee (Wyatt, 1987:109). The issue of confidentiality also affects blood bank laboratories in their function of providing a safe and adequate blood supply to the public. With the implementation of the HIV antibody test, legal and ethical dilemmas pertaining to the disposition of positive results have emerged.

Discrimination against the AIDS patient is well documented, and it has prompted demands by members of certain high risk groups that the strictest confidentiality be maintained in regard to individual's AIDS status. In response to these demands, hospitals are being forced to avoid labelling specimens as being specifically from AIDS patients (Wyatt, 1987: 109). This generates a dilemma, for in order for medical technologists to protect themselves, they argue that they have a right to know.

A health professional's right to refuse treatment (or of contact with patients with AIDS) is often raised in the context of conflict between one's personal values and one's professional responsibilities (Vittetoe, 1990:25). Some questions may arise when our personal values conflict with what are, or are perceived to be, professional obligations. Some of the fields of work that deals with issues that may be problematic are research laboratories using foetal tissue for transplant or experiential purposes; fertility or pregnancy clinics engaging in *in vitro* fertilisation; the freezing and thawing of embryos and the implantation or disposal of embryonic or foetal tissues; and genetic counselling centres performing *in vitro* testing for genetic defects that may lead to decisions to abort defective or unwanted foetuses. Medical technologists need to understand their own value systems to avoid future conflicts with conscience.

* **HIV Testing and Notification Issues**

The information contained in a patient's record belongs to the patient, even though the physical record itself may belong to the hospital. No one except the patient may release patient results without a clinical need to know. General consent for transmittal of patient results from one service or individual to another within the hospital is usually given on admission by the patient. Privacy of employee records should also be maintained (Chamberlain, 1987:99).

Implementation of HIV antibody testing in blood banks and other testing sites has created a dilemma regarding the notification of individuals who test positive for the antibody. The most popular current method of testing is an Elisa procedure (Enzyme-linked immuno-absorbent assay) that demonstrates good sensitivity and specificity, but false positives and false negatives do occur. In a population of healthy donors as many as one out of every 100 test results will be positive, and of these as many as 90% false positives. It should also be noted, according to Wyatt, that an infectious individual may test negative during the interval between infection and sero-conversion.

There has been some question as to whether or not a patient should be notified of positive results. The blood bank laboratory is faced with problems in notification of not only the donor but also the patients who have received blood from a donor who seroconverts at a later donation (Wyatt, 1987:109). Since AIDS is considered a death sentence and since there is a possibility that one who is seropositive can transmit the disease or develop AIDS, to inform an individual that he or she is antibody positive when, in actuality, the positive result is an error, could have serious implications.

*** The AIDS Victim as an Employee**

Since AIDS is considered a death sentence and since there is a possibility that one who is seropositive can transmit the disease, it is inevitable that employers will be increasingly faced with ethical and legal concerns pertaining to the AIDS victim as an employee. Concerns include discrimination against hiring or retaining employees with AIDS, the fear of co-workers who must work alongside the AIDS victim and the fear of disease transmission to patients.

No evidence exists that AIDS can be spread via coffee cups, telephones, toilets or even by non-intimate skin contact (Wyatt, 1990:110). The Centre for Disease Control in the United States of America state that there is no risk of transmission to co-workers. Discussion of AIDS in the workplace cannot be complete without mention of the personal risk of the AIDS victim who is employed in the clinical laboratory. His or her own health is a valid concern considering the AIDS victim's inadequate immune system and the pathogens encountered in the clinical laboratory.

* Professional Ethical Issues

Some of the professional ethical issues facing medical laboratory technologists cluster around several different dimensions:

1. The standards of the profession.
2. Clinical practice.
3. Intra-professional or inter-professional conflicts that may arise in practice.

Intra and inter professional conflicts can become serious and frustrating ethical dilemmas for medical laboratory technologists. Sometimes these value clashes may require blowing the whistle on colleagues. Blowing the whistle is a way to challenge the actions or omissions of others inconsistent with established rules, procedures or common work values.

It requires determination to correct a situation and courage to face the consequences of reporting to the proper authorities. There are two sides to blowing the whistle and which side should be believed! This means that those in authority also have a problem with blowing the whistle (Vittetoe, 1990:27). One effective approach to avoid the problems in re-standardising group norms by specific methods such as:

1. Developing clearly defined parallel lines of technical and administrative authority.
2. Promulgating clearly understandable procedures for reporting errors or problems and for challenging decisions.
3. Designing appropriate rewards and protection for those who are instrumental in reporting and solving problems.
4. Devising measures that will inhibit vindictive use of the system.
5. Composing a programme of ethical values, clarification for each of the inter-connected, inter-dependent layers of administrative, professional and technical staff. (Vittetoe,1990:27).

Screening for drugs of abuse and laboratory tests for AIDS virus have given the clinical laboratory such greater public visibility and, over the past decade, the clinical laboratory has had to defend itself in a growing number of law suits. Liability flowing from negligence is the most common basis of legal action against a medical professional's misconduct that results in injury to a patient. Negligence in the legal sense is not just a "mistake". It is a violation of a duty to exercise reasonable skill and care in performing a task.

If a laboratory has offered its services to one who is subsequently harmed by the laboratory's improper act, the laboratory may be liable. Standards of reasonable care can cover the collection and labelling of a specimen. One is not liable for bad results per se unless some form of warranty is given.

The best defence to any claim of professional negligence or malpractice is the documentation that appropriate standards and procedures were followed. Procedure manuals are written for more important purposes than just satisfying accreditation requirements.

The information contained in a patient's record belongs to the patient, even though the physical record itself belong to the hospital. No one except the patient may release patient results without a clinical need to know. Patient results from the laboratory are not to be given to another employee when that employee has no clinical need for them. Privacy of employee records should also be maintained.

The ethical issues impinging on the profession and its practitioners will be encountered more and more in the future and it is imperative that all become more involved in ethical decisions. Medical laboratory technologists must be willing to open and maintain dialogue with their colleagues in other health professions, to learn more about the South African health care system, of which they are a part and about the society in which we exist. It requires our willingness to rise above the safety of our narrow focus and the security of self-interest to discover how we are connected and related to one another, to the institutions in which we work, to the health-care system itself, to the local communities in which we live and to the society which we serve (Piseneschi, 1990:24).

The advent of AIDS with its devastating effects and socially sensitive characteristics has presented a challenge to the professional fibre of laboratory practice. It is imperative that a rational approach be taken to establish standards and guidelines for dealing with the issues involved (Wyatt, 1987:111).

3.4.4 Competency

Continued competence is expected of medical technologists, as it is of all health professionals. The accelerated rate of research and the advance of technology since 1945 have imposed an obligation on medical technologists to continuously update their cognitive knowledge and technical skills in order to practice competently in the clinical laboratory. The generally accepted mode for the acquisition of new information and technical skills has been participation in continuing education activities. The one-time certification of professionals of any sort does not ensure continued competence for two years, much less than ten or twenty years, after qualifying.

Two problems regarding continued competence have concerned the profession in the United States of America: the lack of a documented relationship between continuing education and continued competence and, how continued competence is to be measured.

Each level of competency should be certifiable with certification becoming in effect a license to practice (Johnson, 1985:779). No such practice exists in the Republic of South Africa.

Continuing education is based on the need for additional learning following entry-level preparation in order to remain current with changing techniques and information. No studies were found in the literature that measured learning accomplished via continuing education.

3.5 SUMMARY OF CHAPTER THREE

The first step in developing a directive for medical technology in the Republic of South Africa is to identify issues perceived to be important. The changes occuring in South Africa may cause the role of the medical technologist to change. The literature revealed that not only will medical technologists have to learn to share their expertise and knowledge by participating in community health education but they must also advise doctors in selecting the correct tests.

- New technologies will continue to be applied to the pathology laboratory with the result that continuing education will be an essential constituent of professional ability. A techni-kon, as the instution responsible for the education of medical technologists in South Africa, should abide by their contract and ensure that academics enable students to have an equal chance of successfully negotiating whatever examination system prevails.

An important finding indicated that, in professional practice, social interaction occurs which involves moral issues. This should be an intrinsic part of professional education. The profession needs to enhance it's visibility with both the public and other health professionals.

CHAPTER FOUR

METHODOLOGY

4.1. INTRODUCTION

Recent overseas studies have shown that combining traditional knowledge of practice and science with new educational, technological and managerial skills will allow the medical laboratory technologist to gain a pivotal position in tomorrow's health-care market. By confronting and surviving the changes, medical laboratory technologists will expand the scope of traditional practice and achieve a position of leadership. Since this study is concerned with the curriculum needs of medical laboratory technologists in the Republic of South Africa with an emphasis on the professional demands of the future, a questionnaire was designed for the purpose of obtaining data on what medical laboratory technologists perceive as the changes necessary to address the challenges of the year 2000.

The absence of empirical evidence in the literature review of any relationship between the scope of knowledge necessary and the quality of medical laboratory technology may considerably hamper an assessment of what constitutes professional competency. It is hoped that the findings of this study would be of use to the Technikons in their planning and provision of courses that would best meet the requirements of the profession in the future. This chapter contains the methodology used to approach the issues in question. The questionnaire design, sample selection and data collecting procedures are explained. The study is of an explora-tory descriptive nature, using the survey mode of observation (questionnaire - annexure B).

4.2 DATA

Data of primary nature was used in this research. The use of primary data tends to ensure the integrity of the study and to strengthen its reliability (Leedy, 1985:119).

4.2.1 Questionnaire Development

The research consisted of an empirical survey using a structured questionnaire. The objectives of the questionnaire were:

1. to assess how medical laboratory technologists perceive their education
2. to assess their future perspectives.

The questionnaire attends to both the present and future perspectives of the profession in three distinct spheres: Education, professional issues and social factors.

A pilot study was undertaken to test the validity of the questionnaire. The researcher was fortunate in having the assistance of senior members of the profession who carefully perused the questionnaire and made suggestions as to items that medical technologists may have had difficulty in understanding or comprehending. The pilot study was pretested on twenty volunteers. Nine were medical technologists involved in medical technology education and the remaining eleven high ranking medical technology practitioners.

The Pilot Study was a small scale study using a small sample of the population and was perceived desirable to iron out weaknesses before the major project was begun. The success of any investigation depends largely on the respect and co-operation of the respondents. Standardization and sufficient time enhances data collection and these were afforded respondents.

The questionnaire consisted of the following:

SECTION A: Demographical and biographical data - 4 questions. Section A is comprised of two sections. One deals with the particular details of the employer which should given an indication as to whether the medical laboratory technologist is employed in the government services, private practice or in rural or urban areas. The second sector consists of biographical data. These biographically based questions will be used as independent variables, viz. sex, age, post held, years of employment.

SECTION B: Issues relating to the present system of educating medical technologists in the Republic of South Africa. Section

B consisted of 18 statements on the present system. The respondents were instructed to rate their attitudes towards specific issues regarding the present course offered by the technikons and also on various professional issues.

SECTION C: Futuristic perspectives.

Section C consisted of 29 demographic and general information questions concerning the future perspectives of the profession. One purpose of these questions was to get an indication of the strategies that should be adopted to improve the educational standing of medical laboratory technologists in the Republic of South Africa. These questions will include space for pre-form comments. This could aid in determining whether there is a positive/negative outlook for medical technology.

4.3 SURVEY ADMINISTRATION (ANNEXURE B)

Letters were written to the chief technologists and pathologists at each of the hospitals/pathology laboratories in the four provinces of the Republic of South Africa. They were asked for assistance and permission to allow their medical technologists to participate in the questionnaire. Employers were not told individual responses to the questionnaire. These remain confidential. The number of questionnaires sent to each laboratory for distribution was in proportion to the number of medical technologists working in that department, to a maximum of 20. A total of 1200 questionnaires were sent out from September 1991 - June 1992. An initial 600 were distributed and later, due to the bad response rate, a further 600 were distributed in February 1992.

The questionnaire was distributed to medical technologists in various laboratories throughout the Republic of South Africa. Medical laboratory technologists chosen for the questionnaire practiced in all branches of medical technology, including research, education and clinical service.

4.4 THE SAMPLE

The first step in selecting any sampling design is to analyse carefully the INTEGRAL CHARACTERISTICS OF THE TOTAL POPULATION.

The basic purpose of sampling is to enable the researcher to obtain the desired information in a reliable manner without involving the population. The researcher thus wants to make observations of the sample in a practical economical manner and generalize the findings to the population (inductive reasoning), (Uys, 1990:85).

The stratified random sampling method was used (Annexure C). This design enabled units to be divided into nomogenous groups, such as medical technologists, senior medical technologist and principal medical technologists.

Although the laboratories in the study are not necessarily representative of the Republic of South Africa, the sample group is heterogeneous and included a wide range of services and staffing patterns. Three are teaching hospitals and one is not.

There are many variables introduced into this study. Various hospitals and pathology laboratories are used in the provinces of Natal, Cape, Transvaal and Orange Free State. Responses were edited from the four main pathology disciplines. i.e. Haema-tology, Microbiology, Chemical Pathology and Cellular Pathology. It is hoped that there was at least ten responses from each discipline. Since Addington Hospital is small in comparison to the larger teaching hospitals such as Tygerberg the complete sample will be drawn. This will also apply to other small laboratories in areas such as Kwa Zulu.

4.4.1 Method of Capturing Data

Those medical technologists who live and work in far removed areas were contacted via the relevant branch secretaries of the South African Society for Medical Laboratory Technologists. This was by means of return postage. The questionnaire was thus accompanied with a self-addressed stamped envelope for the convenience of the respondent. In return for the investment of time and the courtesy of replying to the questions, the respondents were offered a summary of the results of the study at its completion. The respondents were all given a time limit to complete the questionnaire and they, almost without exception, took three times longer. In many instances a reminder letter or phone call was necessary.

When questioned on the delay, or failure to return the questionnaire, respondents stated that they:

1. had forgotten
2. were apathetic about the profession; or
3. they didn't have the time!

4.4.2 Criteria for the Admissibility of the Data

* Data from questionnaires completed under the researcher's auspices or those represented by her, were used. This was to ensure collection of the data as quickly as possible so as not to inconvenience respondents. It was also felt that the longer the respondents had to complete the questionnaire, the more chance there was of jeopardizing the accuracy and validity of the investigation.

* Incompleted questionnaires were ignored at the discretion of the researcher as it was felt that they could prejudice or bias results.

* Only data that had been checked for errors using SAS procedures to check, for example, numeric variables maximum and minimum values for oddments were used.

4.5. STATISTICAL ANALYSIS OF THE DATA

A good understanding of statistical concepts is needed in order to process data and where problems existed, a statitician was consulted. Perfect accuracy in statistical information is possible only in limited circumstances. The process of statistical analysis, namely, organizing raw data, central values, ranking and percentages enabled the data to be compiled.

Data in descriptive survey research is particularly susceptible to distortion through the introduction of bias into the research design. Particular attention was thus given to safeguard the data from the influence of bias so that this could not affect the statistical outcome. Bias occurs if the sample is not representative of the population, that is, the individuals in the sample differ systematically from the population (Katzenellenbogen, 1991:38). People do refuse to participate in research, especially in postal surveys where respondents have to return completed questionnaires by mail (Katzenellenbogen, 1991:38). Bias can grow out of an attempt to reserve one's integrity and thereby distort the truth.

A misleading conclusion may have arisen in this study due to the low percentage of returns (32%). The inward motivation that may have influenced the remaining respondents not to return their questionnaires has not been overlooked. A documented disadvantage of postal questionnaires is a poor response rate. People need a strong incentive in order to persuade them to complete and return a questionnaire. Several descriptive statistical methods were used to analyse the data.

4.5.1 Descriptive Methods

Descriptive statistics is the presentation of data and the calculation of descriptive measures which help to summarize data (percentages, averages, dispersion and correlation).

Statistics divides in two ways; first in terms of its functional aspects, namely statistics whose function is to describe the data. This branch of statistics describes what the data looks like, where their centre is, how broadly they spread and how they are related in terms of one aspect to another aspect of the same data (descriptive statistics).

Frequency tables and certain graphs were compiled on specific questions for the purpose of an overview. Other descriptive methods (frequency distributions) were used to determine central tendencies and measures of dispersion. Data were summarised by the mean, tables and graphs.

4.5.2 Inferential Statistics

Another function of statistics is not to describe but to infer. Inferential statistics were not used in this study.

4.5.3. The Overall View

Statistical approaches most logical for this particular data were chosen. Conventional statistical notations for various parameters such as the mean, standard deviation, probability account for the most part. Parameters are always characteristic of a population. Some of the answers were represented graphically. Non-parametric statistics will not be used for the purpose of this study.

4.5.4 Instrument Ratification

It was decided, in order to control researcher bias and to maximise expert input, that the initial questionnaire should contain very few suggestions (Yes/No). Examination and content analysis of the information presented in the three sections of the questionnaire (A, B and C) addressed three distinctive areas:

These were:

* Social Factors
* Technikon
* Professional Dilemmas

4.6 SUMMARY

This chapter outlines the methodology used and the rationale behind both the questionnaire design and sample selection. The questions asked in the questionnaire are relevant to matters pertaining to the factors affecting the profession, as outlined in chapters 2 and 3. Section A addressed demographic issues, Section B the present system educating medical technologists in South Africa and Section C future perspectives of the profession. Numerical data was used to provide a factual foundation as a method of summarising, in a systematic way, aspects of social, technikon and professional problems. Final sample data capture methods were explained, as well as criteria for the admissibility of data. Results of data processing are discussed in chapter 5.

CHAPTER FIVE

DATA ANALYSIS, FINDINGS AND RESULTS

5.1 INTRODUCTION

In the previous chapter the procedure for the questionnaire design and administration, as well as the analysis of the data were discussed. Responses were analysed on the number of respondents who had completed that particular question. The comments and suggestions of the respondents are grouped under broad headings and, where possible, are depicted in tables or figures.

In this chapter the results of the processed data are tabulated, interpreted and evaluated. Only relevant results that emerged for each sub-problem and its hypothesis will be dealt with. The numerical data are presented in terms of the problem.

Firstly, the results relevant to the investigation regarding the professional future of medical technology in the Republic of South Africa and evaluation of medical technologists attitudes towards their future perceptions are reported on. Secondly, the identification and analysis of the knowledge and skills required for professional education are commented on. Thirdly, analysis and interpretation of the treated data enabled formulation of objectives for a comprehensive course structure for the profession of medical technology in South Africa.

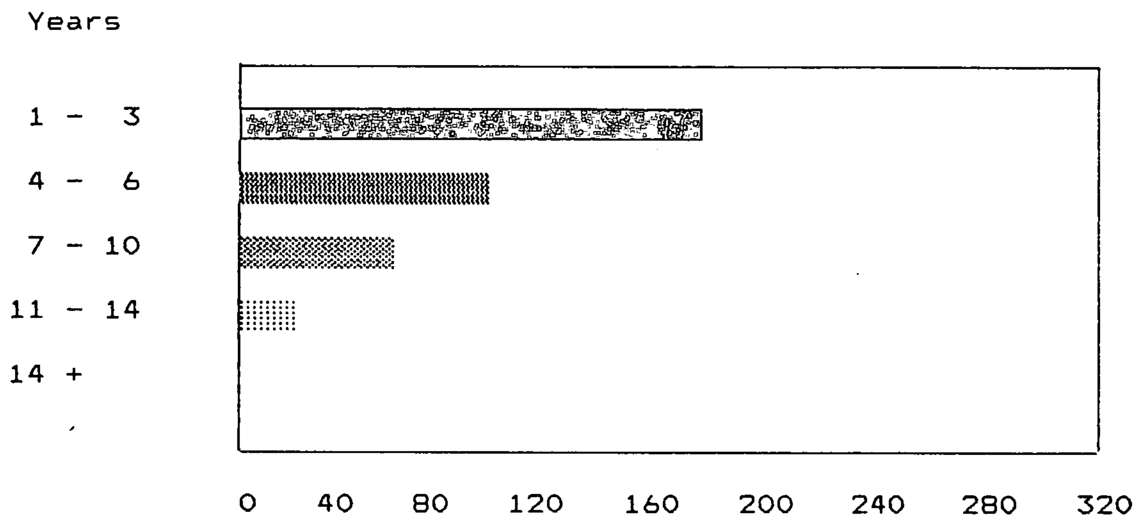
TABLE 5.1 : SAMPLE REALISATION

RANK	No.	%
Chief Medical Technologist	31	9.7
Principal Medical Technologist	35	10.
Senior Medical Technologist	93	29
Medical Technologist	161	50.3
TOTAL	320	100

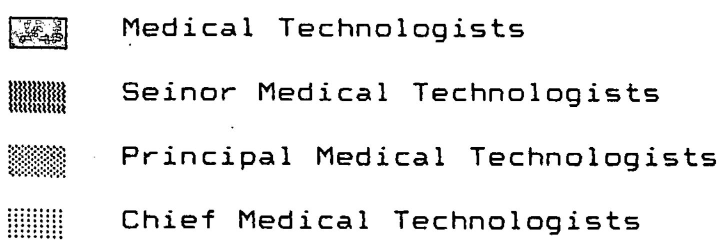
The three hundred and twenty respondents (Table 5.1) comprised thirty-one medical technologists, all of whom had more than ten years of laboratory expertise, thirty five principal medical technologists, all having more than eight years experience, ninety-three senior medical technologists, all having more than four years experience and one hundred and sixty one medical technologists of whom had between one and three years post qualification experience (Figure 1 : Page 165).

Included in the number of responses were very senior members of the profession. Their responses were carefully studied and comments noted. Throughout the study no significant differences of opinion were apparent between male or female medical technologists, except on the specification as the most important reason for leaving the profession. Married females stated that family commitments would have priority. This confirms de Benedictus' (Journal of Medical Technology, South Africa, 1988;139) comment that the profession has become attractive only to secondary income earners or those seeking relative short-term employment.

FIGURE 1 : POST QUALIFICATION EXPERIENCE OF RESPONDENTS



CATEGORIES:



Both black and white medical technologists were approached. One hundred and twenty questionnaires were sent to Kwa Zulu. Of these 38 were returned. The responses from Kwa Zulu regarding regional bias were not taken into account since black medical technologists were encouraged to participate in answering the questionnaire in all four provinces of the Republic of South Africa. There did not appear to be differences in selected responses between Kwa Zulu and the other areas investigated. Medical technologists were seen as a unified body and the attitudes of the different ethnic groups were not investigated. The questionnaire did not address or request nationality.

All three hundred and twenty respondents hold the National Diploma in Medical Technology or its equivalent. Thirty one (9.68%) have obtained additional qualifications in the guise of the National Higher Diploma. Sixty-two (19.3%) were studying towards further qualifications, the most popular course being a B.Sc degree

The issues relating to the professional future of medical technologists as represented by the various questions in the questionnaire (Annexure B) are discussed below.

5.2. DATA PROCESSING

The sectionalization of the problem has been expressed in the form of appropriate sub-problems in order to facilitate the management of the problem as a whole, i.e. there are certain data relating to each sub-problem. These are exhibited in logical sequence within Chapter 5. Tables are drawn wherever applicable.

5.3. SECTION B : THE PRESENT SYSTEM OF EDUCATING MEDICAL TECHNOLOGISTS IN THE REPUBLIC OF SOUTH AFRICA

The next few paragraphs cover this issue and tables are presented wherever relevant.

5.3.1. Present Educational Attitudes

Assessment of medical technologists attitudes towards the present educational system indicates that there presently exists a large degree of dissatisfaction (eighty one per cent) : (Question 1).

Medical technologists have long been dissatisfied is well documented in the United States of America. Much dissatisfaction also exists in the Republic of South Africa as shown in a study undertaken in 1989 (Baker, 1989:237). Reasons given for this dissatisfaction emanate from different sources. Most respondents made several suggestions for either the improvement of the existing course or the restructuring of it. When medical technologists were questioned on the reasons for dissatisfaction with their present educational system, replies were most often very specific.

In order to enhance an understanding of possible general reasons for dissatisfaction, it became important to isolate more "measurable" reasons for their decisions. To do this, an open-ended question allowed respondents to state the most important reasons for dissatisfaction. These reasons were classified into ten categories listed in Table 5.2 (page 169).

Despite the attempt to identify "measurable" reasons, the diversity of responses permitted only the most frequent to be monitored. The directives given in an open-ended question in the questionnaire state:

TABLE 5.2: DISSATISFACTION OF PRESENT EDUCATIONAL SYSTEM

- The practical component offered at the technikons is not adequate;
- The assignment manual is not a true reflection of a student's competence;
- It is often the assignment supervisor who sets the pace and not the student. It is also known that supervisors are often biased towards a student and thus perhaps retard their progress;
- There is little correlation of theory with practical content;
- The theoretical pace set in the syllabus is too large for adequate understanding and comprehension due to the short time available. Students pass exams by rote-learning;
- The course should be accredited for degree purposes;
- The medical technologist would prefer to see the re-instatement of examinations as a final assessment;
- Content should include courses such as management, computer science and personnel skills.

Inadequate Education

In the question pertaining to the adequacy of the present course, the lack of skills and experience was seen as a major consideration

The respondents (eighty one percent) stated the national higher diploma offered insufficient skills and experience, forty two percent felt that the knowledge gained was insufficient. Regarding the National Diploma, seventy three percent stated that the course offered insufficient skills and experience. Thirty Eight percent felt that the knowledge gained was insufficient (Table 5.3.)

TABLE 5.3 PERCENTAGE DISTRIBUTION OF THE OPINION ON MEDICAL TECHNOLOGY EDUCATION

	Insufficient knowledge	Insufficient skills	Insufficient experience
National Diploma (T3)	38%	63%	73%
National Higher Diploma (T4)	42%	81%	81%

Table 5.3 also shows that the majority of respondents are well aware of the shortcomings of their present educational system due to increased demands being made on the profession. The results of a survey in the United States of America indicated that curri-cula will have to reflect the new demands on the profession.

The respondents (sixty five percent) in Raichle's survey felt a need for co-ordinated curriculum revision due to increased demands being made on the profession (Raichle, 1992:222). The above comments compares with Baker's study (1989:237-240) undertaken in the Republic of South Africa. In her study respondents made several suggestions for either the improvement of the existing course or the restructuring of it.

A major problem with the National Diploma has always been the lack of integration of practice with theory Baker (1989:237). The subjects offered are not often taught as a continuum. A tremendous amount of theoretical knowledge needs to be assimilated, despite the fact that the profession is practically orientated, only a small percentage of time at the technikons is spent doing practicals due to the high theoretical syllabi.

¤ <u>Manpower Needs Assessment</u>

<u>Thirty four per cent (34%) of respondents stated that they would be leaving the profession within the next few years : (Question 3a)</u>

There is a considerable demand for qualified medical technologists as a result of the phenomenal development of medical science and this is likely to continue. Laboratory managers in the United States of America have expressed concerns over impending shortages of qualified personnel (Bissonette, 1988: 283) and it was therefore necessary to assess the manpower situation the Republic of South Africa. Thirty four percent of respondents stated that they anticipated leaving the profession within the next few years. Reasons for leaving emanated from this open-ended question (Question 3b), included responses such as:

- lack of upward mobility
- lack of professional recognition
- lack of personal fulfilment
- lack of opportunity to use extensive education
- low pay.

Given the limitations of employment available to medical technologists, it was a revelation that the exit rate from the profession was thirty four percent.

☼ <u>Medical laboratory technologists feel that their work lacks challenge : (Question 3c)</u>.

TABLE 5.4: PERCENTAGE REGARDING CHALLENGE OF MEDICAL TECHNOLOGY EMPLOYMENT

Response	Frequency	Percent
Yes	140	45.4
No	166	54.6
Frequency Missing = 15		

Much of the work in a clinical pathology laboratory is repetitive, despite the advent of automation. It is well documented that medical technologists have a low level of job satisfaction, partly due to a lack of challenge in everyday work. When questioned on whether periodic rotation through all laboratory sections was important for review and update, eighty three percent agreed (Table 5.4 : page 172).

In encouraging rotation through different departments, medical technologists might find an extra challenge in coping with the strenuous mental demands of new technology. Most medical technologists chose their career out of interest in its scientific and practical aspects (Baker, 1989:243) and by permitting rotation a re-kindled enthusiasm might be fostered.

☼ Formal Studies

Only nineteen per cent (19%) of respondents are presently engaged in formal studies. : (Question 5).

This number is very low despite the opportunity medical technologists have to further their education. The end of 1989 saw the first part-time graduates of the National Higher Diploma (level IV). This diploma offers further education to qualified medical technologists and is extremely worthwhile as it provides knowledge in relevant and as yet untouched fields (Baker, 1990:279). Baker observes that these medical technologists who have or would like to complete the National Higher Diploma may encounter enormous difficulties which, if not addressed, could result in unhappiness and a high drop-out rate. The plight oflevel IV medical technologists revolves around three main areas. These are work commitments, home commitments and learning problems, states Baker. It is perhaps because of the above factors and their general dissatisfaction with their education that medical technologists have failed to upgrade and extend their knowledge.

In an open-ended question (Question 5) as to what formal studies are being undertaken, sixteen percent of respondents were involved in university education.

☆ Degree Status

Degree status as a qualification ranked first in a list of criteria for medical technologists to improve their professional status : (Question 7)

(1-very important; 5-not important)

TABLE 5.5 MEAN RANKING OF CRITERIA NECESSARY TO IMPROVE THE STATUS OF MEDICAL TECHNOLOGISTS

Criteria	Ranking Mean
- a new course design	1.77
- an increase in total professional course credits	2.16
- degree status as qualification	2.28
- improved professional and ethical approach to their work	1.70

Proponents of degree status as a qualification ranked first in a list of priorities as to the criterion necessary to improve the professional status of medical technologists. Degree status as a qualification of medical technologists in the Republic of South Africa was first documented when eighty-nine per cent (89%) of respondents in Baker's survey (1989:237, undertaken at Medunsa and Garankuwa) stated that the introduction of a Bachelor's degree in medical technology would increase their academic knowledge, whilst thirty eight per cent (38%) felt that both diploma and degree courses should be available. The latter is in accordance with overseas trends.

The results of this finding are contrary to the technikons' agenda that with the introduction of the National Higher Diploma, Masters Diploma and Laureates, medical technologists would continue to accept technology-based education in preference to that of a university. Since the release of the questionnaire the technikons have stated that they would be instituting degree courses in January 1995 (Society of Medical Laboratory Technology, Newsletter, March 1994). It is presumed that medical technology would be a suitable course for degree purposes and the degree would have the title Bachelor of Biotechnology.

Scrutiny of the literature included examination of the motives of the professionals who seek degree status. Mendelson

(1988:30) stated that if the profession is to achieve recognition, power and esteem, medical technologists need to compete successfully with colleagues in medicine and the applied science. The motive appears to be the need for greater career mobility and essential professional recognition. The mean ranking (1:very important, 5:not important) of the criteria necessary to improve the professional status of medical technologists also revealed that an increase in total professional course credits (mean 2.16) were a requisite to achieve the above (Table 5.5).

* **An open-ended question allowed respondents to state any other criteria that would be of importance in this regard : (Question 7).**

Ideas that evolved from these responses included opening a school of medical technology (seven members suggested this) and that in order to standardise the profession, all the courses at the technikons should be examined by one examining body. The responses to this open question were nearly all related to the improvement of the educational level, although these were often non-specific.

* **Public Image**

Although medical technology as a profession is now more than fifty years old, its public image is still weak : (Question 8).

Respondents were asked a series of questions related to the public image of the profession. Responses were tallied using frequencies and percents. Medical technologists were asked if they thought the public image of the profession would improve if certain criteria were followed. According to table 5.6 it appears as though the ability to demonstrate leadership abilities (ninety-four per cent) is considered essential. This was followed by the need to follow a professional code of ethics (ninety-one per cent) and the necessity of publicly upgrading the image of medical technology. These findings show that there is a desperate need for professional recognition and correlate well with studies undertaken in the United States of America (Rosland, 1985:130).

TABLE 5.6 PERCENTAGE RESPONSES OF METHODS REQUIRED TO UPGRADE THE PUBLIC IMAGE OF MEDICAL TECHNOLOGY

Medical technologists were asked if they thought the public image of the profession would improve if medical technologists:		
	Frequency	Percent
- made a conscious effort to publicise and upgrade their image	28	89.0
- demonstrated leadership abilities in research, education, clinical practice and administration	303	94.7
- dressed like professionals	232	72.8
- studied towards a degree	217	67.9
- followed a professional code of ethics	291	91.0
- chose the members of the profession more carefully by some type of selection examination	240	75.3

The famous clothing advert says that before you have said your first word, you have created your first impression. From outward appearances, stereotypes are formed (Notter, 1990:99). According to the author's perception certain medical laboratory technologists in the Republic of South Africa can generally be regarded as untidy in their attire and frequently walk in dirty, soiled laboratory coats. Flimsy sandals and clothing are often worn, which does not create a professional image

A major contention is that education for the professions not only involves educating students in the theory and practice of their occupations but that they should learn about the commitment to professionalism, ie they must learn specific attitudes that might be regarded as relevant to professional practice and unique to it (Jarvis, 1984:127). Medical technologists take pride in their work, now they must take pride in their physical appearance. Seventy three per cent of respondents were of the opinion that this would improve public image. The author is of the opinion that by wearing the logo of the Society on laboratory coats would perhaps be an encouragement and re-instate pride among the medical technologists.

The results of the questionnaire indicated that medical technologists in general perceive themselves as having a low public image. Comments in this regard state that this is due to their education - namely that no matter what subsequent diplomas are called, technikon diplomas are still perceived be inferior qualifications.

* <u>Regarding the course as a whole, an overwhelming 75% agreed that when leaving the technikon, students are inadequately trained for the demands of the profession</u>

TABLE 5.7. MEAN RANKING OF MEDICAL TECHNOLOGISTS' ATTITUDES TO THE COURSE AS A WHOLE

Attitude towards the course	Ranking mean
The course is unsatisfactory	3.4
On completion of the course do you consider yourself to be a broad based professional?	3.3.
When leaving the technikon, medical technology students are inadequately trained for the demands of the profession	
a) Theory knowledge	1.7
b) Practical application	2.9
Medical technologists are insufficiently trained to adapt to new professional opportunities such as alternate test sites, private practice etc.	2.4
There should be an increase in course duration from 18 months to three years at the technikon	2.27
The course should be accredited for degree purposes	2.05
Examination as a means of evaluation of one's competence is preferable to the assignment manual	1.81

In order to compare questions posed elsewhere, respondents were asked to rank their degree of attitude regarding the course as a whole. Table 5.7. reflects rankings in this regard. Rankings are based on a strongly agree/strongly disagree (1-5) rate.

The major issue as to whether medical technologists in the Republic of South Africa perceived the present course as satisfactory/unsatisfactory, serves to identify possible perceptions and reasons for their various responses.

Mean ratings place dissatisfaction of the edcuational courses by medical technologists from all areas in the Republic of South Africa, at the top rating. Medical technologists saw themselves as inadequately practically trained for the demands of the profession (mean 2.9), whilst their theoretical knowledge (mean 1.7.) they perceived to be adequate. This issue should be addressed with the introduction of a new course. Attitudes towards an increase in the duration of the course (mean ranking 2.27) may have signifi-cance in the credibility that medical technologists attach to the course being accredited for degree purposes (mean 2.05).

This factor may be substantiated by the findings that medical technologists consider themselves to be broad-based professionals (mean 3.3.).

* Experiential Training

<u>Ninety One per cent (91%) of respondents agree that experiential training is essential.</u>

The in-service training component of all national diplomas in medical technology forms an important aspect and it was therefore deemed necessary to question its purpose. Medical technologists presently undertake in-service training before registration with the Medical and Dental Council as a qualified medical technologist.

TABLE 5.8

PERCENTAGE DISTRIBUTION OF WHETHER, WITH THE IMPLEMENTATION OF A THREE YEAR FULL-TIME COURSE AT THE TECHNIKON, EXPERIENTIAL TRAINING COULD BE LIMITED

Time	Percent		
	Yes	No	Uncertain
3 months	3	94.7	2.3
6 months	5.8	85.4	8.8
12 months	83.9	11.8	4.3

There is general agreement (87%) that the in-service training component (experiential training) is essential and is therefore educationally relevant. It serves distinctive aims that the formal education at the technikon cannot achieve. Despite reasonably equipped laboratories at the Technikon they cannot simulate those in a clinical setting. Percentage distribution of medical technologists' attitudes to whether experiential training may be a waste of time indicated that apprimately nine per cent (8,7%) saw it as so, the remaining approximately ninety one per cent (91,3%) were negative in this response. In an open-ended question, medical tech-nologists indicated that the formal technikon programmes cannot successfully achieve these aims.

The value of experiential training lies in the opportunity it affords students of practising techniques and applying knowledge in practical context. With the implementation of the three year full-time course beginning in 1994, respondents were questioned on the time span required for experiential training. This was requested since it has been suggested by the convenor technikon for the new syllabus, (The Cape Technikon) that experiential training could be shortened. Eighty four per cent (84%) of the respondents agreed that experiential training of more than one year, was relevant to the profession. That experiential training could be limited to three months met with an overwhelmingly ninety four per cent (94%) negative response.

An area that this research has not dealt with concerning experiential training is that experiential training contracts often varies from one employer to another and should be uniform (de Benedictus, 1988:139). The many problems associated such as monitoring students and bias of supervisors towards students is outside the scope of this dissertation, but warrants research.

TABLE 5.9 PERCENTAGE DISTRIBUTION OF MEDICAL TECHNOLOGISTS' PERCEIVED TYPES OF INSTRUCTIONAL OFFERINGS BEST SUITED TO THE PROFESSION.

Instructional Offerings	Percentages		
	Yes	No	Uncertain
Formal tuition only (theoretical and practical instruction at the technikon) without any prescribed experiential training	4.9	86.4	8.6
Alternating periods/terms of formal tuition and experiential training	55.6	20.5	24.0
A parallel form of co-operative education (periods of theoretical per week)	47.1	27.1	25.9
Three years full-time at the technikon plus experiential training	63.4	20.9	15.7

Sixty three per cent (63%) indicated that three years at the technikon plus experiential training of one year was the best type of instructional offering suited to professional demands. This is the system offered by the technikons with the inauguration of the new course in January 1993. Responses confirm the directive taken which suggest that medical technologists are agreeable to this new system.

Eighty seven per cent (87%) of respondents stated that formal training (theoretical and practical instruction at the technikon) without any prescribed experiential training was unacceptable (Table 5.9.).

* **The Assignment Manual**

<u>Seventy three per cent (73%) of respondents who completed the manual during experiential training found it to be relevant to the demands of the profession</u> : <u>(Question 10)</u>

In an attempt to determine the attitude of those medical technologists who completed the assignment manual during experiential training they were asked to rate the level of their experiential training in terms of certain criteria:-

- value;
- relevance to the demands of the profession;
- acquisition of practical skills, and
- linking the theoretical programme to experiential training.

The manual covers standard diagnostic procedures pertaining to the various disciplines. It must be completed in a registered training laboratory under the direction of a suitably qualified supervisor.

A list of four parameters was presented to the pupils for rating according to very bad/very good, on a scale of 1-5 (low to high) to see how the manual featured as an educational tool. The perceptions of these student medical technologists to the manual is reflected in table 5.10.

TABLE 5.10 MEAN RANKING OF STUDENT MEDICAL TECHNOLOGISTS' ATTITUDES TO THE ASSIGNMENT MANUAL.

Perceptions		Mean
- Value		3.84
- Acquisition of practical skills		3.67
- Linking the theoretical programme taught at the technikon to the experiential		2.67
	Relevant	**Not Relevant**
Relevance to the demands of the Profession	73%	26%

The information contained in table 5.10. confirms the necessity of a practical component, such as the assignment manual being undertaken whilst students undergo experiential training.

Nearly all professions validate their courses for training, having their own requirements about what should be taught, but not all actually undertake the assessment procedures nationally. Even in centralized examinations, variation of standards is known to occur and in localized systems this must also be present (Jarvis, 1984:37). Therefore, competency to enter the profession does not depend on having reached an objective standard in all of the facets specified. Compentency to practice the profession is not guaranteed by success in the qualifying examinations so that it is maintained that competency is not the aim of professional education, but rather that of the professionals (Jarvis, 1984:37).

The new course in medical technology does not appear to require an assignment manual but students will be requested to perform projects during the fifth semester. The author is, however, of the opinion that problems already exist in this area as both the profession and technikons agree that the range of tasks set during this experiential training period are of too low a standard. Experiential training will once more be the responsibility of an individual staff member with relatively little support coming from other members of the laboratory.

The linking of the practical and theoretical aspects of the course is constantly being shown as a problem. The lowest ranking shown is the linking of the theoretical programme to the experiential (Mean 2.67). The in-service training component of medical technology programmes is an essential aspect and the above results (Table 5.10) indicate its importance as an integral part of medical technology education. There is presently a shortage of vacancies for students in which to do their experiential training.

education. There is presently a shortage of vacancies for students in which to do their experiential training. This is perhaps the result of a depressed economy or due to the excessive intake of students by some of the technikons.

An open-ended question (Question 12) allowed respondents to state if this training could be replaced by a suitable practical training period at the technikon. The reasons given were principally of the same tone, namely that one cannot simulate a laboratory environment with its accompanying stress, and that a clinical environment is essential. These results confirm the statement by McKenna (Journal of Medical Technology, South Africa, Vol.4, 1989) that the theoretical component of medical technology education is the responsibility of the technikons. This includes the practical application of the basic principles. The true practical component is, however, the responsibility of professionals in the laboratories.

* **Job Satisfaction**

Sixty per cent (60%) of respondents (Question 16) are of the opinion that seniority is the policy favoured for promotion

TABLE 5.11 FREQUENCY AND PERCENTAGE DISTRIBUTION OF MEDICAL TECHNOLOGISTS' PERCEPTIONS OF POLICY FAVOURED FOR PROMOTION.

Policy	Frequency	Percentage
* Technical ability	126	38.9
* Seniority	186	58.9
* Higher national diploma in medical technology or any business or management diploma/degree	7	2.2

The policy favoured by most pathology departments with regard to promotion indicates that less than forty per cent (38.9%) favoured technical competence. Seniority (58.9%) appears to be the requisite for promotion. With the immense cost in running a laboratory, medical technologists who are well educated in management skills are essential. The need for management skills is well documented and management training is being stressed in the United States of America for both undergraduate and graduate programmes (Baisden, 1993:98).

The policy of advancement has been linked to seniority. A great deal of the dissatisfaction emanating from the profession is due to career immobility (Baker, 1990). There is a decided lack of a career structure, with the result that many qualified personnel drift away from the profession.

These facts have become more of an issue with the implementation of level IV. Questioned on the policy most favoured in their departments for promotion to senior positions, respondents indicated that only two per cent saw the national higher diploma in medical technology or any management/business diploma or degree as a promotional tool. This is an important result and warrants further comment - this is addressed in chapter six.

Technical competence is rated highly (thirty nine per cent) - a credit to the profession but does not help the level IV medical technologist who has completed the national higher diploma. With no career and very little financial reward, the situation of level IV medical technologists has been commented on by Baker (1990).

☆ **Medical Technology as a Career**

Less than fifty per cent (only 46.8%) of respondents would recommend medical technology as a career in the future. : Question 18)

TABLE 5.12 PERCENTAGE DISTRIBUTION OF RESPONDENTS' ATTITUDES TO CAREERS IN MEDICAL TECHNOLOGY

	Percentage	
	Yes	**No**
Would they have recommended it:		
- as a career in the future	46.8	53.2
- as a career in the past	76.5	23.5

The respondents were asked whether they would recommend medical technology

- as a career in the future and
- would they have recommended it in the past?

The primary reason, stated in an open-ended question (Question 18), indicated that the profession would only be recommended after the needs of the person had been very carefully determined. It would not be recommended to a person with high academic aspirations and only after lengthy discussion with prospective applicants. This could be the result of the inability of the profession to offer a structured career ladder based on academic ability.

It is distressing to note that although medical technologists would have recommended the profession in the past, they are reluctant to recommend it as a career in the future. This finding agrees with sub-problem one, which stated that medical technologists were not optimistic or satisfied with the future of the profession.

This response could also be related to the profession not being seen as a challenging role. One of the reasons for changing careers is the result of an employee's reaction to boredom, blockage and burnout. These affect those who are trapped in unchallenging mundane or stressful positions ("Focus", Adult Development, 1993:36).

5.4. FUTURE PERSPECTIVES

5.4.1. <u>The future of the profession depends on its ability to respond to the opportunities and responsibilities afforded by change.</u>

TABLE 5.13 MEAN RANKING OF OPINIONS ON THE PROFESSIONAL FUTURE OF MEDICAL LABORATORY TECHNOLOGY

Opinion	Ranking Mean
Good	2.64
Prosperous	2.95
Dangerous	3.01
Worth it	2.72
Despondent	3.21

It was necessary to determine the number of the target population who felt positive/negative about their professional future (Question 1). There must be commitment, for without it, the profession will not survive.

Table 5.13 reflects ratings on the list comprising five conditions concerned with respondents opinions on the professional future of medical laboratory technology in the Republic of South Africa. The list is reported for rating on a scale of 1-5 (Low to high) and comprises the following:

- good/bad
- prosperous/disastrous
- dangerous/safe
- worth it/not worth it
- happy/despondent

Table 5.13 indicates an overall rating of opinions and feelings of respondents to the future of the profession of medical laboratory technology in the Republic of South Africa. Mean ratings place despondency at the top of the list. The top ranking of this opinion may have been influenced by many factors associated with professional responsibilities. Despite the advent of HIV, medical technologists still considered the profession relatively safe (Mean 3.01). This is either indicative that medical technologists are well-read in this respect and understand the mechanisms of HIV of that they don't know enough about it. That the members see their work in the future as not prosperous (Mean 2.95) is expected in the economic climate and by the fact that the profession has long worked hard hours for little financial reward. That the members of the profession responded with a mean of 2.72 to the question as to whether they found the profession worth it, is more alarming. The results here correspond to paragraph 5.3.1. which states that medical technologists are dissatisfied with their profession.

* <u>Medical Technologists in South Africa are not motivated</u>

Medical technology education will have to adapt to provide needed adjustments in curricula because of practice changes, technologic advances, growth in the knowledge base and economic pressure (McKenzie, 1992:22). Table 5.14 reflects ratings concerned with how respondents feel about meeting the challenges of the future of medical laboratory technology in the Republic of South Africa.

TABLE 5.14 MEAN RANKING OF MEDICAL TECHNOLOGISTS' PERCEPTIONS ON MEETING THE CHALLENGES OF THE FUTURE

Perception	Ranking Mean
Unconcerned	3.07
Enthusiastic	2.37
Satisfied	2.88
Unmotivated	3.49
Uncertain	3.43

The list of five factors presented for rating are:

- unconcerned/worried
- enthusiastic/not enthusiastic
- satisfied/dissatisfied
- unmotivated/motivated
- uncertain/determined

These are presented on a scale of 1-5

With regard to these challenges that the profession faces, despite the fact a number of its members are dissatisfied (Mean 2.88), lack of motivation (Mean 3.49) is a serious problem. Motivation offers an immense amount of strength if utilised, and if the profession is able to tap its source, it will have the ability to survive. Medical technologists need to be motivated, despite grievances with their education and professional status. Motivation has always been important for managers to understand (Stoner, 1986:417). People are complex and sometimes irrational in their behaviour and their motivations are not always easy to discern says Stoner.

Surprising because although the attitude trend is generally in the medium strata (ratings low to high), responses generally are non-specific in their meaning as they appear to contradict. Example, uncertain/determined scored a mean of 3.43, whilst unmotivated/motivated scored a mean of 3.49. It appears that the question was ambiguous or that statistically, medical technologists are hedging their bets.

* <u>Fifty-two per cent (52%) of medical technologists are satisfied with subjects offered in the National Diploma whilst sixty-one per cent (61%) are satisfied with those presently offered in the National Higher Diploma : (Question 2)</u>

TABLE 5.15 SATISFACTION WITH SUBJECTS OFFERED IN CURRENT COURSE (1992)

	Percent	
	Yes	No
National Diploma	52.0	48.0
National Higher Diploma	61.4	38.6

Respondents were next questioned on their satisfaction with the subjects offered in the current course with regard to future work in the profession. (Please note that the questionnaire was completed prior to June 1992 and the subjects here pertaining to the National Diploma have now changed). The content of the National Higher Diploma has not, however, changed. In order to enhance an understanding of their satisfaction with their education, they were requested to state difference of opinion between the National Diploma and the National Higher Diploma subjects. Responses indicated fifty two per cent (52%) were satisfied with the

National Diploma subjects, whilst forty eight per cent (48%) were not. The results here are thus inconclusive.

Despite the demise of this course, the comments from medical technologists are pertinent as it indicates that fifty per cent of the profession were not satisfied with their educational arena. Sixty one per cent (61%) of respondents were satisfied with the National Higher Diploma subjects whilst only thirty eight per cent (38%) were not. The frequency missing in this category was seventy one, perhaps indicative of the low number of medical technologists that have pursued this course (Table 5.15).

A significant issue to be addressed here is that whilst sixty one per cent (61%) of medical technologists appear satisfied with the National Higher Diploma only nineteen per cent (19%) have studied further. This could be that whilst medical technologists did recognise the innovative capacity of the subjects offered in the National Higher Diploma, the lack of a career ladder has led to apathy. The factors most affecting this attitude could be salary advancement opportunities, stressful working conditions and working hours available. Family commitments and financial constraints would also play their role in diminished numbers for the National Higher Diploma.

☆ <u>Additional Course Credits : (Question 3)</u>

Having identified attitudes and perceptions of medical technologists regarding their present education system, it was then necessary to determine their attitudes towards additional course credits. A list of eleven subjects was presented to the respondents for rating according to strongly agree/ strongly disagree, on a scale of 1-5 to see which subjects were considered more essential (Question 3).

TABLE 5.16 MEAN RANKING OF ADDITIONAL COURSE CREDITS NECESSARY FOR PROFESSIONAL DEMANDS.

Subject	Ranking Mean
Clinimetrics........................	2.36
Basic Electronics	2.27
Business Practice	2.26
Introduction to legal process	2.25
Phlebotomy	2.12
Communications	1.95
Urinalysis	1.94
Laboratory management	1.82
Computer competency	1.75
Instrumentation	1.70
Pathophysiology	1.67

Futuristic perspectives regarding subjects that should be available to medical technologists in the Republic of South Africa with regard to future work in the profession, revealed the following in order of preference:

* <u>Clinimetrics</u>

Table 5.16 indicated a high ranking of clinimetrics (Mean 2.36 on a 5 point scale) which places this relatively new discipline at the top of the list (Refer to 2.6.3.1). The top ranking of this subject may have been influenced by the advent of private practice where medical technologists will be called upon to advise physicians of the application of scientific and epidemiologic principles with regard to clinical management processes. The low ranking of pathophysiology (Mean 1.67) is perhaps due to the advent of the national higher diploma, where the subject is taught at level IV. (Laboratory management is discussed after Table 5.17).

* <u>Basic Electronics</u>

<u>A predominantly male orientated sphere such as basic electronics (Mean 2.27), business practice (2.268) and introduction to legal process (Mean 2.25), is rated similarly by both sexes.</u>

With the advent of both primary health care and private practice, it is essential that medical technologists are able to understand basic concepts of the above subjects. Basic electronics will enable medical technologists to both repair and understand their instrumentation, whilst business practice will ensure that they can successfully complete lease agreements, banking facilities etc. In their new roles, medical technologists will be expected to surpervise, troubleshoot technical equipment and manager human resources (McKenzie, 1992:225). Legal processes will equip the profession with the ability to beware of potential problems which could lead to lawsuits.

Trouble-shooting will become more and more important since laboratory services have expanded and continue to expand into decentralised settings of all kinds because of recent advances in technology. The future of medical technology education lies in broader degrees and multiple certification (Harmening-Pittiglio, 1988:331). Regarding the preparation of an operating budget, only thirty-nine per cent (39%) of medical technologists were able to do so, which compares well with business practice being a future recommendation.

¤ **Phlebotomy**

Comment must be made here of the necessity for proficiency in phlebotomy. When this question was asked separately to cross-examine response (Section B, Question 19: Annexure B), seventy eight per cent (78%) of respondents voted in favour of acquiring phlebotomy as an additional skill. Private practice will demand a cost-effective service and it warrants medical technologists to become adept at this procedure. The demand for phlebotomy services has increased in most pathology laboratories and supplying well-trained phlebotomists is the responsibility of those in laboratory management and education (Narlock 1987:197).

☼ Urinalysis

Urinalysis (Mean 1.94) and communications (Mean 1.95) is ranked close together, ie. the practical and theory are not taught together.

Urinalysis is presently not taught as a continuum despite the large numbers of renal units through the Republic of South Africa. As a result, the majority of medical technologists have a piecemeal knowledge of this important field. The advent of private practices will warrant its professional members to be competent in communications (Mean 1.95). Effective communication is important for two reasons. First, communication is the process by which the management functions of organizing,leading and controlling are accomplished. Second, communication is the activity to which people devote an overwhelming proportion of their time. Medical technologists need to communicate with other health professionals and their colleagues, in both the written and oral form.

* Laboratory Management

The low ranking of both laboratory management (Mean 1.82) and computer competency (Mean 1.75) are perhaps due to the inclusion as level II subjects in the National Higher Diploma. In the latter, the subject is actually termed computer literacy, not competency and respondents may have confused the terminology. The response could also be the result that medical technologists are not interested or cannot envisage advancement in the future. This could substantiate findings regarding their dissatisfaction with the profession. Medical technologists must take responsibility for acquiring knowledge and skills necessary to shape their destiny. The 200 educational process must, however, provide the information and skills needed for employment in the laboratory.

* Computer Use

Eighty Six per cent (86%) of medical technologists have to use computers in their departments, whilst seventy eight per cent (78%) need to manage data through input, storage and retrieval Students are not presently offered computer science in any aspect of their educational strata. The National Higher Diploma offers computer literacy, which deals with the workings of the computer, not how to operate it!

¤ **Management training**

The mean rating for laboratory management as an additional course credit at level IV ranked 1.82. in Table 5.16.

At the moment we are rapidly reaching a stage where the need for qualified medical technologists, particularly those with managerial skills, is outstripping supply (de Benedictus, 1988:139). A contribution to this problem, observes de Benedictus, is the lack of long-term career opportunities. Laboratory management is presently offered in the National Higher Diploma at level II. When respondents were also questioned as to whether the management training of medical technologists would be a positive factor in controlling laboratory costs (table 5.17), seventy eight per cent (78%) felt positive in this regard.

TABLE 5.17

PERCENTAGE DISTRIBUTION OF MANAGEMENT TRAINING S A MEANS OF CONTROLLING LABORATORY COSTS

Comment	Frequency	Percentage
Yes	147	78.2
No	6	3.2
Uncertain	35	18.6
Frequency Missing 10		

It thus seems that medical technologists are well aware of the importance of laboratory management, yet despite this it has not ranked as a priority as an additional course credit. Any attempt to suggest reasons may become merely speculative.

¤ Job Satisfaction

With the low level of job satisfaction for medical technologists as found in the literature, seventy one per cent (71%) of respondents agree that management training of medical technologists could help to alleviate personnel problems within the laboratory e.g. low morale, high staff turnover etc.

Job satisfaction among clinical laboratory workers is well documented in the results of several studies conducted throughout the United States. The most consistent complaint was a lack of recognition for a job well done (Roberts, 1988: 101). In clinical laboratory science, the level of employee job satisfaction may affect a laboratory's operations in a number of ways. Satisfaction may be linked to traditional performance indicators such as turnover, absenteeism, tardiness, waste, grievance and accidents. It may also, however, be related to variables such as employee receptivity to change, loyalty, commitment to organisational objectives and degree of participation and contribution (Spencer, 1990:189).

¤ Dissatisfaction with the Profession

That laboratory personnel feel low on the recognition and reward ladder was revealed by Jeswald in the results of one of the most extensive and relative studies of job satisfaction among clinical laboratory scientists. Jeswald's data show that clinical laboratory scientists attach the most importance to fulfilment of security and self-actualization needs (Roberts, 1988:101). Laboratory personnel consistently expressed a lack of sufficient appreciation and recognition for good ideas and good work. Roberts also cites a study where lack of upward mobility and esteem by other health professionals, job stress and low pay were selected by the majority of the one hundred and seventy five medical technologists in the sample.

TABLE 5.18 PERCENTAGE DISTRIBUTION OF MEDICAL LABORATORY TECHNOLOGISTS' PERCEPTIONS PERTAINING TO INCREASING PROFESSIONAL COURSES

	Yes Response	
	Frequency	Percent
a) so that the medical technologist is more adaptable	235	73.0
b) so that medical technologists are able to work in other allied health fields, e.g. electro-cardiography	200	62.8
c) so that medical technologists are able to function in a wide range of activities such as rural areas and small pathology laboratories	280	86.7
d) the professional courses available are sufficient, but need to be made more relevant	160	50.8
TOTAL	320	100.

Employees are frequently frustrated by the inability of their direct supervisors to implement change. Change often requires many levels of management approval before realisation at the bench. Another area of frustration for medical laboratory technologists is perceived exclusion from the decision making process (Brown, 1989:340). Initiative and innovation must be rewarded as these employees are natural leaders and motivators to the rest of the staff.

The above responses (Table 5.18) reflect the responses on issues which are dealt with elsewhere in the questionnaire. The course content is regarded as relevant (50.8%) by only half the respondents indicates faults with the present syllabi. Indeed, it is the author's opinion that many sections of the syllabi are outdated (Benedict's, animal care etc.) but instead of the syllabus being pruned, more information is continually added. The result is students are taught and made to learn redundant methods to the detriment of modern technology.

* **Pathophysiology**

Forty per cent (40%) of medical technologists have the perception that their knowledge of pathophysiology is inadequate : (Question 20).

TABLE 5.19 FREQUENCY AND PERCENTAGE OF MEDICAL TECHNOLOGISTS'COMPETENCY WITH REGARD TO PATHOPHYSIOLOGY

Reply	Frequency	Percentage
Yes	65	28.7
No	91	40.7
Uncertain	70	30.6
Frequency 90 (230 responses)		

The upgrading of demands and responsibilities in the health professions has created a need for practitioners with increasingly sophisticated preparation (Miller, 1983:5). The clinical laboratory scientist will evolve from one who makes and reports laboratory measurements to an information specialist (Ehrmeyer, 1990b:29). To fully clarify the dynamic nature of pathology, it is necessary to delve beneath superficial signs and symptoms into the conceptual basis of disease. Medical technologists today have to achieve a satisfactory knowledge of pathophysiology to adequately perform their tasks. Pathophysiology, or the study of dynamic deviation from a baseline steady state, thus lies at a very crucial point at the crossroads between basic science and clinical theory. Presently pathophysiology IV is offered as a subject for those medical technologists enrolled for the National Higher Diploma. With the commencement of the new course in 1993 it is offered at level II in the National Diploma. Results in the questionnaire (Question 3) indicate that medical technologists generally have a less than moderate knowledge of pathophysiology (mean 1.97). Regarding competence in respect of pathophysiological expertise, forty per cent (40%) of respondents stated that they were not able to advise medical practitioners on what tests should be requested. Thirty one per cent (31%) stated that they were uncertain of their competence in this field.

TABLE 5.19 FREQUENCY AND PERCENTAGE OF MEDICAL TECHNOLOGISTS' COMPETENCY WITH REGARD TO PATHOPHYSIOLOGY

Reply	Frequency	Percentage
Yes	65	28.7
No	91	40.7
Uncertain	70	30.6
	Frequency 90 (230 responses)	

The extent to which respondents rate pathophysiology may depend on their direct or indirect exposure to the subject and subsequent experience of the effects of such knowledge. The low percentage who feel themselves competent (28.7%) in this field is indicative of its importance in being incorporated into a new curriculum (Table 5.19).

¤ <u>Grading Professional Competence</u>

<u>Seventy seven per cent (71%) of respondents are in favour of grading the profession : (Question 10).</u>

Laboratory testing is big business and it seems to be diversifying at unprecedented proportions (Podell, 1990:13). Predictions for 1990 were that about sixty per cent (61%) of all diagnostic testing in the United States of America would be performed outside the hospital laboratory.

The overall aim of stratification of the profession is not to cause fragmentation of the academic structure, but to diversify a curriculum data base from which students can move from one strata to the next.

With the enormous costs incurred in laboratory practice and approximately fifty per cent of these costs caused by manpower needs, it would seem reasonable that less qualified personnel performed the majority of automated tests. (Refer to 2.6.2.4).

Grading professional competence would enable the medical technologist to concentrate on tasks of a higher nature. Splitting the profession of medical technology into two, if not three grades would also permit upward mobility. The programme that can identify ways to meet the needs of both the emerging professional and the technician will survive and thrive into the next decade and beyond (Raichle, 1992:230).

Opinions were then cross-referenced (Question 10b) and respondents were questioned as to whether the profession warranted different grades.
The responses were as follows:

TABLE 5.20 PERCENTAGE DISTRIBUTION OF POSITIVE RESPONSE TO THE GRADING OF MEDICAL TECHNOLOGISTS.

Level	Percentage
Medical technician	71.0
Medical technologist	83.5
Medical laboratory scientist	65.0

That the grading should be based on academic qualifications alone met with a less than fifty per cent (43,6%) response. Nearly eighty-five per cent (84,9%) of respondents agreed that academic qualifications and service should be a basis for grading. That the grading should be based on service only met with a low response of three percent (3%). This question was inserted since many medical technicians have no qualifications and are merely assessed by means of their years of service. Having identified perceptions and attitudes of medical technologists towards grading of the profession, it was then necessary to determine their attitudes towards implementing such a system. The dilemma of which qualification warranted which title was then made known. Table 5.21 indicates the overall ratings.

TABLE 5.21 PERCENTAGE DISTRIBUTION OF MEDICAL TECHNOLOGISTS' PERCEPTIONS AS TO GRADING LEVELS.

Title	Qualification	Percent
Medical Technician	National Diploma	42.9
Medical Technologist	National Higher Diploma	52.7
Medical Laboratory Scientist	Masters Diploma	47.0

That a medical technologist should hold a national diploma in medical technology rated a fifty two per cent (52%) response. This was the top ranking of this table. The need for a technician level is evident and cognisance can be taken of how other professions have solved this problem. At a symposium on the profile of the engineering technician held in Pretoria in 1989, it was stated that a technician for forty per cent of his time should be engaged in intellectual work rather than in tasks requiring manual skills. The principle advanced at this symposium was that persons could only be registered with a proven ability, rather than to limit their acceptance on the basis of qualifications only.

The National Diploma was, however, the standard against which their competence was measured. It would appear that, despite the principle of grading having been accepted by medical technologists in the Republic of South Africa, the confusion arises as to the criteria needed to implement such a system. (Refer Questions 10 and 11). Although academic qualifications and service rated highly (eighty five per cent), no distinction can correctly be drawn from the final results as to the level of competence needed. Cognissance must perhaps be taken of bias in that the system could depend on academic qualifications. Since only a small percentage of medical technologists have passed the National Higher Diploma, they are automatically precluded as medical technologists in this new system.

☼ <u>Diverse Opportunities</u>

<u>The employment area for medical technologists has been changing steadily (Gregg, 1990;32) : (Question 29).</u>

Alternate test sites for laboratory testing have become a significant issue for all clinical laboratory scientists. Of particular concern is the proliferation of relatively simple testing procedures performed in physician office laboratories. All too often, however, those who are performing such tests are untrained and unskilled (Podell, 1990:13). They may be office personnel, a receptionist or a member of the physician's own family. These alternate testing sites have not been regulated leading to a potentially high rate of errors and misdiagnosis.

Expansion of practice will be facilitated with the emergence of the clinical laboratory generalist, manager and consultant. The generalist results from the blurring of traditional laboratory specialities and has a broader responsibility, focussing on patient outcomes rather than on a fragmented diagnostic process. The generalist concentrates on interpretations and analyses of data rather than the repetitive procedures of preparing test results (Flanagin, 1988:10). The clinical laboratory consultant is the newest of the emerging roles. They provide technical assistance to physicians, manufacturers and end-users of clinical laboratory services, they advise physicians in the appropriate utilisation, selection and sequencing of clinical laboratory tests.

* <u>Medical technologists in the Republic of South Africa are insufficiently trained to adapt to new professional opportunities (Table 5.22) such as alternate test sites, private practice, primary health care etcetera.</u>

With changes of working environment envisaged for the future, an attempt to probe further information regarding futuristic needs as perceived by the profession (Question 29, Section C : Annexure B), six questions as listed on Table 5.22 emerged from several relevant sources in the literature. The table reflects rankings of the sources for each criterior, i.e. those sources that

- provide the most information on basic <u>knowledge</u> necessary.
- provide the most information on <u>skills</u> necessary.

TABLE 5.22: PERCENTAGE DISTRIBUTION OF MEDICAL LABORATORY TECHNOLOGISTS' PERCEPTIONS REGARDING FUTURE WORKING ENVIRONMENTS

	Percentage	
	Yes	No
- Clinical pathology should be the basic qualification for medical technologists	83.4	16.6
- Medical technologists will need multiple skills?	87.7	12.3
- These skills should include multi-disciplinary skills (such as electro-cardiography, blood pressure observance etc.)?	59.8	40.2
- Presented with a diagnostic dilemma we should be sufficiently qualified to suggest tests that would prove useful in elucidating the problem?	95.8	4.2
- Less highly trained individuals could perform most of the laboratory work in an automated setting?	63.7	36.3
- Medical laboratory scientists should become more involved in trouble shooting, management of information and supervision i.e. they should be more highly trained?	85.0	15.0

To determine the extent to which medical technologists approach various issues concerning their future roles, their responses were recorded on a yes/no basis. Eighty three per cent (83%) stated that they were in favour of clinical pathology being the basic qualification for medical technologists. Presently, students are allowed to follow only one discipline if they choose. This grossly limits their ability and produces a narrow sphere of knowledge which cannot allow them to appreciate the complexities of the other disciplines. Flexibility is needed for the future and this may be achieved by ensuring that clinical pathology is the basic diploma.

That medical technologists will need multiple skills in the future was recognised by eighty eight per cent (88%) of respondents. That these skills should include multi-disciplinary skills outside the normal field of expertise met with a sixty per cent (60%) response. This response was ranked lowest in this table. Reasons could be that medical technologists don't yet appreciate that unless they are very flexible in their ability, they will find themselves in a predicament with the advent of physician office laboratories and primary health care. Peripheral laboratory staff of the future must cope with all the simple routines and other such requirements as may be dictated by local conditions (Editorial, Journal of Medical Technology, South Africa, Vol.6, 1992:31).

The necessity of pathophysiology and clinimetrics in the future prompted ninety six per cent (96%) of respondents to agree that, presented with a diagnostic dilemma, we should be sufficiently qualified to suggest tests that would prove useful in elucidating the problem.

There is a recognised need for a technician level to do the repetitive mundane work. Sixty four per cent (64%) felt that less highly trained individuals could perform most of the labora-tory work in an automated setting. This agrees with the statistics dealt with previoiusly (Table 5.20), that is, that the profession warrants being split into at least two grades, technician/technologist. This could be achieved by a modified format of the existing programme. With a shortened data base only basic techniques would be taught.

It has been agreed upon by the respondents that medical technologists will need multiple skills (Table 5.22). Medical laboratory technologists were requested to state their perceptions as to whether the medical laboratory technologist of the future needed to be more highly trained than at present. Eighty five percent (85%) of respondents agreed that this would be essential. Articles in the literature reviewed identified multi-diciplinary skills or cross-training as essential to meet the demands of the future (Raichle, 1992:227).

* **Continued educational programmes**

Eighty four per cent (84%) of medical technologists want continuous educational programmes made available.

There are powerful practical arguments why continuing professional education is vitally important to the future of the health service. Continued education was considered an essential element by all those who responded to the questionnaire, (Question 25 b and c). Attendance of continued education programmes and thus exposure to changes in technology is significant in that respondents (78%) state that they would attend such programmes regularly if they were made available (seventy eight per cent). Yet, from personal observation, several such seminars have been held and are poorly attended. This lack of attendance may be the result of the medical technologists' attitudes to the subject under discussion or because of priority of other commitments, or perhaps the reason that medical technologists do not use these programmes is that they are not motivated and therefore they did not answer the questionnaire truthfully.

* **Professional competency**

Having identified attitudes and perceptions of medical technologist towards members of the profession who might be incompetent (Question 17, Section B), it was then necessary to determine their attitudes towards methods of ensuring professional competency.

The three questions asked by the questionnaire were (Question 16, Section C):

- Medical technologists should attend a certain number of seminars / lectures per year;
- The Professional Board ensures certification of all individuals concerned;
- Continued education should be offered with emphasis on up-date of technological advances.

Answers were rated in order of preference. Ranked in order of preference was that the Professional Board ensures certification (forty eight per cent), second, continued education nearly thirty seven per cent (36.5%) and lastly, that medical technologists attend a certain number of lectures per year, fifteen per cent (15%). The top ranking of certification may have been influenced by its name which is associated with the Professional Board (generally held in esteem) and the term certification which suggests academic merit.

☼ **Examination as a means of evaluating competence**

Although evaluation of the clinical performance of medical technologists is time-consuming and sometimes difficult for educators, such an evaluation offers reasonable guarantees to the public and the profession that practising medical technologist pass a certain degree of competency. Presently, students do not write a final examination at the conclusion of their experiential training. As a result, there is no means to assess competence. On the acceptance of the assignment manual by the technikon concerned, students are able to deem themselves as qualified medical technologists. In an attempt to assess how respondents felt about examinations, the following question was posed, namely that at the end of experiential training, students should be examined by means of the following:

TABLE 5.23 PERCENTAGE DISTRIBUTION REGARDING EXAMINATIONS AT THE CONCLUSION OF EXPERIENTIAL TRAINING.

	Percent	
	Yes	No
A theory examination	81.4	18.6
A practical examination	81.9	18.1
An oral	40.3	59.7
A theoretical examination on the practical aspects of the course	51.1	48.9
On the contents of the assignment manual	-	-

From Table 5.23, one can infer that medical technologists accept both a theory (eighty one per cent) and a practical (eighty two per cent) examination as being an acceptable procedure. Having assessed perceptions regarding examinations, medical technologists were then requested to state who should conduct any such examinations.

Fifty nine per cent (59%) felt that a combination of the technikon and an independent examining body would be acceptable. (See table 5.24).

TABLE 5.24 PERCENTAGE EVALUATION OF RESPONSIBILITY FOR FINAL EXAMINATIONS.

Examining Body	Frequency	Percent
The technikon concerned	65	100.0
An independent examining body	49	75.5
A combination of both the above	90	59.4
Other	14	86.0

The tremendous number of missing frequencies have rendered these results as tentatively unacceptable. Possible misconceptions and resultant inaccuracies have thus occurred. Bearing in mind that the questionnaire responses may have been interpreted as a continuum or medical technologists may just have indicated preferences, one can make the assumption that confusion has occurred. This may be due to the respondents' ignorance of the nature/function of any such examining body, or an indecision regarding which examining body would be preferable. The connotations associated with these results seem to indicate that further discussion on this issue would be unacceptable.

✡ Important issues

The extent to which medical technologists rate an issue as an important problem will depend on their direct or indirect exposure to that issue. The opinion of medical technologists was requested on several issues which the profession will have to solve in the future. Some may regard the issues as important problems whilst others will not regard these issues as problematic at all. For this reason each issue was ranked 1-5 (low to high) on a scale of important problem/no problem. Eleven questions in this respect are tabled below. (Table 5.25).

TABLE 5.25 MEAN RANKING OF MEDICAL TECHNOLOGISTS PERCEPTIONS ON IMPORTANT ISSUES FACING THE PROFESSION

Issue	Ranked in order of importance Mean
Laboratory safety	1.35
Shortage of posts for medical technologists	1.67
Maintaining the standards of the profession	1.75
Educating medical technologists for future roles	1.76
Job satisfaction	1.78
Professional image	1.79
Ethics (including HIV)	1.80
Lesser-trained individuals usurping the role of medical technologist	1.91
Shortage of posts for experiential training	1.95
Cost containment of laboratory services	2.08
Shortage of medical technologists	2.23

* **<u>The low ranking of laboratory safety (Mean 1.35) warrants further discussion</u>**

Medical laboratory technologists are daily involved in the AIDS epidemic. Infection with HIV is a small but real risk to laboratory workers (Wood, 1988:71). It is the medical laboratory technologist who assists in the diagnosis and assessment of HIV-infected individuals through the isolation of pathogenic organisms, investigation of biochemical status and examination of blood specimens. This new disease has affected every aspect of society. No less than any other sector of society, clinical laboratories have been unalterably changed. New approaches to familiar problems such as employee safety in the health-care setting have evolved (Sazama, 1988:290).

Documented observations have suggested a world-wide shortage of medical technologists (Estry, 1992:96), although the apparent shortage does not seem apparent in the Republic of South Africa. (The low ranking mean 2.2.3 on a 5 point scale). Respondents' opinions regarding maintenance of professional standards in the future (mean 1.75) is seen as a reflection of the fear that pervades the profession regarding the advent of the new South Africa. This fear is <u>not</u> unfounded since there appears to be such a demise in all African countries once "independence" is obtained (Refer to paragraph 2.10).

It appears as though the overall results in table 5.25 are similar with those undertaken elsewhere in the questionnaire.

* <u>Ethical Issues</u>

<u>Sixty four per cent (64%) of respondents acknowledged that they knew of members who were incompetent while seventy three per cent knew of member who are technically unreliable : (Question 17).</u>

TABLE 5.26 PERCENTAGE DISTRIBUTION OF RESPONDENTS KNOWLEDGE OF UNETHICAL MEMBERS

Knowledge	Frequency	Percentage
Incompetent	147	64.2
Professionallydishonest	639	27.9
Technically unreliable	165	72.6

Despite the fact that many members of the profession are known to be incompetent very few, if any, are dismissed from their posts.

The extent to which respondents rated the above may depend largely on their direct or indirect exposure to the above. It must understood that clinical competency cannot be measured. Respondents' perceptions that colleagues in the profession are incompetent is thus a complex issue. Many factors could have combined to have an influence on these attitudes and subsequent opinion formation.

* Cost containment

<u>Nearly ninety-three per cent (92.7%) of respondents felt that medi-cal practitioners are not always capable of interpreting all types of laboratory results : (Question 13).</u>

Previous studies (Pailet, 1991:4) have shown that the tremendous costs incurred in laboratory practice can be curtailed. Respondents were asked to commentate on whether medical practitioners were capable of interpreting all types of laboratory results. An alarming ninety three per cent (93%) indicated a negative response which corresponds well, not only with the literature, but also with the need to include subjects such as clinimetrics in the syllabi of the future. Questioned on whether medical practitioners request profiles when individual tests would suffice, answers were classified into three categories, namely, 1) frequently; 2) sometimes; 3) never. A mean of 1.49 suggests that frequently was the common response.

The above questions re-iterate the necessity of allowing medical technologists an adequate education to help alleviate the unnecessary financial burdening of the health-care system. By advising colleagues on which tests to select, unnecessary tests and expense can be curtailed.

5.5 SUMMARY

In this chapter the results of the research were presented. Individual issues relating to each of the sub-problems were discussed, based on the analysis of statistical data relating to each of the issues.

The low response rate to the questionnaire (thirty two per cent) may have been as a result of many years of substandard recognition of the vital role played by the medical technologist. This apathy has been noted previously as only forty three per cent of members bothered to vote for Council in 1991 (Editorial, Journal of Medical Technology, South Africa, Vol. 5 No. 3).

Eighty four per cent (84%) of respondents agreed that examinations should be re-introduced. It still remains the best means of assessing an individual's competency. Responses to perceptions indicate that the medical technologist in the Republic of South Africa is well aware of the shortfall that exists in professional courses offered. The results of the questionnaire indicate that medical technologists in the Republic of South Africa are not satisfied with their education and have forebodings for the future. Suggested improvements for education will be dealt with in the following chapter. These approaches will be considered in the light of the responses to the questionnaire and from the literature reviewed.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

This study is the end product of an investigation (attitudinal survey) into the challenges facing the profession of and education in medical technology. The study primarily focused on critical issues such as the roles of the technikon and the Professional Board of Medical Technology in the education process; licensure; ethics, primary health care and cost containment. These issues are perceived as important indicators that could indicate the direction medical technology education should follow when considering changes in the present curriculum to meet a challenging future.

In the light of the present position of medical technologists in the health and medical profession, the question was asked at the commencement of this study as to whether or not in these modern times, medical technology, as it is presently constituted and taught, is adequate for a challenging and changing future. This study is, therefore, an undertaking to answer the question in a scientific and empirical manner, thus identifying specific trends that could be used as guidelines in the restructuring of medical technology education.

An extensive literature review was undertaken to identify the key issues facing the profession. These issues were incorporated into a questionnaire with a view to determine how medical technologists perceived the future needs of the pro-fession. The questionnaire applied particularly to the attitudes and perceptions of medical technologists with regard to the education and training they received. The study further embraces the intergration and interpretation of the different aspects and trends with the purpose of proposing approriate changes in medical technology education and the profession.

The literature review focussed specifically on the development of the profession in different countries in relationship to South Africa and also on important other mega-indicators that have excercised an important influence on the development of medical technology in first and third world countries. As with any historical study, the information helps to enhance one's understanding of the profession and may be of help to educators' planning for the future without repeating mistakes of the past (McKenzie, 1992:221). Failure to adjust to the number of key issues facing the profession could see its demise.

By confronting and surviving the changes, medical technologists will be able to expand their scope of traditional practice and achieve a recognised position in the century ahead.

6.2 SUMMARY

6.2.1 **Chapter One** provided basic information on the education of medical technologists and the necessity for change in professional ability. With the re-organisation of health services in South Africa educational objectives have changed and it has become increasingly important to educate and train appropriate, effective and efficient medical technologists.

6.2.2 **Chapter Two** outlined the education of medical technologists both in the Republic of South Africa and certain other countries. Disclosures of the historical development of the profession indicated many changes having taken place in the past. These changes have been largely influenced by academic drift. In an effort to provide medical technologists with the ability to meet the challenges presented by the rapidly changing environment, the demand for additional skills was made apparent. The need for improved curricula to enable medical technologists to perform in the laboratory of the future was thus disclosed.

6.2.3 **Chapter Three** identified the changes occuring in South Africa which will cause the role of the medical technologist to change. An extensive literature review revealed that the advent of Primary Health Care will demand a plan of action from both the technikon and the Professional Board of Medical Technology to ensure that meaningful curriculum reform will attend to the specific needs addressed in annexure K. Medical technologists will also need to enhance their visibility in this new environment.

6.2.4 **Chapter Four** explained the methodology. A questionnaire was distributed to certain practising medical technologists in South Africa. It was designed for the purpose of obtaining data on the attitudes and perceptions of medical technologists towards their education, both present and in the future. Section A of the questionnaire dealt with demogaphic details; Section B the present educational system and Section C the future perspectives. The chapter included questionnaire design, data capture and statistical analysis of data procedures.

6.2.5 **Chapter Five** dealt with relevant findings of the questionnaire which indicated several important issues. The results pertaining to both the present and future educational directives required, indicated curricula changes that would place emphasis not only on the flexibility required by the profession (multi-skills), but also on the urgent need to provide a career ladder. This approach would ensure cost-containment strategies and enable realistically trained medical technologists to progress in the profession.

6.3. SUMMARY OF FINDINGS

In this chapter, the interpreted results are reported on. Findings, conclusions and recommendations of a general and specific nature are presented.

6.3.1. General observations pertaining to study

On scanning the literature in an attempt to understand the factors and process which determine educational directives, it is evident that various contributors have placed emphasis in different areas. Despite this, an in-depth look has shown a myriad of problems.

* <u>Social Factors</u>

South Africa faces increasing problems common to all politically unsettled nations. The social factors affecting the profession are at the root of the challenge to prepare a generation of medical technologists that can fulfill a professional role in the future.

The emphasis on high technology medicine has led to the maldistribution of health services with poor health care for disadvantaged rural populations. The advances of new technology and a world wide economic slump have repercussions for both clinical laboratories and the medical technologists who work in them. Clinical laboratory education will have to adapt accordingly.

¤ **Technikons**

Technikons, created out of the former colleges of advanced technical education account for twenty three percent of total tertiary enrolment (Optima, Vol. 39, No. 1 1993). Strikingly absent from the South African tertiary education system is the two year diploma which can effectively and efficiently bridge the gap between school and work for so many in other countries (Donaldson, 1993:12). The truth is that most successful black secondary A school leavers are not adequately prepared for higher education. The result is a high failure rate. Donaldson further states that it is nonsense to think that bridging programmes can compensate for this circumstance - the adaptations required in tertiary education are far more fundamental.

The literature reviewed indicated that a degree should be the ultimate goal of the academically orientated medical technologist. The study has been overtaken by events in this regard and a technikon degree programme will begin in January 1995.

The most pressing problem appears to be that medical technologists graduating from the technikons are not suited to deal with the health needs of the majority of South Africans (diploma/technician level). There is, however, a need for highly competent professionals at the other end of the spectra (degree/medical technologist). There also appears to be a discernable difference between the perception of needs and actual educational practices in the Republic of South Africa.

What is more important to address is the current social and political climate in the Republic of South Africa, where qualifying students are faced with the very real prospect of a limited number of posts for an increasingly competitive group of applicants. Whilst it might be said that students are responsible for their own future, surely the Technikons and the profession must have a share in this responsibility?. (Refer Technikon autonomy, page 119).

¤ **Professional Dilemmas**

A conscious effort must be made to publicize and upgrade the image of medical laboratory technologists. This effort must be directed at other health professionals and the public.

Career mobility and new-job opportunities call for redefinition of possible careers based on the skills already associated with medical technologists. Money, frustration, burnout, scheduling, lack of career mobility or advancement, the poor self esteem of the profession, are all issues that have eroded the laboratory ranks of qualified personnel and discourage others from entering the profession.

With the advent of private practice cognisance must be taken of the need for licensing laboratories. In the United States of America, despite the fact that the office laboratory constitutes a major provider of laboratory services, data presented strongly suggest that unlicensed laboratories operated with little self-regulation and provide less accurate results than licensed laboratories.

Issues are complex and not easily resolved as to whether the government must set minimum quality standarads for physician office laboratories or that the government has no business meddling in the private practice of medicine (John, 1985:559). The public deserves to be protected from work that does not meet the accepted standards. The emergence of the physician office laboratories is both a threat to and an opportunity for the medical technologist.

The historical overview of the educational system for medical technologists in the Republic of South Africa shows one change after another, with little thought to the quality and quantity of the final product. The assignment manual as an assessment of a student's final ability is not found elsewhere in the world. Whereas other students in medical technology normally write a final examination at the completion of their training, those in South Africa do not. However, the implementation of the new course in 1994 will see the re-introduction of final examinations.

The repercussions of each of the factors influencing the education of medical technologists should be clarified so that adequate compensation can be made.

6.3.2 Specific observations pertaining to study

With reference to sub-problem one, which was to investigate the professional future of medical technology in the Republic of South Africa and evaluation of medical technologists' attitudes towards their future perceptions, it was hypothesized that the medical technology profession does not reflect a positive future. This study reveals that the majority are despondent and worried and see the future in the profession as overly dangerous. On account of these responses from the questionnaire, the hypothesis can be accepted.

The most important findings were the following:

* Eighty one per cent (81%) of the sample indicated a large degree of dissatisfaction towards the educational system (Table 5.2.) existing in 1993.

* The implementation of a new course structure in 1993 has challenged educators and the Professional Board to provide a more realistic education for future medical technologists.

* An overwhelming seventy five per cent (75%) of respondents agreed that students are inadequately trained for the demands of the profession (Table 5.7.).

* Opinions on the professional future of medical technologists indicated that the majority of medical technologists were despondent (Table 5.13)

* Forty five per cent (45%) of medical technologists felt that their work lacks challenge. This low degree of job satisfaction correlates with the thirty four per cent (34%) of respondents who opted for leaving the profession (Table 5.4.)

* Eighty nine per cent (89%) of medical technologists in this survey indicated that the public perception of the profession would improve if medical technologists made a conscious effort to publicise and improve their image (Table 5.6.)

* Only forty seven per cent (47%) of the respondents in the survey would recommend medical technology as a career in the future whereas seventy six per cent (76%) would have recommended it in the past (Table 5.12).

* The apparent exodus of experienced medical technologists from the profession of thirty four per cent (34%) is alarming (refer paragraph 5.3.1). Whether professional attrition is worse now than in the past is difficult to determine as accurate measurements of the problem have not been attempted in the Republic of South Africa.

* Despite the fact that sixty four per cent (64%) of the sample knew of incompetence, very few dismissals have been reported. (Table 5.26).

The second sub-problem was to identify and analyze knowledge and skills required for a comprehensive course structure. It was hypothesized that the course structure and educational system does not provide an adequate base for the knowledge and skills required for a professional career in medical technology.

* The historical background material for this dissertation included the United States of America, not only in its context as providing an excellent health care system, but more especially in its attempt to survey the needs of remote rural areas. "Frontier" countries are preponderant in the Western United States (eg. Alaska, Nevada, New Mexico etc.). Health care delivery in frontier America reflects the relative isolation of the surrounding area. Of the country's land mass, forty five percent (45%) is designated as frontier with a population of 2.2. million people; because it differs from the sociology of urban areas, health care in these areas has its own unique characteristics (Paivar, 1992:231).

The results of the literature review revealed that in the United States of America, which has long been at the forefront of clinical laboratory science, the clinical laboratory has been plagued by a host of problems. Examination of their educational system and the problems encountered repeatedly showed the same pattern, namely, that in order to meet the future needs of the profession, there must be curriculum changes.

The results of the questionnaire indicated that the sample of medical technologists used in the study in South Africa also realised that their educational system did not fulfil the requirements for the future needs of the profession. On account of these findings the second hypothesis can be accepted.

An evaluation of the dimension of the knowledge base needed revealed that:

* Medical technologists should be able to function in a wide range of activities ie. they should have multiple skills (Table 5.18).
* The base structure of the course should be extended (Table 5.16).
* Eight three percent (83%) of the sample indicated that clinical pathology should be the basic qualification (Table 5.22)
* The majority of the sample indicated a positive commitment to an increase in the total number of professional courses so that medical technologists would be made more adaptable. Most approved of degree status as qualification.
* Respondents indicated a lack of skills obtained with the practical component of both the National and Higher National Diplomas (Table 5.3.)

* Medical technologists were generally dissatisfied with their education, in particular with the practical components. Examination as a means of evaluation (Table 5.23) was also preferred rather than the assignment manual.

* The enormous shortage of experiential posts for students leaving the technikon must be addressed. Ninety per cent (90%) of respondents saw this as a very important issue.

* With rapid continuing changes in technology, a need for continued revision of curricula with the availability of continued education programmes was agreed upon by eighty four per cent (84%) of respondents.

* The question pertaining to clinical negligence in the laboratory indicated that medical technologists are aware of members of the profession that are incompetent and technically unreliable. Dismissal of members found quilty of misconduct should be considered as a means to protect medical technology from malpractices and unprofessionalism.

<u>Sub-problem 3</u> allows analysis and interpretation of the treated data so as to formulate objectives for a comprehensive course structure for the profession of medical technology in the Republic of South Africa. It was hypothesized that medical technology can diversify into at least a three tier system.

* The results show that whilst medical technologists agree to grading of the system, the actual mechanism of implementing such a system is still debatable. Possible reasons for these responses and the factors that may have an influence on the formation of these attitudes will be addressed.

The findings support the need to improve "secondary" characteristics of the laboratory environment and that medical technologists have similar needs for advancement, professional recognition, job challenge and increased responsibility as their colleagues elsewhere in the world.

Technological advances have seen the seizing of more roles by lesser-trained individuals. Since simpler technology has made testing possible by less-skilled personnel. Clarification from the professional bodies must be made available so as to distinguish areas of competence. Pharmacists are presently increasing the number of pathology tests offered; these are usually "done" by staff behind the counter.

6.4 RECOMMENDTIONS

The literature revealed that knowledge, skills and attitudes together form the essentials of professional practice. Each in its own way is a vital constituent to practice and should one be lacking in any one of these dimensions, one may be regarded as being less than a total professional (Jarvis, 1984:79). Consequently, these should form the bare essentials of the curriculum. The education and training of medical laboratory technologists is incomplete since the curriculum has not provided the student with the opportunity to learn and acquire competency in all of these fields.

Criteria for the selection of curriculum content in professional education is usually constructed by the professional body or by the staff of the academic institution (Jarvis, 1984:50). If the aims of professional education are to be achieved, it is necessary that the content of what is to be taught or learned is in accord with them. Since one of the aims of professional education is that the learner should understand the knowledge that is learned, it is illogical for a student to claim to know something but not to understand it. Rote learning does not always lead to comprehension and this is an important educational criteria that is overlooked in the Republic of South Africa.

It is therefore recommended that students develop a critical awareness of the subject taught, so that knowledge and skills included in the curriculum are not beyong dispute. The subjects must be taken to, at least, sufficient depth to allow the learners to develop a critical approach to what they learn. Failure to encourage students to do this lessens the ideals of professional education and even of education itself.

The aims of professional education with regard to competency indicate that, whilst competency is a concept which adjudges a candidate to have achieved a level of excellence acceptable to those who make the assessment, practice of the occupation demands more than the mere possession of theoretical knowledge.

Three main areas of concern were outlined in Chapter 3 and the recommendations are discussed according to each area.

6.4.1. Social Factors

* <u>Educators and medical technologists should take cognisance of social realities where the primary role of pathology services will be to serve the wider society</u>.

When questioned on the importance of grading the educational levers for medical technology and the necessity of multi skilled personnel, respondents expressed that this would be pertinent in the future. Two distinct but inter-related solutions are suggested.

i) The political, economical and social development of the disadvantaged communities in South Africa will require lesser trained personnel for the needs of primary health care.

ii) As the shift in health care delivery to comprehensive primary health-care centres necessitated, the need for multi-skilled personnel. These are important issues to consider should we wish to meet the health care needs of the South African population.

While each of these factors constitutes a separate element of the educational process, their inter-dependence must be emphasized. Primary health care is likely to be most effective if it employs a cost the community and the country can afford (Alma-Ata, 1978:35). The categories of staff used at the different levels of the health system will vary according to the resources of the country (Alma-Ata, 1978:63). It is part of national primary health care policy to insist on technology that is appropriate (Alma-Ata, 1978:61).

¤ Educators and Medical Technologists should propose a model for educating technicians

Separation of laboratory service into two categories (basic and specialised) would clarify the roles undertaken by technician and technologist.

A universal delineation of basic versus specialized laboratory procedures would contribute to the construction of curriculum content needed for the educational process to technician level. This concept is however, outside the realms of this study and deserves further research.

A broad division of functions carried out must be determined. Unfortunately, all the aspects, namely the functions of a technician, will continually be needing adaptation as technology develops, so that there is no fixed answer to the problem. The analysis would have to be repeated, probably every two to three years. The difference between a technician on the one hand and the technologist on the other hand is not whether any of the competence skills are present or absent, but the level and frequency of their application.

☆ Educators and medical technologists should take cognisance of the overlapping of workgroups (based on the Goode report) (Annexure H).

The need for technicians has not only resulted from political realities but also from technological advancements which decrease the need for highly qualified personnel to perform many of the routine automated tests. This in itself brings about the need for the two year medical technician level.

6.4.2 The Technikon

The following recommendations should provide insight into and ideas for a restructured and re-oriented medical technology education. The mandate for innovation arose as a result of the attitude of medical technologists towards their present and future educational needs. In order to fulfil its role as a tertiary institution,

* <u>Educators and medical technologists should ensure Standards of excellence within the context of the health care needs of the majority of South Africans</u>.

Medical technology education must move away from exclusive reliance on standards appropriate only to small minority of the population. Multi-disciplinary skills in addition to electives such as computer science, phlebotomy and laboratory management were gaps in the curriculum revealed by this survey. Yet these are areas that have been identified as critical in broadening the expertise and marketability of medical technologists (Raichle, 992:227).

* <u>Educators and medical technologists should foster better co-operation with the profession</u>

On a formal level, professional representatives' involvement in instructional programme design and revamping will ensure relevancy of subject matter and endorsement of the correct educational format. Guest lectures by professional experts will also promote liaison and ought to be encouraged.

On a non-formal basis, the technikon should host practical concepts in new technology and assist the profession wherever possible. Lecturers in medical technology should also serve actively on committees of professional associates. A fully co-operative situation between the technikon and the profession is imperative, particularly since the institution is educating for a specific market which will be employing the diplomats and evaluating them qualitatively.

¤ <u>Educators and medical technologists should capitalise on the medical technologists readiness to learn by providing up-to-date reference material i.e. continuing education</u>

New technology has dictated that continued education is essential to remain clinically competent. A pattern of continuing education that compromises intermittent episode or discontinuous learning experiences cannot effectively bring about the depth and scope of learning required for professional practitioners. The primary aim of continuing education is the improvement of laboratory services but it should also raise morale, increase job satisfaction, self satisfaction and increase the status of the profession by producing up-to-date professionals.

¤ <u>Educators and medical technologists should restructure curricula to keep programmes viable</u>

The impact of political and economic reality will accelerate efforts towards cost containment. In order for the technikons to maintain viability, restructuring the format of the medical technology curriculum should be undertaken to include long-distance education.

6.4.3 Professional Dilemmas

¤ <u>improve the public perception of the medical technologist.</u>

The profession needs enhanced visibility and to be recognized for its efforts. Medical technologists throughout South Africa must realise that a cohesive group is needed to influence and facilitate an improved public image.

The organisation is, therefore, urged to launch a national public relations campaign and issue statements on health related issues - just as other professional organisations do when an issue relates to them. Any organisation or individual making a statement demeaning or derogatory to medical technologists or indicating ignorance of our work, role and responsibilities should be dealt with. The profession must reward its members, acknowledge their expertise and encourage involvement at the national level (Mendelson, 1988:331).

¤ <u>The profession should insist on licensure of screening sites</u>

Many cholesterol screening sites do not employ qualified personnel, properly maintain equipment or refer patients for appropriate medical follow-up care (Pailet, 1990a:3).

Criticism, by the Professional Board of Medical Technology, should be directed against these "fast buck" operators, citing the lack of standards and quality assurance as public health risks. The question on usurpation of the role of the medical technologist hinges on whether these screening sites fall under the definition of clinical laboratory and if not, how they can be regulataed! The answer is of paramount importance. All laboratory testing sites, including physician office laboratories and pharmacy laboratories should be licensed by the Government (McDaniel, 1990:8).

¤ <u>The profession should understand the dilemmas of professionalism</u>

A profession may perhaps be defined as an occupation based upon specialised intellectual study and training, the purpose of which is to supply skilled service of advice to others for a definite fee or salary (Jarvis, 1990;21). Professions are, therefore, service occupations which are valuable to society.

However, society must be protected from practitioners who fall short of competence.

The existence of professional disciplinary bodies are not sufficient to ensure professional competency and the degree of competency/incompetency in a profession is unknown. Once a student has passed the qualifying examinations and is safely installed within his occupational niche, he has considerable freedom unless he makes catastrophic mistakes. If a practitioner is relatively incompetent, his professsional colleagues may be aware of it and critise him among themselves, but their code of professional ethics would stop them from doing this publicly. An incompetent practitioner may then be left to practice his mistakes. It is, therefore, recommended that attitudes towards professional roles need to be assessed. This may be on an informal basis, during experiential training.

6.5. FINAL COMMENTS

The literature review and findings presented indicated the necessity for curriculum changes emphasising the importance of theories and principles of the laboratory-testing processes rather than traditional laboratory skills. Responses to the study have indicated that changes in the role of medical technologists will inevitably necessitate changes in the educational programme. The findings agree with some of the findings of published work in the United States of America.

This study has, therefore, shown that despite the inauguration of the new course in 1993, our efforts to train medical technologists are not yet adequate for the demands of the future. It is only armed with an adequate education that medical technologists can face the future and create their own identities within the health-care team. They must be able to demonstrate to others within the medical and health care fields their own unique and significant role in the diagnosis, treatment and management of patients.

Now is the time of great opportunity. Medical technologists have the right to private practice and, with the advent of new technology, alternative testing sites now allows freedom not felt before. However, this is also a dangerous time in that the greatest weakness would be to deny reality. There are serious challenges in store for the future, but it is within the profession's ability to turn these disadvantages and challenges into advantages and opportunities.

Recognition of the issues that will determine the direction is the basis on which one can build the future path. No longer can medical technologists afford to be lethargic and allow opportunities to pass them by. For the profession to survive usurpation of its role it must adopt an aggressive posture. Medical technology is now at the crossroads, we can take the right path and assume our rightful place, or we can be like the pharmacist of old and fade into oblivion.

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ANNEXURE A

160 Northway
DURBAN NORTH
4051

23rd January 1992

Dear Sir/Madam

INVESTIGATION INTO THE PROFESSIONAL FUTURE OF MEDICAL TECHNOLOGISTS IN THE REPUBLIC OF SOUTH AFRICA.

The rapidity of change within the entire field of health care demands a realistic look at both the quality and the quantity of Medical Technologists. Educational curricula must be evaluated to determine what is required to produce a Medical Technologist who can function in tomorrow's reality.

The task of educating laboratory professionals to perform in the future is an enormous one. The aim of this questionnaire is to determine the future direction of the profession as seen by its members. It is in this respect that your opinion will be appreciated.

The success of the research will be determined by the honest and objective way in which you complete this questionnaire. The answers you provide will be used for research only. No information of your responses will be given to your employer.

Thank you for your co-operation.

Yours faithfully

C M WINCHESTER

160 Northway
Durban North
4051
13 May 1992

Dear Colleague

Urgent ! Please help !

Would you please assist me in persuading five members of the medical technology profession in your area to please complete the enclosed questionaires ?

The answers are pertinent to research I am currently undertaking . At the completion of they study , my findings in this regard will be posted to you in appreciation for your co-operation .

Thanking you for your assistance .

Yours sincerely

C.M. Winchester (Mrs)

MEDICAL TECHNOLOGY QUESTIONNAIRE

INSTRUCTIONS

* Please respond to the questions by placing a (X) over each item's answer.
* Answer all the questions as honestly and objectively as possible.
* The information will be treated confidentially and used for research purposes only.
* In answering the following type of question place an "X" anywhere on the lines between the two extremes. "Good" and "Bad".

Example 1:

Professional future

Good X___ ____ ____ ____ ____ Bad

By placing the "X" on the extreme left side, you have indicated that you feel good about the issue being addressed.

Good ____ ____ ____ X___ ____ Bad

By placing the "X" on the right side you have indicated that you don't feel at all good about the issue being addressed.

QUESTIONNAIRE

Section A

A. Particulars of Employer

1. Name: ....

2. Address: ....

3. Employed in:

Private Sector	1
Government Sector	2

4. Which department employed in: ....

5. Period employed by present employer ....

6. Size of laboratory in which you are employed:

Approximately 10 Medical Technologists	Approximately 50 Medical Technologists	Approximately 100 Medical Technologists

B. Biographical Data

1. Sex

Male	Female
1	2

2. Age Group:

18-24	25-29	30-34	35 & over
1	2	3	4

3. Post Held:

Chief Medical Technologist	1
Principal Medical Technologist	2
Senior Medical Technologist	3
Medical Technologist	4
Student Medical Technologist	5
Other	6

4. Years of employment as a Medical Technologist in:

a) pathology laboratory ☐☐ years

b) other (e.g. lecturer) ☐☐ years

Section B

The Present System of educating Medical Technologists in the Republic of South Africa

1. Are you satisfied/dissatisfied with:

a) the education of Medical Technologists

Satisfied	1
Dissatisfied	2

b) if dissatisfied, please state your reason:

a) ....

....

b) ....

....

2. Do you think that the present educational system is adequate/inadequate in respect of:

	Insufficient knowledge	Insufficient skills	Insufficient experience
National Higher Diploma (T4)	1	2	3
National Diplomas (T3)	1	2	3

OR

	Sufficient knowledge	Sufficient skills	Sufficient experience
National Higher Diploma (T4)	1	2	3
National Diplomas (T3)	1	2	3

3. a) Do you anticipate leaving the profession within the next few years?

Yes	No
1	2

b) If YES please specify the most important reason for leaving:

....

....

c) Do you feel your work as a Medical Technologist lacks challenge?

Yes	No
1	2

4. Qualifications:

Diploma 1	Higher National Diploma 2	Degree 3	Post Degree 4

5. Are you presently involved in formal studies?

Yes	No
1	2

If YES, in what? ....

6. How would you rate the professional status of medical technology on a 5 point scale?

Very Bad 1	Bad 2	Moderate 3	Good 4	Very Good 5

7. What criterion is of greatest importance for Medical Technologists to improve their status?

Please rate each on a 5 point scale as per instruction.

a) A new course design:

Very Important 1 2 3 4 5 Not Important

b) An increase in total professional course credits:

Very Important 1 2 3 4 5 Not Important

c) Degree status as qualification:

Very Important 1 2 3 4 5 Not Important

d) Improved professional and ethical approach to their work:

Very Important 1 2 3 4 5 Not Important

e) Other: ....

....

....

(Please suggest)

8. Do you think that the public image of the profession would improve if Medical Technologists:

a) made a conscious effort to publicize and upgrade their image

Yes	No
1	2

b) demonstrated leadership abilities in research, education, clinical practice and administration

Yes	No
1	2

c) dressed like professionals

Yes	No
1	2

d) studied towards a degree

Yes	No
1	2

e) followed a professional code of ethics

Yes	No
1	2

f) chose the members pf the profession more carefully by some type of selection examination

Yes	No
1	2

9. With regard to the course as a whole, please indicate your degree of attitude to the following statements.

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1. The course is satisfactory	1	2	3	4	5
2. There should be an increase in course duration from 18 months to three years at the Technikon	1	2	3	4	5
3. When leaving the Technikon, medical technology students are inadequately trained for the demands of the profession					
a) Theory knowledge	1	2	3	4	5
b) Practical application	1	2	3	4	5

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
4. Medical Technologists are insufficiently trained to adapt to new professional opportunities such as alternate test sites, private practice, etc.	1	2	3	4	5
5. On completion of the course do you consider yourself to be a broad-based professional?	1	2	3	4	5
6. The course should be accredited for degree purposes	1	2	3	4	5
7. Examination as a means of evaluation of one's competence is preferable to the assignment manual	1	2	3	4	5

10. **Instructions**

This question is to be answered only by those medical technologists who completed the assignment manual during experiential training.

Please rate the level of your experiential training in terms of:

a) Value

Very Bad	Bad	Moderate	Good	Very Good
1	2	3	4	5

b) Relevance to the demands of the profession

Relevant	Not Relevant
1	2

c) Acquisition of practical skills

Very Bad	Bad	Moderate	Good	Very Good
1	2	3	4	5

d) Linking the theoretical programme taught at the Technikon to the experiential

Very Bad	Bad	Moderate	Good	Very Good
1	2	3	4	5

11 a) Do you think that experiential training may be a waste of time?

Yes	No
1	2

b) Please give the most important reason for your response.

....

....

12. Please rate your attitude towards the assignment manual on a five point scale.

Very Good	Good	Moderate	Bad	Very Bad
1	2	3	4	5

13. Do you think that medical practitioners are capable of interpreting all types of labratory results?

Yes	No
1	2

14. Do you think medical practitioners request profiles when individual tests would suffice?

Frequently	Sometimes	Never
1	2	3

15. Are you competent enough in respect of pathophysiological expertise to advise medical practitioners on what tests should be requested?

Yes	No	Uncertain
1	2	3

16. Which policy does your department favour for promotion to senior positions.

Technical ability competency	Seniority	Higher National Diploma in Medical Technologists or any Management/Business Diploma or Degree
1	2	3

17. Do you know of any members of the profession who are:

	Yes	No	Uncertain
a) Incompetent	1	2	3
b) Professionally Dishonest	1	2	3
c) Technically Unreliable	1	2	3

18. Would you recommend medical technology

a) As a career in the future?

Yes	No
1	2

b) Would you have recommended it in the past?

Yes	No
1	2

c) Please state your major reason

....

....

....

....

Section C

Futuristic Perspectives

Please refer to instructions and rate each on a 5 point scale.

1. a) What is your opinion about the professional future of medical laboratory technology in the Republic of South Africa?

Good	1	2	3	4	5	Bad
Prosperous	1	2	3	4	5	Disastrous
Dangerous	1	2	3	4	5	Safe
Worth It	1	2	3	4	5	Not Worth It
Despondent	1	2	3	4	5	Happy

b) How do you feel about meeting the challenges of the future of medical laboratory technology in the Republic of South Africa?

Unconcerned	1	2	3	4	5	Worried
Enthusiastic	1	2	3	4	5	Not enthusiastic
Satisfied	1	2	3	4	5	Dissatisfied
Unmotivated	1	2	3	4	5	Motivated
Uncertain	1	2	3	4	5	Determined

2. Are you satisfied with the subjects offered in the current course for medical technologists with regard to future work in the profession?

	Yes	No
National Diploma	1	2
National Higher Diploma	1	2

3. To what extent do you agree or disagree that the following subjects should be available to medical technologists with regard to their future work in the profession.

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
1. Phlebotomy especially venous blood collection	1	2	3	4	5
2. Urinalysis (suitable for renal laboratories	1	2	3	4	5
3. Pathophysiology (II to V)	1	2	3	4	5

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
4. *Clinimetrics	1	2	3	4	5
5. Laboratory Management IV	1	2	3	4	5
6. Communications in general	1	2	3	4	5
7. Business practice	1	2	3	4	5
8. Computer competency	1	2	3	4	5
9. Instrumentation	1	2	3	4	5
10. Basic Electronics	1	2	3	4	5
11. Introduction to legal processes	1	2	3	4	5

*Clinimetrics denotes the application of scientific and epidemiologic principles to the design, development, operation and management of clinical management processes.

Can you suggest any other subjects which would increase our professional ability?

....

....

....

....

5. Do you think that there should be an increase in the total number of professional courses

	Yes	No	Uncertain
a) so that the medical technologist is more adaptable	1	2	3
b) so that medical technologists are able to work in other allied health fields, e.g. electrocardiography	1	2	3
c) so that medical technologists are able to function in a wide range of activities such as rural areas and small pathology laboratories	1	2	3
d) the professional courses available are sufficient, but need to be made more relevant	1	2	3

6. Indicate which of the following types of instructional offerings are best suited to the profession.

	Yes	No	Uncertain
a) Formal tuition only (theoretical and practical instruction at the Technikon) without any prescribed experiential training	1	2	3
b) Alternating periods/terms of formal tuition and experiential training	1	2	3
c) A parallel form of co-operative education (periods of theoretical per week)	1	2	3
d) Three years full-time at the Technikon plus experiential training	1	2	3

7. With the implementation of a three year full-time course at the Technikon experiential training could be limited to:

	Yes	No	Uncertain
a) 3 months	1	2	3
b) 6 months	1	2	3
c) 12 months	1	2	3

8. Do you think that at the conclusion of the experiential training students should be examined by means of the following:

	Yes	No
a) A theory examination	1	2
b) A practical examination	1	2
c) An oral	1	2
d) A theoretical examination on the practical aspects of the course	1	2
e) On the contents of the assignment manual	1	2

9. Do you think that final examinations should be conducted by any of the following:

	Yes
a) The Technikon concerned	1
b) An independent examining body	2
c) A combination of both of the above	3
d) Other	4

Please answer by placing an X in the block(s) of your choice in Questions 10 and 11.

10. a) Do you think that Medical Technology in the Republic of South Africa warrants the profession split into different grades?

Yes	No
1	2

b) That the grading should be, for example,

	Yes	No
Medical Technician	1	2
Medical Technologist	1	2
Medical Laboratory Scientist	1	2

11. a) Do you think grading should be based on

	Yes	No
Academic qualifications	1	2
Academic qualifications and service	1	2
Service only	1	2

b) Do you think grading on the following levels should be adopted if the system of academic qualifications is accepted?

		Yes	No
Medical Technician	National Diploma	1	2
Medical Technologist	National Higher Diploma	1	2
Medical Laboratory Scientist	Masters Diploma	1	2

If No, your recommendations ....

....

....

12. Do you think that experiential training can be replaced by a suitable practical training period at the technikon?

Yes	No
1	2

Please give main reason ....

....

13. Do you believe that management training of Medical Technologists would be a positive factor in controlling rising laboratory costs?

Yes	No	Uncertain
1	2	3

14. Do you believe that management training of Medical Technologists could help to alleviate personnel problems within the laboratory? i.e. low morale, high turnover, etc.

Yes	No	Uncertain
1	2	3

15. Do you think that periodical rotation through all laboratory sections is important for the purpose of review and update?

Yes	No	Uncertain
1	2	3

16. Which of the following methods do you believe is the best means of ensuring professional competency: (Please rate your answers in order of preference.)

1. Ensuring medical technologists attend a certain number of seminars/lectures per year ______
2. Ensuring that the Professional Board ensure certification of all the individuals concerned ______
3. Offering continued education with emphasis on up-date of technological advances ______
4. Any other ....

   (your suggestion) ....

17. Do you have to use computers in your department?

Yes	No
1	2

18. Do you need to manage data through input, storage and retrieval?

Yes	No
1	2

19. Do you think that Medical Technologists should be proficient in the collection of venous blood (Phlebotomy)?

Yes	No
1	2

20. To what degree would you rate your general knowledge of human diseases and disabilities, i.e. pathophysiology?

Poor	Moderate	Good
1	2	3

21. To what extent would you be capable of undertaking a research project?

Poor	Moderate	Good
1	2	3

22. To what degree are you able to perform method evaluation of laboratory procedures?

Poor	Moderate	Good
1	2	3

23. Can you establish and use a quality assurance programme which includes statistics, calculating of costs/per test?

Yes	No	Uncertain
1	2	3

24. Can you prepare an operating budget?

Yes	No	Uncertain
1	2	3

25. With rapid continuing changes in technology:

a) do you think that there is a need for co-ordinated curriculum revision and development in respect of the National Higher Diploma?

Yes	No	Uncertain
1	2	3

b) do you think continued education programmes should be made available?

Regularly	Occasionally	Never
1	2	3

c) would you attend continued education programmes if they were made available?

Regularly	Occasionally	Never
1	2	3

Please rate on a 5 point scale as per instructions

26. Some people may regard the following as important problems which South African Medical Laboratory Technologists have to solve while others will not regard these issues as problematic at all. What is your opinion on each of the following matters?

1. Laboratory Safety (including AIDS)

Important Problem 1___ 2___ 3___ 4___ 5___ No Problem

2. Professional Image of Medical Laboratory Technology

Important Problem 1___ 2___ 3___ 4___ 5___ No Problem

3. Cost containment of Laboratory Services

Important Problem 1___ 2___ 3___ 4___ 5___ No Problem

4. a) Shortage of qualified Medical Technologists

Important Problem 1___ 2___ 3___ 4___ 5___ No Problem

b) Shortage of posts for Medical Technologists

Important Problem 1___ 2___ 3___ 4___ 5___ No Problem

c) Shortage of posts for experiential training

Important Problem 1___ 2___ 3___ 4___ 5___ No Problem

5. Maintaining the standard of the Profession

Important Problem 1___ 2___ 3___ 4___ 5___ No Problem

6. Job Satisfaction

Important Problem 1___ 2___ 3___ 4___ 5___ No Problem

7. Role of the Medical Technologist being usurped by lesser trained individuals (nurses, pharmacists etc. who do laboratory tests)

Important Problem 1___ 2___ 3___ 4___ 5___ No Problem

8. Educating Medical Technologists for future roles

Important Problem 1___ 2___ 3___ 4___ 5___ No Problem

9. Ethics (including AIDS)

Important Problem 1___ 2___ 3___ 4___ 5___ No Problem

27. Do you think that Medical Technologists in the Pathology Laboratories provide an adequate service?

Yes	No	Sometimes
1	2	3

28. How would you rate your communication skills?

Very Good	Good	Moderate	Bad	Very Bad
1	2	3	4	5

29. With changes of working environment envisaged for the future (e.g. primary health care centres, alternative testing sites, such as office laboratories etc.), do you think that:

a) clinical pathology should be the basic qualification for Medical Technologists

Yes	No
1	2

b) Medical technologists will need multiple skills?

Yes	No
1	2

c) these skills should include multi-disciplinary skills (such as electro-cardiography, blood pressure observance etc.)?

Yes	No
1	2

d) presented with a diagnostic dilemma we should be sufficiently qualified to suggest tests that would prove useful in elucidating the problem?

Yes	No
1	2

e) less highly trained individuals could perform most of the laboratory work in an automated setting?

Yes	No
1	2

f) Medical Labratory Scientists should become more involved in trouble shooting, management of information and supervision i.e. they should be more highly trained?

Yes	No
1	2

ANNEXURE C

DECLARATION OF ALMA-ATA

The International Conference on Primary Health Care, meeting in Alma-Ata this twelfth day of September in the year Nineteen hundred and seventy-eight, expressing the need for urgent action by all governments, all health and development workers, and the world community to protect and promote the health of all the people of the world,. hereby makes the following Declaration:

I

The Conference strongly reaffirms that health, which is a state of complete physical, mental and social wellbeing, and not merely the absence of disease or infirmity, is a fundamental human right and that the attainment of the highest possible level of health is a most important world-wide social goal whose realisation requires the action of many other social and economic sectors in addition to the health sector.

II

The existing gross inequality in the health status of the people particularly between developed and developing countries as well as within countries is politically, socially and economically unacceptable and is, therefore, of common concern to all countries.

II

Economic and social development, based on a New International Economic Order, is of basic importance to the fullest attainment of health for all and to the reduction of the gap between the health status of the developing and developed countries. The promotion and protection of the health of the people is essential to sustained economic and social development and contributes to a better quality of life and to world peace.

IV

The people have the right and duty to participate individually and collectively in the planning and implementation of their health care.

V

Governments have a responsibility for the health of their people which can be fulfilled only by the provision of adequate health and social measures. A main social target of governments, international organisations and the whole world community in the coming decades should be the attainment by all peoples of the world by the year 2000 of a level of health that will permit them to lead a socially and economically productive life. Primary health care is the key to attaining this target as part of development in the spirit of social justice.

VI

Primary health care is essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination. It forms an integral part both of the country's health system, of which it is the central function and main focus, and of the overall social and economic development of the community. It is the first level of contact of individuals, the family and community with the national health system bringing health care as close as possible to where people live and work, and constitutes the first element of a continuing health care process.

Primary health care:

1. reflects and evolves from the economic conditions and sociocultural and political characteristics of the country and its communities and is based on the application of the relevant results of social, biomedical and health services research and public health experience;

2. addresses the main health problems in the community, providing promotive, preventive, curative and rehabilitative services accordingly;

3. includes at least: education concerning prevailing health problems and the methods of preventing and controlling them; promotion of food supply and proper nutrition; an adequate supply of safe water and basic sanitation; maternal and child health care, including family planning: immunisation against the major infectious diseases; prevention and control of locally endemic diseases; appropriate treatment of common diseases and injuries; and provision of essential drugs;

4. involves, in addition to the health sector, all related sectors and aspects of national and community development, in particular agriculture, animal husbandry, food, industry, education, housing, public works, communications and other sectors; and demands the coordinated efforts of all those sectors;

5. requires and promotes maximum community and individual self-reliance and participation in the planning, organisation, operation and control of primary health care, making fullest use of local, national and other available resources; and to this end develops through appropriate education and ability of communities to participate;

6. should be sustained by integrated, functional and mutually-supportive referral systems, leading to the progressive improvement of comprehensive health care for all, and giving priority to those most in need;

7. relies, at local and referral levels, on health workers, including physicians, nurses, midwives, auxiliaries and community workers as applicable, as well as traditional practitioners as needed, suitably trained socially and technically to work as a health team and to respond to the expressed health needs of the community.

VIII

All governments should formulate national policies, strategies and plans of action to launch and sustain primary health care as part of a comprehensive national health system and in coordination with other sectors. To this end, it will be necessary to exercise political will, to mobilize the country's resources and to use available external resources rationally.

IX

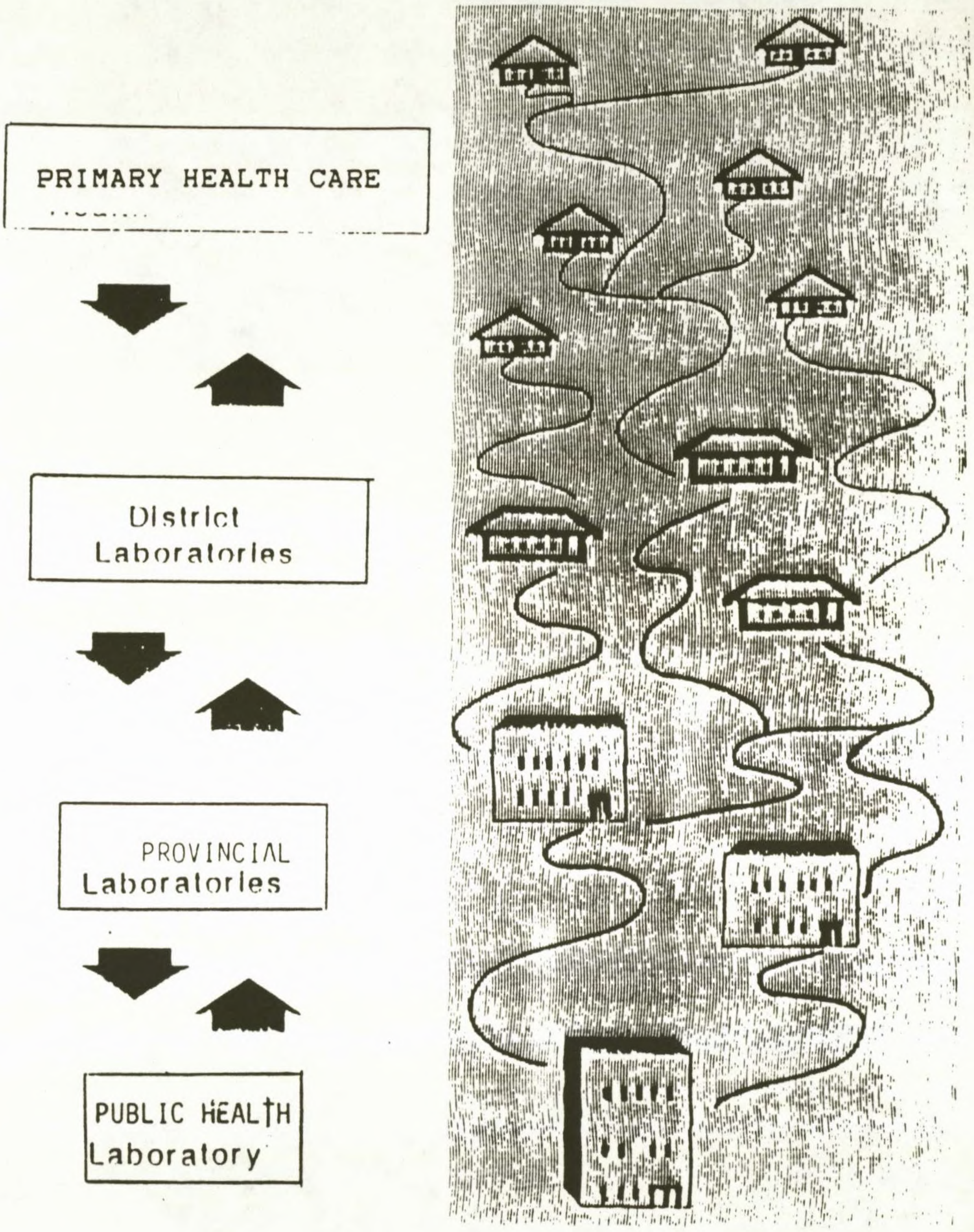
All countries should cooperate in a spirit of partnership and service to ensure primary health care for all people since the attainment of health by people in any one country directly concerns and benefits every other country. In this context the joint WHO/UNICEF report on primary health care constitutes a solid basis for the further development and operation of primary health care throughout the world.

X

An acceptable level of health for all the people of the world by the year 2000 can be attained through a full and better use of the world's resources, a considerable part of which is now spent on armaments and military conflicts. A genuine policy of independence, peace, detent and disarmament could and should release additional resources that could well be devoted to peaceful aims and in particular to the acceleration of social and economic development of which primary health care, as an essential par, should be allotted its proper share.

* * *

The International Conference on Primary Health Care calls for urgent and effective national and international action to develop and implement primary health care throughout the world and particularly in developing countries in a spirit of technical cooperation and in keeping with a New International Economic Order. It urges governments, WHO and UNICEF, and other international organizations, as well as multilateral and bilateral agencies, non-governmental organizations, funding agencies, all health workers and the whole world community to support national and international commitment to primary health care and to channel increased technical and financial support to it, particularly in developing countries. The Conference calls on all the aforementioned to collaborate in introducing, developing and maintaining primary health care in accordance with the spirit and content of this Declaration.



LABORATORY SERVICE NETWORK IN A DEVELOPING COUNTRY BASED ON HEALTH NEEDS AND POPULATION DISTRIBUTION (CHEESEBROUGH 1987)

(AMENDED)

Professional Associations with Codes of Ethics

1. American Academy of Allergy
2. American Association of Nurse Anesthetists
3. American Chiropractic Association
4. American Dental Assistants Association
5. American Dental Hygienists' Association
6. American Dental Association
7. The American Dietetic Association
8. American Geriatrics Society
9. American Board of Health Physics
10. American College of Hospital Administrators
11. Society for Clinical and Experimental Hypnosis
12. American Medical Technologists
13. American Society of Medical Technology
14. International Society of Clinical Laboratory Technologists
15. American Medical Record Association
16. American Nurses' Association
17. National Association for Practical Nurse Education and Service
18. American College of Nursing Home Administrators
19. American Occupational Therapy Association
20. Association of Operating Room Technicians
21. American Association of Opthamology
22. Guild of Prescription Opticians of America
23. American Optometric Association
24. American Pharmaceutical Association
25. American Physical Therapy Association
26. American Osteopathic Association
27. American Podiatry Association
28. American Proctologic Society
29. National Association of Human Service Technologies
30. American Psychiatric Association
31. American Psychoanalytic Association
32. American Board of Professional Psychology
33. American Psychological Association
34. American Registry of Clinical Radiography Technologists
35. American Registry of Radiologic Technologists
36. American Corrective Therapy Association
37. National Rehabilitation Counseling Association
38. American Association for Respiratory Therapy
39. American Speech and Hearing Association
40. American Association of Neurological Surgeons
41. American Academy of Physician Assistants

From Clapp, Jane. *Professional Ethics and Insignia.* Metuchen, N.J.: The Scarecrow Press, 1974; and other sources.

SUGGESTED CODE OF PROFESSIONAL CONDUCT FOR MEDICAL LABORATORY PERSONNEL

1. Place the well-being and service of the sick above your own interests.
2. Be loyal to your medical laboratory profession by maintaining high standards of work and striving to improve your professional skills and knowledge.
3. Work scientifically and with complete honesty.
4. Do not misuse your professional skills or knowledge for personal gain.
5. Never take anything from your place of work that does not belong to you.
6. Do not disclose to a patient or any unauthorized person the results of your investigations.
7. Treat with strict confidentiality any personal information that you may learn about a patient.
8. Respect and work in harmony with the other members of your hospital staff or health centre team.
9. Be at all times courteous, patient, and considerate to the sick and their relatives.
10. Promote health care and the prevention and control of disease.
11. Follow safety procedures and know how to apply First Aid.
12. Do not drink alcohol during laboratory working hours or when on emergency stand-by.
13. Use equipment and laboratory ware correctly and with care.
14. Do not waste reagents or other laboratory supplies.
15. Fulfil reliably and completely the terms and conditions of your employment.

(Cheesebrough, 1987:5).

//

THE ELEMENTS OF PROFESSIONAL COMPETENCY (Jarvis, 1983;35)

Knowledge and understanding of:

- Academic dicipline(s)
- The psycho-motor elements
- Interpersonal relationships
- Moral values.

Skills to:

- Perform psycho-motor procedures
- Interact with others

PROFESSIONAL ATTITUDES

Knowledge of, professionalism

Emotive commitment to professionalism

Willingness to perform professionally

ANNEXURE H

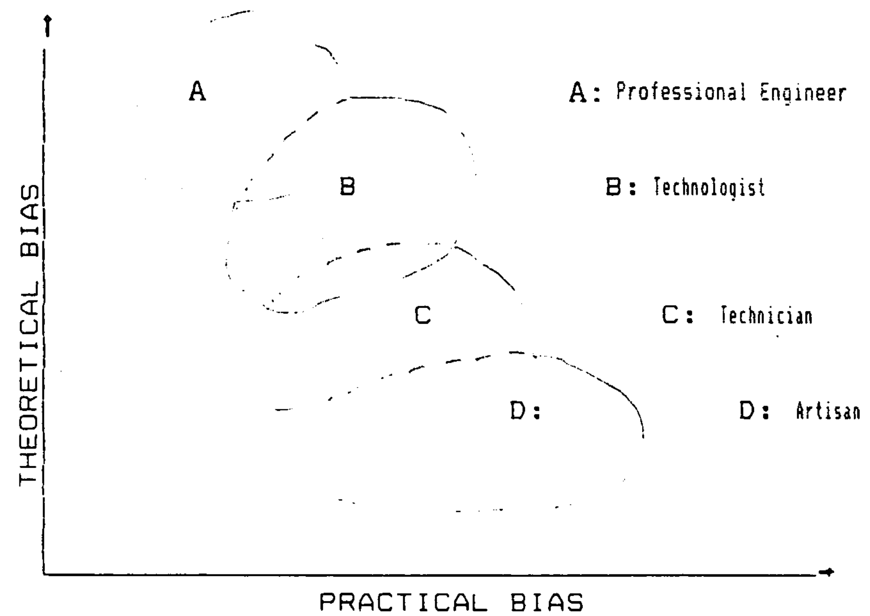


FIG 1: The Overlapping of Workgroups according to the Goode Report

Symposium on the profile of the Engineering technician held in Pretoria in 1989.

ANNEXURE I

WORLD HEALTH ORGANISATION 1980

MANUAL OF BASIC TECHNIQUES FOR A HEALTH LABORATORY

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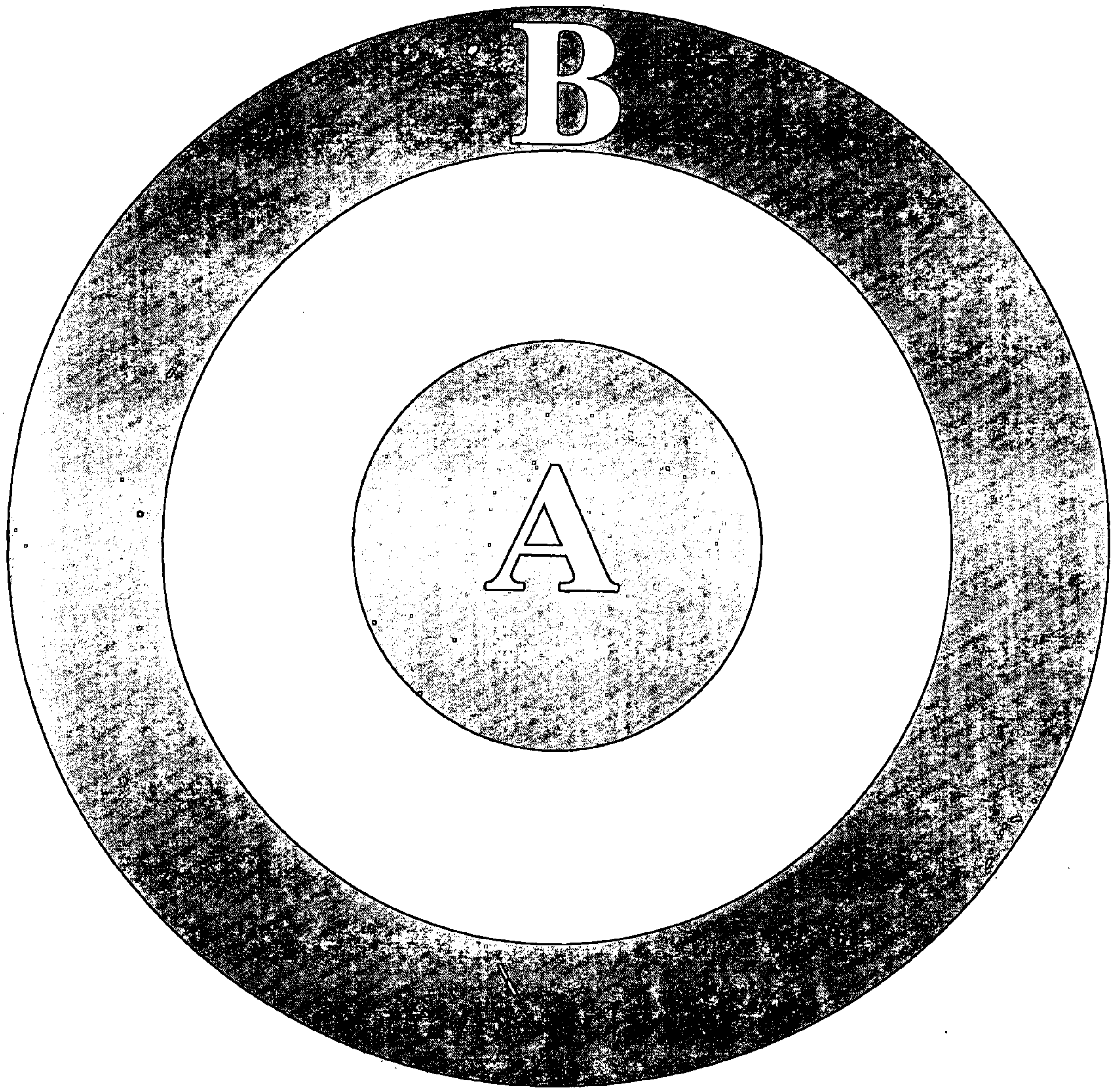
ANNEXURE J

VIEW 1

MEDICAL LABORATORY TECHNOLOGY



VIEW NO. 1

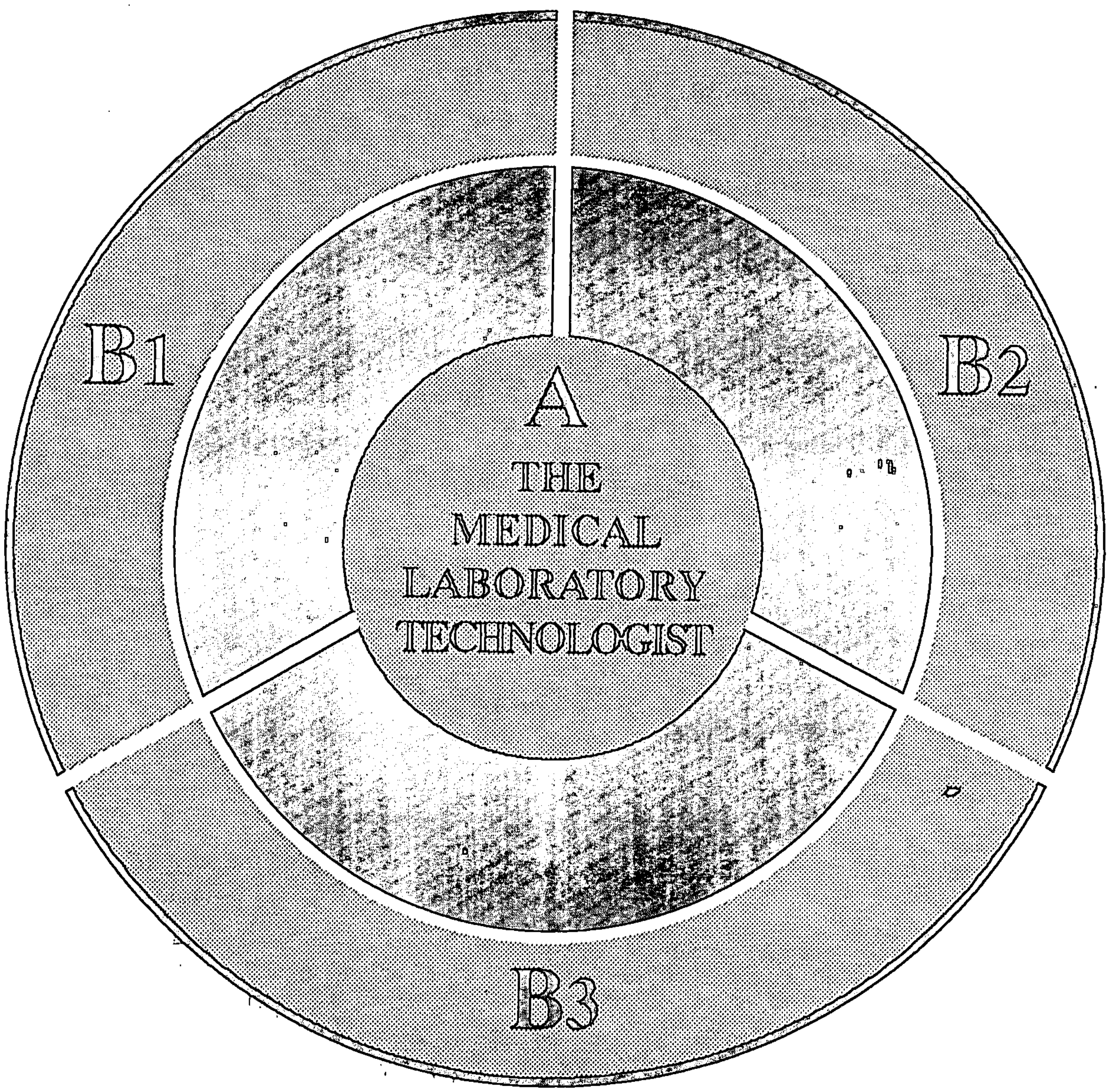
A. THE MEDICAL LABORATORY TECHNOLOGIST

B. FACTORS AFFECTING THE PROFESSIONAL FUTURE OF MEDICAL LABORATORY TECHNOLOGY

VIEW 2

B1
SOCIAL FACTORS

B2
TECHNICON



B3
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LABORATORY SAFTEY
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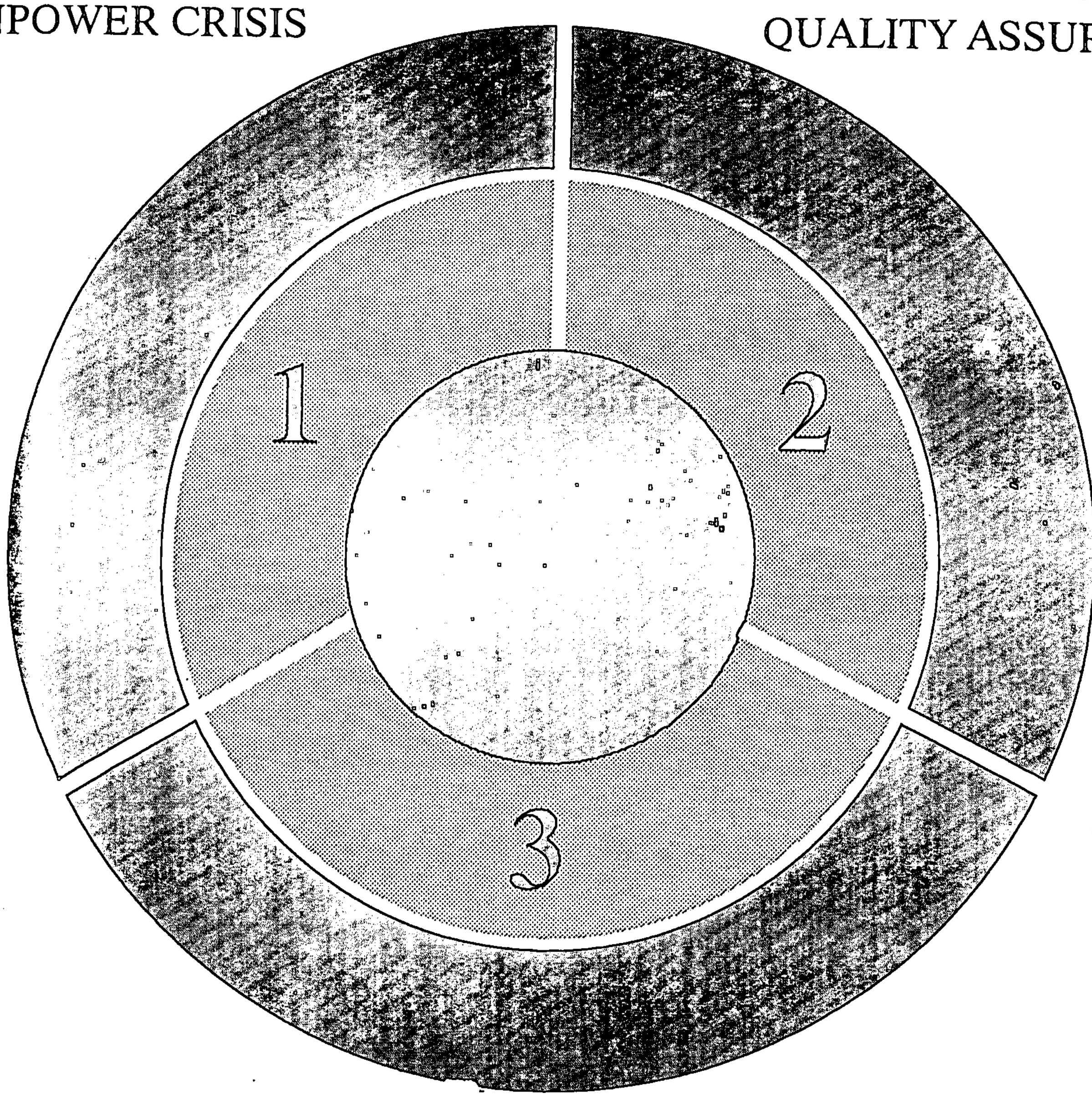
CO-OPERATIVE EDUCATION
COMPUTER LITERACY
LABORATORY MANAGEMENT
CLINIMETRIC'S
PHLEBOTOMY
QUALITY ASSURANCE



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PSYCHOMOTOR SKILLS
AFFECTED DOMAIN
COGNITIVE DOMAIN
PROFESSIONAL IMAGE
ETHICS

ANNEXURE K

(Extract from Natal Coastal Branch Newsletter, Society of Medical Technology, February 1992)

Three main areas of health care have been identified by the profession as providing scope for the utilisation of medical technologists. These are:

a. Provision of safe water
   * Detection of faecal contamination
   * Monitoring of water status
   * Tracing sources of contamination

b. Mother and child health services
   * Ante-natal
   * Blood grouping
   * Screening for STD
   * Diabetes screening and monitoring
   * Nutritional status
   * Identification of other clinically significant diseases e.g. viral (HPV, HSV).
   * Post-natal
   * Haemolytic disease of the newborn
   * Other diagnostic testing as required
   * Family Planning
   * STD screening
   * Pregnancy testing
   * Screening for Ca cervix

c. Prevention and control of endemic disease
   * TB identification and patient monitoring
   * Identification and monitoring of diarrhoeal diseases and parasitic infestation e.g. malaria, bilharzia, helminths, amoebae.
   * Carrier identification e.g. typhoid and cholera
   * Challenges Issued to other Health Professions

1. To identify areas where medical technologists could make the services of allied health professions more effective.

2. To include medical technologists in relevant training programmes.

3. A challenge to other groups in pathology to exchange ideas in areas of mutual concern.