

**ASSESSMENT OF CURRENT STUDENT SELECTION CRITERIA AS PERFORMANCE
PREDICTORS FOR ACADEMIC SUCCESS IN ENTRY LEVEL RADIOGRAPHY
EDUCATION AT THE CENTRAL UNIVERSITY OF TECHNOLOGY**

by

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requirements for the degree**

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FACULTY OF HEALTH SCIENCES
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BLOEMFONTEIN**

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DECLARATION

I hereby declare that the content of this mini-dissertation is the result of my own independent work. Where help was sought, it has been acknowledged. I also declare that this work has been submitted for the first time at this institution, University of the Free State, towards a Master's degree in Health Professions Education and that it has never been submitted at any other institution for the purpose of obtaining a qualification.

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DEDICATION

I dedicate this mini-dissertation to the Central University of Technology entry-level Radiography students of the past decade, whose contact sessions I have had the privilege to facilitate, and who showed optimism, resilience and a will to succeed in their studies.

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LIST OF ACRONYMS

ALP:	Academic Language Proficiency
ALT:	Academic Literacy Test
APS:	Admissions Points Score
B. Tech.:	Bachelor of Technology degree
CPUT:	Cape Peninsula University of Technology
CUT:	Central University of Technology
DHET:	Department of Higher Education and Training
DUT:	Durban University of Technology
ECP:	Extended Curriculum Programme
ESL:	English Second Language
GSAT:	General Scholastic Aptitude Test
HEQC:	Higher Education Qualification Committee
HEQF:	Higher Education Qualifications Framework
HPE:	Health Professions Education
LOLT:	Language of Learning and Teaching
NMMU:	Nelson Mandela Metropolitan University
NSC:	National Senior Certificate
RiT:	Research informed Teaching
TUT:	Tswane University of Technology
UFS:	University of the Free State
UJ:	University of Johannesburg
UK:	United Kingdom
UL:	University of Limpopo
UP:	University of Pretoria
QLT:	Quantitative Literacy Test
SA:	South Africa
SAQA:	South African Qualifications Authority
SC:	Senior Certificate

TERMINOLOGY USED IN THE STUDY

Terms which are used in this study are explained and described in the following paragraphs:

Admission Points Score (APS) is a rating score that is assigned for various achievement levels according to percentages scored in each subject in the NSC examination, for example, achievement level 4 (50-59%) (CUT 2013b:Online). The scores of the first six subjects are added up to calculate a total APS. The subject 'Life Orientation' contributes only one point on the APS score, irrespective of the achievement level of the subject (CUT 2013a:Online).

Articulation, a term indicating the permitted progression between different, but related qualifications, and which is achieved by the "intentional design of structure and content" of the above qualifications (SAQA 2013:Online).

Credits, a term which indicates the amount of learning contained in a qualification or part of a qualification and one (1) credit is equal to ten (10) notional learning hours (SAQA 2013:Online).

Department of Higher Education and Training (DHET) was formed when the National Department of Education was split into two: Department of Basic Education (DBE) and the DHET. The latter body coordinates education and training of post-school education, including universities, Further Education and Training (FET) Colleges, Sector Education and Training Authorities, and Adult Basic Education (HESA 2013:Online).

Exit-level outcome, a term which refers to the outcomes required of a candidate when completing a qualification or part of a qualification (SAQA 2013:Online).

General Scholastic Aptitude Test (GSAT) is a psychometric test registered by the Human Sciences Research Council (HSRC) of South Africa with a Test Reference Number of 18/11/18 (HPCSA 2013b:Online).

Health Professions Council of South Africa (HPCSA) is a statutory body, guided by a formal regulatory framework including the Health Professions Act 56 of 1974. This Act

governs all HPCSA activities, clearly defines the scope of each profession registered with HPCSA, and sets clear processes to be followed by the HPCSA in achieving the statutory mandate (HPCSA 2013a:Online).

Human Sciences Research Council (HSRC) of South Africa is a public-purpose organisation generating scientific knowledge through research in social and human sciences (HSRC 2013:Online).

Life Orientation is a subject at the Further Education and Training (FET) phase in South Africa, and is an interdisciplinary subject, dealing with the study of the person in relation to other people and to society (RSA DoE 2003:Online).

National Benchmark Tests (NBTs) are tests which have been commissioned by Higher Education South Africa (HESA) focussed on assessment of academic readiness of first-year university students. Three tests are undertaken by prospective first-year students, namely an Academic Literacy (AL) test, a Quantitative Literacy (QL) test and a Mathematics (MAL) test. According to the level of achievement, the student is rated as proficient, intermediate or basic. In this manner, the NBTs serve as an assessment of the needs of the student at university, to gauge whether the student is likely to cope, whether the student is likely to need complementary support in the form of additional tutorials, workshops, augmented courses, and additional language proficiency. Students who need to be placed into an extended programme are also identified. NBTs form part of the National Benchmark Test Project (NBT 2013:Online).

National Senior Certificate (NSC), a qualification at level 4 on The National Qualifications Framework (NQF), undertaken by full-time students as “a school-leaving examination”. This qualification is a requirement for entry into higher education in South Africa (NQF 2013:Online).

National Qualifications Framework (NQF) is a framework which has been established as part of a national education and training system to provide quality learning. The objectives of the NQF as outlined in the NQF Act No 67 of 2008 are as follows:

- To create a single integrated national framework for learning achievements;

- Facilitate access to, and mobility and progression within, education, training and career paths;
- Enhance the quality of education and training; and
- Accelerate the redress of past unfair discrimination in education, training and employment opportunities (NQF 2013:Online).

Professional Board for Psychology of the HPCSA is constituted in terms of the Regulations relating to the Constitution of the Professional Board for Psychology, Regulation No. R1249 dated 28 November 2008 (HPCSA 2013a:Online).

Self-Directed Search Questionnaire (SDS), is a psychometric test condoned by the Human Sciences Research Council (HSRC) of South Africa. It is a test with no listed reference number, but uses Form 207 of 2009 (HPCSA 2013b:Online).

Society of Radiographers of South Africa (SORSA) is a non-profit professional association with voluntary membership, representing radiographers from Diagnostic, Nuclear Medicine, Radiotherapy and Ultrasound categories. The society is a member country of the International Society of Radiographers and Radiological Technologists (ISRRT) (SORSA 2013:Online).

The South African Qualifications Authority (SAQA), is a juristic person, meaning that it is an entity given a legal personality by the law. The South African Qualifications Authority Board is a body of 12 members appointed by the Minister of Higher Education and Training. The objects of SAQA are to advance the objectives of the NQF; oversee the development and implementation of the NQF; and co-ordinate the sub-frameworks (SAQA 2013:Online).

Qualification, is a term which refers to “a planned combination of learning outcomes which has a defined purpose or purposes, intended to provide qualifying learners with applied competence and a basis for further learning and which has been assessed in terms of exit-level outcomes, registered on the NQF and certified and awarded by a recognised body” (SAQA 2013:Online).

SUMMARY

Key words: Admission criteria, Selection tests, Radiography education, Professional Bachelor Degree in Radiography, Academic success

The numbers of students enrolled in the Radiography programme at the Central University of Technology (CUT) are increasing each year, and selectors are therefore faced with critical admission decisions when selecting prospective students for a programme with limited spaces. This research study was undertaken to assess current student selection criteria in Radiography education, by retrospectively analysing the degree to which these criteria predicted actual academic performance over a three-year period amongst entry-level students enrolled in a three-year National Diploma in Radiography.

The rationale behind the interest in student selection in Radiography education was the fact that the South African Qualification Authority (SAQA) has approved and registered a professional Bachelor's degree in Radiography (480 credits), with a new curriculum and altered exit-level outcomes, including research skills. The transition from a diploma-level to a degree-level qualification in Radiography in South Africa indicated that a review and an assessment of current diploma-level student selection criteria could provide a benchmark for selecting students for degree-level education.

An extensive literature study and document analysis provided background information and perspectives related to student admission criteria and selection tests in the health sciences, both nationally and internationally. The research design and methodology included a retrospective quantitative study and document analysis. In the research process, data were collected for each student, including biographical data, prior tertiary education, matriculation or National Senior Certificate (NSC) subject marks and a total Admission Points Score (APS) as calculated from each matriculation certificate. The CUT selection test results for each student were also documented, and included a General Scholastic Aptitude Test (GSAT) score, an English Proficiency Test score and a Self-Directed Search Questionnaire score. By using the above selection scores, a total CUT Rating Score was calculated, and a statistical correlation procedure compared all of the above variables with the marks of all entry-level Radiography modules, for each first-year student in the study group. A further correlation procedure compared selection criteria

with whether the student had achieved the first year exit-level outcomes, or whether they had not achieved these exit-level outcomes.

The main findings of the statistical analysis indicated that certain selection criteria are valid and can be used as academic performance predictors. This retrospective research study presents data which shows success rates for entry-level Radiography students in diploma-level Radiography education at the CUT over a three-year period were at a level of 71.53%. Recommendations for the future degree-level student selection process were made, which included increasing NSC achievement level admission requirements, using the current tests of merit and implementing methods to help students make valid and informed decisions about their career choice. The goal of optimising the student selection process would evolve over a number of years, and degree-level Radiography education has already been implemented at certain institutions since January 2014. The aim of this study was fulfilled by assessing current selection criteria as performance predictors for academic success.

OPSOMMING

Sleutelterme: Toelatingskriteria, Keuringstoetse, Radiografie-onderrig, professionele Baccalaureusgraad in Radiografie, Akademiese sukses

Al hoe meer studente skryf jaarliks vir die Radiografie program aan die Sentrale Universiteit van Tegnologie (SUT) in, en keurders het dus met belangrike toelatingsbesluite te kampe wanneer hulle voornemende studente vir 'n program met 'n beperkte aantal plekke keur. Hierdie navorsingstudie is onderneem om die bestaande keuringskriteria in Radiografie-onderrig te assesseer, deur retrospektiewelik die mate waarin hierdie kriteria werklike akademiese prestasie voorspel oor 'n drie jaar tydperk by intreevlakstudente wat vir 'n drie jaar Nasionale diploma in Radiografie ingeskryf is, te analiseer.

Die grondrede vir die belangstelling in studentekeuring in Radiografie-onderrig is die feit dat die Suid-Afrikaanse Kwalifikasieowerheid (SAKO) 'n professionele Baccalaureusgraad in Radiografie (480 krediete) goedgekeur en geregistreer het wat 'n nuwe kurrikulum en gewysigde uittreevlakuitkomst, met inbegrip van navorsingsvaardighede, insluit. Die oorgang van 'n diplomavlak- na 'n graadvlakkwalifikasie in Radiografie in Suid-Afrika het daarop gedui dat 'n hersiening en 'n assessering van bestaande keuringskriteria 'n maatstaf vir die keuring van graadstudente kan verskaf.

'n Uitgebreide literatuurstudie en dokumentanalise het inligting en perspektiewe rakende studentetoelatingskriteria en keuringstoetse in die gesondheidswetenskappe op nasionale en internasionale vlak verskaf. Die navorsingsontwerp en metodologie het 'n kwantitatiewe navorsingsontwerp ingesluit. Dataversameling vir elke student het plaasgevind, insluitend biografiese data, vorige tersiêre onderrig, matriek of Nasionale Senior Sertifikaat (NSS) vakpunte en 'n totale (Toelatingspunttelling) TPT soos bereken uit elke matrieksertifikaat. Die SUT-keuringstoetsuitslae vir elke student is ook aangeteken, en sluit 'n algemene skolastiese aanlegtoetstelling, 'n vaardigheidtoetstelling vir Engels en 'n selfgerigte soekvraelystelling in. 'n Algehele SUT-keuringstelling is op grond van hierdie afsonderlike keuringstellings bereken, en 'n statistiese korrelasieprosedure het al die bostaande veranderlikes met die punte van al die intreevlak Radiografiemodules, ten opsigte van eerstejaarstudente in die studiegroep, vergelyk. 'n Verdere

korrelasieprosedure het seleksiekriteria vergelyk met of die student die eerstejaaruitreevlakuitkomste behaal het, al dan nie.

Die vernaamste bevindinge dui daarop dat bepaalde keuringskriteria geldig is en as akademiese prestasie aanduiders kan dien. Hierdie retrospektiewe navorsingstudie bied data wat sukseskoerse vir intreevlak Radiografiestudente in diplomavlak Radiografie-onderrig aan die SUT oor 'n driejaartydperk op 71,53% te staan bring. Aanbevelings vir die toekomstige graadvlakstudentekeuringsproses word gemaak, wat insluit dat die NSS-prestasievlak toelatingsvereistes verhoog moet word; gebruik gemaak word van die bestaande merietetoetse; en metodes implementeer word om studente te help om geldige en ingeligte besluite oor hulle loopbaankeuse te maak. Die doelwit om die studentekeuringsproses te optimaliseer sal oor 'n aantal jaar ontwikkel word en die graadvlak Radiografie-onderrigprogram is alreeds deur verskeie instansies geïmplementeer in Januarie 2014. Die oogmerk van hierdie navorsingstudie was om bestaande keuringskriteria as prestasievoorspellers van akademiese sukses te assesser.

ASSESSMENT OF CURRENT STUDENT SELECTION CRITERIA AS PERFORMANCE PREDICTORS FOR ACADEMIC SUCCESS IN ENTRY LEVEL RADIOGRAPHY EDUCATION AT THE CENTRAL UNIVERSITY OF TECHNOLOGY

CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

In this research project, an in-depth study was done to assess current student selection criteria as performance predictors for academic success in entry-level Radiography education at the Central University of Technology (CUT) in Bloemfontein, South Africa. This first chapter begins with an introduction and then describes the background to the research problem within the context of the study, indicating the current student selection process for Radiography education and training. Thereafter, the research questions, problem statement, scope of the study, overall goal, and aim of the study are outlined. Finally, Chapter 1 concludes by providing an outline of this study and the chapters which are to follow.

In South Africa, for a prospective undergraduate student to be eligible to be admitted to university, the requirement is "a university entrance" pass in the National Senior Certificate (NSC), a school-leaving examination. An assessment of a student's academic capabilities, either in the form of a final school-leaving examination, or a university entrance examination, is used worldwide in the process of admission to institutions of higher education. Institutions of higher education set their own minimum requirements that a student must achieve to be considered for admission to a specific programme at that particular institution. Different qualifications such as certificates, diplomas and degrees have varying minimum requirements for admission. In the case of Radiography education, as will be discussed in the literature study and document analysis, these minimum requirements and criteria often differ from institution to institution in South Africa.

There has been considerable debate about the NSC results as predictors of preparedness for university study (Badat 2011:Online), and most institutions also use other admissions criteria to select students. At the CUT, a number of alternative selection tests

complement the NSC examination results when assessing a prospective student's eligibility for admission to the university. This practice is in line with "a strategy of equity and redress" as described by Badat (2011:Online). Additionally, some students were admitted to the Radiography programme as "walk-ins" at the beginning of the academic year in question, based on their NSC results and without undergoing other selection criteria. The above practice remains subject to availability within the programme to accommodate these students, as well as subject to each student not only meeting all other admission requirements of the institution, but also to the student obtaining financial support in the form of a bursary.

Provision has also been made in the past to admit mature students based on their prior learning experiences, such as in the case of Supplementary Radiographers who hold a qualification allowing them to perform certain basic diagnostic x-ray examinations, and who wish to improve their qualifications and graduate with a National Diploma in Radiography. Principles of equity are in place at CUT, and there are numerous transparent and fair opportunities for students to enter a variety of programmes which are presented. The challenge for educators is to foster an environment where, once students have entered the programme of their choice, the students also succeed in graduating within a reasonable timeframe.

The aim of this research project is to assess current selection criteria for the Radiography programme critically and determine whether the criteria serve their purpose in selecting students most likely to succeed in the above programme, bearing in mind that only a limited number of students can be accommodated annually. The fact remains that students gain entry to university and more specifically entry into a specific selection course, such as the programme in Radiography at the CUT, based on their ability to fulfil certain selection criteria. It is recognised that numerous additional factors, such as the availability of finances, student living conditions, socialisation factors, time management and dedication to studies all play a role in the academic success or failure of the entry-level student during the first year of study. It is also relevant to consider the "extent to which prospective students demonstrate the likelihood of being able to cope successfully with university study" (Wilson-Strydom 2012:36). Additionally, institutions of higher education in South Africa, including the CUT, have also recognised that various academic development programmes are a useful intervention to provide academic and other support to entry-level students, once they are enrolled at the university.

Aside from these other contributing factors, this study strives to consider whether a pattern emerges between how Radiography students were initially selected and their academic progression to their second year of study, in terms of a correlation between predicting the initial success through selection criteria and their actual academic achievement at entry-level.

The consideration of student selection criteria and academic success as topic is not new. It has been the subject of scrutiny in a number of research studies, amongst other student groups, up to a decade ago (Jenkins 2004:3 & Van der Merwe 2003:Online). This current research project, with a focus on Radiography entry-level students, may serve to highlight whether the correlation, or lack of thereof, between selection criteria and academic success is aligned with previous research, or whether there are new considerations which have to be taken into account.

Radiography student selection criteria at some institutions of higher education in South Africa, for a variety of valid reasons, remain similar to selection criteria used a decade ago. Other universities offering Radiography education have implemented alternate selection criteria. This topic will be discussed in Chapter 2, under the literature review.

1.2 RADIOGRAPHY EDUCATION IN CONTEXT

Admission into an institution of higher education in South Africa is dependent on the student's academic achievement in the NSC or Grade 12 final examination, as indicated in the introduction. To assess the student's level of achievement in the NSC final examination, an achievement level rating is assigned for each subject, and these scores are added up to calculate a total. The total score is referred to by institutions of higher education, as an Admissions Points Score (APS) (CUT 2013a:Online). The use of rating scores, rather than actual mark percentages, can make interpreting the scores for purposes of selection into a higher education programme more difficult. In addition to using the APS for selection purposes, the National Benchmark Tests (NBTs) have been used for a number of years by many, but not all, universities and higher education institutions across South Africa with the purpose of assessing the preparedness of prospective students for tertiary education. The NBTs are designed to assess both academic and quantitative literacy according to specific national standards. At the present time, CUT does not employ NBTs as student selection criteria, but uses its own institutional student selection criteria.

Radiography education in South Africa is currently in a transitional phase, with a definitive move to replace the National Diploma in Radiography (360 credits), with a professional Bachelor's degree in Radiography (480 credits). The credits are according to the National Qualification Framework (NQF) guidelines, where specific credits for specific learning outcomes are allocated according to an established national system (NQF 2013:Online). The move in Radiography education to introduce a professional Bachelor's degree was initiated by radiographers representing the profession, the Society of Radiographers of South Africa (SORSA) and higher education institutions offering Radiography education. During 2010, the Health Professions Council of South Africa (HPCSA) and the South African Qualification Authority (SAQA) approved and registered a professional Bachelor's degree in Radiography (480 credits), on a level 8 of the Higher Education Qualification Framework (HEQF), after an accreditation process was completed.

From the beginning of the academic year of 2014, two institutions of higher education, namely the CUT and the Cape Peninsula University of Technology (CPUT), began the process of phasing out the National Diploma in Radiography and for the first time enrolled entry-level students for the professional Bachelor's degree in Radiography. Specialities in the Bachelor's degree, which include those of Diagnostic Radiography, Ultrasound, Nuclear Medicine and Radiation Therapy, will ensue from the second year of study. The current B. Technology (B. Tech.) in Radiography (120 credits), which articulated from the current three-year National Diploma in Diagnostic Radiography, is still offered at the CUT, but will be phased out over a number of years at the institution. In addition to the above changes, SAQA has also reregistered a mid-level qualification, namely an Advanced Certificate in Radiography (240 credits), and currently this proposed mid-level qualification is under discussion by stakeholders (SAQA 2012b:Online).

The Bachelor's degree in Radiography consists of a new curriculum with altered exit-level outcomes, and it is structured over a four-year programme. An additional exit-level outcome which the Bachelor's degree requires, is that the graduate has the ability to "demonstrate research skills and foster a research climate in Radiography" (HPCSA 2013a:Online). This exit-level outcome is not a requirement of the National Diploma in Radiography, and is in line with international trends that a Bachelor's degree student in Radiography, from an undergraduate level, will need to learn to critically reflect on academic knowledge, master clinical practice and demonstrate progressive personal growth and intellectual development (Baird 1996:120). Radiography educators who introduce research principles to undergraduate students, and facilitate progression of

students to develop critical thinking skills and reflective writing skills may thus have altered expectations of language proficiency and literacy levels amongst the entry-level students.

This current research study analysed and correlated matriculation and NSC scores in language and other key subjects, as well as other CUT student selection scores and compared these with the academic marks of Radiography students at the end of their first year of study. The analysis and correlation was done over a three-year period. One of the aims of this study was to critically assess the current student selection criteria and also to determine the degree to which these criteria predicted actual academic performance in entry-level students. Through this research process, it was hoped that information could be gained which could be used to optimise the future student selection process for a Bachelor's degree in Radiography.

This study may serve as a directive for future student selection criteria during the transition to a Bachelor's degree in Radiography, which is envisaged for all institutions of higher education in South Africa offering Radiography education.

1.3 BACKGROUND TO THE RESEARCH PROBLEM

The Director-General of the Department of Higher Education and Training (DHET), Mr G. Qonde, in the *Presentation on the Annual Performance Plan 2012/13*, highlighted the strategic objectives of the Department to expand access to education and training for young people; to increase the number of students who enter the labour market on completion of their training; and furthermore, to expand research development (DHET 2012:Online). The number of students enrolled in the Radiography programme offered at CUT is steadily increasing in line with the above strategic objectives, and the challenge facing educators and student selectors is to ensure that, once selected for a course, the enrolled students have the ability to successfully complete their training, within a reasonable timeframe, and then enter the labour market as envisaged by the DHET.

To be considered for admission to the National Diploma in Radiography programme offered at the CUT during the years 2010-2012, the prospective student first had to qualify according to the general admission requirements of the institution. The general admission requirement remains at a minimum of 27 on a CUT admission points rating scale, which has levels equivalent to those of the widely-used general Admission Points

Score (APS) for the NSC exam. Additionally, the prospective candidate seeking to gain admission to the Radiography programme at the CUT would need to have passed the following core NSC subjects: Physical Science, Life Sciences, Mathematics and English.

According to the CUT general admission requirements (CUT 2013a:Online), candidates who matriculated in 2007 or before, and who did not obtain the required 27 points on the CUT APS rating scale, but who obtained between 20 and 26 points on the CUT scale of notation could undergo a test to determine their potential. These students could still be eligible to qualify for admission if they showed potential, provided that there was place in the programme in that particular academic year. This is in line with strategies to accommodate students in an equitable manner, as described in the introduction of this study.

To calculate the CUT admission points score for prospective students who matriculated in 2007 or before, with a Senior Certificate (SC), a value is allocated to the symbol obtained in a subject, and the values according to the symbols obtained in the examinations are added together to calculate the total score, according to Table 1.1 below.

TABLE 1.1: THE SCALE USED FOR THE CALCULATION OF CUT ADMISSION POINTS SCORE (APS) ACCORDING TO MATRICULATION RESULTS IN 2007 AND EARLIER

Symbol obtained in grade 12 subjects	A	B	C	D	E
Higher Grade	8	7	6	5	4
Standard Grade	6	5	4	3	2

(CUT 2013a:Online)

For prospective students who completed the NSC in 2008 or in subsequent years, academic weights for achievement, according to the CUT scoring scale, are done according to Table 1.2, below.

TABLE 1.2: THE SCALE USED FOR THE CALCULATION OF CUT ADMISSION POINTS SCORE (APS) ACCORDING TO NSC RESULTS FOR MATRICULATION FROM 2008 ONWARDS

90-100%	80-89%	70-79%	60-69%	50-59%	40-49%	30-39%	0-29%
8	7	6	5	4	3	2	1

(CUT 2013a:Online)

According to the Independent Examination Board (IEB), to study at a South African institution of higher education for any diploma-level qualification requires a NSC score in one official language, at home language level, at an achievement level 3 (40-49%), and three other subject scores with an achievement level 3. The additional requirement is two other subjects at an achievement level 2 (30-39%) (IEB 2013:Online).

In order to qualify for entry into any Bachelor's degree qualification, the requirement is a one official language on home language level at achievement level 3 (40-49%), and four subjects from a designated list of subjects at an achievement level 4 (50-59%). Additionally, two other subjects could be at achievement level 2 (30-39%) (IEB 2013:Online). The difference between diploma-level studies and degree-level studies is therefore the requirement to have at least four designated subjects on achievement level 4, instead of three subjects on achievement level 3.

If one considers the above minimum requirements for diploma-level study, then it is clear that, at the time that research study was undertaken, the admission requirements for a National Diploma in Radiography at CUT, see below, were higher than recommended requirements for a diploma. For the Bachelor's degree in Radiography, however, the requirements would have to be adjusted in line with the recommended minimum requirements for a Bachelor's degree, i.e. at least four designated subjects on an achievement level 4.

The 2010-2013 minimum requirements for selection to the Radiography programme were as follows:

- APS, according to CUT scale = 27;
- Language of instruction, English = Achievement level 3 (40-49%);
- Life Orientation = Achievement level 3 (40-49%);
- Mathematics = Achievement level 3 (40-49%);
- Physical Science = Achievement level 4 (50-59%);
- Life Sciences = Achievement level 4 (50-59%).

(CUT 2013b:Online).

At CUT, the language of instruction is English, and thus there was a requirement that a prospective student had achieved English either at home language level or first additional

language level, and at the time when the research was conducted, the required achievement level was level 3 (40-49%).

In order to accommodate the exit-level outcomes in the new curriculum, a change from an achievement level 3 (40-49%) for the English language, as language of learning and teaching (LOLT), to an achievement level 4 (50-59%) has been suggested. This may have an impact on prospective students who are second language English speakers, and student profiles may potentially be altered.

The prospective students were also expected to undertake further selection tests at the CUT, including psychometric tests provided by the Human Sciences Research Council (HSRC) of South Africa, endorsed by the Professional Board for Psychology of the HPCSA. These tests include a General Scholastic Aptitude Test (GSAT) (HSRC Test Reference Number 18/11/18), and a Self-Directed Search Questionnaire (SDS) (an HSRC condoned Test with no listed reference number, Form 207 2009) (HPCSA 2013b:Online). Prospective students were also expected to undertake an English Proficiency Test, under the auspices of professional psychologists at the CUT. For the purposes of this research report, these tests themselves are not described or analysed; the focus of this study was on how accurately all the selection criteria, including the above tests, had served as performance predictors for success in entry-level radiography education.

According to CUT general admission requirements (CUT 2013a:Online), if a prospective Radiography student met the core matric or NSC subject requirements of Physical Science, Life Sciences, Mathematics and English, but only had between 20-26 points on the CUT APS rating scale, then the student could be eligible to enter the Extended Curriculum programme (ECP) in Radiography, subject to availability of space in the programme.

At the time the research was conducted, the ECP was a foundation or bridging course with the duration of one year, in which the selected students were taught basic sciences, including anatomy and physiology, computer skills, academic language proficiency and English reading proficiency. The students in the ECP bridging course were expected to complete all the first-year modules successfully within the timespan of one academic year, and if this goal was achieved, the students would then have been accepted into the three-year National Diploma in Radiography programme, while still being registered as part of the ECP in Radiography (CUT 2013a:Online).

Only eight students per year were permitted to join the ECP in Radiography at the CUT, according to the allocated government funding grant. The progress of these ECP Radiography students, over the research period of three years, will also be considered in the current research report.

1.4 PROBLEM STATEMENT AND RESEARCH QUESTIONS

As far as could be ascertained, no similar study concerning student selection criteria and the alignment with entry-level academic success in Radiography education had previously been undertaken. Search engines such as: Ebscohost, Scencedirect and Google Scholar were consulted. During the gathering of information for the literature study, books and published articles in accredited international and national journals on the topic under investigation were accessed.

The problem that was addressed in this research study was to analyse the alignment of the current student selection criteria with actual academic achievement in entry-level Radiography education, with a view to ascertain the validity and reliability of the above selection criteria as performance predictors.

The research question which was posed in this study was:

What student selection criteria should be used as performance predictors for academic success in entry-level Radiography education at the Central University of Technology?

1.5 OVERALL GOAL, AIM AND OBJECTIVES OF THE STUDY

1.5.1 Overall goal of the study

The overall goal of the study was to make a contribution towards assessing current student selection criteria as performance predictors for academic achievement in entry-level Radiography education at the CUT. This overall goal serves to inform and to make recommendations for valid and reliable future student selection criteria for the new professional Bachelor's degree in Radiography. A further goal was to assess whether students accepted into the course, during the time that the research was conducted, were adequately prepared for the demands of entry-level Radiography education, in order to achieve completion of their first year of study.

1.5.2 Aim of the study

The aim of the study was to consider current selection criteria as performance predictors for academic success in entry-level Radiography education, and to determine whether selection criteria proved to be valid and reliable, and whether there was a significant correlation between any specific selection criteria and the marks which entry-level Radiography students obtained for their first year compulsory modules. A further aim of the study was to determine whether additional selection criteria should be taken into consideration for admitting students into the Bachelor's degree in Radiography programme at the CUT.

1.5.3 Objectives of the study

In order to address the research question of the study, the following objectives were pursued:

- i) To benchmark, from literature, best practices in prospective student profiling and selection criteria, specifically in the domain of Radiography education. **(Literature perspectives and analysis of documents)** (cf. 2.6)
This primary objective addresses the main research question.
- ii) To gain a thorough insight into the current profile of undergraduate students in a Radiography programme at a tertiary institution (CUT) and to retrospectively compare the various selection criteria with the academic achievement in the first year of study in the Radiography programme at CUT, over the last three years of student intake, 2010, 2011 and 2012. **(Quantitative data analysis using a Retrospective cohort study)** (cf. 3.3)
This primary objective addresses the main research question.
- iii) To ascertain the validity and reliability of current selection criteria, specifically for the purpose of gaining information relevant to Radiography education. **(Quantitative data analysis)** (cf. Chapter 4)
This primary objective addresses the main research question.
- iv) To recommend strategies to ensure that future student selection criteria fulfil the demands and requirements of the professional Bachelor's degree in Radiography. **(Quantitative data analysis)** (cf. Chapter 5)
This secondary objective addresses the future requirements of Radiography education.

1.6 DEMARCATION OF THE FIELD AND SCOPE OF THE STUDY

The study was conducted between May 2012 and March 2013, with the empirical research phase from April 2013 until October 2013. The findings of the study may be applied at the CUT in the domain of future student selection for the Radiography programme. The study fits in the field of health professions education and Radiography education, as an interdisciplinary study. The value of identifying best practice student selection criteria at the CUT may also benefit other institutions of higher education which offer Radiography education, as well as the profession as a whole.

In a personal context, the researcher in this study is a qualified diagnostic radiographer, currently practising in private practice. At the time of the research study, the researcher was also a part-time lecturer at the CUT in the Radiography programme, and also held a contract position as Junior Lecturer in the Division of Health Sciences Education at the University of the Free State (UFS).

1.7 THE VALUE AND SIGNIFICANCE OF THE STUDY

This research study will provide valuable information by correlating the student selection criteria with academic success rates in first-year Radiography students. By retrospectively analysing data regarding first-year students in the National Diploma in Radiography programme at CUT during 2010, 2011 and 2012, it is hoped that recommendations for the selection of students into the professional Bachelor's degree in Radiography programme can be facilitated. The ultimate value of the research will be to optimise the selection process of students for degree-level Radiography education, to ensure that students enrolled in the programme can successfully complete their studies.

The value of identifying best practice student selection criteria at all institutions of higher education which offer Radiography education may also benefit the profession as a whole. The recommendations of this study can be made public to other educationalists in Radiography education through paper presentations at Radiography conferences and seminars and by the publishing of articles in applicable journals.

The results and recommendations of this study may benefit other programmes in the Departments of Clinical Sciences and Health Sciences at the CUT which are also in a transitional phase with the aim to change from diploma-level to degree-level programmes.

Examples of such programmes include Biomedical Technology, Clinical Technology and Emergency Medical Care. The new curricula in the above programmes will also include a new research skills component, so the findings of this study may be relevant for prospective student profiling and student selection criteria in these programmes as well.

1.8 RESEARCH DESIGN OF THE STUDY AND METHODS OF INVESTIGATION

In this study, the literature perspectives and document analysis had the specific aim of contextualising undergraduate teaching and learning and the relevance of prospective student profiling in the domain of Radiography education.

The first step in the research design was to investigate existing practices of prospective student profiling and selection. In this study, student application criteria from the various institutions of higher education offering Radiography education in South Africa were analysed. Documents of the South African Qualifications Authority (SAQA) and other relevant bodies were also consulted to assess requirements of education in Radiography.

The literature perspectives and document analysis in this study had the specific aim of contextualising undergraduate teaching and learning and highlighting the relevance of prospective student profiling in the domain of Radiography education. The importance of interventional strategies intended to assist students, once they have been admitted into the university, were considered as a related factor, although these interventional strategies were not the focus of this research study. Additionally, the review of literature perspectives and analysis of related documents serve to improve the knowledge of the researcher about the topic under investigation.

Electronic searches using keywords/terms such as Radiography, Reflective Teaching and Learning, Radiography education in South Africa, National Benchmark Tests, Academic Literacy and Selection Criteria for Radiography students were entered alone or in combination into search engines such as: Ebscohost, Sciencedirect and Google Scholar. Books on Health Sciences Education and related topics were consulted.

The research design consisted of a quantitative study, which was enhanced with an analysis of documents of Radiography application criteria at various institutions, in order to provide context knowledge (Flick 2009 in de Vos *et al.* 2011:303). The quantitative methods used will be described in more detail in Chapter 3. The methods that were used

and which formed the basis of the study comprised a literature perspective, document analysis and a quantitative, retrospective cohort study.

The literature perspectives and document analysis focussed on relevant national and international journal articles, theses, and research dissertations. The literature perspectives and document analysis will be described in Chapter 2. The literature study was followed up by a quantitative retrospective cohort study. After permission had been granted by the various authorities at the CUT, various sets of data were accessed from the Radiography programme, including student biographical records, selection test records and student examination results.

1.8.1 Design of the study

The study that was undertaken consisted of a quantitative, analytical, retrospective cohort study (cf. 3.3). A detailed description of the population, sampling methods, data collection and techniques, data analysis and reporting and ethical considerations are provided in Chapter 3.

1.8.1.1 Study population

The study population consisted of the first-year students at the CUT enrolled for the National Diploma in Radiography programme, including the ECP in Radiography students, during the years 2010, 2011 and 2012. A complete set of data was available for the students, as all the students in the study group had matriculation SC or NSC results, and all the students wrote their final first-year academic examinations, except for the small number who dropped out of the course during the academic year. A detailed description of the study population is provided in Chapter 3.

1.8.2 Methods of investigation and measurements

The data used for this study included students' demographic information, any prior tertiary education, and matriculation results according to students' SC or NSC certificates, accessed with permission from the CUT. Further data used for this study included the following selection tests: APS rating, the GSAT score, the SDS Questionnaire Test score, and the English Proficiency Test score. The selection test process was managed by the institution, and a total CUT Rating Score was assigned to each student after completion of

the selection tests. The above selection data was made available to the Radiography programme, to assist in the selection process. The final data set used in this research study included total average marks in all entry-level Radiography modules, accessed from the statistical records of the CUT. A detailed description of the data collection and techniques, data analysis, reporting, institutional consent and ethical considerations are provided in Chapter 3.

1.8.3 A schematic overview of the study

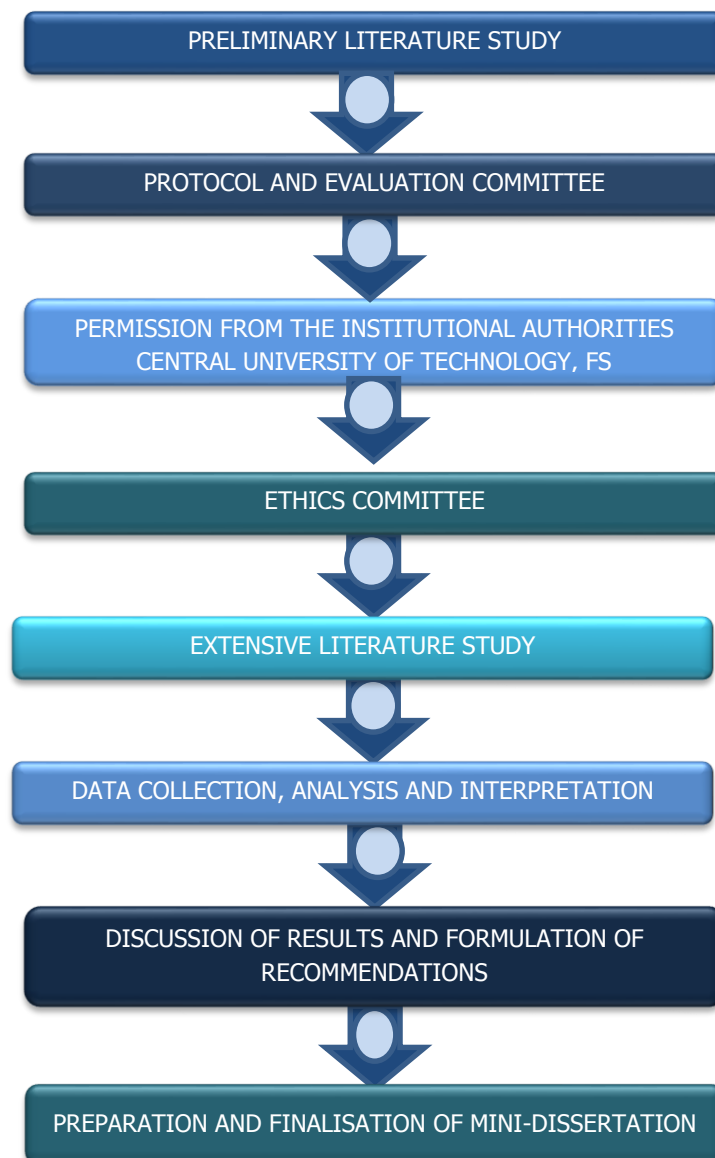


FIGURE 1.1: A SCHEMATIC OVERVIEW OF THE STUDY
[Compiled by the Researcher, Kridiotis 2013]

1.9 IMPLEMENTATION OF THE FINDINGS

A detailed report containing the findings of the research will be made available to the relevant management and institutional research bodies at the CUT. Useful recommendations and conclusions drawn from the research study will be made available to the Radiography programme at the Department of Clinical Sciences, CUT.

The findings of the research may also be applicable to other programmes at the CUT, both in the Departments of Clinical Sciences and Health Sciences, for comparison with their own student selection criteria. The research findings will be submitted to academic journals with a view to publication, as the research findings may make a contribution to other institutions of higher education in South Africa offering Radiography education. The identification of admission criteria and selection tests which serve as performance predictors of academic success may benefit the student selection process for the Bachelor's degree in Radiography.

1.10 ARRANGEMENT OF THE REPORT

To provide more insight into the topic, the methods used to find solutions and the final outcome of the study will be reported as follows:

In this chapter, Chapter 1, ***Orientation to the study***, an introduction and background to the study was provided and the problem was stated, whilst the research questions were also specified. As an overview, the goal, aim and objectives were stated and the research design and methods that were employed were briefly discussed. The significance of the study for future student selection into the Radiography programme was indicated.

In Chapter 2, ***Perspectives on student selection in Radiography education***, provides a review of national and international journal articles, books and theses. The contextualisation of adult higher education, Radiography education, introduction of research skills as related to professional practice, will be discussed. This chapter will serve as a theoretical framework for the study. Included in this chapter is an analysis of documents relating to student selection criteria from various institutions of higher education in South Africa offering Radiography education.

In Chapter 3, ***Research design and methodology***, the research design and methods applied will be described in detail. Data collection and analysis will be discussed.

In Chapter 4, ***Results, data analysis and discussion of findings***, the researcher deals with the results of the data analysis of the quantitative data. The discussion includes a descriptive analysis, tables and graphs.

In Chapter 5, ***Assessment of student selection criteria as performance predictors for academic success***, provides an appraisal of research findings of the study and compares the findings with the literature review. The strengths and weaknesses inherent in the selection criteria will be discussed, as well as challenges and recommendations regarding future student selection criteria.

In Chapter 6, ***Conclusion, recommendations and limitations of the study***, an overview of the study, conclusions, recommendations and limitations will be provided.

1.11 CONCLUSION

Chapter 1 provided the background and introduction to the research undertaken regarding the assessment of current student selection criteria as performance predictors for academic success in entry-level radiography education at the Central University of Technology.

The next chapter, Chapter 2, entitled ***Perspectives on student selection in Radiography education***, will be a study on the relevant literature and documents which were consulted.

CHAPTER 2

PERSPECTIVES ON STUDENT SELECTION IN RADIOGRAPHY EDUCATION

2.1 INTRODUCTION

This chapter serves to provide a perspective on selecting students for the profession of Radiography in South Africa, as well as to provide an overview of Radiography education, nationally and internationally. Developments in biomedical and medical technology constantly present a challenge for Radiography educators to ensure that Radiography curricula keep pace with rapid technological changes. The desired attributes associated with the profession of Radiography will also be considered in this chapter, as Baird (2008:e9) comments that, unlike any other health profession, Radiographic practice is completely mediated by technology. Technical competency, however, does not stand alone in a profession focussed on processes of diagnosis and healing of human medical conditions. The challenge for current Radiography education and Radiography educators is to develop students' critical thinking skills, as well as to ensure that they have the technical competency required for their job (Baird 2008:e9).

Whereas Radiography education and training was initially undertaken within x-ray departments at hospitals in South Africa and abroad during the early decades of the twentieth century (Engel-Hills 2005:Online), Radiography education is currently undertaken at institutions of higher education in South Africa, in line with international trends. In an article entitled "Rethinking university admission for the 21st Century", Sternberg (2007:7) states:

"What is the purpose of university education? Arguably, it is to create active and engaged citizens of the future. If we want to admit students with the potential to become such citizens, the university admissions process should directly assess the skills that students will need to be active and engaged citizens of the world in which they will live".

A discussion on the knowledge, skills and competencies which serve as outcomes for the Radiography graduate will be provided. In order to achieve this goal, literature perspectives highlighting student selections in other health professions, including medicine, may provide guidelines for selecting Radiography students. A further discussion will attempt to review the aims of the health system in South Africa to develop the

profession of Radiography, by increasing the number of students graduating annually, and the challenges facing educators in attempting to achieve these goals. One of the aims of Chapter 2 is to provide a benchmark, from literature, of best practices in prospective student profiling and selection criteria, specifically in the domain of Radiography education.

For a schematic overview of the different aspects which will be discussed in this chapter, and which form the literature perspective and document analysis, see Figure 2.1 below:

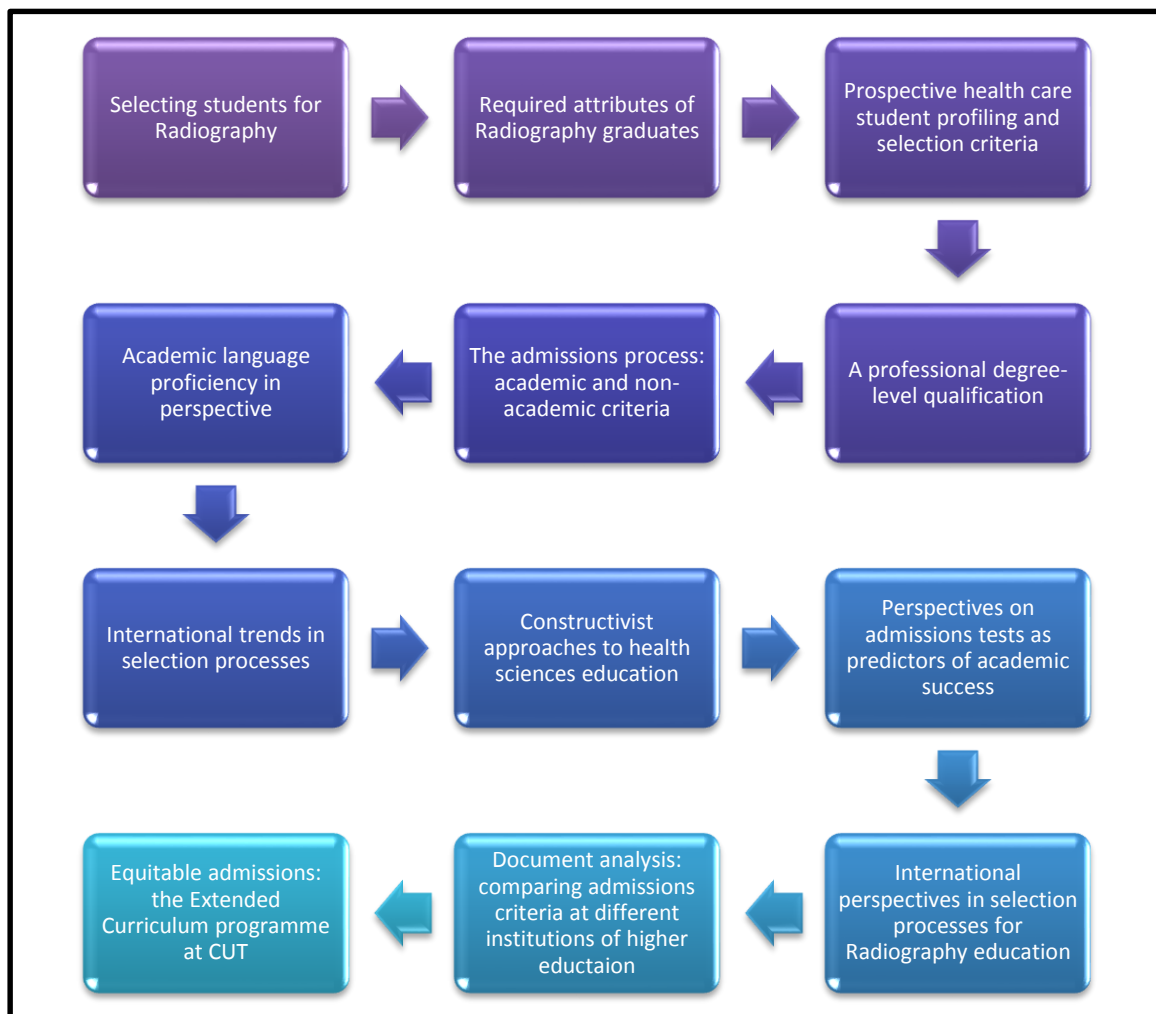


FIGURE 2.1: A DIAGRAMMATIC OVERVIEW OF THE DIFFERENT ASPECTS OF THE LITERATURE PERSPECTIVES THAT WILL BE DISCUSSED
[Compiled by the Researcher, Kridiotis 2013]

2.1.1 Search criteria

The databases Ebscohost, Google Scholar, Medline and Sciencedirect were used to conduct the literature search that covered the time period 2012 to 2013. The search criteria included "Radiography, radiographers, student selections, health professionals,

medical education, academic competence and Radiography student selection criteria in South Africa". The journals which were examined, due to the fact that articles addressing the topics were published in the above, included *Advances in Health Science Education, Health Promotion Practice, Insight, International Education Journal, Journal of Molecular Biology of the Cell, Language Matters: Studies in the Languages of Southern Africa, Medical Teacher, Medical Science Educator, Oxford Review of Education Journal, Radiography, South African Linguistics and Applied Language Studies*, and the *South African Journal of Medicine*.

2.2 ATTRIBUTES ASSOCIATED WITH THE PROFESSION OF RADIOGRAPHY

Radiography and the desired attributes of a new generation of radiographers should be contextualised, if we are to consider how we strive to select students for the profession. Diagnostic radiographers assist specialist radiologists or other physicians by performing diagnostic medical imaging on patients, whilst those radiographers who graduate with a radiotherapy qualification perform therapeutic procedures on patients in accordance with radiotherapy treatment plans initiated by an oncologist and coordinated with a physicist.

A radiographer, according to the professional scope of practice of the HPCSA (HPCSA 2013a:Online), may only undertake diagnostic imaging or therapeutic procedures on a patient upon written instruction from a medical doctor. The medical use of radiation either as imaging or therapeutic procedures, or a combination thereof, is thus only performed on the instruction of a medical doctor, and diagnoses are made either by the attending doctor or by a specialist radiologist, depending on the nature of the imaging procedure. Interventional therapeutic procedures combined with medical imaging are performed by either by specialist radiologists or surgeons. Engineers and medical physicists, trained in specific technology and equipment, are responsible for the calibration of the medical radiation-emitting devices and also ensure the optimal functioning of the equipment. Once the equipment has undergone functionality and acceptance tests, the radiographer's task is use the equipment to produce images, either to enable a diagnosis to be made by the radiologist or to produce images which provide a visual aid to the radiologist or specialist physician during an interventional procedure.

The Directorate of Radiation Control, of the South African Department of Health (RSA DoH 2013:Online), is the statutory body which is responsible for the regulations governing operation of radiation-emitting devices used for medical purposes. Radiation control

measures within health care facilities, both for patients and occupationally exposed persons, are carefully monitored by the Directorate of Radiation Control, which requires quality assurance tests to be done on equipment and records of these tests to be available for routine quality appraisal. Radiation physicists are ultimately responsible for the radiation control measures within health care facilities and they are also the scientists who calculate radiation doses in human tissue, should this be necessary. Radiation physicists are either employed by the health care facility or are privately employed to perform necessary tests on equipment at regular intervals.

The radiographer implements the radiation protection and control measures on a daily basis and is responsible for the personnel radiation monitoring devices in use. These monitoring devices are issued to all persons exposed to radiation due to their occupation. Other health care professionals who make use of radiation monitoring devices include medical doctors and radiologists performing interventional procedures, and theatre staff present during such interventional procedures.

Radiographers, supplementary diagnostic radiographers, chiropractors and radiologists are the persons who are appropriately trained and registered with the HPCSA to operate x-ray equipment, and other radiation-emitting devices. Furthermore, these professionals are each required to remain within their particular scope of practice.

In the case of the profession of Radiography, the focus of this study, radiographers need to have the knowledge and desired attributes of a person operating equipment which is both beneficial, but also potentially detrimental to the patient's health. In this context, author Ahonen (2008:290) refers to Radiography as consisting of processes, actions, responsibilities and goals "to be coordinated as functional entities; often as compromises representing the best possible solution". The author further considers that demonstrating these above qualities illustrates "*synthesis* as an attribute of Radiography". Central qualities would include not only a knowledge base and skills in practice, but also ethics and values (Ahonen 2008:290). This is an astute observation, as the clinical condition of the patient very often places limitations on the image quality and compromises have to be made which take into account both the radiation exposure to the patient and diagnostic value of the images produced.

The use of radiation science in physics and technology, as an interdisciplinary comparison, include "weld Radiography, geochemical investigation, petrophysics, space programmes,

micro-organism detection, and bomb detection” (Ahonen 2008:289). The required attributes of scientists in these abovementioned fields are quite different to those professionals using radiation-emitting devices in the health sciences, where the human element can be considered an integral part of the discipline. It is the human element which requires the Radiography student to be familiar with professional communication, the psychosocial basis of behaviour and illness, ethical theory and patient assessment (Baird 2008:e9).

2.3 PROSPECTIVE HEALTH CARE STUDENT PROFILES AND SELECTION CRITERIA

Prospective students are often asked why they have chosen a specific career or direction of study. The choices made in selecting a particular study direction such as health care are frequently subjective. The student may describe a personal experience a family member or they themselves have had in health care, and how the experience inspired them to want to become a doctor, nurse or allied health science professional. The prospective student profile for a health care profession would be a person who displays an interest in the human condition, in illness and health, in caring for ill or injured people, and who would be committed to undertaking healing processes or to offering palliative care. The prospective student would also have to show an aptitude for working in a team under stressful conditions with potentially uncertain outcomes, as would be the case in a trauma unit.

During their years of secondary schooling, the prospective student would have shown an aptitude and a desire to study subjects such as Mathematics, Physical Sciences, and Life Sciences, including human biology. Once these core attributes have been established, the prospective student in any of health care professions has to undergo a process of application and selection. With limited space in each programme and large numbers of applicants, firstly academic ability and other additional factors such as the display of leadership qualities, extracurricular activities such as sport and cultural achievements and community service may enhance a prospective student’s chances for selection.

2.3.1 Considering academic selection criteria

The selection of students for the M.B.,Ch.B. programme in South Africa is rigorous, with academic criteria being highly rated. De Klerk (2011:Online) described the selection

process for medical students where medical schools use academic and non-academic criteria, as well as awarding bonus points to students according to geographical area of origin, and extra points for students from a rural origin. De Vries and Reid (2003:11) in De Klerk (2011:Online) undertook research at two medical schools and the findings suggest that rural-origin medical graduates were more likely to be found practising in rural areas than urban origin graduates. The authors concluded that selecting rural students could have a positive long-term effect on service delivery in rural areas. In the process of selection for the Radiography programme at the CUT, geographical place of origin was not used to award bonus points to certain prospective students, but the trend that rural-origin graduates return to work in rural areas has been observed by the researcher and could be a topic for further investigation.

With the requirement of very high academic standards and very limited space in the medical programme, prospective students interested in the field of health care may apply for an alternative health science profession with less rigorous selection criteria. Students who do not meet the academic selection criteria for medical school may then opt for an alternative health care career choice, such as nursing or an allied health science such as Radiography. In this research study, the biographical data of the entry-level students included information regarding previous education. It was considered to be of interest to identify the number of students who were selected for the Radiography programme who have previously undertaken, but in some cases only partially completed, studies in medicine, nursing or other health care professions.

Internationally, the selection of students for medicine has been more widely researched than any other health science profession, and information gained by researching selection of medical students may also have some relevance for the selection processes of other health care professions, such as Radiography, particularly when considering non-academic selection criteria. According to Urlings-Strop, Stegers-Jager, Stijnen and Themmen (2013:497), varying selection procedures for admittance into medical school in the Netherlands provide a unique opportunity to compare results of students who were admitted via a lottery system and students who were selected on merit. In their research, the authors showed that there was a lower dropout rate amongst students who had undergone selection than students who gained entry through the lottery procedure.

2.3.2 Considering non-academic selection criteria

Powis (2009:1045) indicated that whilst it has been acknowledged that in order to be able to perform competently, health care professionals need to display attributes other than only academic ability; there remained "a great reluctance to include serious assessment of anything other than academic scores or cognitive skills into selection procedures". The same author states that there appeared to be numerous reasons for this, including the fact that it has been suggested that "the necessary personal qualities can be taught during the course of the studies".

Whilst it remains true that communication and interpersonal skills can be nurtured during the training years, some personality traits - such as emotional stability - are inherent. Benbassat and Baomal (2007:510) argue the case against the use of non-cognitive criteria specifically for the selection of medical students, due to uncertainties surrounding the value of these criteria. The authors made the suggestion that the applicants' non-cognitive traits should rather be used to encourage applicants to make rational, informed decisions about whether or not they should apply to medical school in the first place. This self-evaluation process, according to the authors, may be flawed by a number of external factors, but by providing applicants "with realistic information about the demands of medical training and practice", may in fact help prospective applicants make useful and informed decisions (Benbassat & Baomal 2007:519).

To provide an applicant with useful and realistic information about the health care environment in which they will be working, if selected for the programme, does have merit, and this is also applicable to the profession of Radiography. Certain South African institutions of higher education expected prospective Radiography applicants to visit a diagnostic imaging department (formerly known as an x-ray department) at a hospital before applying for the Radiography programme, and also expected prospective students to motivate and give reasons why they are interested in the Radiography profession as a career (cf. 2.4.6).

As stated in Chapter 1, the initial prerequisite for a prospective student applying for admission into the Radiography programme was to have "a university-entrance" pass in their NSC examination with core subject choices which include Physical Science, Mathematics and in some instances, Life Sciences. English at home language level or first additional language level was also a prerequisite, as English is the language of tuition in

most instances. Although all health care professions have similar core subject choice admission requirements, the level of academic competence in core subjects to gain admission into a programme such as M.B.,Ch.B. or Physiotherapy is considerably higher than that for the Radiography programme.

2.3.3 Considering multiple selection criteria

According to authors Cliff, Ramaboa and Pearce (2007:34), they considered that there was an interest in the higher education context of the importance of assessing applicants using multiple rather than single assessment criteria. The authors stated that the above interest is driven by the following factors:

- (1) "A growing concern internationally that applicants appear increasingly poorly-prepared to cope with generic academic reading, writing and thinking demands placed upon them on entry to Higher Education study;
- (2) A concern that the results of conventional school-leaving examinations are not necessarily providing interpretable understandings of the academic competence levels of incoming students;
- (3) International trends towards greater diversity of educational background and experience in student intake – and a concomitant need for Higher Education to have a common understanding of the differing academic levels of students from these diverse backgrounds;
- (4) A growing need for Higher Education to be responsive to the educational backgrounds of students in a learning and teaching sense, and for an assessment of academic 'needs' to be an important first step towards the placement of students in appropriate curricula according to their educational background".

According to Cliff *et al.* (2007:34), selection tests (also known as admissions tests or entrance tests) were a means of "collecting information" about applicants rather than using only academic criteria, such as school-leaving examinations. The authors also stressed the need for "responsible, ethical and equitable approaches to admissions decisions", and further stressed that "there is a clear need to assess the outcomes of the use of multiple selection criteria on the academic progression of students thus selected." The two questions which the above authors considered in their research were: (1) whether an understanding of students' academic literacy levels (through an initial assessment thereof) had a consequence for teaching and learning and ultimately the

academic performance of the student; and (2) whether “generic levels of academic literacy” could be related to academic performance in discipline-specific contexts.

To consider how Radiography students were initially selected and secondly to assess their academic performance in a Radiography context, where the practical competence of graduates is highly rated, whilst taking into account the considerations listed above by authors Cliff *et al.* (2007:34) may provide insightful answers to questions in the higher education context in South Africa.

Assessing the outcomes of the multiple selection criteria by using a retrospective data analysis, and assessing the correlation between the above criteria and the academic progression of entry-level Radiography students, may help to identify which selection criteria are most predictive of academic progression. Bowen, Chingos and McPherson (2009) in Wilson-Strydom (2012:37) put forward the argument that a combination of school results and content-based achievement tests may provide “the most rigorous and fairest way to judge applicants”. There is an inevitable debate amongst institutions of higher education in South Africa as to the choice of selection and admissions testing combinations for each institution.

Lastly, the concept of readiness for higher education must be linked to the international trend towards degree-level education in Radiography and the need for language proficiency and research skills at both undergraduate and postgraduate level. The research by Cliff *et al.* (2007:47) also relates to trends in Radiography education at CUT, because of the comparisons made between mainstream and extended programme students, and the results which may emerge from this study, when observing the academic progression of both the mainstream and extended programme students, may provide useful information in the context of higher education in South Africa. This will be further described when the results of the current study are discussed in Chapter 5.

In a recent study, authors Mashige, Rampersad and Venkatas (2014:Online) considered whether NSC results predicted first-year academic performance amongst Bachelor of Optometry students at the University of KwaZulu-Natal, South Africa. The study focussed only on first year students who had written the NSC, and did not consider other groups of students who had prior tertiary education. Nel and Kistner (2009) in Mashige *et al.* (2014:Online) reported that little was known about university academic performance of first-year students who had written the NSC examination in 2008 and after. The study

found a weak correlation between APS and the students' first-year average scores, and also found that subjects such as NSC Mathematics, Physical Sciences and Life Sciences subjects were found to be weak predictors for academic success at university entry-level in the Optometry field of study.

2.4 ACADEMIC LANGUAGE PROFICIENCY

According to Drubin and Kellogg (2012:Online), the English language is now, almost without exception, universally used as the language of science and the authors state that English Second Language (ESL) students, who undertake tertiary education in the Health Sciences, where the language of tuition is English, face multiple challenges. In a scientific context such as health sciences education, the student who is rated as "proficient in academic literacy" is one who is capable of reading, assimilating and critically appraising scientific texts in the "language of learning and teaching" (LOLT), in this case, English.

A requirement for a prospective student in the Radiography programme at the CUT would be an acceptable level of verbal and written communication in the language of instruction, in this case, English. As stated in Chapter 1, the challenge for educators is to facilitate the process whereby an undergraduate degree-level student could learn to undertake basic research, could attempt article and academic writing and could read and comprehend scientific documents successfully in English. Quite apart from developing higher level cognitive thinking necessary for research, many students are also faced with the challenge that English is their second language.

This challenge is not unique to South Africa. Bitran, Zúñiga and Leiva (2012:147) of the Pontificia University in Chile have conducted a recent study in which they seek to identify the reading comprehension strategies used by medical students to understand scientific publications, and to study the relationship among self-reported proficiency, both in English and in the subject matter, perceived difficulty of the article, reading time and subjective perceptions of learning and satisfaction. The results of this study highlight the importance of the language proficiency of students. The study found that students who have a lower command of the English language are at a clear disadvantage, irrespective of their level of intelligence. Additionally, it was found that students who lack appropriate English reading comprehension skills are likely to have their interest in scientific research undermined, as reading of English publications becomes exhausting and unrewarding to

these students. This may have a long-term negative impact on their ability to master scientific progress in their respective fields (Bitran *et al.* 2012:150).

Liu and Matthews (2005:Online) note that language discourse is the dual nature of word meaning or language in use, and also comment that “the mastery of language use always entails not just producing grammatically correct texts, but also producing appropriate speech as required by situational and communicative demands”. The acquisition of language lies at the foundation of higher mental thinking, as required in tertiary education.

2.4.1 Student preparedness and interventional strategies

Brüssow (2007:134) in considering the phenomenon of under-preparedness amongst students, through interviews and surveys with experienced local and international higher educationalists, found that language proficiency and reading ability were especially problematic areas. Some under-prepared student groups were those lacking in reading and writing skills, other under-prepared students groups were those lacking in English proficiency because English was their second or third language (Brüssow 2007:135-137). The author further states that “the lack of competency in the foundation skills of reading and writing also translates into inadequacies on post-graduate level”. The student at post-graduate level could be expected to work independently and have an adequate command of academic language.

According to Brüssow (2007:85) the demands of the Higher Education Quality Committee (HEQC) and the national goals set for higher education include: teaching students how to learn; how to become reflective; and how to become lifelong learners. The author also states that “over and above these demands an increasing emphasis on accountability and throughput rates confronts educators in the country, not only to convey knowledge, but also to support students in the learning process to be able to reach academic competency and, ultimately, academic success” (Brüssow 2007:85).

These findings are especially relevant in view of the transition to degree-level education in Radiography (HPCSA 2013a:Online), with an additional required outcome of graduate ability to demonstrate research skills. Institutional interventional strategies to assist students at risk of not achieving academic success must be addressed as early as possible in their tertiary education. A bridging programme, such as the ECP in Radiography,

provides students with a fair chance for success. The use of strategies aimed at the issue of accessing under-prepared students' potential for study, had far-reaching implications, not least for curriculum provision. In the case of mainstream students, there are time constraints placed on both educators and students.

Koch and Foxcroft (2003:193) state that "it is essential at admission to assess the learner's level of preparedness for university education, so as to identify areas that require development, if one is serious about equity and redress". Due to the fact that tertiary institutions in South Africa increasingly view language ability as a potential obstacle to academic success, most tertiary institutions implement interventional strategies to assist students (Weideman 2006:Online).

At the time of this research study, registered CUT students also wrote an Academic Language Proficiency (ALP) test at the commencement of their first academic year. This is in line with other tertiary institutions, where academic literacy tests serve as "diagnostic measures of students' learning and thinking capacities and shortcomings at this early stage of their studies" (Cliff & Hanslo 2009:269).

As an interventional strategy put in place by the institution to assist students to achieve academic success, all first-year students at the CUT were also expected to complete a credit-bearing English Proficiency module, unless they had evidence of credits in a language proficiency module in English at another institution of tertiary education. The module is assessed through summative and formative assessment methods. This module was intended to equip the student with the necessary language proficiency required for studies in tertiary education (CUT 2013b:Online). In other interventional strategies at CUT, entry-level students identified as being "at risk" after the first cycle of formative assessment tests, may have been advised by educators or student counsellors to enrol in modules to assist their academic progress, such as an Academic Literacy module, as well as a Personal Competencies and Life Skills module. These students would then receive counselling and guidance in effective study methods, critical and creative thinking skills, and analytical decision-making skills.

2.4.2 Constructivist approach to health sciences education

The challenges faced by educators with diverse groups of students can be addressed by self-directed learning by students. In constructivist approaches, according to Dent and

Harden (2009:185), students “actively construct or develop their own learning”, depending on the ranges of experiences available to them. Author Fox (2001:Online) states that a valuable insight of constructivism is the realisation that what is learned next is defined by a learner’s existing knowledge and values, and that these both facilitate and inhibit the learning process. Students can be helped by the expertise of teachers and need instruction, demonstration and practice, and the stimulation of challenging problems. In a constructivist approach to health sciences education, “learning plans, goals and study guides should be designed to facilitate integrated learning” (Dent & Harden 2009:185). Implementation of this constructivist approach is evident in Radiography education and is linked to the practical Work-Integrated Learning (WIL) where student learn through demonstration, practice and self-directed learning in a clinical hospital environment.

2.5 PERSPECTIVES ON ADMISSION TESTS AS PREDICTORS OF ACADEMIC SUCCESS

The use of selection tests as part of the university admission process has been debated in national and international studies. The debate considers the predictive value of tests of aptitude compared to tests of achievement, according to Wilson-Strydom (2012:37), who comments on the fact that recent literature shows a level of consensus indicating a preference for the latter (cf. 2.3.3). The use of the Scholastic Aptitude Test (SAT) and American College Test (ACT) as used in the United States of America (USA) has been extensively researched, according to Wilson-Strydom (2012:38). An analysis of SAT data over a 20-year period which was undertaken by Kobrin, Sathy and Shaw (2007:7), where comparisons of performance in SAT’s included groups such as gender, ethnic group, race, English language ability, and parental income. The authors found that even when the tests changed over the 20-year period, performance amongst subgroups were largely consistent. Kobrin *et al.* (2007:20) comment:

"Income and academic performance may always be highly related, but it is imperative to understand the mediating factors that can boost a student's preparedness for college despite his or her socioeconomic status".

A research study conducted by Mellanby, Cortina-Borja and Stein (2009:598) in the UK considered the variety of selection tests which students undertake for admission into university. The researchers developed an open-ended “commentary test” which required

the prospective student to think on a deeper level and approach a subject creatively. The aim was to assess whether abilities and attributes which were not assessed in other tests, could be noted in potential students. Part of the aim of the research was to predict academic outcome, "not biased in favour of those with more advantaged school backgrounds".

The results of emerging research from international and national studies present a perspective that the validity of current selection criteria have come under scrutiny. The common denominator in all emerging research is that academic ability still remains necessary to achieve success in tertiary education, but how that ability and potential ability is measured becomes debatable.

2.5.1 General Scholastic Aptitude Test (GSAT) as selection test

The inclusion of a General Scholastic Aptitude Test (GSAT) and a Self-Directed Search Questionnaire (SDS) at the CUT as part of the selection criteria for Radiography students was unique amongst institutions in South Africa offering Radiography education (cf. Table 2.10). The inclusion of these selection criteria required the researcher to investigate other research, which had previously sought to assess the validity of these selection criteria in a local South African context. Although no research specifically amongst Radiography students could be found, a similar study examining predictive validity of GSAT amongst entry-level students served as a comparative study.

This similar study was undertaken in South Africa a decade ago, at the Port Elizabeth Technikon, and was undertaken by Jenkins in 2004. The study considered the predictive validity of the GSAT for entry-level Information Technology students at the institution. The GSAT was found to have some predictive ability in academic success, but school-leaving marks were considered to have better predictive ability (Jenkins 2004:78). Other factors were also found to play a role in academic success, and the author stated that "the potential of the tests lies in providing access to students who may otherwise have been excluded from programmes based on other selection criteria". Jenkins (2004:78), as a result of his research, recommended both academic support and correct placement of students in programmes. The recommendation for academic support is now widely used at institutions of higher education in South Africa in the form of extended curriculum programmes and interventional strategies. The latter recommendation, that of correct placement of students in programmes is significant. This recommendation highlights "a

great need for comprehensive career counselling as part of the selection process” (Jenkins 2004:78) and this may be an area which still needs to be developed further, even a decade later. The use of the SDS questionnaire as an aptitude test (cf. 2.5.1), does attempt to select students for a specific discipline based on their vocational aptitude, but the validity and reliability of these tests in the South African context remains debatable.

School-leavers may gain access to university through their NSC results, but they may need guidance in career choices, especially if they are undecided regarding their career path. Every attempt must be made to correctly place students in selected programmes, and not only to place students in programmes because there is space available (see below the reference to “walk-in” students). This is particularly relevant in an allied health sciences profession such as Radiography, where students should display certain attributes to work in a hospital setting with ill and injured patients. By providing applicants with detailed and realistic information about the health care environment in which they will work, may help prospective applicants to make an informed decision (cf. 2.8). Through a process of self-reflection, prospective applicants draw their own conclusions about their suitability for the profession.

The above recommendation of comprehensive career counselling as part of the selection process becomes challenging when one considers the trend of accepting “walk-in” students (cf. 1.1 and 2.10).

Wilson-Strydom (2012:38) in a recent study describes how several universities accommodate many ‘walk-in’ students. This practice is applicable to programmes that are not filled up with students who meet the minimum entrance criteria, and who have been conditionally accepted into the programme of their choice. School-leavers who arrive at the university at the beginning of the academic year with NSC results which are adequate for them to gain access to a diploma or degree course, seek to register for a programme and also to apply for bursaries to help them pay for their studies. According to Wilson-Strydom (2012:38) “accommodating such students is, arguably, an important aspect of equity in higher education transformation given the major inequalities in South African society”. Radiography education at the CUT also accommodates such students, and some are accepted without taking the selection tests (cf. 1.1). The research conducted in this research study will also assess these students who have been accepted only on the strength of their NSC results, and without other selection tests and monitor their

achievements. It may be an area for further research to assess to what extent students' decisions to study in a certain discipline was influenced by their acceptance into the programme, whether or not they felt particularly drawn towards the career.

2.5.2 Self-Directed Search Questionnaire (SDS) as selection test

The CUT (cf. Table 2.10) uses a SDS questionnaire (condoned by the HSRC of South Africa) (cf. 1.10) as one of the selection criteria for the Radiography programme. The research conducted in this study seeks to assess whether the SDS questionnaire can be considered a performance predictor amongst entry-level Radiography students. As the CUT is the only institution offering Radiography education in South Africa that uses the SDS questionnaire, a search was conducted to find evidence supporting the use of this method of selection. A study was found, which took place more than a decade ago, where the structural validity of a vocational personality type model, as used for career counselling, was considered by Du Toit and De Bruin (2002), specifically in a South African setting. In their research, the authors questioned whether the model was valid and reliable in a South African cultural context.

The SDS questionnaire is an interest inventory used for career counselling purposes, and is derived from a structural model of vocational personality types developed by Holland (1985) as described in Du Toit and De Bruin (2002:Online). Vocational personality or interest types as classified as follows: "Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E), and Conventional (C)". This model is also known as the R-I-A-S-E-C model (Du Toit & De Bruin 2002:Online). The questionnaire is aimed at making predictions about the relationships between the different vocational types, with the aim of aiding a student in making a career choice.

Du Toit and De Bruin (2002:Online) did not find structural validity of the model in the South African context, and considered the fact that because the questionnaire was in English, even although English was the second and even third language of the respondents used in the study, that this may have influenced the results. The authors expressed the view that further investigation may be necessary, where participants have the opportunity to answer the SDS questionnaire in their first language to understand their interests and vocational personalities more clearly. The conclusion was drawn that "if a poor fit is still obtained in such *further* (own italics) studies, the validity of interest

inventories that are based on Holland's circular order model in the South African context would have to be questioned" (Du Toit & De Bruin 2002:Online).

The SDS questionnaire used in the selection process for Radiography students at the CUT rated students according to their scores in Realistic (R), Investigative (I) and Enterprising (E) interest types. As this method of selection as criteria for admission into a higher education programme has not often been used in South Africa in recent years, the current research may offer an insight into structural validity of the model in the South African context, as did the research conducted by authors Du Toit and De Bruin (2002:Online) more than a decade ago.

2.6 ANALYSIS OF DOCUMENTS: VARIOUS INSTITUTIONS OFFERING RADIOGRAPHY EDUCATION IN SOUTH AFRICA AND THEIR VARYING SELECTION CRITERIA

For purposes of the research study, the website of each institution offering Radiography education in South Africa was visited by the researcher, to identify the institutional and programme requirements for a prospective Radiography student during the years 2010-2012. At the time that the research study was undertaken, it became clear that institutions differed in their selection criteria and admissions requirements, although most institutions used a selection process based on academic achievements at Grade 12 (NSC) level, and most institutions required that the student have achieved core selection subjects of English Language, Mathematics, Physical Sciences and Life Sciences at Grade 12 (NSC) level.

Institutions differed, however, in their requirements for the achieved APS level or equivalent, ranging between level 2 (30-39%) and level 5 (60-69%). Life Orientation at a level of 3 or 4 was a requirement at some institutions, but not all. Mathematical Literacy was accepted at two of the institutions, with minimum APS levels between 5 (60-69%) and 6 (70-79%) for this subject. Proficiency according to the National Benchmark Tests (NBTs) was a requirement for entry into the Radiography course at some of the institutions, whilst other institutions, such as the CUT, used their own institutional academic proficiency tests and other tests (cf. 2.5.1 and 2.5.2).

As a perspective, the NBTs as an alternative and widely-used selection test, must be considered. The NBTs are used by many South African institutions of higher education,

and strive to assess a student's ability and competency in areas of Academic Literacy (AL), Quantitative Literacy (QL) and Mathematics (MAT) (NBT 2013:Online). The NBTs are used in conjunction with the matriculation or NSC marks of each prospective student to make student admission decisions. The aim of the NBT project is to assess prior learning competency which will "directly impact on the success of first year students" (NBT 2013:Online) and the project enables students to write these tests on a variety of dates at numerous examination centres across South Africa. With the advent of degree-level Radiography education, the question of the introduction of NBTs for these prospective students may be a topic for further investigation, as the universities who do use NBTs, also make use of NBT results to assist in decisions regarding "course development, programme planning and placement decisions" (NBT 2013:Online).

During the process of document analysis, it was further noted that institutions offering Radiography programmes also differed in their additional, more qualitative, selection processes. Some institutions required that the prospective student complete a "Value-added Questionnaire", whilst other institutions required that prospective students visit a diagnostic imaging department in a local hospital and then write an essay on their observations and experiences and subsequently give reasons for their interest in Radiography as a career. Some institutions required that prospective students submit proof of visits to diagnostic imaging departments in both the public and private sectors, but did not require any further feedback. Interviews were conducted with prospective students at a number of institutions, but not all institutions, before acceptance into the course.

The process of document analysis also highlighted that there were differences between the various institutions, in terms of timeframes, when the application for admission into the Radiography programme for a specific academic year was closed for entry. At the CUT, for example, students may apply and be accepted into the Radiography programme even during January of the academic year of study. Other institutions offering Radiography education closed applications as early as May or July of the year prior to year of entry into the programme. The selection process is confounded by students who apply and obtain selection in the year prior to entry-level, but then do not take up the position due to a number of factors, including placement in an alternative programme.

2.6.1 Institutions in South Africa offering Radiography education

The institutions of higher education where Radiography education is offered in South Africa are indicated alphabetically, including the abbreviation which will be used to indicate the university, as well as the official website of each institution. The websites listed are those used at the time that the research was conducted and have been used by the researcher to compile Tables 2.1 - 2.13, which serve as an analysis of relevant selection criteria used by each institution.

The institutions of higher education offering Radiography education in South Africa are as follows, including an indication of the city and province where they are located:

- The Cape Peninsula University of Technology (CPUT), Cape Town, Western Cape.
- The Central University of Technology (CUT), Bloemfontein, Free State.
- The Durban University of Technology (DUT), Durban, KwaZulu-Natal.
- The Nelson Mandela Metropolitan University (NMMU), Port Elizabeth, Eastern Cape.
- The Tswane University of Technology (TUT), Arcadia Campus, Pretoria, Gauteng.
- The University of Johannesburg (UJ), Johannesburg, Gauteng.
- The University of Limpopo (UL), Pietersburg, Limpopo.
- The University of Pretoria (UP), Pretoria, Gauteng.

TABLE 2.1: SOUTH AFRICAN HIGHER EDUCATION INSTITUTIONS OFFERING RADIOGRAPHY EDUCATION

INSTITUTION	ABBREVIATION
Cape Peninsula University of Technology (www.cput.ac.za)	CPUT
Central University of Technology (www.cut.ac.za)	CUT
Durban University of Technology (www.dut.ac.za)	DUT
Nelson Mandela Metropolitan University (www.nmmu.ac.za)	NMMU
Tswane University of Technology (www.tut.ac.za)	TUT
University of Johannesburg (www.uj.ac.za)	UJ
University of Limpopo (www.ul.ac.za)	UL
University of Pretoria (www.up.ac.za)	UP

(Compiled by the researcher, Kridiotis 2013: cf. 2.4.1)

2.6.2 Intake in numbers of students per year

According to the websites researched, the institutions of CPUT, CUT and NMMU state their annual Radiography student intake, whereas the other institutions do not, see Table 2.2.

TABLE 2.2: INTAKE IN NUMBERS OF STUDENTS PER YEAR, ACCORDING TO WEBSITE OF EACH INSTITUTION

INSTITUTION	INTAKE NUMBERS
CPUT	80
CUT	60
DUT	Not stated
NMMU	25
TUT	Not stated
UJ	Not stated
UL	"A limited number of students"
UP	Not stated

(Compiled by the researcher, Kridiotis 2013: cf. 2.4.1)

2.6.3 Credits on the National Qualifications Framework (NQF)

The National Diploma in Radiography has an NQF rating of 360 credits, and as can be seen in Table 2.3, most institutions presented this particular diploma-level qualification at the time this research was conducted. The University of Limpopo stated that a Bachelor of Radiography degree was presented, and the relevant website (UL 2013:Online) stated that this qualification had NQF credit rating of 360. The University of Pretoria presented a Bachelor of Radiography (Diagnostic) degree with a recorded 413 credits (UP 2013:Online), which was more than a diploma-level number of credits, but less than the new SAQA accredited professional Bachelor's degree in Radiography, which will have an NQF rating of 480 credits.

TABLE 2.3: DIPLOMA-LEVEL OR BACHELOR'S DEGREE-LEVEL STUDY IN RADIOGRAPHY, WITH RELEVANT CREDITS, PER INSTITUTION OF HIGHER EDUCATION, AT TIME OF RESEARCH STUDY

INSTITUTION	FACULTY & DEPARTMENT	CREDITS
CPUT	Faculty of Health and Wellness Sciences	National Diploma in Radiography (360 credits on NQF)
CUT	Faculty of Clinical Sciences Department of Radiography	National Diploma in Radiography (360 credits on NQF)
DUT	Faculty of Health Sciences Department of Radiography	National Diploma in Radiography (360 credits on NQF)
NMMU	Faculty of Health Sciences	National Diploma in Radiography (360 credits on NQF)
TUT	Faculty of Science, Department of Biomedical Sciences	National Diploma in Radiography (360 credits on NQF)
UJ	Faculty of Health Sciences	National Diploma in Radiography (360 credits on NQF)
UL	School of Medicine	Bachelor of Radiography (Diagnostic) Degree programme (360 credits on NQF)
UP	Faculty of Health Sciences, School of Health Care Sciences, Department of Radiographic Sciences	Bachelor of Radiography (Diagnostic) Degree programme (413 credits)

(Compiled by the researcher, Kridiotis 2013: cf. 2.4.1)

2.6.4 General admission requirements

As was stated in Chapter 1, a diploma-level qualification requires a NSC score in one official language, at home language level, at an achievement level 3 (40-49%), and three other subject scores with an achievement level 3. The additional requirement is two other subjects at an achievement level 2 (30-39%) (IEB 2013:Online).

TABLE 2.4: NSC ENDORSEMENT FOR DIPLOMA-LEVEL OR BACHELOR'S DEGREE-LEVEL STUDY

INSTITUTION	MINIMUM REQUIREMENTS
CPUT	Minimum NSC requirements for diploma entry
CUT	Minimum NSC requirements for diploma entry
DUT	Minimum NSC requirements for degree purposes
NMMU	Minimum NSC requirements for diploma entry
TUT	Minimum NSC requirements for diploma entry, or higher
UJ	Minimum NSC requirements for diploma entry
UL	At least 4 NSC subjects passed with an achievement level of 4, minimum NSC requirements for degree purposes
UP	Minimum NSC requirements for degree purposes

(Compiled by the researcher, Kridiotis 2013: cf. 2.4.1)

According to Table 2.4, all but two institutions stated that they required these minimum requirements for entry into the National Diploma in Radiography, but when comparing the NSC achievement level required per subjects, there appeared to be discrepancies and expectations of higher achievement levels per subject than recommended requirements for a diploma. The Universities of Pretoria and Limpopo websites stated minimum NSC requirements for degree purposes, as did the Durban University of Technology (DUT 2013:Online; UL 2013:Online; and UP 2013:Online).

2.6.5 Admission Points Score (APS) requirements

The institutions surveyed also differed in their online interaction with prospective students, regarding submission of APS requirements. Table 2.5 illustrates that certain institutions indicated the minimum APS requirements for admission, while other institutions had a site where the prospective student could enter his or her NSC subjects and achievement level scores, and the APS score would then be calculated online for the student. The prospective student could thus immediately see if they had the required subject combination and adequate APS to proceed with the online application. Table 2.5 also highlights the controversy surrounding Life Orientation subject mark as part of the overall APS, as the Life Orientation subject is not recognised as a full credit-bearing

subject at many institutions of higher education across South Africa. To illustrate this fact, Table 2.5 shows that the required APS at NMMU is listed as 32 points, higher than any other institution's APS requirement, because the above institution gives full points for the Life Orientation score at NSC level, whereas other institutions only allocate 1 point for the Life Orientation subject.

TABLE 2.5: ADMISSION POINTS SCORE (APS) REQUIREMENTS PER INSTITUTION

INSTITUTION	ADMISSION POINTS
CPUT	Minimum NSC requirements for diploma entry, APS needed not stated, but calculated on application
CUT	27 Admission Points Score as a requirement
DUT	28 Admission Points Score as a minimum. At least two other subjects (20 credit bearing) on NSC achievement level of at least 4 (50-59%), providing both are not languages
NMMU	32, including Life Orientation score at NSC level, i.e.: (5 = 5 APS points)
TUT	26, Life Orientation score is excluded. Applicants with a score of 22-25 will be invited to do the TUT potential assessment and an interview. The APS will contribute 40% to the final admission score, the potential assessment test will contribute 40% and the interview will contribute 20%
UJ	NSC Life Orientation score divided by two when calculating APS 26 APS with Mathematics, 27 with Mathematical Literacy
UL	24, In addition to Mathematics, Physical Science and English scores of 4 each, a further 3 subjects scores should add up to 11. A Life Orientation score needs an achievement level 5 (60%) or above to score 1 point
UP	Life Orientation score excluded, the requirement to have at least four designated subjects on achievement level 4 (50-59%) and undergo a selection process

(Compiled by the researcher, Kridiotis 2013: cf. 2.4.1)

2.6.6 English as language of learning and teaching

All institutions offered the Radiography programme in English as language of learning and teaching (LOLT). According to Table 2.6, all the institutions offering Radiography education in South Africa required that the English language be one of the core language subjects of prospective students, taken either at home language level or first additional language level.

The curriculum of Radiography programme at the UP (2013:Online) showed that this institution was unique in its requirement that students also take a module in either the African language Sepedi (6 credits) or the African language IsiZulu (6 credits) in their first year of study.

The rationale for the additional language skills requirement was that the Radiography students could be better equipped to communicate and interact with their patients from

diverse backgrounds. As part of Radiography training in South Africa, undergraduate students undertake work-integrated learning (WIL), and gain practical experience by performing examinations on patients in hospitals, as part of the Radiographic Practice (Clinical) module.

TABLE 2.6: ADMISSION REQUIREMENTS FOR LANGUAGES, PER INSTITUTION

INSTITUTION	ADMISSION REQUIREMENTS
CPUT	English (Home Language or First Additional Language) Other language (Home Language or First Additional Language)
CUT	English (Home Language or First Additional Language) on at least level 3 (40-49%) of NSC achievement level. NSC achievement level of at least 3 (40-49%) for Life Orientation
DUT	English (Home Language or First Additional Language) on at least level 3 (40-49%) of NSC achievement level
NMMU	English and Afrikaans or isiXhosa (Home Language or First Additional Language) on at least level 3 (40-49%) of NSC achievement level
TUT	English (Home Language or First Additional Language) on at least level 4 (50-59%) on NSC achievement level
UJ	English (Home Language or First Additional Language) and another recognised language on at least level 4 (50-59%) on NSC achievement level
UL	English (Home Language or First Additional Language) on at least level 4 (50-59%) on NSC achievement level
UP	English and /or Afrikaans (as Home Language or First Additional Language) and one other language is recommended

(Compiled by the researcher, Kridiotis 2013: cf. 2.4.1)

2.6.7 Mathematics as a core selection subject

Almost without exception, institutions expected prospective students to have NSC Mathematics as a subject.

TABLE 2.7: ADMISSION REQUIREMENTS FOR "MATHEMATICS" OR ALTERNATIVELY "MATHEMATICAL LITERACY"

INSTITUTION	MATHEMATICS REQUIREMENTS
CPUT	"Mathematics is a compulsory subject"
CUT	NSC achievement level of at least 3 (40-49%) for Mathematics
DUT	NSC achievement level of at least 4 (50-59%) for Mathematics
NMMU	NSC achievement level of at least 2 (30-39%) for Mathematics or 6 (70-79%) for Mathematical Literacy.
TUT	NSC achievement level of at least 4 (50-59%) for Mathematics
UJ	NSC achievement level of at least 4 (50-59%) for Mathematics, NSC achievement level of at least 5 (60-69%) for Mathematical Literacy
UL	NSC achievement level of at least 4 (50-59%) for Mathematics
UP	NSC achievement level of at least 4 (50-59%) for Mathematics

(Compiled by the researcher, Kridiotis 2013: cf. 2.4.1)

Table 2.7 shows that there were variations in the NSC achievement levels required, most notably at NMMU where prospective students with Mathematical Literacy were also considered, and an achievement level 2 was the minimum requirement for Mathematics (NMMU 2013:Online). The University of Johannesburg also accommodated students who had taken Mathematical Literacy as a NSC subject (UJ 2013:Online).

2.6.8 Core selection subjects: Physical Sciences and Life Sciences

According to the selection criteria at most institutions offering Radiography education, the achievement level of core subjects of Physical Sciences and Life Sciences was a minimum of NSC achievement level of 4. NMMU was the exception, with a Physical Sciences requirement of an NSC achievement level of at least 2.

TABLE 2.8: ADMISSION REQUIREMENTS PER INSTITUTION FOR THE SUBJECT "PHYSICAL SCIENCES"

INSTITUTION	PHYSICAL SCIENCES REQUIREMENTS
CPUT	Not stated
CUT	NSC achievement level of at least 4 (50-59%) for Physical Sciences.
DUT	NSC achievement level of at least 4 (50-59%) for Physical Sciences.
NMMU	NSC achievement level of at least 2 (30-39%) for Physical Sciences.
TUT	NSC achievement level of at least 4 (50-59%) for Physical Sciences.
UJ	NSC achievement level of at least 4 (50-59%) for Physical Sciences.
UL	NSC achievement level of at least 4 (50-59%) for Physical Sciences.
UP	NSC achievement level of at least 4 (50-59%) for Physical Sciences.

(Compiled by the researcher, Kridiotis 2013: cf. 2.4.1)

TABLE 2.9: ADMISSION REQUIREMENTS PER INSTITUTION FOR THE SUBJECT "LIFE SCIENCES"

INSTITUTION	LIFE SCIENCES REQUIREMENTS
CPUT	Not stated
CUT	NSC achievement level of at least 4 (50-59%) for Life Sciences.
DUT	NSC achievement level of at least 4 (50-59%) for Life Sciences.
NMMU	NSC achievement level of at least 2 (30-39%) for Life Sciences.
TUT	NSC achievement level of at least 4 (50-59%) for Life Sciences.
UJ	NSC achievement level of at least 4 (50-59%) for Life Sciences.
UL	Not a specific subject requirement
UP	Not a specific subject requirement

(Compiled by the researcher 2013: cf. 2.4.1)

At the UP, Life Sciences as a NSC subject was not a requirement for selection to the programme (UP 2013:Online). Students who were selected would take modules in Physiology and Radiographic anatomy in their first and second years of study. At the University of Limpopo, Life Sciences as a NSC subject was also not a required subject for admittance into the course.

2.6.9 Alternative academic and non-academic selection criteria

In order to gain an overview with the view to benchmark best practices in prospective student profiling and selection in Radiography education, the alternative academic and non-academic selection criteria per institution were considered. Table 2.10 briefly summarises the selection criteria used for selecting students for Radiography programmes in South Africa at the time this research was conducted, as well as highlighting which institutions required additional academic tests, such as NBTs.

Upon analysis of the CPUT website, it was evident that prospective students had to complete a fair and non-discriminatory questionnaire (CPUT 2012:Online). The applicant was asked to state disabilities (if any), mental illnesses, chronic illnesses, accidents, operations or health problems. General information related to employment record, criminal record (if any) and personal achievements were also requested from prospective applicants. Furthermore, the prospective student was asked to write an essay indicating their interest in the career of Radiography. Upon further investigation, it was noted that a number of the above questions are in line with the type of questions requested of prospective applicants seeking admission to a Radiography programme at a university in the United Kingdom (UK) (cf. 2.8).

TABLE 2.10: OTHER SELECTION REQUIREMENTS PER INSTITUTION

INSTITUTION	SELECTION REQUIREMENTS
CPUT	Completion of a questionnaire, expectation to write an essay and to be prepared for an interview if called upon to do so
CUT	General Scholastic Aptitude Test (GSAT), Self-Directed Search (SDS) Questionnaire, and an English Proficiency Test
DUT	Applicants complete 8 hours of voluntary service in a Radiography clinical environment. Essays to be written on observations and experiences in the clinical environment, as well as reasons for choosing Radiography as a career. Applicants undergo placement testing and an interview
NMMU	To be physically fit
TUT	Applicants with a score of APS 26 and higher will be invited for an interview. The APS will contribute 80% to the final admission score and the interview will contribute 20%
UJ	Applicants in Faculty of Health sciences required to write NBT tests. NSC achievement level of at least 4 (50-59%) for Life Orientation. (score to be divided by two to calculate APS) An additional subject also on NSC achievement level 4
UL	Students who fulfil academic requirements will undergo an interview process before final selection. Students who have been refused re-registration in any Faculty or any other University shall not be admitted to this degree programme
UP	Applicants in Faculty of Health sciences are required to write NBT tests

(Compiled by the researcher, Kridiotis 2013: cf. 2.4.1)

According to the official DUT website (DUT 2013:Online), it was clearly indicated to prospective students that different weighting scales would be allotted to each of the selection criteria to be used for calculating scores. Final selection for placement would be based on the matriculation or NSC results, and the ranking scale according to Table 2.11 would be used.

TABLE 2.11: DUT ASSESSMENT AND RELEVANT WEIGHTING SCALES FOR SELECTION PROCESS

ASSESSMENT	WEIGHTING
Results of the Senior Certificate or National Senior Certificate	30%
Written essay	20%
8 hour hospital visit	5%
School/work characteristic questionnaire	10%
Department Interview	35%
TOTAL	100%

(DUT 2013:Online)

The inclusion of a General Scholastic Aptitude Test (GSAT) and a Self-Directed Search Questionnaire (SDS) by the CUT as part of the selection process appeared to be unique amongst the institutions offering a Radiography programme. The prospective student at CUT was also expected to undertake an English Proficiency Test, under the auspices of professional psychologists at the CUT. It was observed by the researcher that the other institutions offering Radiography education, as noted in Table 2.10 and Table 10.11, who requested that prospective students write an essay as part of the selection process, would use the essay as a form of assessment of the prospective students' abilities to express themselves in English as language of learning and teaching.

2.7 A TREND TOWARDS DEVELOPING RESEARCH SKILLS

Due to the fact that the new four-year curriculum for the Bachelor's degree in Radiography, introduced at the CUT in January 2014, includes a module on research principles, it is worth considering the situation in Radiography education at the time when this study was conducted between the years 2010-2012. At that time, students who had completed their National Diploma in Radiography, were placed in provincial hospitals and proceeded to undertake a year of community service. Thereafter, graduates could apply for admission at the CUT to study towards their B. Tech. degree in Diagnostic Radiography, Nuclear Medicine or Radiotherapy (cf. 1.2). During the two-year B. Tech. programme, students were taught research principles, basic statistical principles and were expected to complete a research project. In addition, the students were expected to

deliver a presentation of their research project to an evaluation committee, and were encouraged to write an article for publication in a peer-accredited journal. There have been many students in the past who, on achieving their National Diploma in Radiography, completed their year of community service, and then moved directly into the workplace. Through their own choice, these graduates did not enrol in a B. Tech. degree, as they did not wish to further their studies. As stated above, in the future all prospective degree-level Radiography students will need to take the research modules in order to complete the four-year degree, according to the CUT Radiography programme requirements.

The vertical articulation envisaged for the professional Bachelor's degree in Radiography is a Master's degree in Radiography, NQF level 9 and above (SAQA 2013:Online). This articulation would mean that a graduate with a professional Bachelor's degree in Radiography, in any of the abovementioned specialities, could progress to a Master's degree. This new articulation also highlights the fact that degree-level students will be expected to achieve a certain level of competence in basic research skills by the time they reach their fourth year of study. The challenge for educators is to facilitate the process whereby the degree-level student could learn to undertake basic research, could attempt article and academic writing, and could read and comprehend scientific documents successfully, in the English language. Quite apart from developing higher-level cognitive thinking necessary for research, many students are also faced with the challenge that English is their second language.

The trend towards developing undergraduate research skills in professional practice is highlighted by a study undertaken in the United Kingdom (UK) by Higgins, Hogg and Robinson (2013:62) who stress that developing professional practice has 'as a defining feature' the access to specialised knowledge. Applied knowledge in professional practice needs to be combined with theoretical knowledge, forming a research-teaching nexus, according to the above authors. Research informed teaching (RiT) is an approach where undergraduate students can be exposed to basic research, the aim being to teach students the value of systematic enquiry.

When considering all of the above factors surrounding current student selection criteria, and the transition to a degree-level qualification in Radiography, with the requirement to expose students to research skills, questions may be posed which have implications for both educators and future students. One of the questions posed in this study is to

ascertain what, if any, are the further requirements or tools necessary to establish valid and reliable student selection criteria for degree-level Radiography education.

2.8 INTERNATIONAL PERSPECTIVES: SELECTION FOR RADIOGRAPHY EDUCATION

An international perspective of student selection for Radiography education was gained by considering selection criteria at City University London in the United Kingdom (UK) (CUL 2013a:Online). The minimum requirements included Mathematics, Physics, and proficiency in English. Additionally, prospective students were expected to have academic and character references, occupational health clearance, and also to have disclosed any criminal record, termed "enhanced disclosure and barring service clearance". It was made clear to prospective candidates that having a criminal record would not necessarily bar them from studying, but that an objective evaluation would be undertaken by the university (CUL 2013a:Online). It was also made clear to prospective students that certain categories of criminal conviction would bar them from entry into the programme.

Furthermore, prospective students were expected to visit a diagnostic imaging department, and feedback would be provided by a radiographer at the clinical practice, regarding the perceived suitability for the career by the prospective student. Applicants who did not fulfil all academic subject requirements may be expected to undertake aptitude tests and were expected to show an insight into and a commitment to a career in diagnostic Radiography (CUL 2013a:Online).

Benbassat and Baomal (2007:510) (cf. 2.3) make the suggestion that the applicants' non-cognitive traits should rather be used to encourage applicants to make rational, informed decisions about whether or not they should apply to medical school in the first place. By the same premise, City University London in their programme specification (CUL 2013b:Online) clearly indicate to prospective students the skills and interests they would need to become a successful diagnostic radiographer, so that the prospective student could make an informed decision about their future career in an imaging department themselves.

Amongst other attributes, the above university (CUL 2013b:Online) stressed that: (1) Radiographers should be good at dealing with people and have the ability to reassure ill or agitated patients; (2) Radiographers should have an interest in scientific subjects and

(3) should show confidence in using very costly technological equipment. Furthermore, they should (4) be able to be adaptable and (5) be able to make quick decisions in clinical situations using critical thinking.

As another international comparison, the website of the Queensland University of Technology in Australia was considered. This university offered a Bachelor's degree in Medical Imaging and as entry requirements expected an "assumed knowledge" of Physics, English and Mathematics rated at level 4, classed as a "sound achievement" (QUT 2013:Online). Additional entry requirements were not expected of students.

2.9 ADDITIONAL MODULES FOR ENTRY-LEVEL STUDENTS

As described in Chapter 2 (cf. 2.4.1), the CUT expected all registered entry-level students to complete an English Language Proficiency module, see Table 2.12. To ensure that entry-level students were able to use electronic resources and computer facilities available, computer-literacy modules were offered at most universities, including the CUT. The reason for this strategy was that not all students had access to electronic resources at secondary school level, and they needed an introduction to electronic and library resources at tertiary institutions, in order to maximise their chances for academic success.

At the TUT, entry-level students were also enrolled in a compulsory first-aid programme, indicated in Table 2.12. At the CUT, the first-year students also undertook a first-aid course, although it was not stated on the website. The above highlighted the fact that from the point of view of the prospective student, and this research study, the websites of the institutions offering Radiography education did not always contain all the information relevant to their particular Radiography programmes. In view of this, the information gained from this document analysis was accepted at face value, as stated on each institution's website at the time of the study. In the context of this research study, an overview of each institution's admission and selection requirements has been achieved, notwithstanding errors and omissions beyond the control of the researcher. The prospective student at the time of the study, between the years 2010-2012, would have been able to undertake a similar overview of the institutional websites, and would have made admission applications to the institutions offering Radiography education accordingly.

TABLE 2.12: COMPULSORY ADDITIONAL MODULES AND PROGRAMMES, ACCORDING TO WEBSITE OF EACH INSTITUTION

INSTITUTION	COMPULSORY ADDITIONAL MODULES AND PROGRAMMES
CPUT	Not stated
CUT	English Language Proficiency module
DUT	Not stated
NMMU	No
TUT	A compulsory first-aid programme and a compulsory computer programme are offered at the University in the first year of study.
UJ	Not stated
UL	Not stated
UP	Not stated

(Compiled by the researcher, Kridiotis 2013: cf. 2.4.1)

2.10 EXTENDED PROGRAMMES IN RADIOGRAPHY IN SOUTH AFRICA

At the time of this study, the CUT offered an opportunity to a small number of students per year to enrol for the ECP in Radiography. This programme was available to students who met minimum subject requirements, but who did not fulfil all the other selection requirements. Table 2.13 is also an indication that the CUT as institution was unique in offering students who are deemed by selectors to show potential, but who lack academic preparedness, to enrol in the ECP bridging course. Upon successful completion of the one-year course, an opportunity was given to the ECP students to enrol for entry-level Radiography education.

TABLE 2.13: EXTENDED PROGRAMMES IN RADIOGRAPHY, PER INSTITUTION

INSTITUTION	EXTENDED PROGRAMMES
CPUT	No
CUT	Applicants with a score above 20 who meet minimum subject requirements may undergo further selection tests for the Extended Curriculum programme in Radiography
DUT	No
NMMU	No
TUT	No
UJ	No
UL	No
UP	No

(Compiled by the researcher, Kridiotis 2013: cf. 2.4.1)

The ECP students follow the same curriculum as the National Diploma in Radiography programme students, and this study will also consider the academic achievement levels of the ECP students in the Radiography programme.

2.11 CONCLUSION

Chapter 2 provided a perspective and overview of admission and selection criteria for Radiography students. The literature perspective researched the required graduate attributes, national and international perspectives on student selections and accessed articles highlighting various admission and selection criteria.

The document analysis which followed, which forms part of research question 1, compared selection criteria at different institutions of higher education in South Africa which offer Radiography education, with the intention to benchmark best practices in prospective student profiling and selection criteria, specifically in the domain of Radiography education.

An endeavour has been made by the researcher to contextualise selection of students within health sciences disciplines and whilst being informed of international trends, an attempt has also been made to understand the local South African teaching and learning environment.

The next chapter, Chapter 3, entitled ***Research Design and Methodology***, will deal with the design of the research, and the method used to accomplish the research will be described in detail.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

The aim of this study was to assess the relationship between the current selection criteria for Radiography students and the academic results after the students' first academic year of study.

The literature perspectives and document analysis in Chapter 2 were used to gain information from international and national sources regarding prospective student profiling for Radiography education. A further aim was to determine, retrospectively, whether current selection criteria had been valid and reliable performance predictors for entry-level students in Radiography education at the CUT over a period of three years.

3.2 BACKGROUND

The fact that education in Radiography is undergoing a transition from a diploma-level to a degree-level means that there will be higher academic expectations from registered students, and thus this research was initiated with the aim of a better understanding of the validity and reliability of current selection and admissions tests for diploma-level students, in order to facilitate the selection of degree-level Radiography students.

3.3 STUDY DESIGN

The first step in the research design was to investigate existing practices of prospective student profiling and selection. In Chapter 2, the literature study and perspectives had the specific aim of contextualising undergraduate teaching and learning in the health sciences and highlighted the relevance of prospective student profiling. Additionally, the review of literature perspectives and analysis of related documents helped to broaden the knowledge of the researcher about the topic under investigation.

3.3.1 Literature review and analysis of documents

The analysis of documents which formed part of the literature study in Chapter 2

considered student application documents from the various institutions of higher education offering Radiography education in South Africa, where similarities and differences were noted. The aim was to gain a background perspective for the analysis of the admission criteria and selection tests of the CUT, in particular. As stated by De Vos, Strydom, Fouché and Delport (2011:133) the literature review is not ever completed at any time during the research process, as relevant information can emerge as the research process progresses. This fact was relevant to the analysis of documents described above, as many of the institutions of higher education changed the content of their websites and student application information from the initial phase of the research until the final phase of the research study.

3.3.2 Quantitative retrospective cohort study

A quantitative data analysis using a retrospective cohort study formed the subsequent part of the research study. The aim of the research was to retrospectively compare the various selection criteria with the academic achievement in the first year of study in the Radiography programme at the CUT, over three years of student intake, namely 2010, 2011 and 2012. The study was defined as a cohort study, where cohort refers to a specific group which is studied over time.

In order to establish that the research was appropriate, an approach by Jack, Hayes, Scharalda, Stetson, Jones-Jack, Valliere, Kirchain and LeBlanc (2010:163) was used in order to critically appraise the strengths and weaknesses of the research undertaken, the considerations being as follows:

- (1) The quantitative approach was chosen in order to compare relationships and answer questions about the various data sets available. The relevant data were obtained from records of the Radiography students at the CUT, with permission from the relevant authorities. In order to establish that the study design was appropriately applied, consideration was given as to whether the data were available, measurable and whether the data would provide answers to the research questions. In this case, it was considered that the quantitative study design would provide the required outcomes;
- (2) The study sample consisted of the entire group of students in each of the entry-level student groups, and therefore the consideration that the study sample used must be

representative of the whole group, according to Jack *et al.* (2010:163) was found to be true (cf. 3.3.3);

- (3) Consideration should be given to the validity of the measurements and outcomes used during the research study (cf. 3.7);
- (4) Consideration should be given to the completeness of the data sets. In the case of this research study, data sets of marks, NSC and other academic marks, were complete except in cases where students dropped out of the course. Missing data occurred in the case of some of the selection tests, but only in cases where students did not write the selection tests;
- (5) Consideration should be given to the extent to which the study results were influenced by factors which negatively affect their credibility. A reference is made to both confounding factors and contamination in Jack *et al.* (2010:164), which may affect study results. Due to the fact that the present study was retrospective, contamination was not considered to be an influence, but in this study there was a conscious attempt to avoid confounding factors, in this case demonstrating an apparent association between study variables where no real association between them exists. This will be further considered in the discussion of the validity and reliability of the study (cf. 3.7).

3.3.3 Study population

According to De Vos *et al.* (2011:110) a research study is usually undertaken "in order to generalise to a larger population rather than to make statements about samples" and that a statement regarding the population is required. Population, as defined by De Vos *et al.* (2011:223) refers to individuals who have certain characteristics. The target population for this study was the entry-level, or first-year group of students in Radiography education at the CUT.

The cohort in this study consisted of the "2010, 2011 and 2012 first-year Radiography students". The study population was divided into the entry-level, or first-year, of each of the above years, 2010, 2011 and 2012. Biographical data of each student in each year group were gathered to categorise the students, to further enhance the validity of the study, and assist in the analysis of the data.

The study population consisted of 130 students, divided into three groups, namely the entry-level students 2010 (39), entry-level students 2011 (42) and entry-level students 2012 (49), as represented in Figure 3.1.

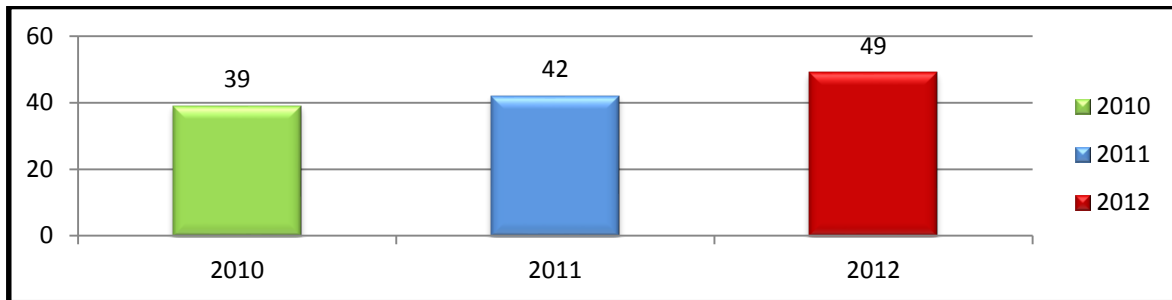


FIGURE 3.1: DISTRIBUTION OF STUDY GROUP ACCORDING TO NUMBER OF STUDENTS PER YEAR GROUP 2010, 2011, AND 2012

The age of the students in the study population, divided into the three year groups, showed that the ages of the students ranged between 17 years of age and 31 years of age. The majority of students were aged 19 years in each of the year groups.

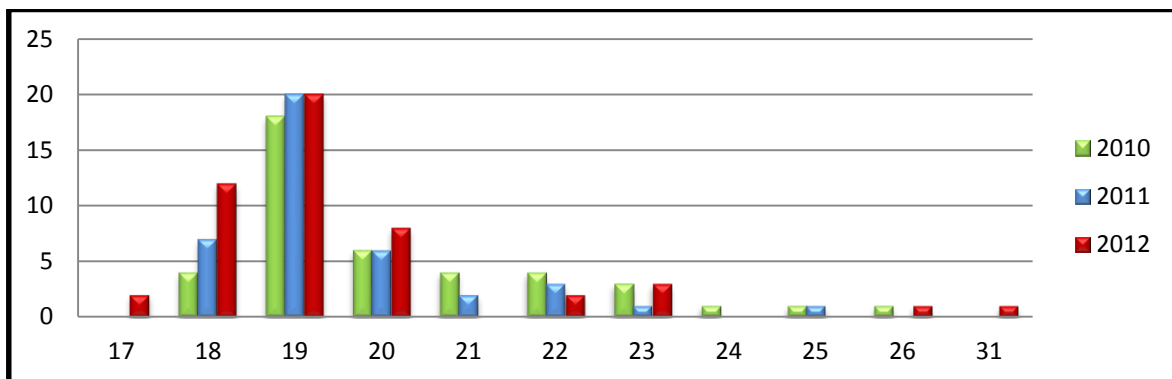


FIGURE 3.2: DISTRIBUTION OF STUDY GROUP ACCORDING TO AGE PER YEAR GROUP 2010, 2011, AND 2012

The distribution of the study group according to gender is shown in Figure 3.3, where it is seen that the number of male students increased in the years from 2010 until 2012.

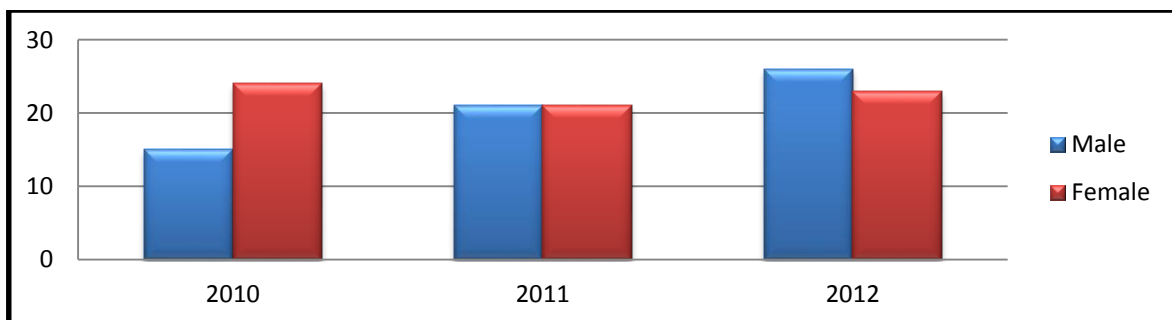


FIGURE 3.3: DISTRIBUTION OF STUDY GROUP ACCORDING TO GENDER PER YEAR GROUP 2010, 2011, AND 2012

3.3.4 Description of the sample

The description of the sample is as follows: the first-year group of students who were enrolled for the National Diploma in Radiography programme and the first-year group of students enrolled in the ECP in Radiography at the CUT, Bloemfontein, Free State during 2010, 2011 and 2012. According to Jack *et al.* (2010:163), a study sample must be representative of the group from which it is drawn. In the case of this study it was feasible to use the data for the entire group of students. The sample size (n=130) consisted of all first-year students of the academic years 2010, 2011 and 2012.

3.3.5 Measurements

The set of data for the study was obtained after gaining permission from the Dean of the Faculty of Health and Environmental Sciences and the Acting Registrar (Academic) of the Central University of Technology. The following resources provided the data:

- Student records at the Department of Clinical Sciences, CUT 2010-2012;
- Selection tests, CUT 2010-2012;
- Selection test results, the CUT Department of Clinical Sciences, CUT 2010-2012;
- First-year Radiography student final end-of-year marks, Examination Department, CUT 2010-2012.

Each set of data used in the research study was comprised of certain relevant aspects of the study and each set was collected by the researcher, and by making use of a quantitative data collection sheet, a complete set of data for each student was compiled. An example of the quantitative data collection sheet used can be found in Appendix A.

The data collection sheet contained the following variables for each student, and the aim of the statistical analysis which followed was to detect associations between these variables:

- **Demographic information** (age, gender, ethnic race group);
- **General school-leaving information** (province where school-leaving examination was written);
- **Grade 12 school results** (Type of Grade 12 examination: SC, NSC or other, individual marks for each core subject, indication of language level: home language,

first additional language, second additional language or third additional language level and language marks);

- **Prior tertiary education information** (whether or not tertiary education had previously been done by the student, whether an uncompleted or completed diploma or higher certificate had been undertaken, whether an uncompleted or completed degree had been undertaken);
- **Marks used for selection process** (APS according to matriculation results, English Language mark, Mathematics mark, Physical Sciences mark, Life Sciences mark);
- **Other selection criteria** (GSAT score, SDS Questionnaire score, English Proficiency Test score, and total CUT Rating Score);
- **First-year academic results** (for all compulsory entry-level Radiography modules).

3.3.6 Pilot study

The study was piloted by examining the data collected for twenty students enrolled in 2010. The biographical data, prior tertiary education records, SC or NSC marks and APS according to matriculation results had been gathered and recorded for the pilot group. When the selection test data set was examined, it was clear that not all students had undertaken selection tests, and note was taken of this fact. When the student academic data were examined, all the final year-end marks from the student examination records were available from the examination department, for each of the students who had written their year-end examinations. The above data collected for the twenty students were also used in the final analysis.

3.4 STATISTICAL DATA ANALYSIS

The researcher recorded all of the data sets for each student on a data collection sheet, and the data collection sheets were numbered for the purpose of maintaining confidentiality. The data collected from the data collection sheets of 130 students were entered into an Excel computer programme by the Data Services of the University of the Free State.

A statistical analysis was done by a statistician from the Department of Biostatistics at the University of the Free State. The main aim of the statistical analysis was to use the data collected retrospectively to undertake an analysis of the student selection criteria used at the CUT and to assess the correlation between the above student selection criteria with

the academic marks of the students at the end of their first year of study. The further aim of the statistical analysis was to determine if there was any correlation between specific core NSC subjects and student academic success at entry-level in the Radiography programme.

The above statistical information was used by the researcher, assisted by a statistician, to identify trends between the student selection criteria and actual academic marks. All student data were used anonymously and students were not penalised in any way based on the results of the study. A comparative analysis of the quantitative phase of the study provided a benchmark from which to determine whether the selection criteria used as performance predictors were in fact accurately linked to academic success in the achievements of the 2010, 2011 and 2012 entry-level Radiography students at CUT.

Due to the fact that a retrospective approach to the study was used, the study relied on the availability of adequate records. The study group all had NSC or equivalent school-leaving marks available according to a matriculation certificate and except for students who dropped out of the course, the first-year academic marks were available for all students. A group of students had gained entry into the programme without undergoing the selection tests, and this fact was taken into consideration when the statistical calculations were done.

A descriptive analysis of the demographic information, according to age, gender and ethnic race group was included in order to inform the researcher regarding the student group profile. A statistical analysis of the student group included the measurement of the distribution of students who had enrolled for the National Diploma in Radiography and those students who were enrolled in the ECP for Radiography. A further analysis was undertaken measuring the percentage of enrolled students with prior tertiary education, including identification of students with prior tertiary education in any of the health sciences, in an attempt to determine whether these students had an equivalent or greater chance of successful completion of their entry-level Radiography education.

The statistical analysis used when measuring SC or NSC marks included using a procedure to calculate median, mean and standard deviation. In this study, the analysis of the correlation between variables was of key importance to understand and determine whether or not there was any correlation between the student selection criteria and tests and the student's academic success at the end of their first year of study. According to

Burdess (2010:53) "a correlation or association occurs when your knowledge of the values of one variable allows you to predict more accurately the values of a second variable". The correlation procedure used was the Pearson Correlation Coefficient and other procedures used included the *t*-test procedure and establishment of the equality of variances. The statistical analysis will be described in Chapter 4.

3.5 SCOPE OF THE STUDY

This study was done in the field of health sciences education and includes the domain of selection and academic preparedness of first-year students in the Radiography programme at the CUT.

3.6 IMPLEMENTATION OF THE FINDINGS OF THE STUDY

The assessment and evaluation of current student selection criteria as academic performance predictors, particularly in view of the transition to degree-level Radiography education at the CUT may benefit the profession of Radiography in South Africa as a whole. By comparing selection criteria at all institutions of higher education which offer Radiography education in South Africa, the identification of best practice student selection criteria may offer value to future student selection processes. The recommendations of this study can be made public to other educationalists in Radiography education through paper presentations at Radiography conferences and seminars and by the publishing of articles in applicable journals.

3.7 RELIABILITY AND VALIDITY

3.7.1 Reliability

Benbassat and Baumal (2007:511) indicate that written examinations and aptitude tests, which they class as cognitive measurements, are found to be reliable, and if there are multiple test items are highly reliable. The marks and scores used in this research study were carefully recorded, and the exact steps of the research process were documented to try to ensure reliability of the results. Due to the retrospective nature of the study, reliability in terms of the reproducibility of the results obtained when a measurement is repeated on the same study sample as described by the above authors, was not possible.

The reliability of the variables used in this research study was confounded by the fact that the APS as an admission criterion was calculated using achievement level scores for SC or NSC subjects, rather than calculated using actual subject percentage scores. A further factor influencing the reliability of school-leaving examinations as admissions criteria is the fact that the academic level of difficulty of the examinations may differ from year to year.

3.7.2 Validity

The value or significance of the current research must be questioned in terms of both internal and external validity. Validity, according to Roberts, Priest and Traynor (2006:Online), relates to "how closely aligned what we believe we are measuring is to what we intend to measure". The internal validity would address reasons for the outcomes of the study, and would analyse all the relevant factors and their relationships to one another. In this study the internal validity would relate to alignment or non-alignment of the CUT admission criteria and selection test scores as academic performance indicators amongst the student group. Another way to describe internal validity, according to Murphy and Yelder (2010:Online) would be to assess whether findings are congruent with reality. In this research study, the APS, GSAT scores, English Proficiency Test scores and SDS Questionnaire scores were assessed to determine their validity as predictors for academic success amongst entry-level students in Radiography education at the CUT.

Jolly (2001:920) describes external validity is the "generalisability" of the results of the educational research. The South African context of this research study may mean that the external validity of this study would be measured in the extent to which the study's findings could be generalised and be applicable to other student populations, as described by authors De Vos *et al.* (2011:153). The findings of the current research study may be relevant to other institutions of higher education offering Radiography education.

De Vos *et al.* (2011:173) stress that to categorise validity of measurement, one could consider "content, face, criterion and construct validity". "Content validity", according to the above authors, refers to the "sampling adequacy of the content of an instrument". Jack *et al.* (2010:164) state that researchers should ensure that a measurement captures what it claims to measure, and this is reiterated by De Vos *et al.* (2011:173), who define "face validity" as being concerned with a measurement technique or procedure and

whether it appears to measure what it claims to measure. In the case of this research study, each of the selection criteria were assessed to determine their content validity.

“Criterion-related validity”, as described by Jack *et al.* (2010:164), is relevant to this research study, as criterion-related validity involves making sure the measures within a survey *or analysis* (own italics) when tested prove(s) to be effective in predicting criterion or indicators of a construct. In this research study, one of the objectives was to assess selection criteria as actual performance predictors for academic success in entry-level Radiography education.

According to De Vos *et al.* (2011:174), the final category of validity, named as “construct validity” involved determining “the degree to which an instrument successfully measures a theoretical construct”. Authors Benbassat and Baumal (2007:511) also describe the validity of admission criteria as the degree to which they can predict a potential student’s academic performance. The validity of admission criteria, in the above sense, is precisely what the current research study sought to investigate.

3.7.3 Minimising of potential misinterpretation of results

Due to the quantitative nature of the study, the minimisation of possible misinterpretation of data is essential. The assistance of a statistician ensured that data were accurately and correctly analysed. A common source of bias, known as “blindness” is not applicable to this study, because only data were used and interaction with students is not part of the study. Limitations to the study will be discussed further in Chapter 6.

3.8 ETHICAL CONSIDERATIONS

3.8.1 Confidentiality

The students were identified only by their student numbers; the use of student numbers was necessary to obtain the different sets of data in the most accurate manner. Student numbers were also essential to be able to link the sets of data to the other sets. Each student number was allocated a numbered code by the researcher for further statistical analysis. No student was identified at any time, and full confidentiality was maintained. The student numbers do not appear in any reports or publications.

3.8.2 Written consent to conduct the study from institutional authorities

Written consent was requested in order to conduct the research study at the CUT. Permission was granted, and written consent was obtained from the Dean of the Faculty of Health and Environmental Sciences at the CUT (Appendix B), to conduct the study using data related to the Radiography students. Further approval was obtained from the Acting Registrar (Academic) at CUT (Appendix B), for the researcher to gain access to Radiography student examination results and other statistics related to entry-level Radiography students. All data were accessed retrospectively and thus no student was affected by the results of the research. Due to the nature of the study, it was not necessary to obtain written consent from the students, and no student was identifiable at any time during the research. All accessed information remained confidential, and all results were reported on anonymously, without any reference to student name or number.

3.8.3 Approval from the Ethics Committee of the UFS

According to the regulations, approval was sought from the Ethics Committee of the UFS for permission to undertake this research study. The Ethics Committee of the UFS duly gave their approval for the research project to take place, and the ethical approval number which was allocated to this research project was ECUFS NR 36/2013. (For the official approval letter, see Appendix B).

3.9 THE VALUE AND SIGNIFICANCE OF THE STUDY

The focus of this study is to ascertain the validity and reliability of current selection criteria at the CUT and to benchmark best practice student selection criteria for Radiography education, specifically for the purpose of gaining information relevant to degree-level Radiography education.

There are financial implications for both the institution of higher education and for students themselves, if students do not successfully complete their studies. There are also financial implications if a student repeats modules in any year of study, particularly in the Radiography programme, due to the fact that there is a clinical, work integrated learning (WIL) component in the programme, and the student cannot progress to the next academic year of study before all modules of the previous year are successfully

achieved. There are also implications if the student relies on bursary funding, and does not achieve academic success.

To offer selected students the best possible chance to complete their studies in a reasonable timeframe, and subsequently seek employment, it is important to critically analyse the challenges faced by educators and to document the progress of the 2010, 2011 and 2012 diploma-level Radiography students. It is hoped that all prospective students seeking to gain admission to the professional Bachelor's degree in Radiography programme will benefit from the research findings.

By retrospectively analysing data obtained from first-year students in the National Diploma in Radiography programme at CUT during 2010, 2011 and 2012, it is hoped that recommendations for admission and selection of students for degree-level Radiography education can be facilitated.

A further value of this research is that the results and recommendations of this study may benefit other programmes in the health professions at the CUT, which will also undergo a transition from a diploma-level to a degree-level course in the near future. Examples of such programmes include Biomedical Technology, Clinical Technology and Emergency Medical Care. The new curricula in these programmes will also include new exit-level outcomes in the form of a research skills component, and the findings of this study may indicate best practices for future admissions criteria and selection processes in the abovementioned programmes as well.

3.10 CONCLUSION

In this chapter, the research methodology was discussed in detail. The study group was described; and the data gathering, as well as the aspects of data collection and statistical analysis thereof was addressed. Both the reliability and validity of the research conducted in this study were considered, and ethical considerations were discussed. The value and significance of the study concluded this chapter.

The next chapter, Chapter 4 which is entitled ***Results, data analysis and discussion of findings***, will deal with the detailed analysis of the data and the findings of the study.

CHAPTER 4

RESULTS, DATA ANALYSIS AND DISCUSSION OF FINDINGS

4.1 INTRODUCTION

The aim of this study was to assess the correlation between the current selection criteria for Radiography students and the academic results which the students attained at the end of their first academic year of study. In addition, the study aimed to assess whether other criteria, such as English language proficiency or any prior tertiary education which the student had undertaken, played any role in predicting the academic performance of the students during their first year of study. Chapter 4 will provide the results of the study, data analysis and a discussion of the findings of the study.

The data used in this study were gathered by the researcher from the records of each entry-level student (n=130) in the Radiography programme during 2010-2012 and were recorded on a single data collection sheet for each student. The biographical data collected for each student included: age, gender, ethnic race group and year of entry into either the mainstream National Diploma in Radiography or the Extended Curriculum Programme (ECP) in Radiography. Secondly, the prior tertiary education (if any) of each student was recorded, and prior tertiary education in any of the health sciences was recorded. The matriculation Senior Certificate (SC) or National Senior Certificate (NSC) results of each student according to their student records served to provide information regarding the students' subjects, the percentages achieved in each subject and the achievement level awarded to the student for each subject. From these records, it could also be ascertained whether the student matriculated in the year 2007 or prior, or in the year 2008 or after. Through scrutiny of each student's SC or NSC records, the admission point score (APS) according to matriculation results could be verified.

The CUT selection tests (which were undertaken by certain students in the study group) were also recorded on the data collection sheets by the researcher. It was noted whether or not the student had in fact undertaken the selection tests, as applicable in cases where students were admitted to the course according to their matriculation marks. From the group of students who had undertaken the CUT selection tests scores, it was noted that the following selection scores were taken into account to calculate a total CUT Rating Score: the APS according to matriculation results, a calculation of the APS with bonus

points (if any) added, a General Scholastic Aptitude Test (GSAT) score, an English Proficiency Test score and a Self-Directed Search (SDS) Questionnaire score. All the above-mentioned scores were recorded on the data collection sheet, including a total CUT Rating Score. Finally, the academic results in each entry-level Radiography module, of each first-year student in the study group, were entered on the data collection sheet. Included in this information was also whether the student had progressed successfully to the second-year of study or whether the student had been unsuccessful and had to repeat the first academic year (cf. Appendix A).

The data collected during this study were verified and validated by a statistician at the Department of Biostatistics, at the University of the Free State. During this process of editing, errors, missing data and item non-response, as described by authors Diamantopoulos and Schegelmilch (2000:41) were noted, identified and corrected where necessary. During the verification process, it was noted that a group of students (n=79) had undertaken all selection tests, and that the remainder of the students (n= 51) within the study group did not have selection test results available. A number of students had been admitted to Radiography education on the strength of their matriculation and NSC results, including those admitted as "walk-ins" as described in Chapter 1 (cf. 1.1).

As the aim of the study was to assess the current student selection criteria as performance predictors for academic success in entry-level education at the CUT, a number of statistical calculations were performed on the variables. In order to assess the selection criteria as objectively as possible, each of the selection or admission criteria as variables were statistically analysed both alone and in combination, with tests for probability and significance being undertaken (cf. 3.4).

4.2 DESCRIPTIVE ANALYSIS OF DEMOGRAPHIC INFORMATION

The statistical analysis and distribution of the demographic information of the study population was as follows:

4.2.1 Frequency of student numbers per year group

The student numbers per year group increased each year in line with the policy of expanding access to education and training (cf. 1.3), as indicated in Table 4.1.

TABLE 4.1: STUDENT NUMBERS PER YEAR GROUP

YEAR	FREQUENCY	PERCENTAGE
2010	39	30.00
2011	42	32.31
2012	49	37.69

4.2.2 Age distribution of study population

As seen in Table 4.2, the majority of entry-level students (44.62%) in the study population were aged 19 years old and the next largest group of students (16.92%) were aged 18 years old. The group of students aged 20 years old (15.38%) included students who had joined the programme after successfully completing one year of study in the ECP bridging course. Only 2 students (1.54%) were aged 17 years at the assumption of their first year of study. The majority of entry-level students had thus entered the Radiography programme within a year or two following matriculation and completion of their NSC. As seen in Table 4.2, the numbers of students entering the programme who were aged 21 years or older, were significantly fewer than those of younger age groups.

TABLE 4.2: TOTAL AGE DISTRIBUTION OF STUDY POPULATION

AGE IN YEARS	FREQUENCY	PERCENTAGE	CUMULATIVE FREQUENCY	CUMULATIVE PERCENTAGE
17 years	2	1.54	2	1.54
18 years	22	16.92	24	18.46
19 years	58	44.62	82	63.08
20 years	20	15.38	102	78.46
21 years	6	4.62	108	83.08
22 years	9	6.92	117	90.00
23 years	7	5.38	124	95.38
24 years	1	0.77	125	96.15
25 years	2	1.54	127	97.69
26 years	2	1.54	129	99.23
31 years	1	0.77	130	100.00

In Table 4.3, the age distribution of the study population per year group can be seen. In each of the years of the study, 2010, 2011 and 2012, the majority of students were aged 19 years old and the cumulative percentage of students aged 20 years or younger was 78.46% of the total number of students in the study group.

TABLE 4.3: AGE DISTRIBUTION OF STUDY POPULATION PER YEAR GROUP

YEAR	AGE											TOTAL
	17	18	19	20	21	22	23	24	25	26	31	
2010	0 0.00	6 15.38	20 51.28	6 15.38	2 5.13	3 7.69	1 2.56	0 0.00	1 2.56	0 0.00	0 0.00	39
2011	0 0.00	4 9.52	18 42.86	6 14.29	4 9.52	4 9.52	3 7.14	1 2.38	1 2.38	1 2.38	0 0.00	42
2012	2 4.08	12 24.49	20 40.82	8 16.33	0 0.00	2 4.08	3 6.12	0 0.00	0 0.00	1 2.04	1 2.04	49
TOTAL	2	22	58	20	6	9	7	1	2	2	1	130

4.2.3 Gender distribution within the study group

The gender distribution of the study population is shown in Table 4.4, with the total number of males (n=62 or 47.69%) and the total number of females (n=68 or 52.31%).

TABLE 4.4: GENDER DISTRIBUTION OF STUDY POPULATION

GENDER	FREQUENCY	PERCENTAGE
MALE	62	47.69
FEMALE	68	52.31

Although there were slightly more females enrolled in the Radiography programme within the study population, the number of males enrolled increased steadily over the years, 15 males (38.46%) enrolled in 2010, 21 males (50.00%) enrolled in 2011 and 26 males (53.06%) enrolled in 2012. The number of females enrolled decreased from 24 females (61.54%) in 2010, to 21 females (50.00%) in 2011 and 23 females (46.94%) enrolled in 2012. This is indicated in Table 4.5 (cf. Figure 3.3).

TABLE 4.5: GENDER DISTRIBUTION OF STUDY POPULATION, PER YEAR GROUP

YEAR		GENDER		TOTAL
		MALE	FEMALE	
2010	Frequency	15	24	39
	Percentage	38.46	61.54	
2011	Frequency	21	21	42
	Percentage	50.00	50.00	
2012	Frequency	26	23	49
	Percentage	53.06	46.94	
TOTAL		62	68	130

4.2.4 Ethnic race group distribution within the study population

In Table 4.6, the distribution of students within the student group according to ethnic race group as classification showed that the majority of students (79.23%) were black African, followed by (17.69%) white students and (3.08%) coloured students.

TABLE 4.6: DISTRIBUTION OF STUDENTS ACCORDING TO ETHNIC RACE GROUP

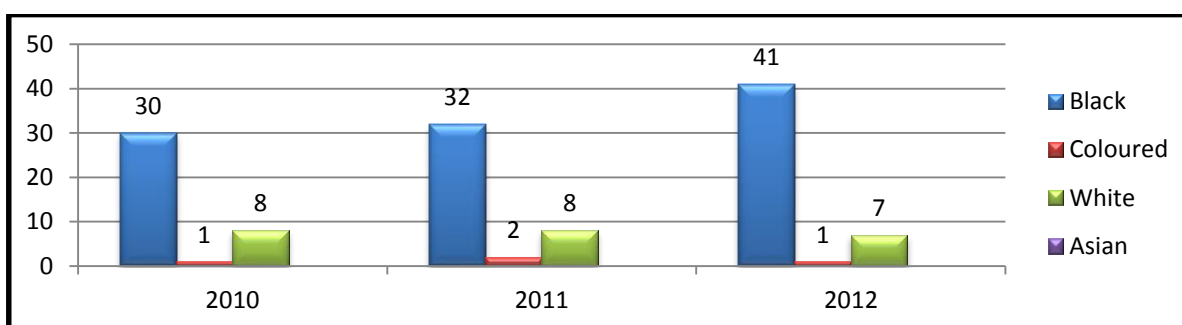
ETHNIC RACE GROUP	FREQUENCY	PERCENTAGE
Black African	103	79.23
Coloured	4	3.08
White	23	17.69

Table 4.7 shows the distribution of students according to their ethnic race group for each year, 2010, 2011 and 2012. The analysis of the data shows that the increase in the total number of students was due to an increase in the number of black African students admitted to the programme, the numbers of students from other ethnic race groups did not increase over the years 2010-2012.

TABLE 4.7: DISTRIBUTION ACCORDING TO ETHNIC GROUP, PER YEAR GROUP

YEAR		ETHNIC RACE GROUP			TOTAL
		BLACK	COLOURED	WHITE	
2010	Frequency	30	1	8	39
	Percentage	76.92	2.56	20.51	
2011	Frequency	32	2	8	42
	Percentage	76.19	4.76	19.05	
2012	Frequency	41	1	7	49
	Percentage	83.67	2.04	14.29	
TOTAL		103	4	23	130

The distribution of students which form the study group, according to ethnic race group, is graphically illustrated in Figure 4.1, which shows an increase in the number of black African students, and small variations in the number of coloured and white students.

**FIGURE 4.1: DISTRIBUTION OF STUDY GROUP ACCORDING TO ETHNIC RACE, PER YEAR GROUP 2010, 2011, AND 2012**

The student distribution within the study group, when analysed according to both gender and ethnic race group is graphically illustrated in Figure 4.2. There were no students with Asian ethnicity in any of the three year groups, and therefore Figure 4.2 which follows does not include any reference to the Asian ethnic race group.

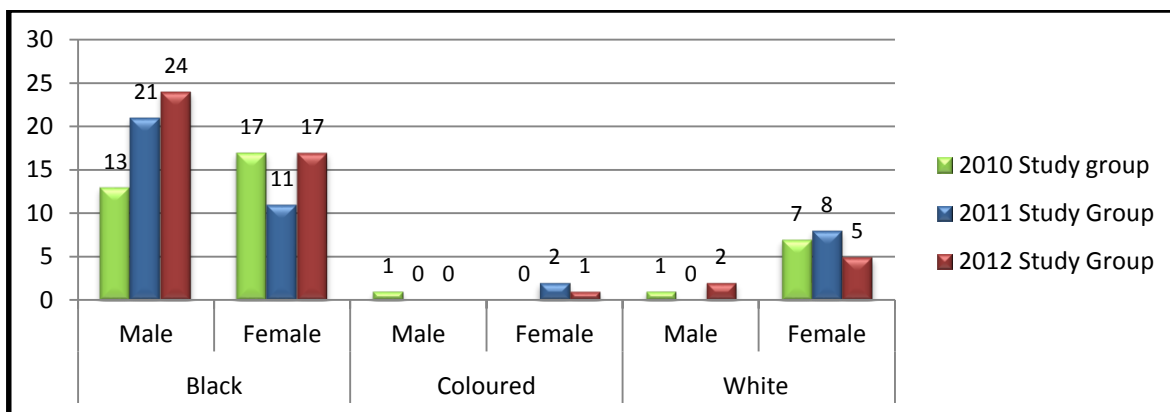


FIGURE 4.2: DISTRIBUTION OF STUDY GROUP ACCORDING TO ETHNIC RACE AND GENDER, YEAR GROUP 2010, 2011, AND 2012

4.3 ANALYSIS RELATED TO TERTIARY EDUCATION

In order to establish which students had previously been enrolled in the Radiography programme, and to differentiate between students enrolled in the National Diploma in Radiography and those students enrolled in the ECP in Radiography, data were collected regarding year of entry into the programme.

4.3.1 Year of entry into the National Diploma in Radiography

The small percentage of students (0.91%) entered the programme in 2009 or prior to the year 2009 (1.82%). These students were thus repeating their first year of study in one or more subjects. These students (n=3) were in fact historically in their second academic year, as they were attempting entry-level subjects for a second time. Although the statistics do not assess the student groups prior to 2010, the small percentage of students repeating their first year of study is an indication of the success of the programme. There would have been a number of students who had dropped out of the course completely, prior to 2010, but this information was not available and was beyond the scope of this research study. The further distribution of students according to year of entry is shown in Table 4.8.

TABLE 4.8: DISTRIBUTION OF STUDENTS ACCORDING TO YEAR OF ENTRY INTO THE MAIN PROGRAMME OF THE NATIONAL DIPLOMA IN RADIOGRAPHY

YEAR	FREQUENCY	PERCENTAGE	CUMULATIVE FREQUENCY	CUMULATIVE PERCENTAGE
Prior 2009	2	1.82	2	1.82
2009	1	0.91	3	2.73
2010	34	30.91	37	33.64
2011	33	30.00	70	63.64
2012	40	36.36	110	100.00

In addition to the students in Table 4.8, Table 4.9 shows the distribution of students who joined the Radiography programme after successfully completing one year of study in the ECP bridging course. A first-year ECP student in 2010 thus started his or her ECP studies in the calendar year 2009, and upon successful completion of specific core subjects at the end of 2009, was then admitted as an entry-level Radiography student in 2010. There were 5 ECP students in the entry-level first year group of 2010, 6 ECP students in 2011 and 8 ECP students in 2012.

TABLE 4.9: DISTRIBUTION OF STUDENTS ACCORDING TO YEAR OF ENTRY INTO THE EXTENDED CURRICULUM PROGRAMME IN RADIOGRAPHY

YEAR	FREQUENCY	PERCENTAGE
2009	5	26.32
2010	6	31.58
2011	8	42.11

A further analysis was done to assess whether students who had enrolled for the ECP were more likely to achieve success in entry-level Radiography education. This analysis showed that in the entry-level first year group of 2010, only 1 student in ECP programme was successful and passed into the second-year of study. The remaining students (n =4) did not achieve exit-level outcomes in one or more entry-level subjects, and did not progress to their second-year of study. In the entry-level first-year group of 2011, the majority of ECP students (n=5) were successful and progressed to their second-year of study. Only 1 student did not achieve exit-level outcomes. In the entry-level first-year group of 2012, the majority of ECP students (n=7) were successful and progressed to their second-year of study. Only 1 student did not achieve first year exit-level outcomes. Unsuccessful students were given the opportunity to repeat the entry-level modules in each year group.

4.3.2 Tertiary education prior to Radiography studies

The students in the study group who had not undertaken any prior tertiary education were in the majority (93 students or 71.54% of the study group).

TABLE 4.10: DISTRIBUTION OF STUDENTS WITH PRIOR TERTIARY EDUCATION IN ANY STUDY DIRECTION

PRIOR EDUCATION	FREQUENCY	PERCENTAGE
YES	37	28.46
NO	93	71.54

The remaining 37 students (28.46%) in the study group had undertaken tertiary studies prior to entering the Radiography programme, and all had attempted either degree, diploma or higher certificate studies. Table 4.10 shows the distribution of students with prior tertiary education.

The student group of each year of entry-level Radiography education had varying levels of prior tertiary education, as follows:

Amongst the 2010 entry-level group:

- Three students had partially completed a diploma or higher certificate,
- Two students had completed a diploma or higher certificate,
- Four students had partially completed a degree,
- One student had completed a degree, and
- 29 Students had no prior tertiary education.

Amongst the 2011 entry-level group:

- Four students had partially completed a diploma or higher certificate,
- One student had completed a diploma or higher certificate,
- Eleven students had partially completed a degree,
- No students had completed a degree, and
- 26 Students had no prior tertiary education.

Amongst the 2012 entry-level group:

- Two students had partially completed a diploma or higher certificate,
- One student had completed a diploma or higher certificate,
- Eight students had partially completed a degree,
- No students had completed a degree, and
- 38 Students had no prior tertiary education.

Tables 4.11-4.13 indicate the prior education of each study group, according to gender and race, and also indicate, using an asterisk (*) which prior education undertaken was in the field of any of the health sciences. Prior education in any of the health sciences is further documented in 4.3.3.

TABLE 4.11: 2010 STUDENT GROUP, WHERE * INDICATES PRIOR EDUCATION IN ANY OF THE HEALTH SCIENCES

ETHNIC RACE GROUP	NUMBER OF STUDENTS	GENDER	NUMBER	PARTIALLY COMPLETED DIPLOMA	COMPLETED DIPLOMA OR HIGHER CERTIFICATE	PARTIALLY COMPLETED DEGREE	COMPLETED DEGREE
Black	30	Male	14			1	
		Female	16		2	2* + 1	1
Coloured	1	Male	1				
		Female	0				
White	8	Male	1	2			
		Female	7	1			
Total	39		39	3	2	4	1

TABLE 4.12: 2011 STUDENT GROUP, WHERE * INDICATES PRIOR EDUCATION IN ANY OF THE HEALTH SCIENCES

ETHNIC RACE GROUP	NUMBER OF STUDENTS	GENDER	NUMBER	PARTIALLY COMPLETED DIPLOMA	COMPLETED DIPLOMA OR HIGHER CERTIFICATE	PARTIALLY COMPLETED DEGREE	COMPLETED DEGREE
Black	32	Male	20	2		4*	
		Female	12	2*		5	
Coloured	2	Male	0				
		Female	2				
White	8	Male	0				
		Female	8		1*	2	
Total	42		42	4	1	11	

TABLE 4.13: 2012 STUDENT GROUP, WHERE * INDICATES PRIOR EDUCATION IN ANY OF THE HEALTH SCIENCES

ETHNIC RACE GROUP	NUMBER OF STUDENTS	GENDER	NUMBER	PARTIALLY COMPLETED DIPLOMA	COMPLETED DIPLOMA OR HIGHER CERTIFICATE	PARTIALLY COMPLETED DEGREE	COMPLETED DEGREE
Black	41	Male	23	1*		3*+1	
		Female	18	1		1*+3	
Coloured	1	Male	0				
		Female	1				
White	7	Male	2				
		Female	5		1		
Total	49		49	2	1	8	

4.3.3 Prior tertiary education in any of the health sciences

Of particular interest were students with prior tertiary education specifically in the health sciences (n=14). Of the students in this study group, 3 students (17.65%) had previously studied towards a M.B.,Ch.B. degree, for two or more years and had been unsuccessful in these studies. Another 4 students (23.53%) had undertaken studies in other Bachelor of Science programmes, and 2 students (11.76%) had studied towards a nursing qualification.

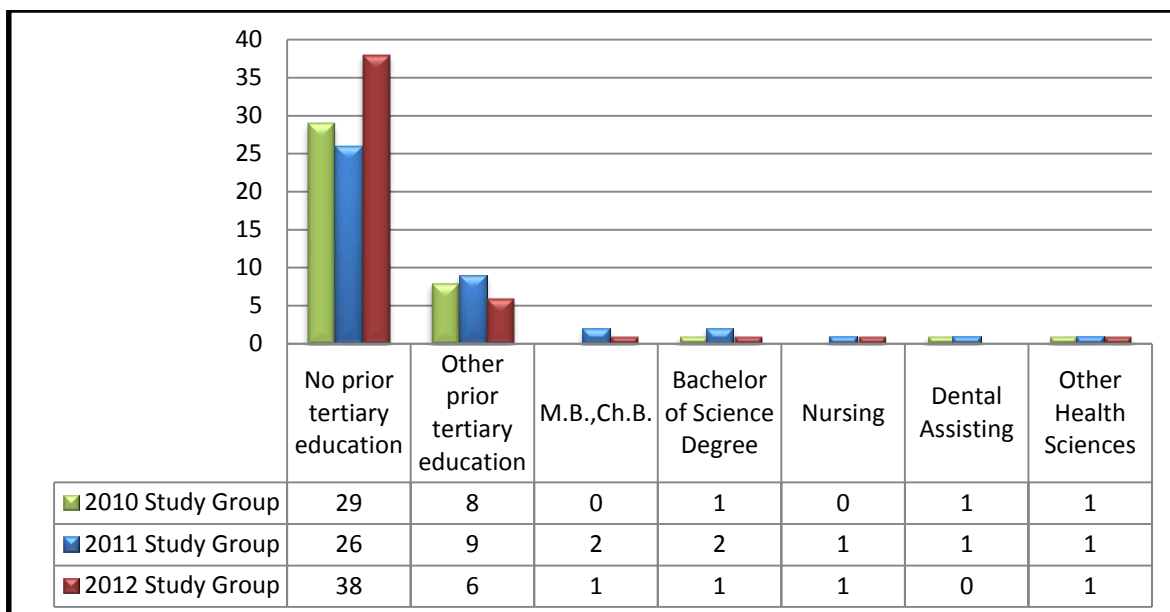


FIGURE 4.3: DISTRIBUTION OF STUDENTS ACCORDING TO PRIOR TERTIARY EDUCATION, IN EACH YEAR GROUP: 2010, 2011 AND 2012

In Figure 4.3, the total distribution of students with no prior tertiary education, other prior tertiary education, with education in any of the health sciences whether uncompleted or completed, is graphically illustrated. After successful completion of a one-year Higher Certificate in Dental Assisting (offered by the CUT), 2 students (17.65%) entered the National Diploma in Radiography programme. A final category was allocated for other related health science diplomas or degrees, for example Somatology.

A further analysis was done to assess whether students who had prior tertiary education in any of the health sciences were more likely to achieve success in entry-level Radiography education. The assumption that prior tertiary education in health sciences was an indicator for academic success under entry-level Radiography students was correct, and not an unexpected result, as students previously enrolled for a degree-level qualification such as an M.B.,Ch.B or another Bachelor of Science degree could be expected to achieve success in diploma-level Radiography education. Only 2 students who had previously completed a Higher Certificate in Dental Assisting did not achieve exit-level outcomes at the end of their first year, whilst the remaining students (n=12) achieved first year exit-level outcomes and progressed to their second year of study.

Figure 4.4 shows the distribution of students per year group; those with no prior tertiary education, which is the largest group; a group with uncompleted prior tertiary education; and a small number of students (n=5) who had successfully completed a diploma or degree before entering the Radiography programme. The total number of students

(n=32 or 24.61%) within the study group who had previously undertaken uncompleted prior tertiary education, and who were now part of the study group enrolled for Radiography education, may be the subject for further investigation in a future study.

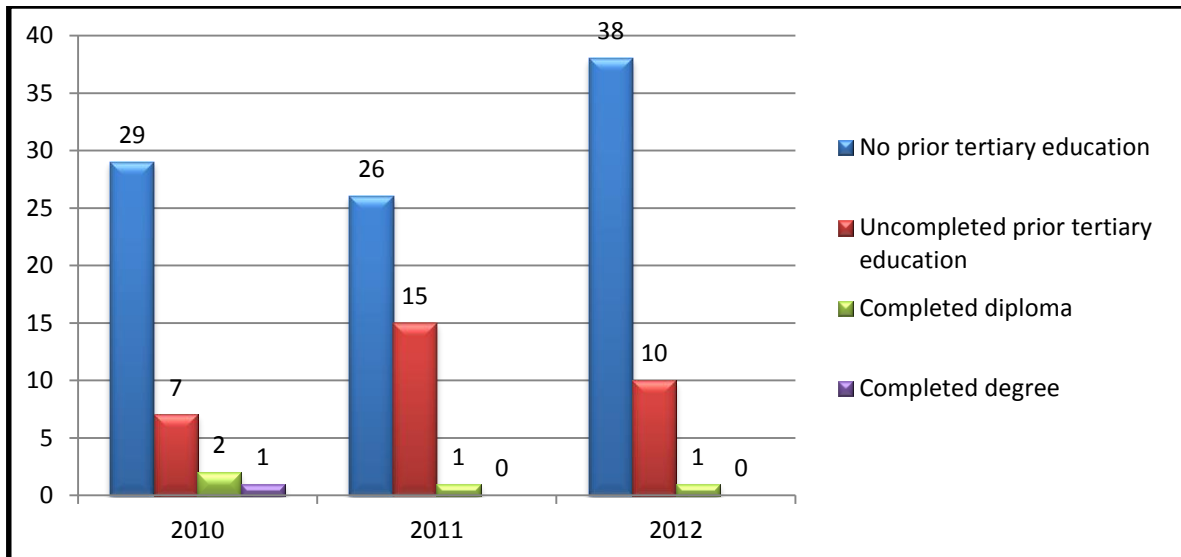


FIGURE 4.4: DISTRIBUTION OF STUDENTS ACCORDING TO PRIOR TERTIARY EDUCATION, IN EACH OF THE STUDY GROUPS: 2010, 2011 AND 2012

4.4 ANALYSIS RELATED TO STUDENT MATRICULATION

4.4.1 Distribution of students according to province where SC or NSC was written

All the students in the study group had matriculated in South Africa and had a Senior Certificate or National Senior Certificate which indicated in which year the student had been awarded the certificate. In addition, the NSC indicated each the subject, with percentages and achievement levels awarded to the student.

The provinces in which students in the study group matriculated were of interest in compiling the research, and the data in Table 4.14 show that the majority of students (n=85 or 65.38%) matriculated in the Free State Province. The second largest group of students (n=14 or 10.77%) matriculated in the Northern Cape Province. There were 8 students (6.15%) who had matriculated in Limpopo Province, 6 students (4.62%) who had matriculated in the Eastern Cape Province, 5 students (3.85%) who had matriculated in Gauteng Province, 4 students (3.08%) who had matriculated in Mpumalanga Province, 4 students (3.08%) who had matriculated in Northwest Province and 3 students (2.31%)

who had matriculated in the Province of KwaZulu-Natal. Only 1 student (0.77%) had matriculated in the Province of the Western Cape.

TABLE 4.14: DISTRIBUTION OF STUDENTS, BY PROVINCE WHERE NSC WAS WRITTEN

PROVINCE	FREQUENCY	PERCENTAGE
Eastern Cape	6	4.62
Free State	85	65.4
Gauteng	5	3.85
KwaZulu Natal	3	2.31
Limpopo	8	6.15
Mpumalanga	4	3.08
Northern Cape	14	10.8
Northwest Province	4	3.08
Western Cape	1	0.77

TABLE 4.15: DISTRIBUTION OF STUDENTS ACCORDING TO PROVINCE WHERE SC OR NSC WAS WRITTEN, PER YEAR GROUP 2010, 2011 AND 2012

YEAR	PROVINCE WHERE STUDENT MATRICULATED									
	Eastern Cape	Free State	Gauteng	KwaZulu Natal	Limpopo	Mpumalanga	Northern Cape	Northwest	Western Cape	Total
2010	1 2.56	27 69.23	1 2.56	2 5.13	2 5.13	0 0.00	4 10.26	2 5.13	0 0.00	39
2011	3 7.14	27 64.29	1 2.38	0 0.00	3 7.14	1 2.38	6 14.29	0 0.00	1 2.38	42
2012	2 4.08	31 63.27	3 6.12	1 2.04	3 6.12	3 6.12	4 8.16	2 4.08	0 0.00	49
TOTAL	6	85	5	3	8	4	14	4	1	130

In Table 4.15, the distribution of students according to province where NSC was written per year group 2010, 2011 and 2012 is shown. The majority of students are from the Free State Province, the province where they wrote the NSC, in the year group of 2010 (n=27 or 69.23%), in the year group of 2011 (n= 27 or 64.29%) and in the year group of 2012 (n = 31 or 63.27%). The same table shows that the distribution of students according to the province where the SC or NSC was written and shows that students studying at the CUT come from provinces across South Africa, even from provinces where institutions of higher education offering Radiography education are located (cf. Table 2.1).

4.4.2 Distribution of students according to year of matriculation

Amongst the 2010 study group, 11 students had matriculated prior to or in 2007 (28.21%) and the remaining 28 students had matriculated in 2008 or later (71.79%).

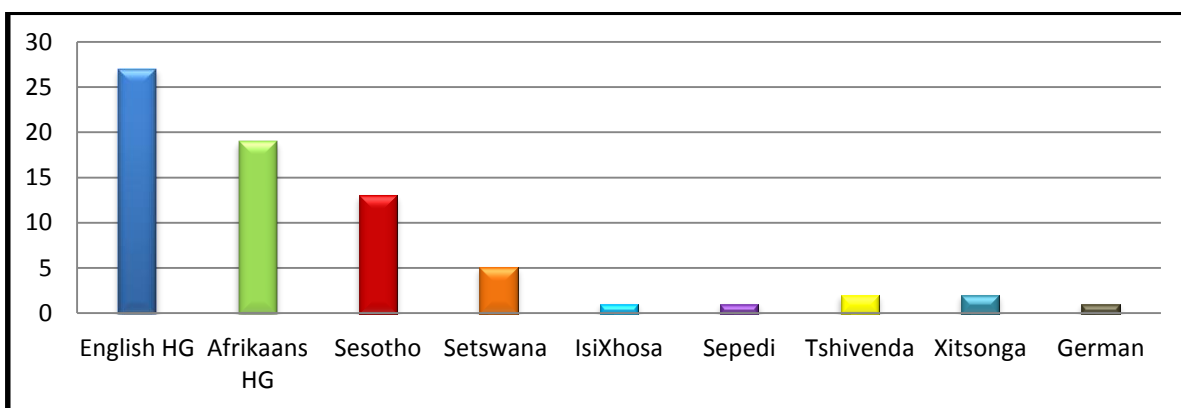
TABLE 4.16: DISTRIBUTION OF STUDENTS ACCORDING TO YEAR OF MATRICULATION

YEAR	(SC) MATRIC PRIOR TO OR DURING 2007	NSC (MATRIC) DURING 2008 OR LATER	TOTAL
2010	11 (28.21%)	28 (71.79%)	39
2011	10 (23.81%)	32 (76.19%)	42
2012	6 (12.24%)	43 (87.76%)	49
Total	27	103	130

Amongst the 2011 study group, 10 students (23.81%) had matriculated prior to or in 2007 and the remaining 32 students (76.19%) had matriculated in 2008 or later. Amongst the 2012 study group, only 6 students (12.24%) had matriculated in 2007 or prior and the remaining 43 students (87.7%) had matriculated in 2008 or later, see Table 4.16.

4.4.3 Distribution of matric language subjects

The students (n=27) who wrote matric prior to or during 2007 all took the English language subject on Higher Grade level, with student numbers divided according to year groups as follows, in 2010 (n=11), in 2011 (n=10), and in 2012 (n=6): as shown in Figure 4.5.

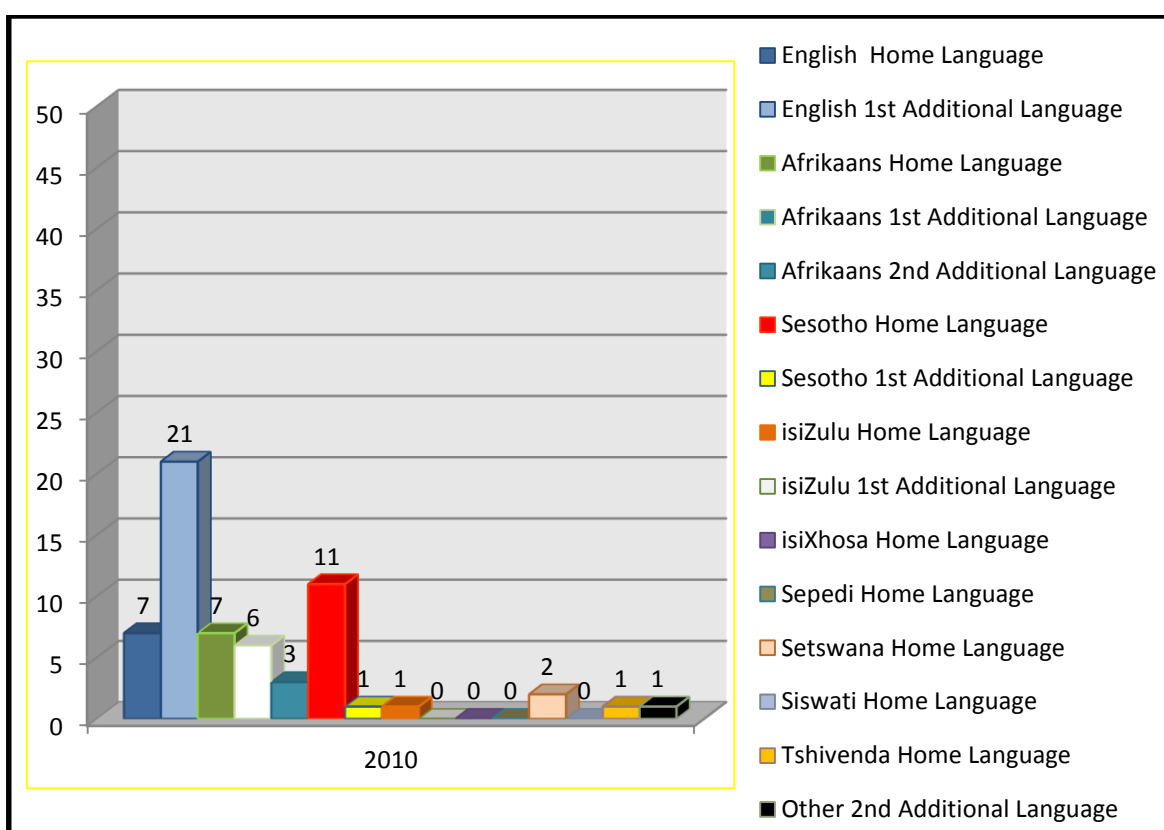
**FIGURE 4.5: MATRIC 2007 AND PRIOR, LANGUAGE SUBJECT DISTRIBUTION AMONGST THE STUDENT GROUP**

Other matric language subjects in this group who wrote matric in 2007 and prior were as follows: Afrikaans Language on Higher Grade level (n=19), Sesotho (n=13), IsiXhosa (n=1), Xitsonga (n=1), Sepedi (n=1), Tshivenda (n=2), Setswana (n=5) and German (n=1), shown in Table 4.17.

TABLE 4.17: MATRIC LANGUAGE SUBJECTS, 2007 AND PRIOR

LANGUAGE	NUMBER OF STUDENTS	MINIMUM MARK %	MAXIMUM MARK %	MEAN	STANDARD DEVIATION
English	27	49	90	66.667	10.355
Afrikaans	19	49	80	62.368	10.232
Sesotho	13	59	80	75.692	6.250
IsiXhosa	1	69	69	69	.
Sepedi	1	79	79	79	.
Setswana	5	69	79	73	5.477
Tshivenda	2	69	79	74	7.071
Xitsonga	2	79	79	79	0.000
German	1	49	49	49	.

The students (n=103) who wrote their NSC and matriculated in the year 2008 or after, wrote language subject papers at home language level, first additional language level or second additional language level (see Figures 4.6-4.8 for distribution of languages).

**FIGURE 4.6: DISTRIBUTION OF NSC LANGUAGES IN 2010 STUDY GROUP**

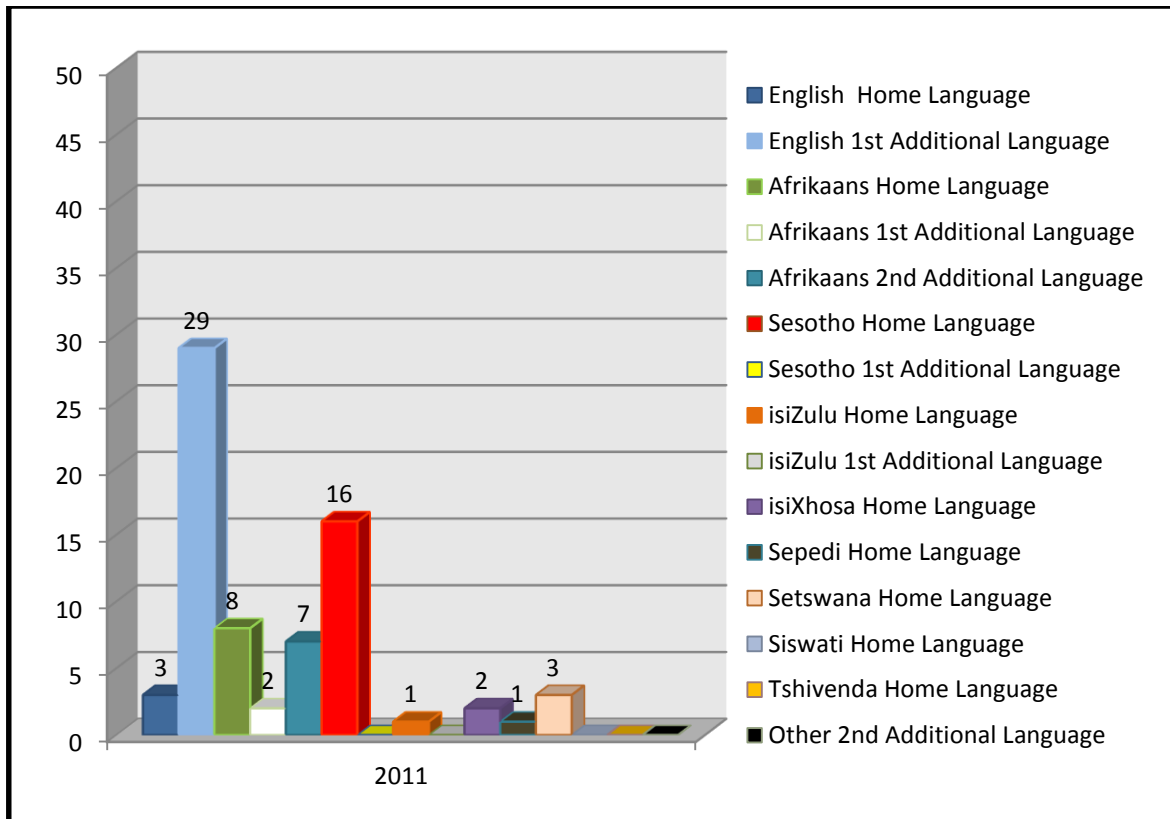


FIGURE 4.7: DISTRIBUTION OF NSC LANGUAGES IN 2011 STUDY GROUP

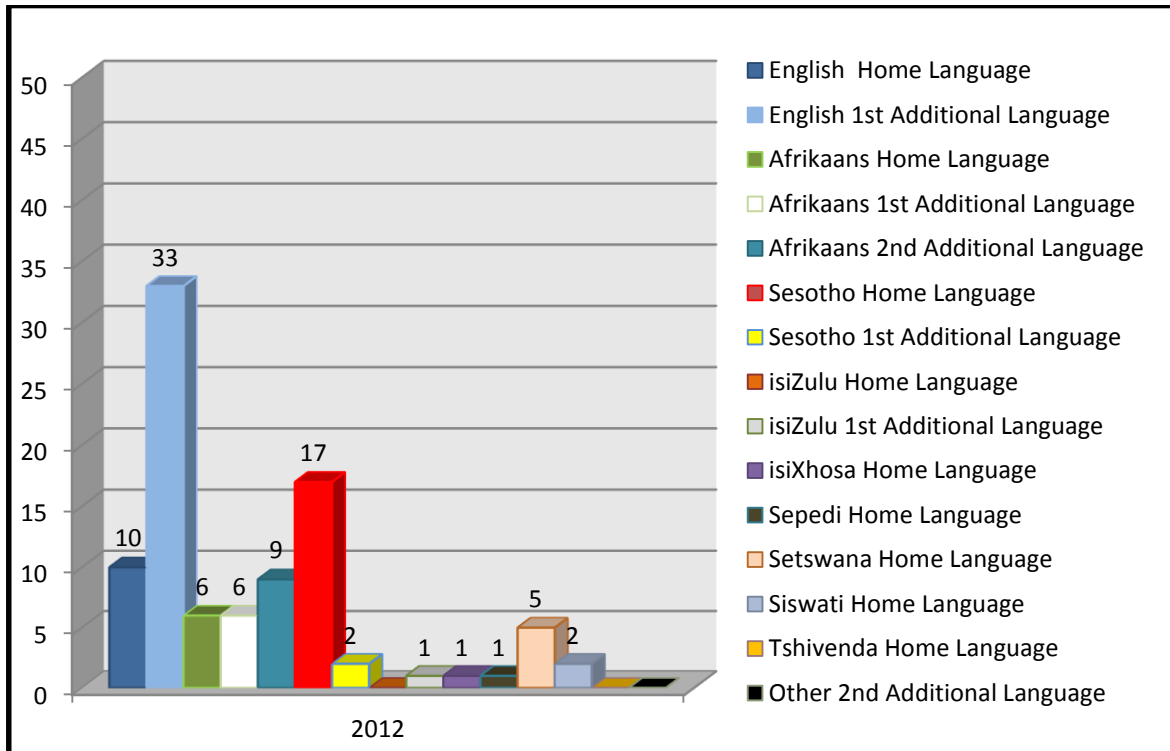


FIGURE 4.8: DISTRIBUTION OF NSC LANGUAGES IN 2012 STUDY GROUP

All students in the study group who passed the English language as a NSC subject (n=103), achieved either at home language level (n=20 or 19.41%) or at first additional

language level (n= 83 or 80.58%), which shows that the majority of students were English second language speakers.

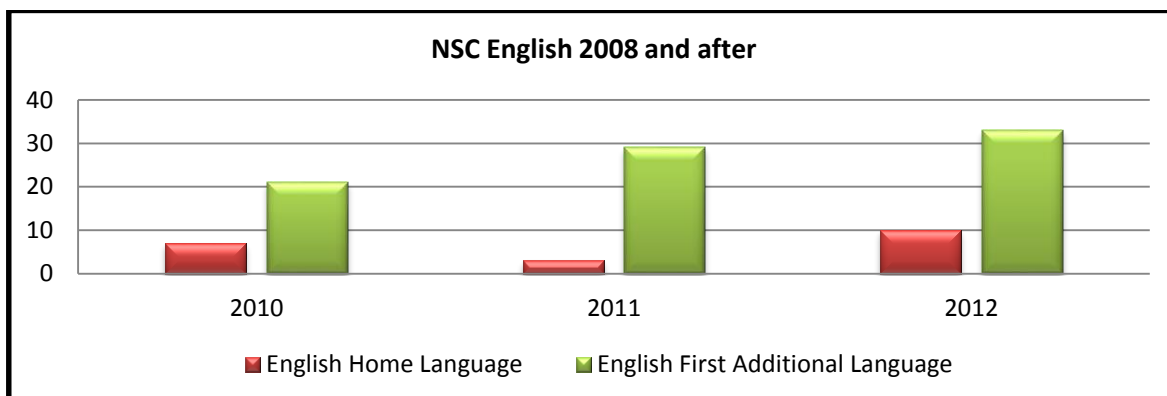


FIGURE 4.9: DISTRIBUTION OF NSC ENGLISH HOME OR FIRST ADDITIONAL LANGUAGE

Other NSC language subjects in this study group were as follows: Afrikaans language (n=54), Sesotho language (n=48), IsiXhosa language (n=3), IsiZulu language (n=2), Sepedi language (n=2), Tshivenda language (n=1), Setswana language (n=10), SiSwati language (n=2) and the German language (n=1), as shown in Table 4.18.

TABLE 4.18: MATRIC LANGUAGE SUBJECTS 2008 AND AFTER

LANGUAGE	NUMBER OF STUDENTS	MINIMUM MARK %	MAXIMUM MARK %	MEAN	STANDARD DEVIATION
English	103	44	83	63.408	7.652
Afrikaans	54	38	91	65.389	12.786
Sesotho	48	60	81	68.313	5.605
IsiXhosa	3	63	77	69.333	7.095
IsiZulu	2	65	80	72.500	10.607
Sepedi	2	68	79	73.500	7.778
Setswana	10	41	83	64.900	11.120
SiSwati	2	81	82	81.500	0.707
Tshivenda	1	66	66	66.000	.
German	1	41	41	41.000	.

The NSC language subjects, other than the English language, were as follows: the total number of students taking Afrikaans (n = 54) were divided into Afrikaans Home Language (n=21), Afrikaans First Additional Language (n=14) or Afrikaans Second Additional Language (n=19). The total number of students taking Sesotho as a NSC language subject (n= 47) were divided into Sesotho Home Language (n=44), or as Sesotho First Additional Language (n=3). Setswana Home language was taken by 10 students. Other home language NSC subjects included the SiSwati language (n=2), the IsiXhosa language (n=3), the IsiZulu language (n=2), and the Sepedi language (n=2). Only 1 student took

Tshivenda Home Language as a subject and 1 student took German Second Additional Language. No students took Xitsonga Home Language or Xitsonga First Additional Language as subjects in this study group of students who matriculated in 2008 or after.

Due to the fact that the language of instruction at CUT is English, students are required to be proficient in the English language. The English language matric (in 2007 and prior) marks and English language NSC (2008 and later) marks were further analysed to establish whether there was a correlation between these marks and academic success at entry-level in Radiography education (cf. 4.9).

4.4.4 Distribution of core matric subject marks

The 2010-2012 minimum requirements for selection to the Radiography programme at CUT (cf. 1.3), in addition to an achievement level of 3 in the English language, included an achievement level of 3 for Life Orientation and Mathematics as core subjects, and an achievement level of 4 for Life Sciences and Physical Sciences as additional core subjects. Prospective students who matriculated in 2007 or prior were also selected according to their achievements in core subjects, these subjects could have been achieved on Higher Grade or Standard Grade, and for those students who matriculated in 2007 or prior, Life Orientation as a subject was not a requirement.

All students (n=27) in the study group who had written matric in 2007 or prior had Mathematics, Science and Biology as core subjects, written either on Higher Grade or Standard Grade. In cases where the student's marks in core subjects were too low for admission into the Radiography programme, selected students were given the opportunity to join the ECP, as a bridging course before acceptance into the Radiography programme.

TABLE 4.19: DISTRIBUTION OF CORE SUBJECT MARKS, MATRICULATION 2007 AND PRIOR

SUBJECT	NUMBER OF STUDENTS	MINIMUM MARK %	MAXIMUM MARK %	MEAN	STANDARD DEVIATION
Mathematics	27	47	80	65.778	11.617
Science	27	39	79	53.704	9.539
Biology	26	39	80	57.000	9.209
Other subject (1)	16	49	80	67.125	12.712
Other subject (2)	4	59	80	69.250	8.578

Table 4.19 shows the minimum percentage mark, maximum percentage mark, mean and standard deviation for each subject. Subjects which are not regarded as core subjects for admission, such as Accounting or Geography, are listed in the table as "other subject (1) or other subject (2)".

All students (n=103) in the study group who had written the NSC in 2008 or in a subsequent year had as core subjects Life Orientation, Mathematics, Physical Sciences and Life Sciences, and in some case other subjects (n=84), other than language subjects, as shown in Table 4.20.

TABLE 4.20: DISTRIBUTION OF CORE SUBJECT MARKS, NSC IN 2008 AND AFTER

SUBJECT	NUMBER OF STUDENTS	MINIMUM MARK %	MAXIMUM MARK %	MEAN	STANDARD DEVIATION
Mathematics	102	41	92	59.176	11.267
Physical Sciences	103	40	85	58.126	9.694
Life Sciences	103	50	89	70.097	8.464
Life Orientation	103	51	95	75.631	9.420
Other subject (1)	84	25	85	60.345	12.034

4.5 ADMISSION CRITERIA AND SELECTION TESTS

To calculate matriculation mark scores of a student for admission purposes, the CUT, in line with other institutions of higher education, has used a CUT APS specifically for students who matriculated with a SC in 2007 and prior, taking into account that subjects could be written on Higher Grade or Standard Grade at that time. The calculations were made in respect of the students' marks in their matric subjects, with different numeric value allocations being given if the subject had been taken on Higher Grade or Standard Grade (cf. 1.3).

The CUT has also allocated a CUT APS for students who wrote the NSC from 2008 and after, where the APS refers to a calculation of numeric values assigned to the various achievement levels of matriculation subjects. The notable exception is the subject Life Orientation, where a pass at any achievement level only scores 1 point for the APS, irrespective of the actual achievement level of the subject (cf. 1.3).

Acceptance into the Radiography programme was subject to successful achievement of core subjects in the NSC final examination. An APS was calculated for each student's set of marks, based on the achievement level of each subject.

Of the students (n=130) in the study group, 19 students were part of the ECP in Radiography. These students did not have adequate marks in core subjects to gain direct admission into the National Diploma in Radiography, but were admitted into the ECP as a bridging course. Selection tests for these 19 students were not available. Of the students (n=111) within the study group who were admitted directly into the National Diploma in Radiography programme, a large number of students (n=79 or 71.17%) undertook CUT selection tests.

After establishing the achievement of specific core matriculation subjects for each student, the selection criteria also included the following calculations: the APS of each student according to their matriculation SC or NSC marks (cf. 1.3). Bonus points were added to the student's APS in certain cases (where students who had matriculated with a SC in 2007 and prior). In other cases no bonus points were added, and a preliminary total score was obtained. A calculation was made by dividing this total score by 48%, and dividing the answer by 2, to gain a mark out of a total of 50 points. This mark contributed half the value (or 50%) of the total CUT Rating Score for selection purposes.

As a second part of the selection process, selection tests were undertaken by prospective students, which included: the GSAT, the English Proficiency Test and the SDS Questionnaire (cf. 1.3). A calculation was made for each student's score for each of the above 3 selection tests, each out of a total of 50 points, and an average total mark out of 150 points was obtained, and converted to a percentage. The percentage was divided by 2, to gain a mark out of a total of 50 points. This mark contributed half the value (or 50%) of the total CUT Rating Score for student selection purposes. The total CUT Rating Score, for each of the prospective students who undertook the admission tests, was a factor for selection and placement in the Radiography programme, subject to availability of space and adherence to institutional admission policies.

Table 4.21 shows the number of students (n=79) who undertook the selection tests, minimum and maximum scores, mean, standard deviation and the total CUT Rating Score. As this research report strives to consider how accurately the above selection criteria served to predict academic performance of entry-level students in the Radiography

education, the statistical data analyses which follow attempt to ascertain the validity and reliability of each of the selection tests as performance predictors.

TABLE 4.21: DISTRIBUTION OF SCORES FOR SELECTION TESTS

VARIABLE	N	MINIMUM	MAXIMUM	MEAN	STANDARD DEVIATION
APS according to matric or NSC marks	130	18.00	43.00	30.496	4.418
APS + Bonus points	87	25.00	43.00	30.828	3.657
GSAT	79	16.00	96.00	51.127	20.467
English Proficiency	79	5.00	99.00	57.532	21.221
SDS – Questionnaire	79	40.00	100.00	66.911	14.765
Total CUT Rating Score	79	49.00	87.00	62.152	8.5334

In order to ascertain the validity of the above selection tests as performance predictors, the distribution of academic marks in entry-level Radiography modules amongst students within the study group was examined.

4.6 DISTRIBUTION OF ACADEMIC MARKS IN ENTRY-LEVEL MODULES IN RADIOGRAPHY EDUCATION

The data collection sheet was used to record the mark each student achieved in each of the following entry-level modules: Radiographic Practice (Theory), Clinical Radiographic Practice, Radiographic Pathology, Radiographic Image Recording, Physics, Anatomy, Physiology and Psychodynamics of Patient Care. The total average mark for all modules was also calculated, and progression to the second year of study was also recorded.

Not all the students (n=130) in the study group wrote the end of year final examinations in their first year of study. A small group of students (n=7 or 5.38%) dropped out of the programme during the academic years 2011-2012. In the 2010 year group, no student dropped out of the course during the year. In the 2011 year group, 2 students dropped out of the programme in the first semester, for non-academic reasons. In the 2012 year group, 4 students dropped out of the programme in the first semester, also for non-academic reasons, and only 1 student dropped out of the programme for academic reasons.

Table 4.22 shows the the distribution of academic marks for entry-level modules amongst students in the study group.

TABLE 4.22: DISTRIBUTION OF ACADEMIC MARKS FOR ENTRY-LEVEL MODULES IN RADIOGRAPHY EDUCATION

MODULE	NUMBER	MINIMUM	MAXIMUM	MEAN	STANDARD DEVIATION
Radiographic Practice Theory	122	42	93	66.098	8.823
Clinical Radiographic Practice	122	47	89	70.918	9.310
Radiographic Pathology	123	35	86	59.927	12.245
Radiographic Image Recording	123	30	90	57.390	10.685
Physics	123	30	78	55.439	9.237
Anatomy	123	30	91	64.746	10.607
Physiology	123	34	84	58.203	10.306
Psychodynamics of Patient Care	123	33	90	65.244	10.613
Total Average	123	43.125	85.750	62.191	8.614

The remaining students (n=30 or 23.07%) who did not progress to the second year of study, did not achieve the exit-level outcome for their first year of study in one or more modules, based on their total course and examination marks, and the distribution per year group was as follows:

- In the 2010 year group, the total group of unsuccessful students (n=15) were divided into students enrolled for the Nat. Diploma in Radiography (n = 11), and students enrolled in the ECP in Radiography (n=4).
- In the 2011 year group, the total group of unsuccessful students (n=8) were divided into students enrolled for the Nat. Diploma in Radiography (n = 7), and a student enrolled for the ECP in Radiography (n=1).
- In the 2012 year group, the total group of unsuccessful students (n=7) were divided into students enrolled for the Nat. Diploma in Radiography (n = 6), and a student enrolled for the ECP in Radiography (n=1).

A further set of analyses was done with reference to the group students who achieved a pass in entry-level Radiography education and progressed to the second year of study (n=92), and with reference to the group of students who did not achieve a pass (n=37), and who would be required to repeat one or more entry-level modules.

A number of variables were tested, to identify whether there was a correlation between the various selection criteria and academic performance amongst entry-level Radiography students. To achieve a comprehensive analysis, statistical tests were performed both with

individual module marks, admission criteria and selection tests, as well as using average total scores in each instance.

4.7 PREDICTORS OF STUDENT ACADEMIC PERFORMANCE

The study group could be divided into students (n=92) who achieved entry-level academic success and progressed to their second year of study, and those students (n=37) who were unsuccessful (cf. 4.6) and who had to repeat one or more of the entry-level modules before they could progress to their second year of study.

A procedure known as the Student's *t*-test procedure was used to observe the variables associated with student selection and the groups of students who either achieved entry-level academic success, or those who did not. A probability level of 5% was used, and the results of this procedure were as follows:

4.7.1 Assessment of core matriculation subject marks as predictors of academic success in entry-level Radiography education

A number of *t*-test procedures were used to observe the correlation of core matriculation subject marks of English, Mathematics, Science and Biology amongst the group of students who matriculated in 2007 or prior, who either achieved a pass in entry-level Radiography education, or who did not achieve a pass, as shown in Table 4.23.

TABLE 4.23: RESULTS OF T TEST PROCEDURE SHOWING SIGNIFICANCE OF MATRIC SUBJECT MARKS 2007 AND PRIOR, WITH ACADEMIC SUCCESS IN RADIOGRAPHY EDUCATION

MATRIC SUBJECT MARK 2007 & PRIOR	ACHIEVED ENTRY-LEVEL PASS IN RADIOGRAPHY	N	MEAN	T VALUE	PR >[T]
English	Yes	16	67.44	0.46	0.65
	No	11	65.55		
Mathematics	Yes	16	68.13	1.28	0.21
	No	11	62.36		
Science	Yes	16	53.25	-0.29	0.77
	No	11	54.36		
Biology	Yes	16	58.56	1.10	0.28
	No	11	54.50		

In this analysis, the results showed that the matriculation subject marks were not significant as performance predictors associated with the group of students who achieved a pass, or those who did not achieve a pass, in all the entry-level Radiography modules.

Similarly, a *t*-test procedure was used to observe the correlation of core matriculation subject marks with the group of students who matriculated in 2008 or in subsequent years, who either achieved an entry-level pass in Radiography education, or those who did not pass, and the results are shown in Table 4.24. According to this analysis, the only significant matriculation subject mark predictor for academic success proved to be the students' Life Sciences subject marks.

TABLE 4.24: RESULTS OF T-TEST PROCEDURE SHOWING SIGNIFICANCE OF MATRIC SUBJECT MARKS 2008 AND AFTER, WITH ACADEMIC SUCCESS IN RADIOGRAPHY EDUCATION

MATRIC SUBJECT MARK 2008 & AFTER	ACHIEVED ENTRY-LEVEL PASS IN RADIOGRAPHY	N	MEAN	T VALUE	PR >[T]
English	Yes	76	63.48	0.12	0.91
	No	26	63.26		
Mathematics	Yes	75	59.85	1.01	0.31
	No	27	57.29		
Physical Sciences	Yes	76	58.93	1.43	0.16
	No	27	55.85		
Life Sciences	Yes	76	71.68	3.35	0.001
	No	27	65.62		

4.7.2 Assessment of "APS according to matriculation results" as a predictor of academic success

A *t*-test procedure was used to observe the variable "APS according to matriculation results" with the groups of students who either achieved an entry-level pass in Radiography education, or those who did not achieve a pass, and the results are shown in Table 4.25.

TABLE 4.25: ASSESSMENT OF "APS ACCORDING TO MATRICULATION RESULTS" AS A PREDICTOR OF ACADEMIC SUCCESS

SELECTION TEST MARK	ACHIEVED ENTRY-LEVEL PASS IN RADIOGRAPHY	N	MEAN	T VALUE	PR >[T]
APS	Yes	92	30.89	1.61	0.11
	No	37	29.51		

According to this analysis, the "APS according to matriculation results" did not predict academic success, in terms of students who achieved a pass or those who did not achieve a pass, at entry-level. There were students (n=51) within the study group who were admitted to the Radiography programme based only on their "APS according to matriculation results", and who did not undertake other selection tests.

4.7.3 Assessment of CUT selection criteria and admission tests as predictors of academic success in entry-level Radiography education

Further *t*-test procedures were used to observe the correlation of the CUT selection tests with the groups of students who either achieved entry-level academic success (Yes), or those who did not (No), and the results are shown in Table 4.26.

TABLE 4.26: STUDENT'S T-TEST PROCEDURE FOR SIGNIFICANCE OF CUT SELECTION TESTS WITH ENTRY-LEVEL RADIOGRAPHY EDUCATION ACADEMIC ACHIEVEMENT

SELECTION TEST MARK	ACHIEVED ENTRY-LEVEL PASS IN RADIOGRAPHY	N	MEAN	T VALUE	PR >[T]
APS	Yes	92	30.89	1.61	0.11
	No	37	29.51		
APS + Bonus	Yes	60	31.32	1.89	0.06
	No	27	29.74		
GSAT	Yes	53	53.90	1.75	0.08
	No	26	45.46		
English Proficiency	Yes	53	58.88	0.81	0.42
	No	26	54.76		
SDS Questionnaire	Yes	53	68.62	1.48	0.14
	No	26	63.42		
Total CUT Rating Score	Yes	53	63.24	1.64	0.10
	No	26	59.92		

According to the analysis, the statistical significance at the 0.05 level of significance for each of the selection tests as predictors of academic success, as measured by a pass at entry-level, showed that none of the selection criteria was significant in predicting whether the student would pass or fail. These selection criteria included; the APS according to matriculation results, APS with bonus points added, the GSAT score, the English Proficiency Test score, the SDS Questionnaire score and the total CUT Rating Score.

4.8 CORRELATION PROCEDURES

Statistical analyses were also performed to establish whether there was any significant correlation between the variables. The advantage of using a coefficient of determination, such as the Pearson's correlation coefficient, was that it was a "proportional reduction in error measure" (Burdess 2010:89). Pearson's correlation coefficient is usually termed *Pearson's r* (Burdess 2010:161). Burns and Grove (2003) in Botma, Greeff, Mulaudzi and Wright (2010) provide the following general guideline for interpreting the *r* value:

- A weak linear relationship ranges between 0.1-0.29.
- A moderate linear relationship ranges between 0.3-0.5.
- A strong linear relationship is found in the range >0.5.

4.8.1 Correlation coefficients between the variables of selection criteria

In the following correlation procedure, *Pearson's r* was used to test the association between various selection and aptitude tests, as seen in Table 4.27.

TABLE 4.27: CORRELATION COEFFICIENTS BETWEEN VARIABLES OF SELECTION CRITERIA

PEARSON CORRELATION COEFFICIENTS PROB > R UNDER H ₀ : RHO=0 MARK SCORE NUMBER OF OBSERVATIONS						
	APS according to matriculation results	APS with bonus points added	General Scholastic Aptitude Test	English Proficiency	Total CUT rating score	Self-Directed Search Questionnaire
APS according to matriculation results	1.0000 _a	0.83* _b	0.45* _d	0.31** _d	0.64* _d	-0.03 _d
CUT Selection Total 1 = APS with bonus points added		1.0000 _b	0.45* _c	0.36** _c	0.74* _c	0.03 _c
General Scholastic Aptitude Test			1.0000 _c	0.67* _c	0.77* _c	-0.15 _c
English Proficiency				1.0000 _c	0.72* _c	-0.19 _c
Total CUT rating score					1.0000 _c	0.12 _c
Self-Directed Search Questionnaire						1.0000 _c

Where * indicates <0.01 and ** indicates < 0.05

Where ^a indicates n=129, ^b indicates n=87, ^c indicates n=79, ^d indicates n=78

From this correlation procedure, it was observed that there was a strong positive correlation (0.83) between the variable "APS according to matriculation results" and the variable "APS with bonus points added". This was to be expected, due to the fact that the same APS data were used in both of these variables. Additionally, moderate relationships were found between the variable "APS according to matriculation results" and the following variables: the GSAT score (0.45), and English Proficiency Test score (0.31).

The variable "Self-Directed Search (SDS) Questionnaire score" did not correlate with the scores of the other selection tests seen in Table 4.27. The SDS Questionnaire, as an interest inventory used for career counselling purposes (cf. 2.5.2), could be expected to produce different results to other academic selection criteria. The SDS Questionnaire Test score used did contribute to the total CUT Rating Score, and therefore played a role in a prospective student's chances for selection.

4.8.2 Correlation coefficients between the variables for selection tests and entry-level module marks in Radiography education

In this correlation procedure, *Pearson's r* was used to test the association between selection tests, and student academic marks in the various entry-level Radiography modules, as well as the total average entry-level Radiography mark, as seen in Table 4.28.

When a Pearson's correlation was performed using the "APS according to matriculation results" score as variable as related to individual entry-level Radiography module marks, a number of differing results were found. The Radiographic Practice module, the main module associated with patient positioning for diagnostic imaging, showed a moderate correlation (0.42) to "APS according to matriculation results". The GSAT score showed the same moderate correlation (0.42), the English Proficiency Test score showed a weaker correlation (0.33) and the SDS Questionnaire score showed a very weak correlation (0.05). Clinical Radiographic Practice, the module associated with clinical application of radiographic techniques, showed weak correlations with all the selection tests as follows: "APS according to matriculation results" (0.27), the GSAT score (0.27), the English Proficiency Test score (0.16) and the SDS Questionnaire score (0.01). This result was of interest because practical and technical competence was highly rated in this

particular module, and this result may bring the use of the SDS Questionnaire Test, as the aptitude and career counselling test under review.

TABLE 4.28: CORRELATION COEFFICIENTS OF SELECTION CRITERIA AND ACADEMIC MARKS

PEARSON CORRELATION COEFFICIENTS						
PROB > R UNDER H₀: RHO=0						
NUMBER OF OBSERVATIONS						
Entry-level Radiography Module mark	APS according to matriculation results	APS with bonus points added	GSAT	English Proficiency	Total CUT Rating Score	SDS Questionnaire
Radiographic Practice	0.42 * a	0.43 * 81	0.42 ** e	0.33 ** e	0.42 ** e	0.05 0.68 e
Clinical Radiographic Practice	0.26 ** a	0.27 ** 81	0.27 ** e	0.16 0.19 e	0.21 ** e	0.01 0.97 e
Radiographic Pathology	0.45 * b	0.38 ** c	0.27 ** d	0.18 0.12 d	0.41 * d	0.27 ** d
Radiographic Image Recording	0.32 ** b	0.31 ** c	0.23 ** d	0.17 0.16 d	0.28 ** d	0.03 0.78 d
Physics	0.28 ** b	0.31 ** c	0.23 ** d	0.01 0.96 d	0.25 ** d	0.22 0.06 d
Anatomy	0.28 ** a	0.31 ** 81	0.27 ** e	0.12 0.31 e	0.27 ** e	0.14 0.23 e
Physiology	0.16 0.07 b	0.25 ** c	0.17 0.16 d	0.07 0.53 d	0.19 0.11 d	0.08 0.46 d
Psychodynamics of Patient Care	0.48 * b	0.38 ** c	0.41 ** d	0.37 ** d	0.46 * d	0.11 0.35 d
Total Average Mark	0.40 * b	0.39 ** c	0.34 ** d	0.21 0.07 d	0.38 ** d	0.14 0.23 d

Where * indicates <0.01 and ** indicates < 0.05

Where ^a indicates n=121, ^b indicates n=122, ^c indicates n= 82, ^d indicates n=74, ^e indicates n=73

The results of the correlation for the Radiographic Pathology module, associated with pattern recognition in diagnostic imaging, were of interest: a moderate correlation was shown for "APS according to matriculation results" (0.45), weak correlations for the GSAT score (0.27), and the English Proficiency Test score (0.18). The SDS Questionnaire Test

score (0.27), although a weak correlation, showed slightly more correlation with Radiographic Pathology module marks than with the other modules.

The remaining modules, Radiographic Image Recording, Physics, Anatomy, and Physiology showed moderate to weak correlations to the admission and selection tests, as seen in Table 4.28. The correlation of marks in the module Psychodynamics of Patient Care, associated with clinical care of the patient in a health care environment, with the various admission and selection tests showed the following results: "APS according to matriculation results" (0.48); the GSAT score (0.41); the English Proficiency Test score (0.37) and the SDS Questionnaire Test score (0.11). The results showed moderate correlations, although the weak correlation of the SDS Questionnaire Test score led the researcher to question the use of the SDS Questionnaire as a suitable aptitude test for the Radiography programme. It is suggested that the suitability of the questionnaire when linked to a career in the health care environment in the South African context, should be reviewed.

As stated previously, the total CUT Rating Score comprised of scores from the other selection tests, and results found using this variable were linked to results found when using the other variables. The "APS with bonus points added" variable also had a data set closely linked to the "APS according to matriculation results", with corresponding results (see Table 4.28). The relationship between the total average mark for entry-level Radiography modules and the admission and selection tests showed a moderate correlation with "APS according to matriculation results" (0.40). The GSAT score (0.34) showed a weaker, moderate correlation. The English Proficiency Test score (0.21) and the SDS Questionnaire Test score (0.21) showed weak correlations (as shown in Table 4.28).

4.9 THE RELATIONSHIP BETWEEN ENGLISH LANGUAGE AND ENTRY-LEVEL ACHIEVEMENT

Due to fact that the language of instruction at CUT is English (cf. 4.4.3), the degree of proficiency in the English language may be a predictor of academic success in entry-level Radiography education at the CUT. The English language SC marks (2007 and prior) and English language NSC marks (2008 and later) were further analysed (cf. 4.9.1, 4.9.2 and 4.9.3) to establish whether there was a relationship between these marks and academic success at entry-level in Radiography education.

4.9.1 Matric English language marks as performance predictors

TABLE 4.29: DISTRIBUTION OF ALL MATRIC ENGLISH LANGUAGE MARKS, TOTAL AVERAGE RADIOGRAPHY MODULE MARK AND ENGLISH PROFICIENCY SELECTION TEST SCORES

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
English language HG mark 2007 and prior	27	10.35	10.35	49	90
English language mark 2008 and after	103	63.40	7.65	44	83
All English marks	130	64.08	8.34	44	90
Total average Radiography module mark	123	62.19	8.61	43.12	85.75
English Proficiency Selection Test score	79	57.53	21.22	5	99

The overall distribution of students, according to numbers, mean, standard deviation, minimum and maximum marks are shown in Table 4.29.

A correlation procedure, using *Pearson's r*, tested the association between the variables of all matriculation English language marks, total average entry-level Radiography module marks and the English Proficiency Selection Test score, showed the following results, as seen in Table 4.30.

TABLE 4.30: CORRELATION OF MATRIC ENGLISH LANGUAGE MARKS, TOTAL AVERAGE RADIOGRAPHY MODULE MARK AND ENGLISH PROFICIENCY SELECTION TEST SCORES

PEARSON CORRELATION COEFFICIENTS PROB > R UNDER H0: RHO=0 NUMBER OF OBSERVATIONS		
Variable	Radiography modules: total average mark	English Proficiency Selection Test
English language HG marks 2007 and prior	0.44 ** 26	0.34 ** 13
NSC English language marks 2008 and after	0.35 ** 97	0.52 * 66
All matric English language marks	0.33 ** 123	0.48 * 79
English Proficiency Selection Test	0.21 0.07 74	

Where * indicates <0.01 and ** indicates < 0.05

When an association was tested between the total average entry-level Radiography module mark and the matric language marks as variables, there was a moderate positive correlation between English language HG marks in 2007 and prior (0.44), NSC English language marks in 2008 and after (0.35), and all matric English language marks (0.33).

When an association was tested between the English Proficiency Selection Test and the matriculation English language marks as variables, there was a moderate correlation between English language HG marks in 2007 and prior (0.34). A stronger correlation between the English Proficiency Test and the NSC English language marks in 2008 and after (0.52), as well as with the variable using all matric English language marks (0.48), as shown in Table 4.30. When an association was tested between the total average entry-level Radiography module mark and the English Proficiency Test (0.21), a weaker correlation was found.

In order to understand the association between academic success and the English language marks, as written in the NSC from 2008 and after, the marks were further divided per subject: as English Home Language subject and as English First Additional Language subject, and these marks were compared to the other variables. (cf. 4.9.2 and 4.9.3).

4.9.2 NSC English Home Language subject as performance predictor

Students (n=103) who wrote their NSC and matriculated in 2008 or after wrote either the subject English Home Language (n=20) or the subject English First Additional Language (n= 83). Table 4.31 shows the distribution of English Home Language marks, as well as the distribution of the other variables used.

TABLE 4.31: DISTRIBUTION OF NSC ENGLISH HOME LANGUAGE MARKS, TOTAL AVERAGE RADIOGRAPHY MODULE MARK AND ENGLISH PROFICIENCY SELECTION TEST SCORES

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
English Home Language mark 2008 and after	20	64.95	8.57	44	82
Radiography module mark average	17	65.80	7.88	52.2	78.13
English Proficiency Selection Test score	14	78.29	14.50	52	97

A weak correlation (0.22) was found between NSC English Home Language marks and the total average Radiography module mark. When an association was tested between the English Proficiency Selection Test, and the NSC English Home Language marks, there was a stronger correlation (0.59), as seen in Table 4.32.

TABLE 4.32: CORRELATION OF ENGLISH HOME LANGUAGE MARKS, TOTAL AVERAGE RADIOGRAPHY MODULE MARK AND ENGLISH PROFICIENCY SELECTION TEST SCORES

PEARSON CORRELATION COEFFICIENTS PROB > R UNDER H ₀ : RHO=0 NUMBER OF OBSERVATIONS		
Variable	Radiography subjects: total average mark	English Proficiency Selection Test
NSC English Home Language mark 2008 and after	0.22 0.39 17	0.59 ** 14

Where ** indicates < 0.05

4.9.3 NSC English First Additional Language subject as performance predictor

When comparing numbers of students with the NSC subject English First Additional Language (N=83) and the entry-level Radiography subject mark average (N=80), it was noted that only 3 students (or 3.61%) in this group did not write their year-end Radiography examinations, see Table 4.33.

TABLE 4.33: DISTRIBUTION OF NSC ENGLISH FIRST ADDITIONAL LANGUAGE MARKS, TOTAL AVERAGE RADIOGRAPHY MODULE MARK AND ENGLISH PROFICIENCY SELECTION TEST SCORES

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
NSC English First Additional Language mark 2008 and after	83	63.036	7.421	46	83
Total average Radiography module mark	80	62.24	8.96	43.12	85.75
English Proficiency Selection Test scores	52	52.96	20.72	5	99

The group of students (n=83 or 80.58%) who wrote the NSC in 2008 or after, and who took the subject English First Additional Language were in the majority (cf. Figures 4.6-4.8). This was also an indication of the large number of Radiography students who were not studying in their home language (cf. 2.4), but in their second language.

The correlation coefficient of NSC English First Additional Language marks and the total average entry-level Radiography module marks shows a moderate correlation (0.37).

There was a stronger correlation (0.49) between the English Proficiency Selection Test as variable with NSC English First Additional Language marks, as seen in Table 4.34.

TABLE 4.34: CORRELATION OF NSC ENGLISH FIRST ADDITIONAL LANGUAGE MARKS, TOTAL AVERAGE RADIOGRAPHY MODULE MARK AND ENGLISH PROFICIENCY SELECTION TEST SCORES

PEARSON CORRELATION COEFFICIENTS PROB > R UNDER H ₀ : RHO=0 NUMBER OF OBSERVATIONS		
Variable	Total average Radiography module	English Proficiency Selection Test
NSC English First Additional Language mark 2008 and after	0.37 ** 80	0.49 ** 52

Where ** indicates < 0.05

4.10 A LINEAR REGRESSION ANALYSIS

A linear regression analysis was done to assess the relationship between variables in this study. A linear regression, in addition to the correlation analysis, made it possible to identify which variable in this study could be considered to be the best performance predictor. To avoid multi co-linearity, the total CUT Rating Score was not used, as this variable was made up of scores already used in the other variables.

When the total average mark of students' individual entry-level Radiography modules were used as the dependent variable, and the "APS according to matriculation marks", GSAT scores and SDS Questionnaire Test scores were used as predictor variables, the "APS according to matriculation marks" was shown to be the only significant predictor. Table 4.35 shows the analysis of variance.

TABLE 4.35: ANALYSIS OF VARIANCE

SOURCE	DF	SUM OF SQUARES	F VALUE	PR > F
Model	3	1329.20	7.35	0.0002
Error	69	4159.39		

The regression analysis showed that GSAT and SDS Questionnaire scores did not add any significant prediction in the students' academic performance in Radiography education, see Table 4.36.

TABLE 4.36: REGRESSION ANALYSIS WITH APS, GSAT AND SDS QUESTIONNAIRE

	PARAMETER ESTIMATE	STANDARD ERROR	T VALUE
Intercept	27.49	8.27	3.32**
APS according to matriculation results	0.76	0.26	2.88**
GSAT	0.08	0.05	1.61
SDS Questionnaire Aptitude Test	0.09	0.06	1.60

Where ** indicates $P < 0.01$

A further analysis was done which used the total average mark of students' individual entry-level Radiography modules as the dependent variable, and the "APS according to matriculation marks", GSAT scores and SDS Questionnaire Test scores as predictor variables. In addition, the matriculation Biology subject marks (according to the SC results) and the matriculation Life Sciences subject marks (according to the NSC results), were combined as used as an additional predictor variable named as "Life Sciences marks". Table 4.37 shows the analysis of variance.

TABLE 4.37: ANALYSIS OF VARIANCE

SOURCE	DF	SUM OF SQUARES	F VALUE	PR > F
Model	4	1986.25	9.64	<0.0001
Error	68	3502.33		
Corrected Total	72	5488.58		

TABLE 4.38: REGRESSION ANALYSIS WITH LIFE SCIENCES MARKS, APS, GSAT AND SDS QUESTIONNAIRE

	PARAMETER ESTIMATE	STANDARD ERROR	T VALUE
Intercept	18.89	8.02	2.36
Life Sciences marks	0.42	0.11	3.57**
APS according to matriculation results	0.26	0.28	0.93
GSAT	0.05	0.04	1.24
SDS Questionnaire Aptitude Test	0.04	0.05	0.84

Where ** indicates $P < 0.01$

In the linear regression, the "Life Sciences marks" as variable were shown to be a more significant predictor even than the APS, see Table 4.38. It was noted that the Biology subject marks (SC) and Life Sciences subject marks (NSC) formed part of the "APS according to matriculation results".

TABLE 4.39: CORRELATION OF MATRICULATION BIOLOGY OR LIFE SCIENCES MARKS, APS AND TOTAL AVERAGE ENTRY-LEVEL RADIOGRAPHY MARK

PEARSON CORRELATION COEFFICIENTS			
PROB > R UNDER H0: RHO=0			
NUMBER OF OBSERVATIONS			
Variable	Biology or Life Sciences matriculation subject marks	APS according to matriculation results	Total average Radiography marks
Life Sciences marks	1.00 129	0.49** 128	0.51** 122
APS according to matriculation results		1.0 129	0.40** 122
Total average Radiography module marks			1.0 123

Where ** indicates < 0.01

As shown in Table 4.39, a Pearson correlation tested the relationship between the "Life Sciences marks", the "APS according to matriculation marks" and the total average entry-level Radiography module mark. The strongest correlation was found between the "Life Sciences marks" and the total average entry-level Radiography module mark. The "APS according to the matriculation marks" also showed a strong correlation. It was concluded that the "APS according to matriculation results", and "Life Sciences marks" were the best predictors of academic success for the Radiography programme.

This retrospective research study presented data which showed that success rates for entry-level Radiography students in their first year of university study who progressed to their second year of study was at a level of 71.53%. During the three-year period researched in this study, 2010-2012, the entry-level students (n=7 or 5.38%) who dropped out of the Radiography programme, during their first year of study, were a small percentage of the total. The percentage of students (n=30) who did not achieve exit-level outcomes at the end of their first year of study, and who would be expected to repeat one or more entry-level modules before they could progress to their second year of study was at a level of 23.09%.

The value and significance of the above findings (cf. 3.9), was to gain information which was considered relevant for admission and selection criteria for degree-level Radiography education.

4.11 CONCLUSION

In this chapter, the results of the study were summarised under headings which included a descriptive analysis of demographic information, an analysis related to tertiary education, an analysis related to student matriculation, admission criteria and selection tests, academic marks in Radiography modules, *t*-test procedures, correlation procedures and regression analyses. The different methods of analysis of data highlighted influences of the variables and aided in the interpretation of the results. The results of the study will be discussed in Chapter 5.

The next chapter, Chapter 5, entitled ***Assessment of student selection criteria as performance predictors for academic success***, provides an appraisal of research findings of the study and compares the findings with the literature review.

CHAPTER 5

ASSESSMENT OF STUDENT SELECTION CRITERIA AS PERFORMANCE PREDICTORS FOR ACADEMIC SUCCESS

5.1 INTRODUCTION

This retrospective research study was undertaken to assess current student selection criteria in Radiography education, to analyse the degree to which these criteria predicted academic performance amongst entry-level students over a three-year period.

Through this research process, it was hoped that the information gained could be used to optimise the future student selection process for Radiography education at the Central University of Technology (CUT). The rationale behind the interest in student selection in Radiography education was the fact that the South African Qualifications Authority (SAQA) had approved and registered a professional Bachelor's degree in Radiography (480 credits), with a new curriculum and altered exit-level outcomes, including research skills. The transition from a diploma-level to a degree-level qualification in Radiography in South Africa indicated that a review and an assessment of current diploma-level student selection criteria could provide a benchmark for selecting students for degree-level education.

This chapter is an appraisal of the main findings of the research, as well as a consideration of the alignment of these findings with the literature review and document analysis. As indicated in Chapter 1, the numbers of students enrolled in the Radiography programme at the CUT are currently increasing each year, and selectors are faced with critical admissions decisions when selecting prospective students for a programme with limited spaces.

5.2 THE STUDY METHODOLOGY

The approach to this research study was based on an assessment of student selection criteria for diploma-level Radiography education and how accurately these selection criteria predicted entry-level academic success. The study of the relevant literature in Chapter 2 helped the researcher gain background information and perspectives related to

student admission processes and selection tests in the health sciences, both nationally and internationally. The document analysis of various institutions offering Radiography education in South Africa underpinned the variety of general admission requirements and specific selection criteria in the domain of Radiography education. The insight gained in this literature review helped to structure the research design and methodology, as described in Chapter 3.

A data collection sheet was completed for each student, and included information regarding student biographical data, enrolment in the mainstream National Diploma in Radiography or the Extended Curriculum Programme (ECP), prior tertiary education, matriculation or NSC results and the Admission Points Score (APS) as calculated from each matriculation certificate. The CUT selection tests included a General Scholastic Aptitude Test (GSAT), an English Proficiency Test and a Self-Directed Search (SDS) Questionnaire, which is an aptitude test. By using the above matriculation results and APS, as well as the selection test scores, a total CUT Rating Score was calculated for each student, and this score was used in the selection process by which prospective students were accepted into the Radiography programme. The abovementioned scores were used as variables in the statistical analysis which formed part of the research study.

Furthermore, a correlation procedure compared the above variables with the total average mark of all entry-level Radiography modules, for each first-year student in the study group.

5.3 A COMPREHENSIVE PROFILE OF ENTRY-LEVEL RADIOGRAPHY STUDENTS

In order to determine a profile of the undergraduate Radiography student in the research study, extensive documentation of the demographic information was collected and recorded, and the descriptive analysis of this information (cf. 4.2) provides a comprehensive overview of the Radiography student profiles within the study group (n=130), in terms of age, gender and ethnic race group. Age, gender and ethnic race group as classifications were used only for student profiling purposes in this study, and were not correlated with student academic success rates, in line with a policy of equity and non-discrimination.

A further differentiation was made between mainstream National Diploma in Radiography or the Extended Curriculum Programme (ECP) students. At the time the research was undertaken, the CUT was unique amongst institutions of higher education in offering an extended curriculum in Radiography education to students who did not qualify for admission to mainstream Radiography education.

Further analysis differentiated between students with prior tertiary education and those with no prior tertiary education. Those students with prior tertiary education in health sciences were analysed according to the specific field of study, and whether the prior education had been completed.

5.3.1 Tertiary education prior to Radiography studies

Within the study group, a total of 37 students (28.46%) had undertaken tertiary studies prior to entering the Radiography programme, and had attempted either degree, diploma or higher certificate studies. Within this group of 37 students with prior tertiary education, only five students had completed their prior tertiary education. A total of four students had graduated with a diploma or higher certificate and only one student had graduated with a Bachelor's degree, before attempting Radiography education. These statistics provided a useful insight into the number of students (n=32 or 24.61%) who entered Radiography education after an initial drop-out from another tertiary education programme (cf. 5.3.2).

5.3.2 Prior tertiary education in health sciences

When prior tertiary education in health sciences was statistically analysed within the group with any form of prior tertiary education (n=37 or 28.46%), it was found that a significant number of these students (n=14 or 37.83%) had previously studied in one of the health sciences. Of particular interest were three students who had completed two or more years towards a M.B.,Ch.B. degree, but had not been able to continue with this study direction for academic reasons. The fact that the majority of students in the study group with prior tertiary education in health sciences were successful in entry-level Radiography education, was a positive finding (cf. 4.3.3), and prior tertiary education in health sciences could be considered a predictor for entry-level academic success in Radiography education. This was not considered to be an unexpected finding, because

students previously enrolled for a qualification such as an M.B.,Ch.B or other Bachelor's degree in Science or Nursing could be expected to achieve success in diploma-level Radiography education.

5.3.3 Re-entry into tertiary education

The current research study has shown that in spite of students having dropped out of other degree-level or diploma-level programmes at other institutions, they have in fact re-entered tertiary education in diploma-level Radiography education, and in most cases have been successful at entry-level. Further research is envisaged to follow the progress of this group of students in the second year and third year of diploma-level Radiography education. A complete profile could be obtained of overall graduation success rates, if the student group was surveyed over all three years of their Radiography education.

Although further investigation into the statistics of students re-entering tertiary education is beyond the scope of this research study, these statistics do provide a unique insight into the percentage of students, classed as "dropouts" after an initial unsuccessful attempt at tertiary education at other institutions of higher education. The statistics of this study showed that after an initial dropout, many have persevered in furthering their education. Wilson-Strydom (2012:5) provides comprehensive international and national statistics on first-year student success rates, related to bachelor degree seekers. The findings of the current research study regarding entry-level student success rates are considered to be positive in the context of South African higher education.

5.4 AN APPRAISAL OF CORE MATRICULATION SUBJECT MARKS AS PERFORMANCE PREDICTORS FOR ACADEMIC SUCCESS

A statistical analysis in the form of *t*-test procedures was used to observe the association of variables used in the study. Firstly, core matriculation subject marks and achievement levels were considered, as these were used as institutional admission criteria and also formed part of the selection test scores. The core matriculation achievement levels of each student were used to calculate the APS total, which was used as an admission and selection criterion.

A number of *t*-test procedures were used to observe the association of core matriculation subject marks with the group of students who matriculated in 2007 or in prior years, who either achieved a first year pass in Radiography education (n=16 or 59.25%) or those who did not pass their first year of study (n=11 or 40.75%). According to this particular analysis, these matriculation subject marks did not show any significance as predictors for academic success, in terms of whether the student achieved or did not achieve a pass at the end of their first year of study.

A *t*-test procedure was used to observe the association of core matriculation subject marks with the group of students who matriculated in 2008 or in subsequent years, who either achieved an entry-level pass in Radiography education (n=76 or 73.80%), or those who did not pass (n=26 or 26.20%). According to this analysis, the only significant matriculation subject mark predictor for academic success proved to be the students' Life Sciences subject marks. It was noted that the percentage of students who achieved a pass at entry-level differed considerably for the group who matriculated in 2007 and prior (59.25%) and for the group who matriculated in 2008 and after (73.80%). A much higher entry-level pass rate was found in the group who had matriculated in 2008 and after.

5.5 AN APPRAISAL OF STUDENT SELECTION TESTS AND ACHIEVEMENT OF ENTRY-LEVEL SUCCESS

A number of *t*-test procedures were used to observe the association of the "APS according to matriculation results" with the group of students who either achieved or did not achieve a pass at the end of their first year of Radiography education. In this procedure, the APS did not predict academic success at entry-level. Similarly, further *t*-test procedures were used to observe the association of other selection criteria with students who either passed or did not pass at entry-level, and according to the analysis, it was shown that none of the selection criteria was significant in predicting whether the student would pass or not. These selection criteria included; APS with bonus points added, the GSAT score, the English Proficiency Selection Test score, the SDS Questionnaire score and the total CUT Rating Score.

A number of factors could have contributed to the above findings, and these findings substantiate the fact that academic success at entry-level was not only dependent on

admission and selection tests, but on numerous additional factors, including availability of finances, student living conditions, socialisation factors, time management and dedication to studies (cf. 1.1).

Statistical analyses were also performed to establish whether there was any significant correlation between the selection variables themselves. The variable "APS according to matriculation results" and the variable "APS with bonus points added" showed a strong correlation, which was expected as the data used were similar in both variables. Moderate relationships were found between the variable "APS according to matriculation results" and the variables: the GSAT score, and English Proficiency Selection Test score. The variable Self-Directed Search (SDS) Questionnaire Test score did not correlate with the scores of the other selection tests. The SDS Questionnaire Test score was used to calculate the total CUT Rating Score and contributed to a prospective student's chances for selection. The total CUT Rating Score was expected to correlate strongly with the other variables, as the data from the other variables were used to calculate this rating score.

From the above results, it became clear that using the variables "achieved an entry-level pass" and "did not achieve an entry-level pass" provided limited information for an investigation into whether selection criteria predicted academic success. A contributing factor was that the category of students who "did not achieve an entry-level pass" and failed their first academic year, included both students who failed numerous modules by a large margin, as well as those students who failed only one first-year module by a narrow margin. An analysis, appraisal and correlation of selection criteria and tests and the individual entry-level Radiography module marks was then undertaken to gain further insight into the relationship between the variables. It was also considered important to assess the relationship between the total average entry-level Radiography module mark and the admission criteria and selection tests. Individual and average academic first-year module marks provided more information about academic success.

5.6 AN APPRAISAL OF STUDENT SELECTION TESTS AND STUDENT ACADEMIC MARKS

In a Pearson correlation procedure, the association between various admission and selection tests, and the actual student academic marks in the various entry-level

Radiography modules, as well as the total average entry-level Radiography mark was tested. Moderate to weak correlations were found between admission and selection tests and academic marks.

The "APS according to matriculation results" showed a moderate correlation with entry-level Radiography modules. The additional selection tests, the GSAT, the English Proficiency Test and the SDS Questionnaire Test were undertaken by prospective students in order for student selectors to gain additional information about the suitability of the student for the Radiography programme. From the results of the current study, it was shown that the additional selection tests do not appear to predict student academic performance, over and above the information gained from the "APS according to the matriculation results".

When a further linear regression analysis was performed, and the total average mark of entry-level Radiography modules was used as the dependent variable, and the "APS according to matriculation results", GSAT scores and SDS Questionnaire scores were used as predictor variables, the "APS according to matriculation results" was shown to be the only significant predictor. The regression analysis showed that the GSAT score and SDS Questionnaire Test scores did not add any significant prediction for the total average mark of entry-level modules in Radiography education.

5.7 MATRICULATION LIFE SCIENCES MARKS AS PERFORMANCE PREDICTOR

A Pearson correlation was used to test the relationship between the SC Biology subject marks and the NSC Life Sciences subject marks, combined into a variable named "Life Sciences marks". The "APS according to matriculation results" and the total average entry-level Radiography module marks were also used as variables. The strongest correlation was found between the "Life Sciences marks" and the total average entry level Radiography module marks. This finding may be linked to the similarity between some of the subject matter in the matriculation Biology subject and Life Sciences subject curricula and the Radiography programme curriculum. Further recommendations regarding this finding will be discussed in Chapter 6.

5.8 AN APPRAISAL OF ENGLISH LANGUAGE AS PERFORMANCE PREDICTOR

A moderate correlation was found between the total average entry-level Radiography module mark and the English Proficiency Test. There was a slightly stronger correlation between the English Proficiency Selection Test and the matriculation English language marks. The fact that the matriculation English language marks and the English Proficiency Test scores did not show a stronger correlation, does imply that further investigation into methods of assessing language proficiency may be necessary.

The matriculation SC and NSC English language marks did not appear to be strong performance predictors in the entry-level Radiography programme. Due to the fact that English is the language of learning and teaching, consideration must be given to the fact that Radiography education is undergoing a transition from a diploma-level to a degree-level programme, with research skills having been added as an additional exit-level outcome for the professional Bachelor's degree in Radiography. In the degree-level Radiography programme, students will be expected to develop reflective writing skills, and Radiography educators may expect students' English language skills to be more advanced. With the development of a new curriculum for degree-level Radiography education, Radiography educators who are responsive to the teaching and learning needs of their students within a discipline-specific context, could play a pivotal role in the transition from diploma-level to degree-level Radiography education. The fact that this study has shown that the majority of Radiography students at the CUT are English second language speakers, and have achieved matriculation NSC English at first additional language level may inform Radiography educators of the learning needs of future students in the degree-level Radiography programme.

5.9 AN APPRAISAL OF FINDINGS AND COMPARISON WITH LITERATURE STUDY AND DOCUMENT ANALYSIS

In Chapter 2 (cf. 2.3.3) reference was made to the authors Bowen *et al.* (2009) in Wilson-Strydom (2012:37) who put forward the argument that a combination of school results and content-based achievement tests may provide "the most rigorous and fairest way to judge applicants". When consideration was given to the findings of the current study in juxtaposition with the literature study and document analysis, it was noted that certain selection criteria used at the CUT did not serve to predict academic progression in the

Radiography programme. The findings of the current research study showed that matriculation Life Sciences subject marks and APS according to matriculation results predicted academic success rates to a better degree than the other selection tests used.

In view of the literature study and document analysis, where the use of multiple selection criteria have been advocated in more than one research study (cf. Chapter 2), the various selection criteria used at the CUT at the time that the research was undertaken, must be critically appraised. In the study undertaken by Jenkins (2004) (cf. 2.5.1), the GSAT selection test was found to have some predictive validity for academic success. In this current study at the CUT, where student selection according to matriculation Life Sciences subject marks and APS proved to have a better predictive ability than the GSAT selection test, and that the GSAT score did not contribute any information over and above the APS. In view of the findings from this study and the transition to degree-level Radiography education, consideration may be given to the use of an alternative form of additional selection test to replace the GSAT.

The lack of predictive validity of the SDS Questionnaire Test in the current research, may also offer insight into use of the test in the South African context. In research conducted by authors Du Toit and De Bruin (2002:Online), more than a decade ago, the authors questioned whether the model was valid and reliable in a South African cultural context (cf.2.5.1). Consideration could be given to the use of an alternative form of selection, other than the SDS Questionnaire Selection Test, in view of the transition to degree-level Radiography education.

An appraisal of the admission criteria and selection tests cannot be complete without considering the overall academic success rates for entry-level Radiography students at the CUT at the time when this study was undertaken. This retrospective research study presented data which showed that 71.53% of first-year Radiography students at the CUT were academically successful and progressed to their second year of study. Students who dropped out (n=7 or 5.38%) were a small percentage of the total, and it was expected that the remaining unsuccessful students (n=30 or 23.09%) would return in the following academic year to repeat one or more modules in entry-level Radiography and would therefore continue with their tertiary education.

The 30 students who did not progress to the second year of study, because they did not achieve the exit-level outcome for the first year of study in one or more modules, were distributed amongst students enrolled for the Nat. Diploma in Radiography and students enrolled in the ECP in Radiography. The findings and the results which emerge from this study, when observing the academic progression of both the mainstream (National Diploma in Radiography students) and the extended programme (ECP) students, provide useful information in the context of higher education in South Africa.

The results show that the majority of entry-level Radiography students, both mainstream students and extended programme students were academically successful, and whilst consideration must be given to the other factors which also played a role in this pass rate, including institutional interventional strategies, curricular teaching and learning strategies and the impact and role of educators, the fact remains that the majority of the students (71.53%) selected for the programme proved to be academically successful in their first year of study.

The challenge remains to bridge the transition from diploma-level to degree-level Radiography, in a manner which is equitable to prospective students, as well as which will meet the demands which a Bachelor's degree in Radiography will place on the prospective student.

From the document analysis, it was clear that degree-level Radiography education would have to meet the specific requirements in terms of NSC achievement levels of four subjects from a designated list of subjects on an achievement level 4 (50-59%) (cf. 1.3). The other requirement for entry into a Bachelor's degree qualification was the requirement of one official language on home language level at achievement level 3 (cf. 1.3). Proficiency in English would become even more important for academic success in degree-level Radiography education, because of the focus on research skills and reflective writing skills. The current research study has also shown that the majority of the NSC students had not taken English at home language level, but rather at first additional language level. In view of this consideration, the recommendation could be made that the NSC subject English First Additional Language should be on an achievement level 4 or higher, to ensure that students have the proficiency in the language to be able to cope with the expectations of the new curriculum for the degree-level qualification, including the research skills module.

Although beyond the scope of this research study, it was noted that the minimum achievement level requirements for both diploma-level and degree-level tertiary education fall far short of the actual APS expected by institutions of higher education for admission into university programmes.

The further document analysis showed that a university in the UK (CUL 2013a:Online) and other South African institutions of higher education offering Radiography education expected applicants to either complete a questionnaire answering questions about themselves, or to visit an imaging department. A visit to an imaging department could help provide an applicant with useful and realistic information about the health care environment in which they would be working (cf.2.3.2). A number of institutions also expected prospective students to write an essay indicating their interest in the career of Radiography (cf. 2.6.9). In this manner, prospective applicants could be expected to consider their career choice, and this was in line with aiding the prospective applicant "to make a useful and informed decision" (Benbassat & Baomal 2007:519).

Further document analysis also highlighted the fact that certain institutions of higher education offering Radiography education, other than the CUT, already require prospective students to write National Benchmark Tests (NBTs) as part of the selection process. As the aim of the NBT project was to assess prior learning competency which would "directly impact on the success of first-year students" (NBT 2013:Online), this question may be a topic for further investigation, in view of the fact that there is currently a transition from diploma-level to degree-level Radiography education. The NBT results could also be useful to educators making decisions regarding "course development, programme planning and placement decisions" (NBT 2013:Online).

5.10 CONCLUSION

This chapter has been an appraisal of the main findings of the research, as well as a consideration of the alignment of these findings with the literature review and document analysis. A review and an assessment of current diploma-level student selection criteria has placed future degree-level student selection criteria in perspective. To admit and select students who have the ability and degree of academic readiness to be able to complete the degree-level Radiography programme in a reasonable timeframe remains important, both for the institution and for the students themselves; notwithstanding the

fact that student academic success may be dependent on numerous, often complex factors.

To conclude, this retrospective research study presented data which showed that 71.53% of first-year Radiography students at the CUT were academically successful and progressed to their second year of study. Students who dropped out of the Radiography programme were a small percentage of the total (5.38%). The remaining students (23.09%) were those who did not achieve a pass in all entry-level modules at the end of their first year of study, and these students would have to repeat one or more entry-level modules before they could progress to their second year of study.

A strong correlation was found between matriculation Biology subject marks (SC) and Life Sciences subject marks (NSC) and the total average first-year Radiography module marks. The APS, according to the matriculation results, also showed a strong correlation with the total average first-year Radiography module marks. It was concluded that the APS, according to matriculation results, and the Biology and Life Sciences subject marks were the best predictors of academic success for the Radiography programme in the first year of study.

In Chapter 6, ***Conclusion, recommendations and limitations of the study***, the conclusions, recommendations and limitations will be provided.

CHAPTER 6

CONCLUSION, RECOMMENDATIONS AND LIMITATIONS OF THE STUDY

6.1 INTRODUCTION

An in-depth study was done by the researcher with a view to make a contribution through the assessment of current selection criteria for Radiography education and to determine whether the selection criteria were reliable in predicting academic success amongst entry-level students at the CUT. Additionally, with a transition from diploma-level to degree-level Radiography education at the CUT, the overall goal of the study was to inform and make recommendations for future student selection criteria in Radiography education.

As the aim of the study was to consider the validity of the current selection criteria as performance predictors in entry-level Radiography education, the research study included a literature study and document analysis which served to inform the researcher of trends in Radiography education, as well as providing an overview of selection criteria in health sciences education in general. In the retrospective research study conducted over a period of three years, the demographic information gathered served to establish student profiles. The admissions criteria in the form of matriculation SC and NSC results, as well as other selection tests of entry-level Radiography students, were statistically analysed to assess their correlation with individual Radiography module marks and total average first-year Radiography module marks, to determine the predictive ability of admissions and selection tests for indicating first-year academic success.

6.2 RESEARCH QUESTION AND OBJECTIVES OF THE STUDY

The research question which was posed in this study was: *What student selection criteria should be used as performance predictors for academic success in entry-level Radiography education at the Central University of Technology?*

In order to answer the above question, the following objectives were pursued:

Research objective 1: To benchmark, from literature, best practices in prospective student profiling and selection criteria, specifically in the domain of Radiography education.

This primary objective addressed the main research question. In the literature study, perspectives on selection criteria, both academic and non-academic, as well as multiple selection criteria were considered, for admission of students in the health sciences and specifically for Radiography education. An analysis of documents relevant to the selection criteria at different institutions of higher education in South Africa offering Radiography education was done, with the intention to benchmark best practices in student selection criteria. It was found that tests of merit, such as matriculation SC or NSC core subject marks, as well as the APS were widely used as admission criteria.

Research objective 2: To gain a thorough insight into the current profile of undergraduate students in a Radiography programme at a tertiary institution (the CUT) and to retrospectively compare the various selection criteria with the level of academic achievement in the first year of study in the Radiography programme at CUT, over the last three years of student intake, 2010, 2011 and 2012.

This primary objective addressed the main research question (cf. 1.5.3). A quantitative data analysis using a retrospective cohort study, with a total number of 130 students, was undertaken by the researcher, gaining insight into the academic profiles of entry-level students. A data collection sheet was used to compile the relevant data for each of the students in the study group. A statistician performed the procedures, tested and verified the data.

Research objective 3: To ascertain the validity and reliability of current selection criteria, specifically for the purpose of gaining information relevant to Radiography education.

This primary objective addressed the main research question (cf. 1.5.3). By using statistical analysis to compare core matriculation SC or NSC subject marks, the APS, the GSAT scores, the English Proficiency Test scores and the SDS Questionnaire Test scores with the individual module marks, as well as the total average entry-level Radiography module marks, the results showed that there was a strong correlation between matriculation Biology or Life Sciences marks and the total average entry-level Radiography module mark. The results also showed that there was a strong correlation between the APS according to matriculation marks and the total average entry-level Radiography module mark. Amongst the admission criteria, the English Proficiency Test

scores and English language matriculation marks would have been expected to show a stronger correlation. The GSAT and the SDS Questionnaire used in the CUT selection process did not appear to contribute additional information in predicting entry-level academic success or in correlating with the total average entry-level Radiography module mark.

Research objective 4: To recommend strategies to ensure that future student selection criteria fulfil the demands and requirements of the professional Bachelor's degree in Radiography.

This secondary objective addressed the future requirements of Radiography education (cf. 1.5.3). An analysis of documents relevant to the student application criteria of the various institutions of higher education offering Radiography education in South Africa served to provide context knowledge, by using information from existing literature (Flick 2009 in de Vos *et al.* 2011:303). An analysis of quantitative data, to consider how diploma-level Radiography students were initially selected and secondly to assess their academic performance in a Radiography context, was undertaken. Although the matriculation English language marks or English Proficiency Test did not correlate strongly with entry-level success in the current study, consideration must be given to the fact that Radiography education is undergoing a transition from a diploma-level to a degree-level programme. With a research skills module having been added to the curriculum, the degree-level Radiography students will be expected to develop reflective writing skills, and Radiography educators may expect students' English language skills to be more advanced. Proficiency in English would be a recommended strategy for degree-level Radiography education. The recommended strategies follow in 6.3.

6.3 RECOMMENDATIONS

The recommendations made are that the requirements for admission and selection for degree-level Radiography education include the following criteria:

- The core NSC subjects of Mathematics, Life Sciences and Physical Sciences should be at a minimum achievement level 4 (50-59%), and actual marks of the NSC Life Sciences subject, in particular, were shown to be a strong academic indicator and should be taken into account when selecting students.

- The core NSC language subjects, namely English Home Language or English First Additional Language, should be a minimum achievement level 4 (50-59%), and English Home Language or English First Additional Language subject marks may be academic indicators in degree-level Radiography education and these subject marks should be taken into account when making student selection decisions.
- The APS was an important and valid admission criterion, particularly when used in conjunction with the actual core NSC subject marks, for admission and selection processes. The current requirement of 27 points on the CUT Rating Scale for admission to the diploma-level Radiography programme may need to be raised for degree-level Radiography education, at the discretion of the CUT as institution of higher education.
- The use of the GSAT as a selection test to determine academic ability should be revisited. Although limited predictive value of the GSAT was found in certain analyses to determine academic success, this test was not found to contribute additional information to selectors, over and above the predictions of academic success gained from SC and NSC examination results.
- Although the English Proficiency Test scores in the study did not show a consistent correlation with academic success, the importance of proficiency in English as Language of Learning and Teaching (LOLT) cannot be refuted. An alternative language test may need to be implemented for degree-level Radiography education. An assessment such as the NBT Academic Literacy (AL) test may provide selectors with useful information regarding prospective students' language abilities.
- Consideration should be given to replace the SDS Questionnaire Test as a selection tool. The CUT was the only South African institution of higher education offering Radiography education which used the SDS Questionnaire Test as aptitude test. In view of the lack of any useful student selection information being provided by this aptitude test in the South African context, consideration should be given to replace this selection tool with a visit by the prospective student to an imaging department, either in a government hospital or a private health care facility. This recommendation would help prospective students self-evaluate their career choice, and help prospective students make an informed decision about their suitability to the health-care environment in which they would be working. Consideration could also be given to the implementation of a written motivation, in the form of an essay, by the prospective student, indicating reasons why they believe Radiography to be a suitable career choice for themselves.

- The implementation of a fair and non-discriminatory general information questionnaire, to be completed by all prospective students. The rationale for this recommendation is that such a questionnaire could indicate relevant personal information, including a record of any prior tertiary education in other health sciences, which could be a motivation for selection into the Radiography programme. This information may be of use to educators faced with difficult selection decisions.

6.4 LIMITATIONS OF THE STUDY

The researcher recognises the following limitations to the study:

The fact that not all students in the study group had written the same matriculation examination was perceived as a limitation, although this was seen as unavoidable in terms of the transitional period, subsequent to the introduction of the NSC as school-leaving examination in the year 2008.

The fact that not all students had entered the Radiography programme by the same selection process was seen as a confounding factor. The fact that not all students had undertaken selection tests was a limiting factor. Where the selection test scores were used in the statistical analysis, they had to be used with caution, due to the issue of co-linearity amongst a number of the variables, notably the total CUT Rating Score, where scores of other variables contributed to the scores of this variable.

The entry-level academic success of Radiography students appeared very promising from this study, but it was acknowledged that a more comprehensive analysis would be needed to observe how the same students progressed through their second and third years of study. The issue of a reasonable timeframe to achieve academic success remains relevant (cf. 1.1).

On a personal note, it became clear during the research process that errors and omissions were present on the websites of institutions of higher education offering Radiography education, which were used in the document analysis (cf. 2.9). This observation did not affect the main research study, but was perceived as a limitation in terms of factual accuracy. The subsequent upgrading of a number of the institutional websites also

confounded the issue of revisiting the various institutional requirements for purposes of accuracy.

6.5 CONCLUDING REMARKS

This retrospective research study presented data which indicated that certain selection criteria could predict academic success, and that at the time the research was conducted, the success rates for entry-level CUT Radiography students in their first year of study progressing to their second year of study, was at a level of 71.53%. These statistics indicated that certain selection criteria, such as the APS according to matriculation or NSC examinations, were valid for this particular Radiography programme and could be used as academic performance predictors. Additionally, the matriculation Biology subject (SC) marks and Life Sciences subject marks (NSC) were shown to be strong predictors for academic success. This study showed that English at first additional language level was the most common language level amongst students within the study group. If cognisance of the above fact is taken by Radiography educators, when establishing new curriculum provisions and when developing degree-level study material, this may help contribute to future student academic progression.

The alternative selection criteria used, the GSAT and the SDS Questionnaire Test did not significantly contribute any additional information as performance predictors for academic success. This should not be taken as an assumption that the use of multiple selection criteria did not have worth, but rather that alternative multiple selection criteria could be considered for future degree-level Radiography education.

The fact that practical, discipline-specific competence amongst new graduates in degree-level Radiography education would remain highly rated (cf. 2.3.3), whilst at the same time incorporating new research-based skills at an undergraduate level, highlighted the need for a tailored discipline-specific curriculum, which would address the needs of Radiography education for the future. Additionally, the specific needs of the profession within a South African context should also be an important consideration.

A future research study, considering throughput rates of a study group of degree-level Radiography students across all the academic years of study in Radiography education,

and a consideration of the timeframe in which graduation was achieved, would give a comprehensive indication of degree-level Radiography student success rates.

The answers provided by this research study may be useful in establishing a benchmark level for student selection practices for future degree-level Radiography education in South Africa. Consideration may also be given to the recommendations for implementation in student selection processes at the CUT, in order to facilitate a successful transition to degree-level Radiography education.

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APPENDIX A

QUANTITATIVE DATA COLLECTION SHEET

Quantitative Data Collection Sheet

Quantitative Data Collection Sheet				
		1	2	3
SECTION 1: BIOGRAPHICAL DATA				
1. GENDER				
	MALE	<input type="checkbox"/>	1	<input type="checkbox"/> 4
	FEMALE	<input type="checkbox"/>	2	
2. AGE AT FIRST ENTRY INTO RADIOGRAPHY PROGRAMME				
		<input type="checkbox"/>	<input type="checkbox"/>	5 6
3. ETHNIC BACKGROUND				
	BLACK	<input type="checkbox"/>	1	<input type="checkbox"/> 7
	COLOURED	<input type="checkbox"/>	2	
	WHITE	<input type="checkbox"/>	3	
	ASIAN	<input type="checkbox"/>	4	
	OTHER	<input type="checkbox"/>	2	
IF STUDENT IS IN NAT. DIPLOMA IN RADIOGRAPHY, COMPLETE QUESTION 4.				
4. FIRST YEAR OF ENTRY INTO N. DIPLOMA IN RADIOGRAPHY PROGRAMME				
	PRIOR TO 2009	<input type="checkbox"/>	1	<input type="checkbox"/> 8
	2009	<input type="checkbox"/>	2	
	2010	<input type="checkbox"/>	3	
	2011	<input type="checkbox"/>	4	
	2012	<input type="checkbox"/>	5	
IF STUDENT IS IN EXTENDED CURRICULAR PROGRAMME IN RADIOGRAPHY, COMPLETE QUESTION 5.				
5. FIRST YEAR OF ENTRY INTO RADIOGRAPHY EXTENDED CURRICULAR PROGRAMME				
	PRIOR TO 2009	<input type="checkbox"/>	1	<input type="checkbox"/> 9
	2009	<input type="checkbox"/>	2	
	2010	<input type="checkbox"/>	3	
	2011	<input type="checkbox"/>	4	
	2012	<input type="checkbox"/>	5	

SECTION 2: PRIOR TERTIARY EDUCATION			
6. ANY PRIOR TERTIARY EDUCATION?			
Yes	<input type="checkbox"/>	1	<input type="checkbox"/> 10
No	<input type="checkbox"/>	2	
IF YES, ANSWER QUESTIONS 7-19			
7. A TERTIARY EDUCATION DEGREE COMPLETED?			
Yes	<input type="checkbox"/>	1	<input type="checkbox"/> 11
No	<input type="checkbox"/>	2	
8. A DEGREE PARTIALLY COMPLETED (1 YEAR OR LESS)?			
Yes	<input type="checkbox"/>	1	<input type="checkbox"/> 12
No	<input type="checkbox"/>	2	
9. A DEGREE PARTIALLY COMPLETED (2 YEARS OR MORE)?			
Yes	<input type="checkbox"/>	1	<input type="checkbox"/> 13
No	<input type="checkbox"/>	2	
10. A DIPLOMA OR HIGHER CERTIFICATE COMPLETED?			
Yes	<input type="checkbox"/>	1	<input type="checkbox"/> 14
No	<input type="checkbox"/>	2	
11. A DIPLOMA OR HIGHER CERTIFICATE PARTIALLY COMPLETED (1 YEAR OR LESS)?			
Yes	<input type="checkbox"/>	1	<input type="checkbox"/> 15
No	<input type="checkbox"/>	2	
12. A DIPLOMA OR HIGHER CERTIFICATE PARTIALLY COMPLETED (2 YEARS + MORE)?			
Yes	<input type="checkbox"/>	1	<input type="checkbox"/> 16
No	<input type="checkbox"/>	2	
13. WAS ABOVE PRIOR EDUCATION UNDERTAKEN IN HEALTH SCIENCES?			
Yes	<input type="checkbox"/>	1	<input type="checkbox"/> 17
No	<input type="checkbox"/>	2	
14. IF YES, IN WHICH HEALTH SCIENCES EDUCATION PROGRAMME?			
MB ChB	<input type="checkbox"/>	1	<input type="checkbox"/> 18
BSc Radiation Science	<input type="checkbox"/>	2	
Other Bachelor of Science	<input type="checkbox"/>	3	
Nursing	<input type="checkbox"/>	4	
Dental Assisting	<input type="checkbox"/>	5	
Other Health Science education	<input type="checkbox"/>	6	
15. WAS PRIOR TERTIARY EDUCATION UNDERTAKEN AT CUT?			
Yes	<input type="checkbox"/>	1	<input type="checkbox"/> 19
No	<input type="checkbox"/>	2	
Not Applicable	<input type="checkbox"/>	3	

16. IF NOT AT CUT, IN WHICH PROVINCE IS INSTITUTION OF PRIOR EDUCATION?					
Eastern Cape Province	<input type="checkbox"/>	1			
Free State Province	<input type="checkbox"/>	2			
Gauteng Province	<input type="checkbox"/>	3			
Kwazulu Natal Province	<input type="checkbox"/>	4			
Limpopo Province	<input type="checkbox"/>	5			
Mpumalanga Province	<input type="checkbox"/>	6			
Northern Cape Province	<input type="checkbox"/>	7			
Northwest Province	<input type="checkbox"/>	8			
Western Cape Province	<input type="checkbox"/>	9			
		<input type="checkbox"/> 20			
17. PREVIOUSLY ENROLLED IN RADIOGRAPHY AT ANOTHER INSTITUTION?					
Yes	<input type="checkbox"/>	1			
No	<input type="checkbox"/>	2			
		<input type="checkbox"/> 21			
18. IF YES, COMPLETED ONE YEAR IN RADIOGRAPHY AT OTHER INSTITUTION?					
Yes	<input type="checkbox"/>	1			
No	<input type="checkbox"/>	2			
		<input type="checkbox"/> 22			
19. IF YES, COMPLETED TWO YEARS IN RADIOGRAPHY AT OTHER INSTITUTION?					
Yes	<input type="checkbox"/>	1			
No	<input type="checkbox"/>	2			
		<input type="checkbox"/> 23			
SECTION 3: MATRICULATION RESULTS					
20. IN WHICH COUNTRY DID STUDENT MATRICULATE?					
South Africa (SA)	<input type="checkbox"/>	1			
Other African country	<input type="checkbox"/>	2			
Other country	<input type="checkbox"/>	3			
		<input type="checkbox"/> 24			
21. IF OTHER AFRICAN OR OTHER COUNTRY, STATE SUBJECT MARKS					
English Language	<input type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>	25-26
Physical Science	<input type="checkbox"/>	2	<input type="checkbox"/>	<input type="checkbox"/>	27-28
Mathematics	<input type="checkbox"/>	3	<input type="checkbox"/>	<input type="checkbox"/>	29-30
Biology	<input type="checkbox"/>	4	<input type="checkbox"/>	<input type="checkbox"/>	31-32
Total Percentage of all subject marks	<input type="checkbox"/>	5	<input type="checkbox"/>	<input type="checkbox"/>	33-34
21. IF MATRICULATION IN SA, IN WHICH PROVINCE DID STUDENT MATRICULATE?					
Eastern Cape	<input type="checkbox"/>	1			
Free State	<input type="checkbox"/>	2			
Gauteng	<input type="checkbox"/>	3			
Kwazulu Natal	<input type="checkbox"/>	4			
Limpopo	<input type="checkbox"/>	5			
Mpumalanga	<input type="checkbox"/>	6			

Northern Cape 7
 Northwest Province 8
 Western Cape 9

35

22. MATRICULATION IN THE YEAR 2007 AND PRIOR YEARS

LANGUAGE SUBJECT PERCENTAGE MARK

English Higher Grade (HG)	<input type="checkbox"/>	1			
English Standard Grade (SG)	<input type="checkbox"/>	2	<input type="checkbox"/>	<input type="checkbox"/>	36-37
Afrikaans HG	<input type="checkbox"/>	3			
Afrikaans SG	<input type="checkbox"/>	4	<input type="checkbox"/>	<input type="checkbox"/>	38-39
Sesotho	<input type="checkbox"/>	5	<input type="checkbox"/>	<input type="checkbox"/>	40-41
isiXhosa	<input type="checkbox"/>	6	<input type="checkbox"/>	<input type="checkbox"/>	42-43
isiZulu	<input type="checkbox"/>	7	<input type="checkbox"/>	<input type="checkbox"/>	44-45
Tshivenda	<input type="checkbox"/>	8	<input type="checkbox"/>	<input type="checkbox"/>	46-47
Xitsonga	<input type="checkbox"/>	9	<input type="checkbox"/>	<input type="checkbox"/>	48-49
Siswati	<input type="checkbox"/>	10	<input type="checkbox"/>	<input type="checkbox"/>	50-51
Sepedi	<input type="checkbox"/>	11	<input type="checkbox"/>	<input type="checkbox"/>	52-53
isiNdebele	<input type="checkbox"/>	12	<input type="checkbox"/>	<input type="checkbox"/>	54-55
Setswana	<input type="checkbox"/>	13	<input type="checkbox"/>	<input type="checkbox"/>	56-57
Other Language (s)	<input type="checkbox"/>	14	<input type="checkbox"/>	<input type="checkbox"/>	58-59

CORE AND OTHER SUBJECT PERCENTAGE MARK

Mathematics HG	<input type="checkbox"/>	15			
Mathematics SG	<input type="checkbox"/>	16	<input type="checkbox"/>	<input type="checkbox"/>	60-61
Science HG	<input type="checkbox"/>	17			
Science SG	<input type="checkbox"/>	18	<input type="checkbox"/>	<input type="checkbox"/>	62-63
Biology HG	<input type="checkbox"/>	19			
Biology SG	<input type="checkbox"/>	20	<input type="checkbox"/>	<input type="checkbox"/>	64-65
Other Subject Score	<input type="checkbox"/>	21	<input type="checkbox"/>	<input type="checkbox"/>	66-67
Other Subject Score	<input type="checkbox"/>	22	<input type="checkbox"/>	<input type="checkbox"/>	68-69
TOTAL AVERAGE	<input type="checkbox"/>	1	<input type="checkbox"/>	<input type="checkbox"/>	70-71

23. NATIONAL SENIOR CERTIFICATE (NSC) MATRIC IN 2008 OR AFTER

LANGUAGE SUBJECT PERCENTAGE MARK

Afrikaans Home Language	<input type="checkbox"/>	1			
Afrikaans First Additional Language	<input type="checkbox"/>	2			
Afrikaans Second Additional Language	<input type="checkbox"/>	3	<input type="checkbox"/>	<input type="checkbox"/>	72-73
English Home Language	<input type="checkbox"/>	4			
English First Additional Language	<input type="checkbox"/>	5			
English Second Additional Language	<input type="checkbox"/>	6	<input type="checkbox"/>	<input type="checkbox"/>	74-75
IsiNdebele Home Language	<input type="checkbox"/>	7			

IsiNdebele First Additional Language	<input type="checkbox"/>	8		
IsiNdebele Second Additional Language	<input type="checkbox"/>	9	<input type="checkbox"/>	76-77
IsiXhosa Home Language	<input type="checkbox"/>	10		
IsiXhosa First Additional Language	<input type="checkbox"/>	11		
IsiXhosa Second Additional Language	<input type="checkbox"/>	12	<input type="checkbox"/>	78-79
IsiZulu Home Language	<input type="checkbox"/>	13		
IsiZulu First Additional Language	<input type="checkbox"/>	14		
IsiZulu Second Additional Language	<input type="checkbox"/>	15	<input type="checkbox"/>	1,2
Sepedi Home Language	<input type="checkbox"/>	16		
Sepedi First Additional Language	<input type="checkbox"/>	17		
Sepedi Second Additional Language	<input type="checkbox"/>	18	<input type="checkbox"/>	3,4
Sesotho Home Language	<input type="checkbox"/>	19		
Sesotho First Additional Language	<input type="checkbox"/>	20		
Sesotho Second Additional Language	<input type="checkbox"/>	21	<input type="checkbox"/>	5,6
Setswana Home Language	<input type="checkbox"/>	22		
Setswana First Additional Language	<input type="checkbox"/>	23		
Setswana Second Additional Language	<input type="checkbox"/>	24	<input type="checkbox"/>	7,8
SiSwati Home Language	<input type="checkbox"/>	25		
SiSwati First Additional Language	<input type="checkbox"/>	26		
SiSwati Second Additional Language	<input type="checkbox"/>	27	<input type="checkbox"/>	9,10
Tshivenda Home Language	<input type="checkbox"/>	28		
Tshivenda First Additional Language	<input type="checkbox"/>	29		
Tshivenda Second Additional Language	<input type="checkbox"/>	30	<input type="checkbox"/>	11,12
Xitsonga Home Language	<input type="checkbox"/>	31		
Xitsonga First Additional Language	<input type="checkbox"/>	32		
Xitsonga Second Additional Language	<input type="checkbox"/>	33	<input type="checkbox"/>	13-14
Other Home Language	<input type="checkbox"/>	34	<input type="checkbox"/>	15-16
Other First Additional Language	<input type="checkbox"/>	35	<input type="checkbox"/>	17-18
Other Second Additional Language	<input type="checkbox"/>	36	<input type="checkbox"/>	19-20
CORE AND OTHER SUBJECT PERCENTAGE MARK				
Life Orientation	<input type="checkbox"/>	37	<input type="checkbox"/>	21-22
Life Sciences	<input type="checkbox"/>	38	<input type="checkbox"/>	23-24
Physical Science	<input type="checkbox"/>	39	<input type="checkbox"/>	25-26
Mathematics	<input type="checkbox"/>	40	<input type="checkbox"/>	27-28
Mathematics Literacy	<input type="checkbox"/>	41	<input type="checkbox"/>	29-30
Other Subject Score	<input type="checkbox"/>	42	<input type="checkbox"/>	31-32
Another Subject Score	<input type="checkbox"/>	43	<input type="checkbox"/>	33-34
24. TOTAL AVERAGE	<input type="checkbox"/>	1	<input type="checkbox"/>	35-36
25. APS ACCORDING TO MATRICULATION RESULTS	<input type="checkbox"/>	1	<input type="checkbox"/>	37-38

SECTION 4: CUT STUDENT SELECTION TEST SCORES			
26. STUDENT SELECTION TEST SCORES			
CUT APS with Bonus Points added	<input type="checkbox"/>	1	<input type="checkbox"/> <input type="checkbox"/> 39-40
CUT General Scholastic Aptitude Test (GSAT)	<input type="checkbox"/>	2	<input type="checkbox"/> <input type="checkbox"/> 41-42
CUT English Proficiency Test	<input type="checkbox"/>	3	<input type="checkbox"/> <input type="checkbox"/> 43-44
27. TOTAL CUT RATING SCORE	<input type="checkbox"/>	1	<input type="checkbox"/> <input type="checkbox"/> 45-46
28. FURTHER PROFICIENCY TESTS			
CUT Academic Language Proficiency (ALP) Test.	<input type="checkbox"/>	1	<input type="checkbox"/> <input type="checkbox"/> 47-48
Self-Directed Search Questionnaire Test	<input type="checkbox"/>	1	<input type="checkbox"/> <input type="checkbox"/> 49-50
29. SELECTION FOR NATIONAL DIPLOMA IN RADIOGRAPHY PROGRAMME			
Yes	<input type="checkbox"/>	1	<input type="checkbox"/> 51
No	<input type="checkbox"/>	2	
30. SELECTION FOR EXTENDED CURRICULAR PROGRAMME IN RADIOGRAPHY			
Yes	<input type="checkbox"/>	1	<input type="checkbox"/> 52
No	<input type="checkbox"/>	2	
SECTION 5: RADIOGRAPHY FIRST YEAR ACADEMIC RESULTS			
38. 1ST YEAR PERCENTAGE MARK PER SUBJECT			
Radiographic Practice 1	<input type="checkbox"/>	1	<input type="checkbox"/> <input type="checkbox"/> 69-70
Clinical Radiographic Practice 1	<input type="checkbox"/>	2	<input type="checkbox"/> <input type="checkbox"/> 71-72
Radiographic Pathology 1	<input type="checkbox"/>	3	<input type="checkbox"/> <input type="checkbox"/> 73-74
Image Recording 1	<input type="checkbox"/>	4	<input type="checkbox"/> <input type="checkbox"/> 75-76
Physics 1	<input type="checkbox"/>	5	<input type="checkbox"/> <input type="checkbox"/> 77-78
Anatomy 1	<input type="checkbox"/>	6	<input type="checkbox"/> <input type="checkbox"/> 79-80
Physiology 1	<input type="checkbox"/>	7	<input type="checkbox"/> <input type="checkbox"/> 1,2
Patient Care 1	<input type="checkbox"/>	8	<input type="checkbox"/> <input type="checkbox"/> 3,4
Total Average Percentage of all subjects	<input type="checkbox"/>	9	<input type="checkbox"/> <input type="checkbox"/> 5.6
41. STUDENT PROGRESSION TO 2ND YEAR OF STUDY			
Yes	<input type="checkbox"/>	1	<input type="checkbox"/> 6
No	<input type="checkbox"/>	2	
42. IF NO, WHICH SUBJECTS WILL BE REPEATED			
Radiographic Practice 1			
Yes	<input type="checkbox"/>	1	<input type="checkbox"/> 7
No	<input type="checkbox"/>	2	

Clinical Radiographic Practice 1			
	Yes	<input type="checkbox"/>	1
	No	<input type="checkbox"/>	2
Radiographic Pathology 1			<input type="checkbox"/> 8
	Yes	<input type="checkbox"/>	1
	No	<input type="checkbox"/>	2
Image Recording 1			<input type="checkbox"/> 9
	Yes	<input type="checkbox"/>	1
	No	<input type="checkbox"/>	2
Physics 1			<input type="checkbox"/> 10
	Yes	<input type="checkbox"/>	1
	No	<input type="checkbox"/>	2
Anatomy 1			<input type="checkbox"/> 11
	Yes	<input type="checkbox"/>	1
	No	<input type="checkbox"/>	2
Physiology 1			<input type="checkbox"/> 12
	Yes	<input type="checkbox"/>	1
	No	<input type="checkbox"/>	2
Psychodynamics of Patient Care 1			<input type="checkbox"/> 13
	Yes	<input type="checkbox"/>	1
	No	<input type="checkbox"/>	2
			<input type="checkbox"/> 14

APPENDIX B

ETHICAL APPROVAL AND INSTITUTIONAL CONSENT

B1: Approval Letter from the Ethics Committee, Faculty of Health Sciences, UFS

B2: Letter granting permission for access to CUT statistics from Acting Registrar, CUT

B3: Letter of permission from Dean of Faculty, Health and Environmental Sciences, CUT

Research Division
Internal Post Box G40
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Ms H Strauss/hv

2013-04-10

REC Reference nr 230408-011
IRB nr 00006240

MS CA KRIDIOTIS
c/o DR J BEZUIDENHOUT
DIVISION HEALTH SCIENCES EDUCATION
FACULTY OF HEALTH SCIENCES
UFS

Dear Ms Kridiotis


ECUFS NR 36/2013
MS CA KRIDIOTIS

(DEPT OF CLINICAL SCIENCES, CUT)
DIVISION HEALTH SCIENCES EDUCATION

PROJECT TITLE: ASSESSMENT OF CURRENT STUDENT SELECTION CRITERIA AS PERFORMANCE PREDICTORS FOR ACADEMIC SUCCESS IN ENTRY LEVEL RADIOGRAPHY EDUCATION AT THE CENTRAL UNIVERSITY OF TECHNOLOGY.

- You are hereby kindly informed that the Ethics Committee approved the above project at the meeting held on 9 April 2013.
- Committee guidance documents: Declaration of Helsinki, ICH, GCP and MRC Guidelines on Bio Medical Research. Clinical Trial Guidelines 2000 Department of Health RSA; Ethics in Health Research: Principles Structure and Processes Department of Health RSA 2004; Guidelines for Good Practice in the Conduct of Clinical Trials with Human Participants in South Africa, Second Edition (2006); the Constitution of the Ethics Committee of the Faculty of Health Sciences and the Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines.
- Any amendment, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.
- The Committee must be informed of any serious adverse event and/or termination of the study.
- A progress report should be submitted within one year of approval of long term studies and a final report at completion of both short term and long term studies.
- Kindly refer to the ETOVS/ECUFS reference number in correspondence to the Ethics Committee secretariat.

Yours faithfully


.....
PROF WH KRUGER
CHAIR: ETHICS COMMITTEE

Cc Dr J Bezuidenhout



Central University of
Technology, Free State

■ OFFICE OF THE REGISTRAR

24 May 2013

Our Reference: REG/let/31/05/2013

Ms Carol-Anne Kridiotis
14 General van Schoor Street
Dan Pienaar
BLOEMFONTEIN
9301

Dear Ms Kridiotis,

**PERMISSION TO HAVE ACCESS TO CUT STATISTICS FOR PURPOSE OF
RESEARCH STUDY ON YOUR MASTERS STUDY**

Permission is hereby granted for you to access CUT statistics for purpose of your research study on your Masters study at the University of the Free State where your research topic is Assessment of the Current student selection criteria as performance predictors for academic success in entry level Radiography education at the Central University of Technology.

The understanding is that this data would not be used for any other purpose other than for research on the said study.

By copy of this letter I hereby authorize Mr Anele Magwentshu and Ms Oriah Selolo to release the data for you.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Ab Ngowi'.

**PROF AB NGOWI
ACTING REGISTRAR**

cc: Mr Anele Magwentshu
Ms O Selolo

Consent form to use Academic Data, of the 2011 first year students and 2012 first year students in the Radiography Programme at CUT:

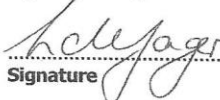
- No names or personal identifiers will appear on any data sheet that is sent for statistical analysis.
- The results of this Master's Degree study will be published without reference to any names of participants.
-

Hereby I, the undersigned **Dean of the Faculty of Health and Environmental Sciences at Central University of Technology** consent to a retrospective study being undertaken to assess the alignment of academic literacy performance predictors and student selection criteria with academic achievement in first year students in the Radiography programme.

My full particulars are as follows:

Title	Prof
Surname	De Jager
Full names	Kinda
Postal address	Faculty of Health and Environmental Sciences CUT
Email address	ldejager@cut.ac.za
Telephone no	051 507 3111
Cellular no	072 588 5311
Fax no	051 507 3555

If you are willing to consent for execution of this study, kindly sign your consent below.


Signature

21-11-2012
Date

Thank you for your kind cooperation.
Yours sincerely

Mrs. C.A Kridiotis Part-time Lecturer, Programme Radiography, Central University of
Technology, Bloemfontein, 9301.
Telephone number: 051 4366661, Cellular phone number: 0828930109
Email address: c.kridiotis@intekom.co.za
Postal address: 14 General van Schoor Street, Dan Pienaar Bloemfontein 9301

APPENDIX C

VERIFICATION OF LANGUAGE EDITING

Letter from Dr L. Bergh to certify language editing

7 June 2014

Luna Bergh

55 Jim Fouché Avenue
Universitas, Bloemfontein

To whom it may concern

This is to certify that I language-edited the Extended Mini-dissertation of Carol-Anne Kridiotis manually. She effected the changes herself. In this way both linguistic excellence and the candidate's ownership of her text were ensured.

I translated the Abstract in Afrikaans.

Sincerely



Luna Bergh

Language and writing specialist

APPENDIX D

VERIFICATION OF REFERENCES

Letter from Ms M. de Klerk to verify references and in-text citation

17 June 2014

237 Pres. Paul Kruger Ave

Universitas

Bloemfontein

9301

TO WHOM IT MAY CONCERN

This is to certify that I have verified the Bibliography and In text-citation of the Extended Mini-dissertation of Carol-Anne Kridiotis manually. She effected the changes herself.

Sincerely,



Michele de Klerk