A WORK-INTEGRATED LEARNING EDUCATION AND TRAINING PROGRAMME FOR RADIOGRAPHY IN SOUTH AFRICA

by

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Thesis submitted in fulfilment of the requirements for the degree Philosophiae Doctor in Health Professions Education

Ph.D. HPE

in the

DIVISION HEALTH SCIENCES EDUCATION

FACULTY OF HEALTH SCIENCES

UNIVERSITY OF THE FREE STATE

BLOEMFONTEIN

JUNE 2015

PROMOTER: DR J. BEZUIDENHOUT

DECLARATION

I hereby declare that the work submitted here is the result of my own independent investigation. Where help was sought, it was acknowledged. I further declare that this work is submitted for the first time at this university/faculty towards a Philosophiae Doctor degree in Health Professions Education and that it has never been submitted to any other university/faculty for the purpose of obtaining a degree.

……. ……

J.G.E. du Plessis **Date**

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DEDICATION

I dedicate this thesis to my wonderful family, my husband Jean and our three sons, Jacques, Wouter and Dewald who offered me unconditional love and support throughout the course of this thesis. You are the joy of my life. I could not have completed this without you as my focus to achieve academic excellence.

****

ACKNOWLEDGEMENTS

I wish to express my sincere appreciation to the following:

- My promoter, Dr J. Bezuidenhout at the Division of Health Sciences Education, Faculty of Health Sciences, University of the Free State for his unending encouragement, guidance, support and advice during the study.
- Prof. M.M. Nel and staff at the Division of Health Sciences Education, Faculty of Health Sciences, University of the Free State for empowering me through numerous workshops and training sessions to become a scholar and a proud PhD graduate of this university.
- The Health and Welfare Seta for granting me a bursary to finance certain aspects of the study.
- The National Research Foundation of South Africa for awarding me a travel grant to fund a visit to present a paper on my research at the International Society of Radiographers and Radiographic Technologists in Helsinki.
- The programme managers/directors, lecturers/work-integrated learning coordinators, workplace learning mentors/supervisors and radiography students who participated in the study and without whom this investigation would not have been possible.
- My dear friend and colleague, Dr. Rassie Smit, who supported me with the interpretation and statistical analysis of the accumulated data.
- Ms. Anneri Meintjies who supported me with the compilation and distribution of the electronic questionnaire.
- Ms Elmarié Robberts, for the typing, editing and her meticulous attention to technical detail with this thesis.
- My wonderful colleagues in the Department of Clinical Science: Programme Radiography at the Central University of Technology, Free State for their encouragement, prayers and trust. Without your valuable inputs, I would not have been able to deliver a quality product.
- Most importantly, thank you Almighty God and Father of our Lord Jesus Christ for having walked each step of the way with me. Without your love and support I would not have been able to complete this work.

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LIST OF ACRONYMS

B. Rad:	**Baccalaureus in Radiography**
B. Rad. Hons.	**Baccalaureus Honours in Radiography**
B.Tech:	**Baccalaureus Tegnologiae**
CT:	**Computed tomography**
CPUT:	**Cape Peninsula University of Technology**
CUT:	**Central University of Technology**
CE:	**Cooperative education**
CHE:	**Council on Higher Education**
DoE:	**Department of Education**
DUT:	**Durban University of Technology**
EL:	**Experiential learning**
HEQC:	**Higher Education Quality Committee**
HEQF:	**Higher Education Qualifications Framework**
HPCSA:	**Health Professions Council of South Africa**
HPE:	**Health Professions Education**
M. Rad:	**Master of Radiography**
MRI:	**Magnetic Resonance Imaging**
M. Tech:	**Master of Tegnologiae**
N. Dip:	**National Diploma**
NRF:	**National Research Foundation**
NSA:	**National Skills Authority**
NQF:	**National Qualifications Framework**
NMMU:	**Nelson Mandela University of Technology**
OSCA:	**Objective Simulated Clinical Assessment**
PBL:	**Problem-based learning**
PjBL:	**Project-based learning**
SA:	**South Africa**
SASCE:	**Southern African Society for Co-operative Education**
SAQA:	**South African Qualifications Authority**
STEPS:	**Strategic Transformation on Educational Programmes and Structures**
SL:	**Service learning**
TUT:	**Tshwane University of Technology**

UJ:	**University of Johannesburg**
UK:	**United Kingdom**
UL:	**University of Limpopo**
UTAS:	**University of Tasmania**
UoTs:	**Universities of Technology**
UP:	**University of Pretoria**
UFS:	**University of the Free State**
US:	**United States of America**
WACE:	**World Association for Cooperative Education**
WDTL:	**Work-directed theoretical learing**
WIL:	**Work-integrated learning**
WILRU:	**The Work-integrated Learning Research Unit**
WBL:	**Work-based learning**
WPL:	**Workplace learning**

SUMMARY

Key terms: work-integrated learning, problem-based learning, project-based learning, work-based learning, workplace learning, generic skills and competencies, curriculum development, module, learning unit, assessment, monitoring

An in-depth study was conducted to investigate current practices in the delivery of work-integrated learning (WIL) in Radiography training at selected universities in South Africa (SA) with the ultimate goal of developing an education and training programme for WIL in Radiography training. The study was prompted by a growing awareness that a gap existed in the delivery of WIL in Radiography programmes in SA.

WIL is a relatively new jargon term that focuses attention on the integration of theoretical learning and learning in the workplace. Until recently the focus in many professional programmes has been on workplace learning (WPL) as a component of the training of students. Although the concept of placing students in the workplace to acquire work experience is not new, the rationale behind WIL goes beyond merely providing a physical workplace environment as a site for students to experience work or to learn from professional practice. However, to achieve success in the delivery of any WIL programme, it is important to structure the WIL component of any learning programme with regards to the diligent and constructive alignment of learning outcomes/objectives, the delivery of learning (i.e., facilitation methods), and assessment. For quality delivery of WIL, the coordination and monitoring of the learning processes, and hence of student progression, are also important.

The research methods comprised a two-fold approach. First, a literature review was conducted in order to provide an appropriate background for the formulation of a conceptual framework and to contextualise the problem against related theory and research. Second, data were collected using questionnaires that generated both quantitative and qualitative data. The latter data were obtained by means of open-ended questions that allowed for comments that facilitated the gathering of information about the current status of the delivery of WIL in Radiography training.

The compilation of an education and training programme for WIL for the Bachelor of Radiography in Diagnostics degree to enhance undergraduate radiography training in SA was achieved by merging the information from the literature review and the collected data. The findings on the current status of WIL, which emanated from the questionnaire survey, were compared with suggestions garnered from the literature for best practice in WIL in order to make recommendations to bridge the identified shortcomings in the delivery of WIL in Radiography training.

By developing an education and training programme for WIL in Radiography and by providing recommendations towards improvements in the delivery of WIL, the study contributed significantly to the creation of new knowledge in the Radiology field and was thus successful in bridging the identified gap in the delivery of WIL. The implementation of the proposed programme for WIL can aid in the development of a curriculum for WIL that includes appropriate modules, learning units, assessment and monitoring strategies, and guidelines for the development of generic skills.

The sound research approach and methodology that were employed ensured the quality, reliability and validity of the study. The completed research can form the basis for a further research undertaking.

OPSOMMING

Belangrike terme: werk-geïntegreerde leer, probleem-gebaseerde leer, projek-gebaseerde leer, werk-gebaseerde leer, algemene vaardighede, kurrikulum-ontwikkeling, module, leereenheid, assessering, monitering

'n In-diepte studie is onderneem om die huidige praktyke in die aanbieding van werk-geïntegreerde leer (WGL) in Radiografie onderrig by uitgesoekte universiteite in Suid-Afrika te ondersoek. Die uiteindelike doel van die studie was om 'n onderrigprogram vir WGL in Radiografie-opleiding te ontwikkel. Die idee vir die studie het ontstaan nadat tekortkominge in die onderrig van WGL in Radiografie geïdentifiseer is.

Werk-geïntegreerde leer is 'n relatiewe nuwe konsep wat fokus op die integrasie van teoretiese kennis met ondervinding in die werksplek. Tot onlangs toe was die fokus van die meeste professionele programme slegs gemik op die ondervinding wat opgedoen word in die werksplek as deel van die student se opleiding, en nie as 'n geïntegreerde program wat vloei tussen universiteitsopleiding en die praktyk nie. Alhoewel die plasing van studente in die werksplek nie 'n nuwe praktyk is nie, strek die aanbieding van WGL verder as net die beskikbaarheid van plasing in die werksomgewing om ondervinding in 'n professionele praktyk op te doen. Dus, om WGL suksesvol toe te pas, is dit belangrik dat WGL programme reg gestruktureer moet wees. Dit behels konstruktiewe belyning van leeruitkomste en die fasilitering van leer en assessering. Dit is ook belangrik in WGL dat die koördinering en monitering van studente se vordering en ontwikkeling geïntegreer word met hulle teoretiese universiteitsopleiding.

Die navorsingsmetodes wat vir die studie gebruik is was tweeledig. Eerstens is 'n literatuurstudie gedoen wat die agtergrond verskaf het waarin die navorsingsprobleem gekontekstualiseer is. Tweedens is inligting oor die huidige praktyke in die aanbieding van werk-geïntegreerde leer in Radiografie-opleiding versamel deur middel van vraelyste wat kwantitatiewe asook kwalitatiewe data gegenereer het. Laasgenoemde data is verkry deur opmerkings oor sekere vrae van die respondente in te win.

Die ontwikkeling van 'n onderrigprogram vir WGL vir die graad Baccalaureus in Radiografie – Diagnosties om voorgraadse opleiding van radiografie studente in SA te verbeter, is moontlik gemaak deur inligting rakende goeie praktyke vir WGL uit die

literatuurstudie en die inligting uit die vraelyste met mekaar te vergelyk. Sodoende kon aanbevelings gemaak word om die tekortkominge in die onderrig van WGL in Radiografie-opleiding aan te spreek.

Die ontwikkeling van 'n onderrigprogram en die aanbevelings ter verbetering van die onderrig vir WGL vir Radiografie het 'n waardevolle toevoeging tot kennis gemaak en geïdentifiseerde tekortkominge kon ook uitgewys word. Die implementering van die voorgestelde program kan lektore bystaan in die ontwikkeling van 'n kurrikulum vir WGL wat toepaslike modules, leereenhede, assesserings- en moniteringstegnieke, en riglyne vir algemene vaardighede insluit.

Die navorsingsmetodes wat gebruik is het die kwaliteit, betroubaarheid en geldigheid van die studie verseker. Die vooltooide navorsing kan dien as 'n platform vir verdere navorsing op die gebied van WGL.

A WORK-INTEGRATED LEARNING EDUCATION AND TRAINING PROGRAMME FOR RADIOGRAPHY IN SOUTH AFRICA

CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

In this research project a critical analysis was conducted on the current status of work-integrated learning (WIL) in Radiography training at higher education institutions in South Africa (SA), with the intention of developing a WIL education and training programme for Radiography.

In general, WIL is understood to refer to part of a student's learning happening at a workplace. It is however important to note that WIL is an overriding 'umbrella' pedagogy including the part of a student's learning happening at a workplace. This part of WIL, happening at a workplace, is currently referred to in literature as workplace learning (WPL). WPL is also considered to be an integral part of the student's curriculum. Walshok (1995:23) focuses attention on the revival of the integration debate in conjunction with concerns that, for many professions, the traditional approach to integrating theoretical knowledge with the attainment of skills and capabilities no longer fulfils all the needs of education. In Radiography education it is the changing environment of the modern workplace that poses challenges to implementing a student-centred Radiography curriculum underpinned by clinical practice outcomes (Engel-Hills, 2005:24). As emphasised in the Council on Higher Education's (CHE) *Good Practice Guide for WIL* (CHE 2011:14), an aligned curriculum should endeavour to align the outcomes (appropriate for the specific level), the teaching and learning activities, and the assessment (with assessment criteria) with one another. Similarly, curriculum developers for WIL should endeavour to align outcomes, pedagogy and assessment activities.

Smigiel and Harris (2007:6) describe WIL as "educational activities that integrate theoretical learning with its application in the workplace". Terms such as *practicum, fieldwork, internship, cooperative education* and *clinical placement* describe these WIL programmes. According to Trigwell and Reid (1998:144), WIL is widely used globally to include work experience in profession-based academic programmes such as law, medicine

and nursing, which may be practised after graduation. As Fox (2002:26) points out, providing students with real-world experiences is one of the best methods of preparing them to be successful in their careers. Carpenter (2003:203) refers to WIL as "internship" and describes it as "on-the-job experience prior to graduation".

What is expected of students during these WIL experiences (including WPL) is that they gain new knowledge, understanding and capabilities, and that they master skills considered essential to particular workplace practices. Orell (2011:10) argues that students cannot learn these skills and knowledge in formal classrooms only and should therefore be exposed to the everyday practice or the workplace of the particular profession/vocation. The impact of the changing nature of work and the capacity of educational institutions to prepare their students for this changing environment has been of concern to many governments.

Smith, Meijer and Kielly-Coleman (2010:410) state that WIL incorporates a variety of integrated curricular modalities/learning modes taking place at the university and in the workplace, such as problem-based learning (PBL), project-based learning (PjBL), service learning (SL), WPL and, in most health-related programmes, internships. To confirm the use of a variety of curricular modalities/learning modes for WIL, it is stated unequivocally in the CHE's *Good Practice Guide for WIL* that several innovative curricular, pedagogical and assessment forms have been developed in response to concerns about graduation, employability and civic responsibility. Examples of these curricular forms include action learning, apprenticeships, cooperative education, experiential learning (EL), inquiry learning, inter-professional learning, practicum placements, problem-based learning, project-based learning, scenario learning, service learning, team-based learning, virtual or simulated WIL learning, work-based learning, work experience, and/or workplace learning (CHE 2011:4).

Abeysekera (2006:7) describes WIL by two different terms namely *work-based learning* and *experience-based learning*. Although WIL is primarily intended to enhance student learning for each specific profession, a variety of terms are currently used to describe the different forms of learning associated with WIL. These varieties of terms seem to cause a lot of confusion as to which part is referring to 'what part/s of WIL is happening at the university' and 'what part/s of WIL is happening at the workplace.

At the universities of technology (UoTs) in South Africa (SA), the term *cooperative education* is still used widely to underpin the practice of workplace learning. In addition to the variety of terms connected to the pedagogical practices in WIL, there is the term *experiential learning*. As EL has a variety of meanings in the international literature, WIL has evolved and attempts have been made in many countries abroad (such as Australia and New Zealand) and in SA to define learning associated with experience in the workplace more precisely (Illeris, 2007:86). Despite all the efforts to eliminate the confusion of terms, many authors still refer to periods of time spent in the workplace as WIL, for example, McLuskie and Zipf (2003:46) state that the current term for "what has been known in education for the last 40 years as internship, sandwich year or cooperative education" should now be referred to as WIL. According to the authors, WIL is a period (or periods) of time in a tertiary degree programme curriculum where the student becomes immersed in the pursuit of professional work in industry/practice.

Although it seems that a real "cast-in-stone" definition for WIL does not exist, the term is used in this thesis in preference to other labels, such as *cooperative learning, internship, practicum placement, work practice*, and *work-based learning* to refer to the pedagogy where students are exposed to learning modes to prepare them for their professional role in the workplace setting, including WPL. This decision seems appropriate because it can be argued that, in the South African context, WIL is currently viewed as the part of the curriculum associated with all learning activities aimed at preparing students for their responsibilities in the workplace upon completion of their studies. Although WIL is not yet implemented and practised as it should be in all learning programmes, the term is well defined in the Higher Education Qualifications Framework (HEQF) document published in 2011. It has been accepted as the new term in SA that refers to all activities intended to equip the student with the knowledge, skills and responsibilities necessary for the workplace (previously referred to in Radiography as experiential learning). Therefore the term WIL, instead of a variety of terms, will be used in this thesis as an encompassing/overarching term used for higher education programmes that have compulsory WIL components.

In 2011, a new HEQF was promulgated by the Department of Education (DoE) in SA. In 2012 the Higher Education Qualifications Sub-Framework (HEQSF) was published by the DoE and revised in January 2013. In the midst of restructuring many higher education qualifications, the governing education body in SA, for the first time, in both these

documents, emphasised the required WIL component within the curriculum of envisaged new qualifications. The new HEQSF states the following:

> *Some qualifications will be designed to integrate theory and practice through the incorporation of work-integrated learning (WIL) into the curriculum. WIL is characteristic of vocational and professionally-oriented qualifications, and may be incorporated into programmes at all levels of the HEQSF. In the HEQSF, WIL may take various forms including simulated learning, work-directed theoretical learning, problem-based learning, project-based learning and workplace-based learning. The selection of appropriate forms of work-integrated learning depends on the nature and purpose of the qualification type, programme objectives and outcomes, the NQF level at which the WIL component is pegged, institutional capacity to provide WIL opportunities, and the structures and systems that are in place within professional settings and sites of practice to support student learning. Where WIL is a structured part of a qualification the volume of learning allocated to WIL should be appropriate to the purpose of the qualification and to the cognitive demands of the learning outcome and assessment criteria contained in the appropriate level descriptors. Where the entire WIL component or any part of it takes the form of workplace-based learning, it is the responsibility of institutions that offer programmes requiring credits for such learning to place students into appropriate workplaces.* ***Such workplace-based learning must be appropriately structured, properly supervised and assessed.*** (HEQSF 2013:11).

Two 2004 publications of the Higher Education Quality Committee (HEQC), which is a permanent structure of the CHE of SA, emphasise the last sentence of the quotation above (HEQC 2004:Online; Groenewald 2009:75) with specific reference to the WPL part of WIL. Because the CHE is an independent statutory body responsible for advising the South African Minister of Education on higher education policy matters, the emphasis on WIL in the new HEQF and HEQSF is important to programmes in health sciences education, though WIL should also be considered an important part of other educational programmes since the HEQC, led by an executive director, has executive responsibility for quality promotion and quality assurance of all higher education institutions (Groenewald 2009:75).

As stated earlier, health sciences programmes generally all have a required WPL component as part of WIL, which is regulated by the professional bodies where the

outcomes/objectives achieved by students should be measurable in the clinical/practical environment. In these professions WPL has always been considered an important component of the curriculum. The time students spend in the workplace is strictly prescribed by these professional bodies. In addition to overseeing both the formal curriculum and achievement of competence, professions and state-run bodies have the responsibility of ensuring the quality of such training in the workplace. At many institutions of higher learning in SA, and more specifically the universities of technology, a student cannot achieve a qualification unless a prescribed WPL component in the programme has been achieved.

With the enforced inclusion of WIL as a structured part of many qualifications in SA, this research study will provide valuable information regarding the processes to be followed in curriculation and implementation towards achieving best practice in WIL for Radiography education at higher education institutions in SA.

The aim of this chapter is to orientate the reader to the study by providing background to the research problem, followed by the problem statement, the research questions, the overall goal and the aim and objectives of the study. Also covered in this chapter are the demarcation of the study and the significance and value of the research. Thereafter follows a brief overview of the research design and the methods of investigation. The chapter concludes with an explanation of the subsequent chapters and the presentation of a brief conclusion.

1.2 BACKGROUND TO THE RESEARCH PROBLEM

Although guidelines for WIL were promulgated in the new HEQF (2011) and the HEQSF (2013), these guidelines have not yet been put into action across the educational programmes of all health professions (HPE), including those of Radiography. In some HPE programmes with a WIL component, WIL is only an add-on to the programme and aims only to expose the student to the world of work with little or no attention to the development of students' cognitive abilities. In many instances it can be argued that WIL does not exist in the format it is intended to and that practices related to WIL are still dominated by WPL without clearly outlined outcomes or criteria to measure the achievement of these outcomes. Thus, academics who need to transform their programmes to include a recognised WIL component have little experience of sound WIL practices and the associated responsibilities within the teaching and learning environment.

This lack of experience in the WIL environment has the consequence that a recognised, compulsory WIL component is not yet implemented in all Radiography programmes at higher education institutions in SA.

This phenomenon was confirmed by the final report of the Strategic Transformation of Educational Programmes and Structures (STEPS) task team (June 2011) on WIL after conducting a survey at the Central University of Technology (CUT), as well as by evidence that was collected by the researcher through personal interviews with staff members. The task team's final report states that although many programmes in the health professions at the CUT indicate that they have a WIL component, not all are as yet adhering to the guidelines as stipulated in the HEQF (2011) and HEQSF (2013), or to Criterion 15 of the HEQC (2004:21).

According to Cooper, Orell and Bowden (2010:37), WIL should be seen as a structured strategy for integrating classroom studies with learning through productive work experiences in a field related to a student's academic or career goals. They further state that WIL provides progressive experiences related to integrating theory and practice. WIL should thus be seen as creating a partnership among students, educational institutions and employers, with specified responsibilities for each party. Differently stated, "…WIL is an umbrella term used to describe a range of educational activities that integrate learning within an academic institution with practical application in a workplace setting relevant to each student's programme of study or career goals" (Peters & Julie Academica Group 2012:12). WIL takes on many forms with varying degrees of integration and a multitude of characteristics. Therefore, when designing WIL programmes, educationists should give special attention to all aspects related to the delivery of quality education such as curriculum design, teaching and learning, assessment, formative feedback, reflective practice, and coordination. Educationists in Radiography should be well informed about the intricacies of aligning all these educational practices with the outcomes they want to achieve or, in other words, with the final product (the professional practitioner) who has to enter the world of work as a well-trained employee with a well-established base of knowledge.

Against this background, it may be concluded that a need exists for a structured education and training programme for WIL in Radiography in SA. WIL forms an integral part of the training of radiographers because the application of skills is essential to the profession of medical imaging.

1.3 PROBLEM STATEMENT AND RESEARCH QUESTIONS

The problem that was addressed is the lack of a structured education and training programme for WIL in Radiography in SA. In order to address this lack, the goal of this research study was to investigate current practices in WIL at universities offering Radiography training.

An extensive literature search on the website of the National Research Foundation and the Nexus Database System did not deliver evidence of any recent study conducted in SA on the current status of WIL in Radiography. Furthermore, no evidence could be found of an existing education and training programme for WIL in Radiography in SA that addressed aspects related to the teaching and learning for WIL. However, a number of articles and documents were found relating to the practices of WIL in general, but those concentrated mainly on monitoring and coordinating and on the challenges surrounding the process of placement of students for periods of workplace learning.

Conversely, a wealth of information existed about WIL practices in Radiography education abroad, especially in the United Kingdom, Australia and New Zealand. Information from this international literature, together with the information from the questionnaire survey which was conducted for this study, was therefore used to establish best practice for WIL in Radiography education and training with the intention of developing an education and training programme for WIL in Radiography in SA.

Because there seemed to be no existing education and training programme for WIL in Radiography in SA and because WIL was not previously clearly outlined and promulgated by a governing body such as the HEQF, the question that arose was whether institutions offering programmes where WIL formed an integral part of the qualification (such as Radiography) were adequately equipped to introduce appropriately structured WIL education and training programmes that abided by the prescriptions for WIL as stated in the HEQF. The main research question for this study therefore was:

> *What important fundamentals for teaching, learning, assessment and monitoring should be incorporated in an education and training programme for WIL in Radiography at higher education institutions in South Africa?*

The following sub-questions emanated from the main question:

Are educationists working in the WIL components of Radiography programmes:

1. sensitive towards the best practice for WIL in order to deliver work-ready graduates for the Radiography profession?
2. appropriately equipped to engage in the design of a curriculum for WIL in Radiography to align outcomes, pedagogy and assessment activities?
3. familiar with the different curricular modalities (learning modes) and teaching and learning activities to stimulate active learning in the classroom and to facilitate the achievement of the skills and competencies necessary in the workplace?
4. sensitive towards the principles for the assessment of WIL (including formative feedback and reflective practice) as part of the learning process of the students?
5. coordinating their programmes to ensure good working partnerships among students, the educational institution and the employers involved in WIL to the benefit of all parties?

The current research was carried out and completed with these research questions in mind. It is envisaged that the findings of the study will serve as a foundation for the compilation of an education and training programme for WIL in Radiography in SA.

1.4 OVERALL GOAL, AIM AND OBJECTIVES OF THE STUDY

1.4.1 Overall Goal of the Study

The overall goal of the study was to conduct a critical analysis of the current status of WIL in Radiography training at higher education institutions in SA with the intention of developing a WIL education and training programme for WIL in Radiography.

1.4.2 Aim of the Study

The aim of the study was to develop a WIL education and training programme for Radiography at higher education institutions in SA with reference to the HEQF.

1.4.3 Objectives of the Study

In pursuit of the aim stated above, the following five main study objectives were identified:

1. To benchmark best practice for WIL curriculum design, teaching and learning, assessment and coordination in Radiography at higher education institutions with reference to international and South African literature;
2. To gain a thorough insight into the current state of WIL in Radiography programmes at higher education institutions in SA concerning matters such as curriculum design, teaching and learning, assessment (including formative feedback and reflective practice) and coordination by means of questionnaires administered to lecturers in Radiography, final year Radiography students, and employers involved in WIL at all the higher education institutions offering Radiography training in SA;
3. To identify areas of good practice and areas for improvement in the WIL part of Radiography programmes in SA;
4. To develop action plans to address identified shortcomings against the background of best practices for WIL; and
5. To propose a WIL education and training programme for Radiography at higher education institutions in SA comprising aspects such as curriculum design, teaching and learning strategies, assessment, and the coordination of WIL, in order to ensure the outcome of an adequately equipped graduate radiographer possessing the necessary knowledge and skills to be a confident practitioner.

1.5 DEMARCATION OF THE FIELD AND SCOPE OF THE STUDY

The scope of this study was limited to the field of HPE and included the domain of academic curriculum development. The participants in the questionnaire survey in this study were professionals with expertise in the fields of Radiography, higher education and WIL, and final year Radiography students from all the higher education institutions offering Radiography training in SA.

In a personal context, the researcher is a qualified diagnostic radiographer, registered with the Health Professions Council of South Africa (HPCSA), with 18 years' experience in the clinical practice of Radiography. During the period after completion of a Honours

degree in Radiography, the researcher became interested in the education and training of Radiography students. For the past 15 years, the researcher has been a lecturer in Radiography and acquired a Master's degree in higher education studies from the University of the Free State. Since the researcher started lecturing, she has been intensively involved in the WIL part of the Radiography course at the institution where she teaches. This involvement led to the interest in conducting a study regarding WIL in Radiography training.

Due to the application of the study in the field of Radiography, the study can thus be classified as being interdisciplinary in that it combines at least two professions, namely Radiography and higher education.

1.6 SIGNIFICANCE AND VALUE OF THE STUDY

Australian universities, like their international counterparts, are, to an ever greater extent, engaging their students in the "world of work" through a multitude of mechanisms, including WIL. Crucial to this change is the process of engaging students in learning beyond the traditional confines of the university so that they may enjoy the full benefits of higher education. Globally, the attention of governments and policy makers is focused on the manner in which capacity is built in order to manage skills and maximise the effective use of human capital in a rapidly changing world (Smith, Brooks, Lichtenberg, McIlveen, Torjul & Tyler 2009:1). Until now there has been no education and training programme for WIL in Radiography in SA. This research project thus comes at an important time for the higher education sector. The value of this study is that it identified strengths and weaknesses in the current WIL components of Radiography programmes in SA. The significance of the study is that the education and training programme designed for WIL on the basis of the results of the study will inform programmes in Radiography regarding curriculum design, teaching and learning, and assessment practices in the WIL environment, thereby ensuring quality in teaching and learning in the WIL component of such programmes at universities offering Radiography training.

Guidance in the development of WIL programmes in Radiography is essential at a time when the Radiography profession in SA is in the process of revisiting the status of WIL as part of recurriculation in their programmes. At this time, curriculum developers can benefit from relevant information, such as the information provided by this study, to rectify possible shortcomings in the WIL component of their training. It is envisaged that

the proposed study will contribute significantly to the introduction and eventual implementation of a WIL education and training programme in Radiography programmes where WIL is a requirement. By ascertaining that WIL is a structured part of a programme in a well-aligned curriculum, student learning can be enhanced greatly.

The findings of this study will be made public to other educationists in Radiography education through paper presentations at conferences and seminars and by publishing articles in applicable journals.

1.7 RESEARCH DESIGN AND METHODS

1.7.1 Design of the Study

The research design for this study was mainly quantitative with some qualitative components, and the results and findings were thus based on inquiry and reflection. The qualitative elements of the study were based on an in-depth analysis of documents from the DoE, the HEQF, HEQSF, the Higher Education Quality Committee (HEQC), the CHE, the South African Qualifications Authority (SAQA), and other relevant bodies in order to assist with the design of the questionnaire (Ivankova, Cresswell & Clark, 2007:257).

Quantitative, nonexperimental information was gathered by means of questionnaires consisting mainly of closed questions (cf. Appendices E1, E2 & E3). To augment the information gained from some of the questions, the questionnaire provided opportunities for comment at certain questions. The decision to administer questionnaires for data collection was supported by the fact that questionnaires are effective mechanisms for efficient collection of specific information from participants (Walonick 2004:143). The questionnaires were used to evaluate current practices in the WIL component of Radiography programmes at higher education institutions in SA.

1.7.2 Methods of the Investigation and Flow of the Study

In this study, the literature review and document analysis had the specific aim of contextualising WIL and describing the best practice for WIL in higher education, and more specifically in HPE. A merging of the information from the literature and the documents analysed provided the necessary background to and context for the stated

problem and formed the basis for the development of the questionnaires and, eventually, the WIL education and training programme for Radiography in SA.

To provide the necessary information about the perceptions of and current practices among educationists, employers, and Radiography students regarding WIL, a questionnaire survey was considered appropriate for this research. Quantitative data were thus collected by means of self-compiled, semi-structured questionnaires (cf. Appendices E1, E2 & E3)

The target population for the questionnaires comprised lecturers (coordinators for WIL in Radiography programmes at higher education institutions in SA), selected mentors/supervisors of students placed for WIL, and selected final year Radiography students in Radiography programmes at higher education institutions. The results from the literature study and the questionnaires were used to compile an education and training programme for WIL in Radiography. A more detailed description of the population, sampling methods, data collection techniques, data analysis, reporting, and ethical considerations is provided in Chapter 3. A schematic overview of the study is presented in Figure 1.1:

FIGURE 1.1: SCHEMATIC OVERVIEW OF THE STUDY

1.8 IMPLEMENTATION OF THE FINDINGS

This thesis describes the findings of the research will be brought to the attention of the education committee of the Professional Board for Radiography and Clinical Technology at the HPCSA. The recommended education and training programme for WIL in Radiography will also be presented at training institutions in SA offering Radiography training. The research findings will also be presented at emergency care conferences and seminars. It will be recommended to various role players and stakeholders that the developed programme be adopted in the WIL parts of Radiography courses.

Additionally, the research findings will be submitted to academic journals for publication. By presenting the results from the study and the newly developed education and training programme for WIL in Radiography to a wide population of educationists, the researcher hopes to make a contribution to the quality training of professional radiographers in the future.

1.9 ARRANGEMENT OF THE THESIS

The following section provides a brief outline of the study and layout of the thesis.

In Chapter 1, entitled ***Orientation to the study***, the background to and context of this study are provided. A list of acronyms and definitions of generally used terms that are applicable to this study is presented, followed by an illumination of the background to the problem, the problem statement, the scope, the overall goal, the aim and objectives, and the research design of the study.

Chapter 2, entitled ***Conceptual framework for work-integrated learning,*** provides the theoretical orientation to the study and deals with a review of international literature on WIL in Radiography. The second part of the chapter presents a critical analysis of what is seen as best practice for WIL in Radiography.

In Chapter 3, entitled ***Research design and methodology,*** the research design and methods selected for this study are described and validated. The questionnaire survey processes to determine the current practices of WIL in Radiography education and training are illuminated. This means that the way in which the questionnaire survey was constructed and administered is dealt with, as are the issues of validity, reliability and ethical considerations that were applicable to this study.

Chapter 4, entitled ***Data analysis, interpretation and discussion of the results,*** presents a report on the results of the questionnaire survey as a data collecting method, and the findings are discussed.

Chapters 5 and 6, entitled ***An education and training programme for work-integrated learning for Years 1 and 2 of the Bachelor Degree of Radiography in Diagnostics*** and ***An education and training programme for work-integrated learning for years three and four of the Bachelor Degree of Radiography in***

Diagnostics respectively, present the final outcome of the study. These chapters provide a comprehensive discussion of the proposed education and training programme for WIL in Radiography, which is contextualised against the requirements of the HEQF.

In Chapter 7, entitled ***Conclusions, recommendations and limitations of the study,*** an overview of the study as well as the conclusions, recommendations and limitations are provided.

1.10 CONCLUDING SUMMARY

This first chapter provided an orientation to the study and discussed the background to the problem, the problem statement, the scope of the study, the overall goal, and the aim and objectives. This chapter also presented a brief introduction to the research design and research methods. The chapter was concluded with an outline of the thesis report and a brief synopsis of the chapters to follow. In the next chapter, entitles ***Conceptual framework for work-integrated learning,*** the theoretical orientation and framework of the study are discussed. An analysis of international best practices for WIL is also provided.

CHAPTER 2

CONCEPTUAL FRAMEWORK FOR WORK-INTEGRATED LEARNING

2.1 INTRODUCTION

No one knows when the idea to link theory with work to enhance education first developed. Some authors suggest the date is 1903 when Sunderland Technical College in Northern England introduced a practical program for architecture and engineering students (Franks & Blomqvist 2005:283). Others suggest dates including the 1600s and 1800s when students undertook apprenticeships in areas such as teaching and medicine, as cited by Bates (2005:3). However, in 1906 Herman Schneider, an engineering lecturer at the University of Cincinnati, believed that professional concepts and skills required more than just classroom teaching. He believed students required practical experience to develop and master these professional concepts and skills. He proposed that students learn by alternating on-campus study with off-campus employment experiences (Sovilla & Varty 2004:4). According to Houshmand and Papadakis ([s.a.]:6), the notion of 'learning by doing' has been in formal operation for over 100 years and from the late 1950s to the mid-1980s it went through massive worldwide expansion led by the United States of America (USA) (Sovilla & Varty 2004:4).

Sadly, the original worldwide expansion of 'learning by doing' was more about income generation for higher education institutions than it was about enhancing learning (Coll, Eames, Paku, Lay, Ayling, Hodges, Ram, Bhat, Fleming, Ferkins, Wiersma & Martin 2009:3). Fortunately, the recent growth in programmes with work-related activities has focused mainly on perceptions of shortages in labour for particular areas and represents a key strategy for the development of work-ready graduates exiting the higher education sector. Additionally, as stated by Coll, Pinyonatthargarn and Pramoolsook (2004a:2, 2004b:3) and Taylor, (2004:208), many so-called developing countries have also adopted WIL to enhance economic development and join the knowledge economy.

Complicating current research in the area of WIL is the confusion caused by a number of terms used internationally to describe learning programmes aimed at learning which have a practical component or relation to activities which occur in the workplace or professional practice. For example, in the United Kingdom (UK), the well-established term is *sandwich degree* (Coll *et al.* 2009:3; Ward & Jefferies 2004:16), but in the USA and the rest of the

world *cooperative education* and *internships* are the more common terms used (Coll *et al.* 2009:3; Groenewald 2004:17; Sovilla & Varty 2004:4).

In an effort to lessen the confusion of terms, the world body for cooperative education – i.e. the World Association for Cooperative Education (WACE) - added the term *work-integrated learning* to reflect a broader perspective of the nature of 'learning by doing', which now includes *capstone programmes*, *internships*, *sandwich degrees*, and *work-based learning via industry projects* (Coll *et al.* 2009:3; Franks & Blomqvist 2004:284). As indicated by Smith (2012:248), WIL is a relatively new term that focuses attention on the integration of discipline learning and workplace practice or application. As a consequence, the term puts at the heart of the curriculum its purposes in a way that other terms for apparently the same thing (e.g. placement, internship) do not. Smith (2012:248) further emphasises that one should make a clear distinction between WIL and some theories of work (place)-based learning, because these theories do not specifically focus on the goal of integrating disciplinary knowledge, skills and professional practice.

Amidst the confusion caused by the variety of terms used worldwide it is, according to Dressler and Keeling (2005:217), important to keep in mind that the main purpose of WIL is to benefit the student. They report that employers often describe how many students are initially hesitant and confused but, as a result of the placement in industry as part of their WIL, develop grace and confidence. From the perspective of these employers, the students who have completed a period of well-designed WIL appear to have bright futures.

In this chapter, WIL is conceptualised and contextualised from both an international and a South African perspective. The following main issues are dealt with: defining WIL; stating the purpose of WIL in the SA higher education and the HPE environments; curriculum design for WIL; teaching and learning for WIL; assessment for WIL; and the management and coordination of WIL. Figure 2.1 presents a schematic overview of the different aspects that constituted the conceptual framework of the study. The diagram is followed by a discussion.

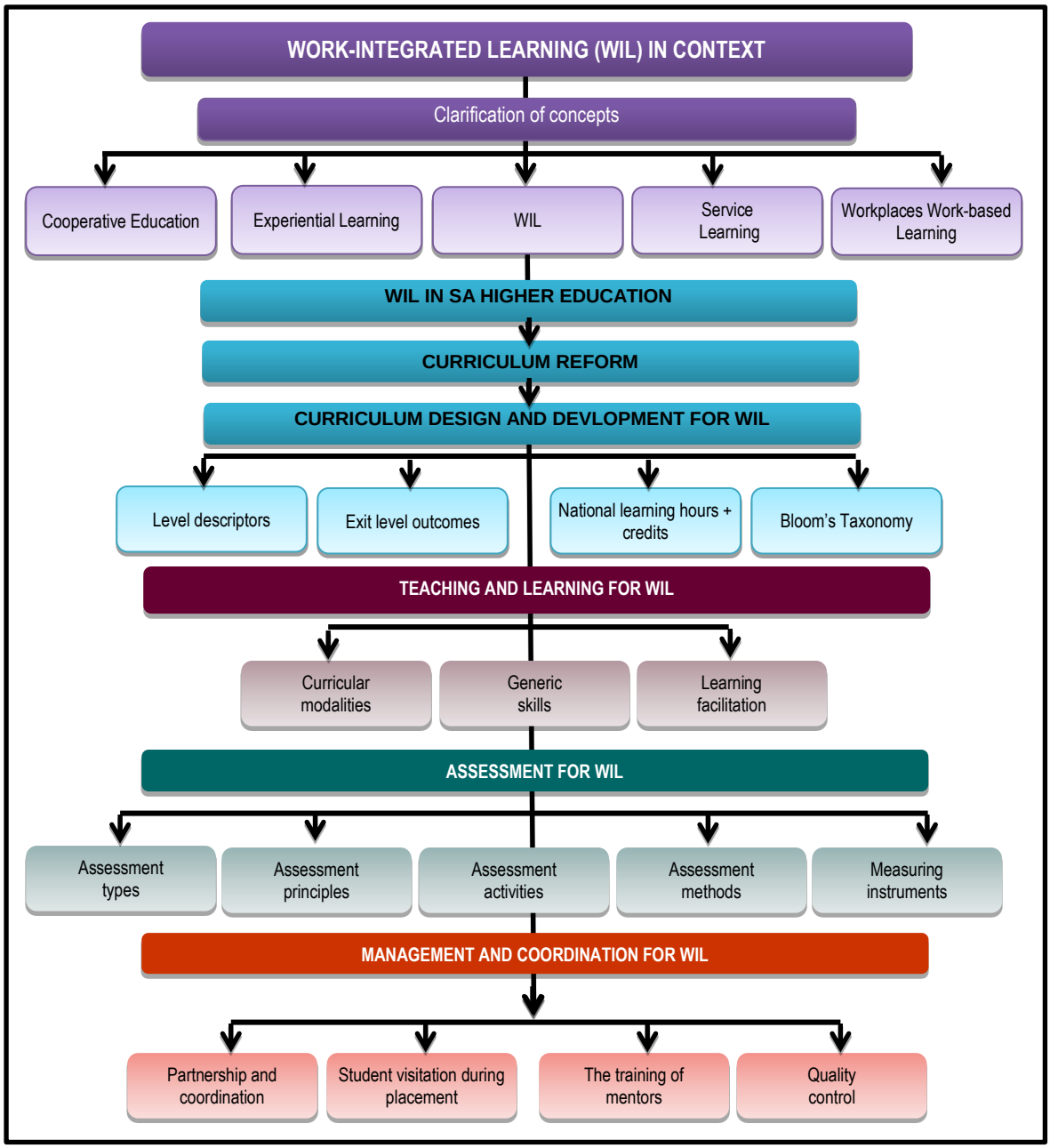


FIGURE 2.1: A DIAGRAMMATIC OVERVIEW OF THE CONCEPTUAL FRAMEWORK FOR WIL

2.2 WORK-INTEGRATED LEARNING IN CONTEXT

Although all higher education institutions do recognise the integration of learning in different contexts to be crucial to the achievement of learning outcomes and the development of skills and competencies, the ways in which academic learning, learning in the workplace and other social/experiential contexts are combined are quite varied across higher education institutions worldwide.

Some terms used interchangeably by institutions of higher learning to describe the

integration of academic content (disciplinary knowledge) with learning in the world of work (practical skills and competencies) are, to name but a few, *cooperative education*, *experiential learning*, *apprenticeships*, and *internships*. This diversity makes it difficult to explain in a simple way what WIL really means. Houshmand and Papadakis ([s.a.]:6) use the following definition in their publication of April 2009: "**Work-integrated learning/cooperative education** is an educational strategy in which students undergo conventional academic learning at a higher education institution, and combine this with some time spent in a workplace relevant to their programme of study and career aims". As can be seen from this definition, the two terms *work-integrated learning* and *cooperative education* are used as if they are exactly the same concept, which accentuates the confusion caused by the variety of terms used to describe the concept *learning by doing*.

2.2.1 Clarification of Concepts

2.2.1.1 *Cooperative Education (CE)*

In its year calendar, the University of Alberta defines CE as a program that formally integrates a student's academic studies with work experience in selected employer organisations (University of Alberta 2013:Online). In other words, the integration of on-the-job, practical experience with academic studies provides students with the opportunity to broaden their knowledge and skills from the classroom into a workplace setting. Cooperative experiences can be remunerated or not; however, the important point is that it should result in graded academic credits for students. Crucial to the success of any CE learning programme is to connect it to classroom learning and academic standards. Connecting activities can take many forms and should take place at all stages of the learning experience (Vermont Agency of Education 2013:Online). In light of the above, one can derive that CE is a specific international movement with its own particular approaches to WIL.

It is important to keep in mind when endeavouring to develop a CE programme for student learning that partnerships are crucial to such programmes. CE cannot occur without partners who represent the different knowledge fields (CHE 2011:51). In most CE programmes the partnership is formed by three parties, namely the student, the higher education institution and the external partner (i.e. the employer/workplace mentor). The term *cooperative education* thus reflects the three-party nature of WIL in

which **the student, higher education and the workplace** work together collaboratively to develop a comprehensive skills set in students (Coll 1996:29). The effectiveness of CE programmes depends to a major extent on the commitment of all these partners. CE in its intended form thus creates opportunities for 'learning by experience' (i.e. experiential learning). In SA, UoTs have, till recently, used the term *cooperative education* to describe the placement of students in appropriate workplaces for the purpose of gaining work experience in their chosen fields or disciplines, with the cooperation of potential employers.

WACE, based in the USA, is an international organisation devoted to promoting WIL by conducting research involving higher education institutions, businesses, and governments (Martin & Hughes 2009:18). In their publication "How to make the most of work-integrated learning: a guide for students, lecturers and supervisors", Martin and Hughes cite Fleming and Martin's definition for the term *cooperative education*: "Cooperative education opportunities provide a **structured educational strategy** integrating classroom studies with learning through productive work experience in a field related to a student's academic or career goals" (Martin & Hughes 2009:19). Fleming and Martin (2007:116) specifically point out that CE should provide progressive experiences in integrating theory and practice. They further state that these experiences usually involve a partnership among students, educational institutions and employers, with specified responsibilities for each party (Fleming & Martin 2007:117). The educational philosophy of integrating knowledge and experience to ensure real learning was already expressed by Dewey in 1938 when he stated that "all genuine education comes through experience" (Dewey 1938:25).

2.2.1.2 *Experiential learning (EL)*

Gentry (1990:9) states that most people adhere to the notion of 'trial-and-error' learning. To emphasise this notion, a quote from Sophocles (400 B.C.) still applies in the modern world of learning where he states that "you must learn by doing the thing, for though you think you know it, you have no certainty, until you try". Kolb (1984:41) describes EL as the process whereby knowledge is created through the transformation of experience. Knowledge thus results from a combination of grasping and transforming experiences. EL thus takes place when "a personally responsible participant cognitively, affectively, and behaviourally processes knowledge, skills, and/or attitudes in a learning situation characterised by a high level of active involvement" (Hoover & Whitehead 1975:25).

In uncomplicated terms, it can thus be said that EL is a process through which students develop knowledge, skills, and values from direct experiences outside a traditional academic setting. In even simpler terms, EL thus means that a person learns to do a certain job by being exposed to the actions needed to do the job. EL can be supported by a sound theoretical background or it can focus mainly on 'learning-by-doing' with a component of reflection after exposure to practice to form the necessary links for learning to be effective.

In SA the term *experiential learning* is sometimes used synonymously with CE. The term EL is also used in international literature with a great variety of meanings. Therefore, the emergence of WIL has led to an attempt to define the whole concept of 'learning-by-doing' more precisely, with particular reference to its associations with WPL.

2.2.1.3 *Work-integrated learning* (WIL)

Although *work-integrated learning* is a relatively new jargon term that focuses attention on the integration of theoretical learning and learning in the workplace, the term puts at the heart of the curriculum its purposes in a way that other terms for apparently the same thing (e.g. placement, internship) do not. Moreover, the new term embodies a clear distinction between WIL and some theories of work (place)-based learning. The latter (WPL or WBL) does not specifically focus on the goal of integrating theoretical knowledge, skills and professional practice. It rather focuses on the uniqueness of being in a workplace and doing the real work (Smith 2012:248). Differently stated, although the concept of students being placed in the workplace to get work experience is not new, the rationale behind WIL goes beyond merely providing the physical environment of a workplace as a site for students to experience work or to learn from professional practice (Smith 2012:248). Consequently, WIL endeavours to exploit the knowledge acquired in the university setting to develop the skills and attitudes in students to enable them to complete a real-world task successfully. Therefore, WIL differs from experiential learning in that it is embedded in a sound theoretical knowledge base acquired at the university.

As stated earlier, the National Commission for Cooperative Education, based in the USA, defines WIL as "a structured educational strategy integrating classroom studies with learning through productive work experiences in a field related to a student's academic or career goals. WIL is therefore intended to provide progressive experience in integrating

theory and practice and is driven as a partnership among students, educational institutions and employers, with specified responsibilities for each party" (Coll & Eames 2005:17). Interesting to note is that according to Vaughan (2008:5), there is the potential to go in two different directions of learning when it comes to WPL specifically. The student can either focus on the articulation between education and work in order to recognise and provide evidence for all forms of learning, or there can be a focus on the workplace as a learning environment where learning is a process embedded in production and organisational structures in communities of practice. Stated differently, WPL can focus on the individual and/or on social and situated learning and the building of communities of practice (Illeris 2003:171).

Another candid explanation for the term *work-integrated learning* was constructed by Coll *et al.* (2009:Online). They explain that WIL entails an integration of knowledge and skills gained in the tertiary education institution and in the workplace. Groenewald (2004:17) confirms this notion of integration by defining WIL as an educational strategy in which students undergo conventional academic learning at a higher educational institution and combine this learning with some time spent in a workplace (WPL) relevant to their program of study and career aims.

In the WIL environment, integration refers to the way in which students take what they have learnt at university into the workplace, and conversely, they take what they have learned in the workplace into the next phase of learning when returning to the higher education institution after completing a work placement (WPL) or work experience (Coll *et al.* 2009:Online). WIL thus endeavours to form a link between the theoretical (disciplinary knowledge acquired in the classroom) and the practical skills and competencies acquired in the workplace by creating an understanding of how related aspects fit together to form the 'big picture' for a specific scenario/situation. Differently stated, WIL provides a context for learning in many different forms of which WPL is one (Jancauskas, Atchinson, Murphy & Rose 1997:Online).

As indicated earlier, the following terms are, *inter alia*, used interchangeably and often in relation with WIL activities in many higher education programmes: *experiential learning, externships, field-based learning, field placements, internships, practice-orientated education, professional practice, sandwich courses,* and *work-based education*. Although there are a number of terms for WIL, all programmes concerned with WIL should, according to Groenewald (2004:19), possess four core elements. These elements are:

- a curriculum integrated with industry's needs;
- inclusion in the curriculum of a work component (WPL) for the students in the curriculum to learn through experience;
- a group of workplaces offering appropriate placements for students to ensure that the tertiary course remains relevant by providing advice and input regarding the curriculum; and
- well-defined logistics for the program to provide clear detail about organising, coordinating and assessing students.

Research done by Eames (2003) has recently shed light on the context of learning as a social process; our understanding of how and what students learn. An understanding of how students engage in learning while being placed in a community or in practice allows the acknowledgement that learning, which takes place at the university and in the workplace, is certainly different but unquestionably complementary in the social context of learning. As a result, learning that occurs in the workplace is seen to occur through "the mediation of instruction, participation, and scaffolding through the use of language, instruments, stories and other tools that constitute the everyday practice of the workplace" (Eames 2003:10; Eames & Bell 2005:166).

When students are placed in clinical practice for periods of work, they immediately engage in a different form of learning; one that is informed by their understanding of the workplace and of their future role in it. Additionally, students develop critically important generic skills such as teamwork and communication, to mention only two. So, by expanding their knowledge and skills to perform certain work-related tasks, students develop the necessary skills and attitudes for lifelong learning (Jancaukus *et al.* 1997:Online). It is important to remember that the WPL component of WIL best contributes to learning if it happens in a well-planned way. Consequently educationists involved with the placement of students for WPL should encourage learning as a situated, participatory, and socially mediated activity. Moreover, they should focus on assessing learning outcomes consistent with such a placement opportunity (Eames & Bell 2005:166).

The Work-integrated Learning Research Unit (WILRU) at the Cape Peninsula University of Technology (CPUT) identified four different ways to facilitate WIL, which are: WDTL, PBL, PjBL and WPL (Engel-Hills, Garraway, Jacobs, Volbrecht & Winberg [s.a.]:1). Each of

these forms of teaching can be used interchangeably in the university setting and the workplace; they are thus not restricted to learning only in the workplace, as perceived by many role players in the higher education environment. From the above it thus becomes clear that **the alignment between work and education implied in WIL is not necessarily restricted to workplace learning**.

Jackson (2006:1) emphasises that this type of 'blended' higher education curriculum prepares students better for a lifetime of learning in a complex world than a curriculum that only considers the institutional context. This learning in a variety of contexts reflects a belief that students are better prepared for the real world of work than when they are being exposed only to the context of WPL in addition to classroom learning. Jackson (2006:1) firmly believes that the integration of learning in these different contexts is crucial to the development of the student as well as the achievement of the learning outcomes of a programme.

In a developing country such as SA where the unemployment rate is high, it is expected that university graduates should be able to find employment, but there are many who do not. The labour market in SA fluctuates between a skills shortage on the one hand and the number of graduates who are without work on the other. Coll and Zegwaard (2006:31) point out that this situation may arise from the fact that students lack behavioural or soft skills such as analytical and teamwork skills, and the ability to organise and manage themselves. These skills are also referred to as employability skills and should be embedded in a well-designed curriculum as critical outcomes for a qualification. Linking to the above, the key purpose of WIL can be said to be the notion of providing graduates with a comprehensive skills set desired by potential employers. The attainment of these skills usually delivers more competent and employable graduates. Coll and Zegwaard (2006:32) reiterate that it is problematic for higher education providers to equip students with such skills. However, the implementation of a well-structured WIL component in a learning programme may provide a good platform for the development of the desired graduate employability skills.

Based on the contextualisation of WIL as illuminated before, it became possible to form a solid framework for this thesis. From the above it became evident that it is important to understand WIL in the context of being a higher education learning experience which combines and integrates the study, work, formal and informal learning environments combined with the social interaction in institutional, work, and e-learning contexts

(Jackson 2006:1). In other words, WIL is **not** referring **only** to the workplace as an environment where students can form links between the theoretical knowledge they have acquired at university and the application of this knowledge in the workplace. WIL can also refer to many other ways to inspire learning in the student such as was identified by WILRU. As stated explicitly by Smith (2012:247), WIL is not the same as work experience or work-based learning, neither of which require students to specifically learn, apply or integrate disciplinary knowledge. Although the concept of students being placed in the workplace to get work experience is not new, the rationale behind WIL goes beyond merely providing the physical environment of a workplace as a site for students to experience work or to learn professional practice (Smith 2012:248).

With the focus on integration, it actually means that WIL can take place in a variety of environments where learning can be facilitated to form the necessary links between the theory and the practical implementation, of which the workplace is only one such environment. Other such environments, to mention but a few, are simulations laboratories, interactive discussions among groups and forums, virtual environments, and e-learning environments. Additionally, exposing students to a variety of environments to learn stimulates the development of graduate employability skills (soft skills) to ensure that they are better equipped to function in the real world of work. In my endeavours to develop an education and training programme for the profession of Radiography in the domain of HPE, the research that I conducted was consequently based on WIL in its different forms, and not only on the WPL component of WIL.

Summarised appropriately by Jancaukus *et al.* (1997:Online), WIL programmes are special in the sense that they provide students with a definite edge in the competitive graduate employment market, while also providing a mechanism by which the world of work can contribute to curriculum development to keep programs in line with and relevant to the real world. Similarly, WIL programmes are a vital link between the university and the workplace, presenting opportunities for consultation, research and technology transfer. Jancaukus *et al.* (1997:Online) thus reiterate that it is not surprising that WIL programmes are featuring prominently in the strategic plans of universities who have adopted the WIL pedagogy.

2.2.1.4 *Service learning (SL)*

The term *service learning*, as we know it today, has been used to describe a wide array of

experiential activities, from volunteer and community service projects to field studies and internship programmes. This makes one realise that a number of definitions exist for service learning which are causing uncertainty as to where exactly service learning fits into the 'learning by doing' experiences of students. While some educators view service learning as a new term, many others interpret it as just another term for experiential education programmes. So, one can ask the question: "What is service learning really and how does one distinguish it from corporative education, internship programmes, and any other form of experiential learning?". Back in 1979 Robert Sigmon defined service learning as an experiential education approach which is based on reciprocal learning (Sigmon 1979:9). This reciprocal learning implies that both the liberator of the service and the recipient of the service should benefit or learn from it. Some years later, Sigmon broadened his definition to include the notion that service learning "occurs when there is a balance between learning goals and service outcomes" (Furco 1996:3).

The Alliance for Service Learning in Education Reform (1995:Online) broadly defines service learning as "any carefully monitored service experience in which a student has intentional learning goals and reflects actively on what he or she is learning from the experience". One can thus argue that the following types of 'service to the community' learning programmes can also be seen as service learning: community service, volunteerism, internships, and field education. However, if one closely looks at the numerous definitions for each of these 'service' programmes, it becomes clear that none of them assigns an equal weight to the benefit/learning for both the liberator and the recipient of the service. Hence service learning is distinguished from other approaches of experiential education by its intention to "equally benefit the provider and the recipient of the service as well as to ensure equal focus on both the service being provided and the learning that is occurring" (Furco 1996:5).

More recent definitions for service learning as supported by the Colorado State University say basically the same, but have been refined to prescribe the intention thereof much better. They specify the following important aspects of service learning as a pedagogical activity that is important to the formulation of a logical definition for service learning:

- Service learning involves students in community service activities and applies the experience to personal and academic development;
- Service learning occurs when there is "a balance between learning goals and service outcomes" (Furco 1996:3);

- Service learning programs are distinguished from other approaches to experiential education by their "intention to equally benefit the provider and the recipient of the service as well as to ensure equal focus on both the service being provided and the learning that is occurring" (Furco 1996:5);
- Service learning course objectives are linked to real community needs that are designed in cooperation with community partners and service recipients;
- Service learning course materials inform student service and service informs academic dialogue and comprehension; and
- Service learning engages students in a three-part process: classroom preparation through explanation and analysis of theories and ideas; service activity that emerges from and informs classroom context; and structured reflection tying service experience back to specific learning goals (Colorado State University 2013:Online).

In their WIL and service learning policy, the University of Johannesburg (UJ) defines service learning as follows: It is "a form of teaching and learning that is directed at specific community needs and integrated into a credit-bearing academic programme and curriculum in which students participate in contextualised, well-structured and organised service activities aimed at addressing identified service needs in a community and subsequently reflect on such experiences in order to gain a deeper understanding of the link between curriculum content and community dynamics as well as to achieve personal growth and a sense of social and civic responsibility. The experience is assessed and takes place under the supervision and/or mentorship of a person/s representing the community. A collaborative partnership that enhances mutual reciprocal teaching and learning among all members of the partnership (lecturers and students, members of the communities or representatives of the service sector) is required" (UJ 2013:Online). This definition embraces the definition for service learning as portrayed in the HEQC document (2004:33) where service learning is defined as "applied learning which is directed at specific community needs and is integrated into an academic programme and curriculum. It could be credit-bearing and assessed, and may or may not take place in a work environment".

In order to put WIL and service learning in context, it is important to remember that both WIL and service learning take place in an authentic context at the institution of higher learning (curriculum driven) and the workplace (work based) with the major difference of WIL being industry based and service learning being community based. In other words, WIL takes place in the specific industry which informs the purpose of a specific

qualification after a partnership has been formed between the university, the industry (workplace) and the student. Conversely, service learning is underpinned by a partnership between the university, a community of people (e.g. patients at a community service health clinic or pupils at the local high school) and the student. However, both strategies have the ultimate aim of linking what the student has learned in the classroom (disciplinary knowledge) with the real situation in the world of work outside the classroom (application of knowledge). It is important to remember that both WIL and service learning take place in an authentic context at the institution of higher learning or the workplace with the major difference of WIL being industry based and service learning being community based.

For the purpose of this thesis, the term *work-integrated learning* is used in relation with specific pedagogical activities where the focus is on integrating the student's disciplinary knowledge with activities related to the real world of work (industry) for a specific profession, in this case Radiography. This process may include pedagogical strategies such as PBL, PjBL and WPL, among others.

2.2.1.5 *Workplace learning and/or Work-based learning (WPL/WBL)*

As is the case for the concepts discussed above, WPL is hard to define. Holliday and Retallick (1995:7) define WPL as the processes and outcomes of learning that individual employees and groups of employees undertake under the auspices of a particular workplace. Rylatt (1994:10) describes WPL as a sustained and high leverage development of employees in line with organisational business outcomes. Matthews (1999:19) took the above two definitions and formulated a definition which is applicable for use in most organisational situations. She defines WPL as follows: "WPL involves the process of reasoned learning towards desirable outcomes for the individual and the organisation. These outcomes should foster the sustained development of both the individual and the organisation, within the present and future context of organisational goals and individual career development". The key issues for WPL from which she formulated this definition are: 1) the learning context; 2) the learning reason; 3) the learning process; 4) the learning outcomes; and 5) sustained development of both parties involved.

Important to remember is that WPL is not just any form of learning which takes place within a work environment. For WPL to be implemented effectively, it should display the following features:

- Be task focused;
- Occur in a social context characterised by status differences and the risk to one's livelihood;
- Be collaborative;
- Occur in a political and economic context characterised by a currency of favours and pay for knowledge; and
- Be cognitively different from learning in the formal academic classroom.
  (NBEET 1994:11)

From the above discussion on WPL, it is safe to say that WPL and WBL share the same intention. The *Work-based Learning Guide* of the Vermont Agency of Education defines WBL as "learning that results from students engaging in activities on site with employers and is designed to increase the knowledge and skills of the learner" (Vermont Agency of Education 2013:5). The guide describes WBL as work experience which is supplemented with instruction and activities that relate, support, purify or broaden the learning that occurs during work. This interactive learning will in turn ensure the development of attitudes, knowledge, skills, and habits that might not develop from work experience alone (Vermont Agency of Education 2013:6). It is important to remember that employers are required to provide a structured learning experience for students participating in WIL in order for them to develop workplace readiness. In simple terms, WBL is a process that allows students to explore careers, connect with businesses, learn about the functions of an organisation, and understand the relevance of their education (Vermont Agency of Education 2013:6).

In summary, learning experiences in the workplace are activities that involve actual work experience or that connect classroom learning to employment and careers. Through work-based learning experiences, educational programs become more relevant, rigorous, challenging, and rewarding for students, parents, educators, and businesses. These opportunities particularly help students make the connection between academic principles and real-world (Vermont Agency of Education 2013:6). It is important to remember that, in the context of this study, WIL **does not only comprise** WPL/WBL, but WPL/WBL is also considered one of the learning modes through which WIL can be facilitated; hence WPL/WBL should not be seen as the only way to integrate the classroom with the workplace (cf. 2.2.1.3).

2.3 WORK-INTEGRATED LEARNING IN SOUTH AFRICAN HIGHER EDUCATION

The following diagram shows, at a glance, where WIL is situated within the HEQF in the South African context as derived from a presentation at a colloquium and workshop at the University of Johannesburg in 2008.

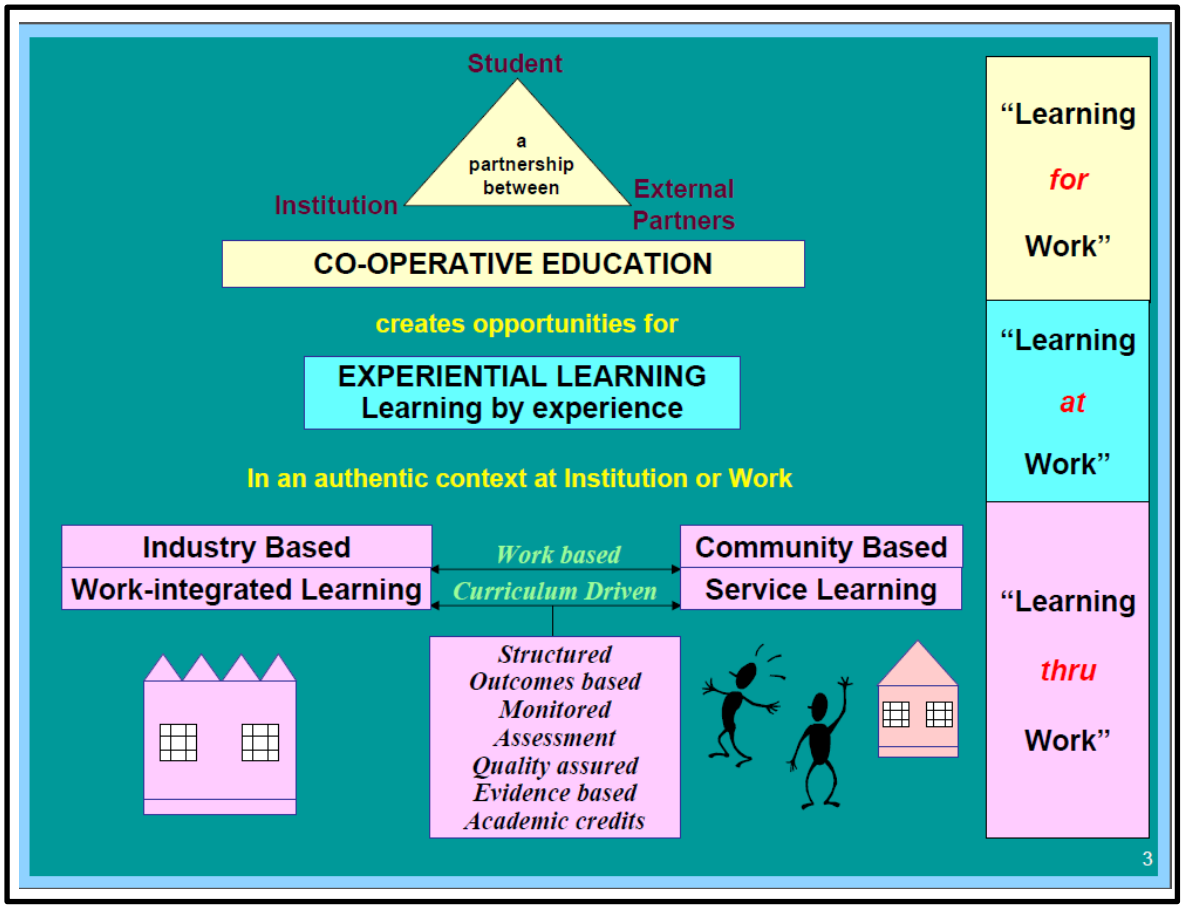


FIGURE 2.2: SCHEMATIC OUTLINE OF WORK-INTEGRATED LEARNING WITHIN THE HEQF (WORK-INTEGRATED LEARNING: QUALITY, CAPACITY AND CURRICULUM WITHIN THE HIGHER EDUCATION QUALIFICATIONS FRAMEWORK, 2008)

2.3.1 Purpose Statement for Work-integrated Learning in South Africa

In an attempt to gain definitional clarity on the relationship and link between learning and work, the Southern African Society for Cooperative Education (SASCE) drew from an international study by the University of Leeds in 1996 which elucidated **three aspects** that link learning to the world of work, namely learning **for** work, learning **at** work, and learning **through** work (Forbes 2007:1).

SASCE believes that this rationale clarifies the distinction between vocational, career-

focused, experiential learning and work-integrated learning programmes where learning **for work** broadly encompasses anything that has a vocational or career focus intention. Learning **at work** relates to training and development that is work-based delivered at companies, whereas learning **through work** is the process of engaging the student in specific work-related tasks where such learning and experiences are **part of and integrated into the curriculum**. This latter type of integration within the curriculum as a continuum is **work-integrated learning**.

SASCE therefore validates in this amended and updated Cooperative Education Policy for WIL programmes of January 2007, the definitions for cooperative education, experiential learning, WIL, and service learning as adopted by the CHE, as follows:

- **Cooperative education** can be defined as "a philosophy of learning that promotes the concept of enhanced learning based on cooperation between education institutions and industry, commerce and the public sector" (HEQC 2004:33; Forbes 2007:2);
- **Experiential learning** is a component of a learning programme that focuses on the application of institutional academic learning in an authentic work-based context (also called work-based learning). It addresses specific skills and competency requirements for the achievement of vertical added-value learning within a qualification that will enhance employability (HEQC 2004:35; Forbes 2007:2);
- For **work-integrated learning** some qualifications are being designed to incorporate periods of required work that *integrate* with classroom study. This is called work-integrated learning. Where Work-Integrated Learning is a structured part of a qualification, the volume of learning allocated to WIL should be appropriate to the purpose of the qualification. It is also the responsibility of institutions that offer programmes requiring WIL credits to place students into WIL programmes. Such programmes must be structured, properly supervised and assessed (DoE 2007:9; Forbes 2007:2). SASCE clearly states that WIL should be directed at the attainment of professional or occupational learning outcomes. They confirm that WIL should not be exclusively experiential learning but should include a continuum of learning that is curriculum driven and is therefore designed and executed at the required NQF levels of the qualification. Examples of this curriculum driven curricular modalities (learning modes) may include combinations and integrated aspects of WDTL, PBL, PjBL and WPL; and
- In this policy, SASCE defines **service learning** as applied learning which is directed

at specific community needs. Service learning should be integrated into the academic programme of the curriculum; it should be credit bearing and assessed and may or may not take place in a work environment (HEQC 2004:37; Forbes 2007:2). Differently stated, service learning is aimed at enhancing the civic responsibility of students within the context of the curriculum. The purpose of service learning is therefore to engender a sense of civic responsibility in students by enabling them to share the knowledge, skills and attitudes learned during their studies with civic society.

According to Forbes (2007:2), in the South African context, service learning thus aims at achieving the following:

- Developing a student's life skills and awareness of personal, social, and cultural values and respect for and understanding of others, thus leading to more responsible citizens;
- Engaging students in activities where both the community and students are primary beneficiaries and where the goals are to provide services to the community; and
- Enhancing student learning in a reciprocal partnership.

Following the clarification of terms as discussed above, SASCE designed the following principles and goals to underpin and drive all WIL activities within the cooperative education model in South African higher education. Hence work-integrated learning

- should be purposefully curriculated to fall in line with the vision and mission of academic institutions;
- will promote learning outcomes that will contribute to skills development, in line with the principles of the National Qualifications Framework (NQF) and the National Skills Authority (NSA);
- will embrace and promote social responsibility and community engagement through the service learning aspects of experiential learning that are linked to work-integrated learning programmes where feasible;
- will adopt a strategic institutional approach to industry-education links so as to maximise the advantages of efficiency and effectiveness within an agreed operational and strategic quality assurance framework; and
- will promote cooperative collaboration in a spirit of trust, accountability and transparency (Forbes 2007:3).

The CHE's *Work Integrated-Learning: Good Practice Guide* (CHE 2011:1) clearly states that university lecturers in SA should be concerned enough to ensure that the students who graduate from their programmes are well prepared for the world in which they will live and work. To confirm the intention for WIL in the South African context, Coll *et al.* (2009:Online) indicate the key purpose of WIL as the notion of providing graduates with a comprehensive skills set as required by the potential employer. Such a comprehensive skills set might include knowledge of the professional subject matter, skills and competencies to perform the tasks required by the profession, and attitudes to function as a well-equipped professional in the real world of work.

Over the past two decades it has been indicated that universities do not sufficiently emphasise the development of behavioural skills to adequately prepare graduates for the world of work (Coll & Zegward 2006:30). As reported by Bell, Crebert, Patrick, Bates and Cragnolini (2003:5), in terms of graduate recruitment in the leisure industry in Australia, a strong knowledge base alone can no longer guarantee employment for a new graduate. What is of more importance in the world of work with its variety of challenges is a set of strongly developed generic attributes and capabilities to ensure success in the demanding work environment of today. The point is that there is a set of features which are deemed important to describe the qualities of an effective worker. These features cannot be developed by acquiring theoretical knowledge only. WIL should thus be the process whereby students develop their skills, behaviour and self-awareness to be successful in their chosen profession (Cooper & Maidment 2001:42).

2.3.1.1 *The purpose of work-integrated learning in Radiography*

One of the definitions most applicable to the purpose of WIL in Radiography training is the one by Martin and Hughes (2009:8). They state that "WIL provides a connection for students between their present academic knowledge and their professional future"; or differently stated, an opportunity to apply and merge theoretical knowledge gained in academic studies with real-world workplace practical experiences. This then prepares students for their chosen careers by providing them with opportunities to develop relevant professional skills.

It can thus be said that the purpose of WIL in Radiography is to change the students' position from disengaged observer to involved learners in an active learning environment. The ideal is that students' achievements in the set learning outcomes/objectives for WIL

are enhanced in such a way that they will be able to apply their acquired knowledge in clinical practice. In other words, students should build knowledge and capabilities through the integration of academic and workplace curricula, thus improving their understanding of what is expected from them in clinical practice (Boles, Beck & Hargreaves 2005:4). In addition, as stated in 2.2.1.3, WIL is an ideal platform in Radiography training to equip graduates with a comprehensive skills set desired by potential employers. Such a skills set is also called generic graduate attributes, or soft skills.

2.3.1.2 *The Professional Board for Radiography and Clinical Technology*

For many professional programmes, the mediating structure between the institutions of higher learning and the world of work is a professional body. In SA the profession of Radiography is regulated by the Professional Board of Radiography and Clinical Technology which mandates the incorporation of workplace requirements into the curriculum. The professional body not only circumscribes the professional role of graduates as it needs to be enacted in the workplace, but also offers parameters for a curriculum that underpins the acquisition of competencies in the role (Shakespeare & Hutchinson [s.a.]:5). The competencies required by a specific profession are usually the dominators according to which the professional body is designing its professional standards. These standards are defining an effective worker. In other words, it is defining the qualities which an employer will be looking for in a practice setting.

2.4 CURRICULUM REFORM

Commonly there are no step-by-step method for curriculum review and reform within health sciences curricula (Rodgers [s.a.]:Online). However, purposeful curriculum enquiry should take into consideration the values and belief systems of the whole team involved in the delivery of a programme. This includes lecturers at the teaching institution and other stakeholders (e.g. employers). In other words, curriculum reform is a process of discussion of what to teach and how to teach where differing perspectives are presented and recommendations are made for long lasting change (Harris 1993:483). If the need for curriculum review and reform occurs within a certain profession, successful change means developing programs which are appropriate to the context, environment and goals of the profession (Bland, Starnaman, Wersal, Moorhead-Rosenberg, Zonia, & Henry 2000:581).

The Radiography profession in SA is currently in the process of recurriculating the three year National Diploma in Radiography (level 6 in the old NQF) to a four year Professional Bachelor degree (level 8 in the new NQF) (SAQA 2013a:Online). This recurriculation demands curricular and pedagogical reform in the theoretical content as well as in the WIL components of Radiography learning programmes in SA. In addition, this reform of the curriculum for the profession should ideally support the development of students from diverse backgrounds and prepare them for the challenges of a global economy. Moreover, it should address the fast development of digital technology in the profession over the past decade.

Smith (2012:247) designates WIL as a curriculum design in which students spend time in professional, work or other practice settings relevant to their degrees of study and to their occupational futures. Learning activities in WIL programmes should be specifically designed to encourage students to apply and learn disciplinary knowledge and skills in a real-world context. Smith (2012:47) also points to the different ways in which WIL can be facilitated as being placements, internships, practica, supervised practice, and even simulations. It is important to remember, as stated by Billet (2001:6), that WIL puts at the heart of the curriculum its purposes in a way that other terms for apparently the same thing (e.g. work placement and internship) do not. A properly designed WIL curriculum also exemplifies a clear distinction between WIL and some theories of work (place)-based learning, which do not necessarily focus on the goal of integrating disciplinary or academic knowledge with the development of skills and competencies in the workplace (Boud & Solomon 2001:21).

Worth noting is that a Professional Bachelor degree demands high intellectual independence together with the development of research capacity in the specific discipline. What should also be kept in mind is that a student, after having achieved a Professional Bachelor degree, should be able to progress directly to a Master's degree. Professional Bachelor degrees are often, in the health professions environment, designed in consultation with a professional body such as the HPCSA and recognition of the qualification by the professional body is a requirement for licensing to practice in the profession. Usually it is required by the professional body that such a qualification be well grounded in knowledge, theory, principles and skills/competencies required by the profession and the ability to apply all the above in the career context (DoE 1997:23). The above requirements are thus applicable to the Professional Bachelor degree in Radiography.

2.5 CURRICULUM DESIGN AND DEVELOPMENT FOR WORK-INTEGRATED LEARNING

The working environment worldwide has undergone a number of changes in the past two decades. These include economic, technological and social changes that have altered the skills that employers require of graduates. This is especially true in the health care environment where technological advances are experienced in all spectrums of health care. Hence it is now even more important for educational institutions to ensure that their graduates have the necessary skills that render them employable after graduation (Cullen 2004:1). This can only be done by critically rethinking the content of the curriculum for a specific qualification and adapting it to include the objectives needed to develop the skills and competencies required by the employers of the world of work as it is today.

As clearly stated by the CHE (2005:50), *curriculum development* refers to a formal and/or informal process of planning, designing, implementing, monitoring, reviewing and evaluating a curriculum aimed at improving teaching and learning in a specific programme. In the outcomes-based approach intrinsic to the NQF, "a qualification signifies and formally certifies the demonstrated achievement by a learner of a planned and purposeful combination of learning outcomes, at a specified level of performance" (CHE 2005:50). Qualification also means "a planned combination of learning outcomes which has a defined purpose or purposes, and which is intended to provide qualifying learners with applied competence and a basis for further learning" (SAQA 2000:4).

The curriculum of a learning programme is understood to be more than syllabus documentation. The term refers to all of the teaching and learning opportunities that take place in learning institutions. It therefore includes the purpose and values of learning; the needs and nature of the learners; the learning outcomes; the content that will support achieving the outcomes; the activities, methods and media for teaching and learning; how assessment will be done; and how the overall effectiveness of the delivery of the curriculum will be assessed (SAQA 2000:6). Broadly stated, the term *curriculum* refers to the subject matter, or "the syllabus for a specific learning programme" (CHE 2011:13). What is however of crucial importance is that the curriculum should also be explicit with regard to how knowledge is organised within a module/subject, how the lecturers teach or facilitate the learning, how the learners should learn, and how the whole process should be assessed (CHE 2011:13) The importance of this is confirmed by

the CHE (2005:50) when they describe *curriculum alignment* as ensuring that the purpose of a programme (or module) is supported by the content selection, learning outcomes, teaching-learning methods, and assessment practices to deliver it.

Pink (2005:32) explains that it is no longer adequate to offer a product or service that is only functional. He further points out that in current economic conditions and modern life styles in most countries, customers choose to engage with something that is fanciful and emotionally engaging. According to Dale and McCarthy (2004:Online), the sound incorporation of WIL into higher education programmes achieves precisely this notion when students engage in the practical application of their studies and interact with real-life experiences. Thus, whether WIL is designed as part of another module in a programme or as a module on its own, the important aspect to always consider is whether it is **designed as an integrated part of the curriculum and not as an add-on**.

From the above it has become quite clear that a curriculum should be seen as the overall map of the educational territory for a learning programme. As stated by Shakespeare and Hutchinson ([s.a.]:5), even in essentially professional programmes such as Radiography and nursing, much of the learning is mapped out as classroom or text-based learning. Important to note, however, is that for the design of the curriculum for any professional program, such as most programmes in health education, it is necessary to demonstrate that the curriculum is informed by practice (Shakespeare & Hutchinson [s.a.]:5). The required competencies, as indicated by the practice of a specific profession, are important indicators for curriculum design to ensure that the curriculum addresses the development of a well-trained professional.

Shakespeare and Hutchinson ([s.a.]:4) reiterate that unless the curriculum for a specific profession reflects the stepping stones to achieve the required competencies for the profession, it is not serving its purpose. In other words, the learning outcomes and theoretical knowledge content in the curriculum need to demonstrate practice outcomes/competencies and should equip the student with the intellectual tools to interrogate and to question a specific set of standards.

In other words, if higher education institutions are interested in partnerships with employers, the curriculum needs to be developed in such a way as to be recognisably work relevant and the overall programme needs to value the inputs from these role

players in the training of their students. Shakespeare and Hutchinson ([s.a.]:4) make it very clear that higher education programmes, and specifically health education programmes where there may be a set of competencies that is seen to define the skills and capabilities of the qualified worker, should be developed according to some external criteria as stipulated by their industry partners.

2.5.1 Curriculum Design for Work-integrated Learning in Radiography

In 2003 Forbes (2003:3) stated that higher education institutions in SA had an obligation to review their curricula and implement strategies in offered programmes to bring them in line with the objectives of the NQF and the principles embedded in an outcomes-based approach to teaching and learning. He further stated that this was essential to ensure the integration of academic learning and WPL to provide a workable model in preparing graduates for the modern world of work.

A variety of learning activities can be used to facilitate learning in the WIL environment such as simulations, observations, demonstration, and reflection sessions. It is important, however, that these activities and the assessment thereof be structured into the different levels of difficulty from Year 1 to Year 4 in a well-designed curriculum for WIL. In order to ensure proper implementation of the different levels of learning, it might be a good point of departure to look at the level descriptors and exit level outcomes for the specific qualification and to implement the levels of Bloom's taxonomy to scaffold the learning and assessment for WIL towards achievement of the exit level outcomes. By implementing the cognitive domain of Bloom's taxonomy by means of the six identified levels, which range from the lowest level of simple recall of facts to the highest level of evaluation, curriculum developers can guide the way in which student learning is developed from the first to the final year.

2.5.1.1 *Level descriptors*

The level descriptors for the Professional Bachelor degree were developed by SAQA and agreed to by the quality councils of the CHE (i.e. the General and Further Education and Training Quality Council and the Quality Council for Trades and Occupations) (SAQA 2012:2). These level descriptors were published in the government gazette of November 2011. According to Samuels (SAQA 2012:2), the primary users of the level descriptors should be qualification experts who are involved in the development of curricula to

support the design and implementation of qualifications and part qualifications within the NQF. He further says that others who should benefit from the level descriptors are the learners and skills development practitioners (i.e. academic staff involved with WIL). Stated differently, the purpose of the level descriptors is to contribute to coherence in learning achievement and to facilitate evaluation criteria for comparability and thus articulation within the NQF (SAQA 2012:2).

The philosophical underpinning of the NQF and the level descriptors is applied competence, which is in line with the outcomes-based theoretical framework adopted in the South African context. According to SAQA (2012:3), *applied competence* has three constituent elements: 1) *foundational competence*, which embraces intellectual/academic knowledge together with analysis, synthesis and evaluation skills, which include information processing and problem solving skills; 2) *practical competence* which includes the concept of operational context; and 3) *reflexive competence* which incorporates learner autonomy.

Ten categories/competencies are used for each of the level descriptors to describe applied competencies across each of the ten levels of the NQF. These categories are, according to SAQA (2012:3):

- Scope of knowledge;
- Knowledge literacy;
- Method and procedure;
- Problem solving;
- Ethics and professional practice;
- Accessing, processing and managing information;
- Producing and communicating information;
- Context and systems;
- Management of learning; and
- Accountability.

To facilitate the contextual application of the level descriptors for the purpose of this research study (i.e. WIL in Radiography training), the following principles (SAQA 2012:5) were adopted:

- Level descriptors are designed to meet the needs of the qualification. This means that the level descriptors embrace learning in a wide variety of contexts (academic and professional) and environments (e.g. classroom, laboratory, practice, and community). In other words, the contextual interpretation of the level descriptors is applied across academic and professional contexts;
- Correlation between qualification levels and occupational levels in the world of work should be sought throughout. Differently stated, the curricula for learning should constantly seek to integrate disciplinary learning with learning in the workplace to ensure a well-trained, skilled graduate ready for employment;
- The Critical Cross-Field Outcomes of SAQA are embedded in the level descriptors. Thus, if the level descriptors are used when designing curricula for new learning programmes, the attainment of generic graduate skills should already be embedded in such curricula;
- Level descriptors are cumulative; i.e. there is progression in the required competencies from one level to the next. This means that level descriptors should provide a scaffold from which more specific descriptors can be developed by a variety of different sectors and practitioners, for example discipline- or profession-based. Also recognised is the fact that in the processes of curriculum design and development, the interpretation of these generic level descriptors will be influenced by, for example, field-, discipline-, and context-specific nuances; and last
- Level descriptors are descriptive and not prescriptive and are thus designed to act as a guide and a starting point for: 1) writing learning outcomes and associated assessment criteria; 2) pegging a qualification at an appropriate level on the NQF; 3) assisting learners to gain admission through RPL at an appropriate level on the NQF; 4) making comparisons across qualifications in a variety of fields and disciplines pegged at the same level of the NQF; and 5) programme quality management used together with purpose statements, outcomes and assessment criteria.

From the above it is evident that by designing the level descriptors for the different levels in a qualification, SAQA endeavours to provide guidance to programme developers to ensure compliance with the requirements of the different governing bodies for higher education in SA. The level descriptors for the Bachelor degree in Radiography were thus used as a departure point in the design of a WIL education and training programme for Radiography in SA (*cf.* 2.5.1.1).

2.5.1.2 *Exit level outcomes*

Exit level outcomes are a description of what a student will be able to do after having successfully completed a unit of learning or a learning event. The exit-level outcomes for the Bachelor degree in Radiography as registered with SAQA (2013a:Online) are as follows:

1. Perform routine and specialised radiographic procedures to produce images of diagnostic quality;
2. Access, organize and present information applicable to the Radiography context in order to record, retrieve and communicate patient data;
3. Evaluate the quality of routine and specialised radiographic images and perform image interpretation to identify normal and abnormal appearances;
4. Plan, develop and apply total quality management appropriate to the diagnostic Radiography context;
5. Perform safe and effective patient care in accordance with the patient's needs and departmental protocol to provide a quality service and to maintain the welfare of the patient;
6. Apply the principles of human rights, ethics and relevant medical law which ensure the wellbeing of the patient;
7. Apply the principles, specific knowledge, skills and values related to one of the chosen electives as listed; and
8. Conduct research.

When developing a curriculum, the exit level outcomes for the specific qualification should be aligned with the purpose of the qualification. Exit level outcomes refer to the outcomes to be achieved by a qualifying learner at the point at which he or she leaves the programme and will be awarded a qualification (Directorate of Quality Assurance and Development 2013:Online). This implies that if a learner has achieved all the exit level outcomes in a learning programme, he/she is equipped suitably to be awarded the qualification. A learning programme usually consists of learning and assessment activities derived from the outcomes that make up the qualification.

When utilising the level descriptors and the exit level outcomes to design a curriculum, SAQA suggests a 'Design Down, Deliver Up' approach which moves from the purpose of the qualification to the outcomes, its assessment criteria and the learning activities (SAQA

2013b:5) (cf. Figure 2.3). When using the 'design down' process, the following critical questions should be asked (SAQA 2013b:6):

- What is the ***purpose*** of the qualification?;
- How can this purpose be achieved? What will my students need to know and be able to do in order to achieve this purpose? Which values are embodied in the purpose? (The answers to these questions are written up as ***outcomes*****);**
- How will I know if my students have achieved the outcomes? What evidence will I look for? In other words, how will I ***assess*** whether my students have achieved the outcomes or not?; and
- How will I prepare my students for the assessment? What ***teaching and learning activities*** will produce the knowledge, skills and values required by the assessment activity?

Once the 'design down' process has been completed, one should follow the 'deliver up' approach which will show one whether the learning activities have prepared one's learners for the assessment activities. These in turn will provide evidence that they have met the outcomes and thereby have achieved the purpose of the qualification (SAQA 2013b:6). Thus, when designing the outcomes for the envisaged education and training programme for WIL in Radiography training, this process was followed intentionally while constantly keeping the purpose of the qualification in mind.

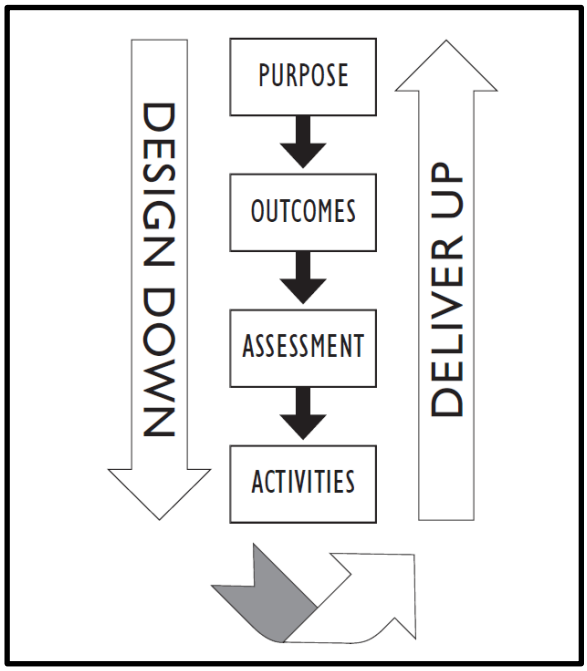


FIGURE 2.3: SCHEMATIC REPRESENTATION OF THE 'DESIGN DOWN, DELIVER UP' PROCESS (SAQA 2013B:6)

2.5.1.3 *Notional learning hours and credits*

A notional learning hour is the unit used to indicate the approximate time it would possibly take an average learner to achieve a defined learning outcome. It is important to remember that notional learning hours include contact time with the student, time spent in WPL, as well as individual learning time spent by the student (CHE 2009:36). Currently one credit is equivalent to 10 notional hours of learning. In other words, a credit is a set value to a given number of notional hours of learning. As prescribed by the CHE, 120 credits are approximately equivalent to one year of full-time study (CHE 2009:13 14). As explained in 2.4, the Radiography profession is currently in the process of reforming the curriculum from a National Diploma to a Professional Bachelor degree. The Professional Bachelor degree will carry 480 credits (4 800 notional learning hours) over a period of four years fulltime study (SAQA 2013a:Online). To abide by the prescriptions of the CHE in their criteria for programme accreditation, a minimum of 60 credits (600 notional learning hours) should be assigned to WIL when developing new programmes (CHE 2009:8).

2.5.1.4 *Bloom's taxonomy*

The implementation of Bloom's taxonomy in the WIL environment can stimulate change in students' position from detached observers to involved performers (Boles *et al*. 2005:Online). These authors further advocate the use of Bloom's taxonomy in the construction of the learning outcomes for WIL to enhance students' learning for the WPL components of their courses in such a way that it will reflect the transition from an industrial to a knowledge-based learning environment. Naturally, the lower three levels of the taxonomy (knowledge, manipulation, application) will relate to 'surface' learning and the higher levels (analysis, synthesis and evaluation) to 'deep' learning (Brown 2001:8).

2.6 TEACHING AND LEARNING FOR WORK-INTEGRATED LEARNING

In his book entitled *Educating the Reflective Practitioner*, Schön (1987:3) describes the challenge confronting educators at modern universities in the following context: *"In the varied topography of professional practice, there is a high, hard ground overlooking a swamp. On the high ground, manageable problems lend themselves to solution through the application of research-based theory and technique. In the swampy lowland, messy, confusing problems defy technical solution. The irony of the situation is that the*

problems of the high ground tend to be relatively unimportant to individuals or society at large, however great their technical interest may be, while in the swamp lie the problems of greatest human concern".

Reflecting on this quote from Schön, it is easy to relate this to the learning which is intended by the implementation of sound WIL programmes in the education of health professions. The intention of WIL programmes is to empower students to be able to analyse and solve the 'problems' in the 'swampy lowland', which are in all health-related professions the problems students will be confronted with in the real world of work/clinical practice. This implies that students will only be able to solve the 'manageable problems' on the 'high ground' (not so important problems) if they depend only on conceptual knowledge and do not have the chance to construct meaning or context by being exposed to activities which reflect what is happening in the real world of work.

Closely linked to what is intended to be achieved by the pedagogy for WIL are the two theories of teaching and learning, namely phenomenography and constructivism. Phenomenography is based on the impression that the student's own perception outlines what is learned and not what the lecturer intended for him/her to learn. In other words, good teaching is the ability to change the student's perception or the way the student sees the world (Biggs 2003:12). On the other hand, the different forms of constructivism (individual, social, cognitive, postmodern) share one common idea which is that what the learner **has to do** to create knowledge is the important thing. The idea that learning takes place through the active behaviour of the student is confirmed by Tyler (1949:128) and corroborated by Biggs (2003:25). In other words, it is what the student **does** that he learns and not what the teacher does.

Biggs (2003:13) advocates that reflective practice be added as a teaching strategy. According to him, reflection is a theory of learning that is broad-based and empirically sound and that easily translates into practice. Thus reflection is actually constructivism with its emphasis on what students **have to do** to create or construct knowledge rather than to represent knowledge. Differently stated, learning is thus a way of interacting with the real world of work. The acquisition of information is not enough to make a student really understand; but the way he/she structures that information and thinks or reflects about it does. It is thus safe to assume that the stimulation of the construction of knowledge depends heavily on the type of learning activities the student engages in (Biggs 2003:13). What people construct from being engaged with different types of

learning activities depends on their motives and intentions or how they use their prior knowledge; thus the construction of meaning is a personal phenomenon. However, motivation is a product of good teaching and not a prerequisite (Biggs 2003:13).

2.6.1 Teaching and Learning for Work-integrated Learning in Radiography

To design sound teaching and learning activities for WIL in Radiography, Biggs (2003:13) advises that it should be clear to students and lecturers at the beginning of each piece of learning what is appropriate to learn to achieve the set outcomes/objectives for that specific piece of learning. In other words, it should be clear to all parties where they are supposed to be going to learn successfully. For new WIL programmes it is thus essential to construct clear learning outcomes for each unit of learning. The learning outcomes should be constructed to encourage the students to 'get there' or to achieve the outcomes for the unit. Brown (2001:4) confirms this philosophy of Biggs by stating that clear and realistic outcomes provide students with a good guide of what has to be learned. Similarly, lecturers should be provided with a good guide on how to teach and what learning opportunities to provide. A curriculum stipulating clear outcomes/objectives also informs the level of understanding required to achieve these outcomes.

When students feel the need to succeed, they automatically revert to a deep approach to learning by focusing on main ideas, themes, principles and successful application. Successful application is at the heart of successful WIL programmes in the health professions because it empowers the student to apply acquired prior knowledge and skills in the clinical environment. It is therefore important to remember that students cannot engage in deep learning and conceptualisation of knowledge if there is not a sound foundation of prior knowledge. This brings us back to the importance of integration when facilitating the learning in WIL programmes. The stimulation of integration of the knowledge acquired in the theoretical modules in the course ensures that the student understands the big picture, as the big picture will never be understandable without the details (Biggs 2003:16).

When adopting the constructivist approach to learning, which was briefly discussed in section 2.6, it is easy to embrace the following teaching principles, as constructed by Biggs (2003:17), for WIL in Radiography education:

- Teach in a way that unambiguously brings out the structure of the topic or subject;

- Teach to provoke an active response from students by, *inter alia,* posing questions, presenting problems, and stimulating interactive discussion, rather than explaining information;
- Teach by building on prior knowledge;
- Confront and eliminate students' misconceptions;
- Assess for structure rather than for independent facts;
- Teach and assess in a way that encourages a positive atmosphere. Students should feel safe to make mistakes and learn from them;
- Emphasise depth of learning rather than breadth of coverage; and
- Most important, structure teaching and assessment activities to support the explicit outcomes/objectives of the course.

Core to the success of teaching, learning and assessment in any learning programme is the concept of constructive alignment. In simple terms, constructive alignment implies that all components in a unit of learning should be structured to accomplish a certain purpose. In other words, each component in the process should work together toward a common end. Over 50 years back Ralph Tyler said that teaching should be directed at what teachers are aiming at, while learning should be assessed according to those aims and the whole unit should be well-organised. The questions he asked back then to direct good teaching were:

- What educational purpose/s does/do the learning programme seek to attain?;
- What educational experiences can be provided to attain this/these purpose/s?;
- How can these educational experiences be effectively organised?; and
- How can the teacher determine whether the purpose/s has/have been attained? (Biggs 2003:25).

When reflecting on these four questions, we see constructive alignment. Differently stated, the fundamental task of the teacher is to design learning activities for the students to engage in which will ensure that they effectively achieve the desired outcomes. Likewise, the assessment activities to measure whether the students have effectively attained the outcomes should be aligned with what was taught and what was aimed at in the first place. Biggs (2003:27) advises that lecturers should be particularly attentive to seek compatibility between what they want as an end result, how they teach to assist the student to achieve it, and how they are going to assess whether it has been achieved.
In summary, good teaching can stimulate qualities conducive to learning such as the need

to know, curiosity and building on prior knowledge, whereas bad teaching can discourage students from making the necessary links to construct their own knowledge for better understanding.

2.6.1.1 *Actions to stimulate deep learning*

Many observers of higher education have criticised the occurrence of superficial approaches to learning which are usually vocationally focused and grade oriented (Borredon, Deffayet, Baker & Kolb [s.a.]:Online). Efforts to improve higher education have included numerous articles and reports from research to stimulate a change in the delivery of content in educational programmes from a surface to a deep approach to learning. Raelin (2006:48) singles out WIL as one of the educational streams where the deep approach to learning can effectively be applied. According to this author, the different learning modes embedded in WIL include a variety of educational methods such as action learning, internships and field placements in organisations, as well as classroom simulations and games. All these education methods, according to Osland, Kolb, Rubin and Turner (2007:14) have a common philosophy of education based on what Dewey (1938) called a "theory of experience". This notion of WIL as an educational stream to stimulate deep learning also connects well with the Kolbs' experiential learning theory (Kolb & Kolb 2007) which holds the constructivist view of learning and knowledge creation. This view of learning implies that learners construct their own knowledge based on previous experience and that learning is remembered and applied when it is integrated within learners' workplace contexts. The WIL environment is thus ideally suited for the stimulation of deep learning as it can be focused on "what is meant by the learning". Moreover, it relates previous knowledge to new knowledge; it relates knowledge from different modules in the course; it relates theoretical ideas to everyday experience; it relates and distinguishes evidence and argument; it organises and structures content into a coherent whole; and its emphasis is internal, from within the student (Atherton 2013:Online).

<u>Asking questions</u>

One proven way to stimulate deep learning is to ask essential questions during the facilitation of a session. Instead of teaching the curriculum strictly from the textbook, rather focus teaching skills and expertise during the preparation phase by designing 'essential questions' to drive the learning in the specific unit (Oxnevad 2012:Online).

These 'essential questions' should require students to construct knowledge by recalling and integrating prior knowledge and experiences which will allow them to express their own learning in original ways. 'Essential questions' should thus be constructed so that they cannot be answered by a simple 'copy and paste' exercise. A good starting point for designing 'essential questions' is to examine the required content for the specific learning unit and to utilise Bloom's taxonomy as a guide to scaffold and develop questions that demand students to use higher level thinking skills to answer the questions (Oxnevad 2012:Online).

Posing a problem or issue a challenge

Problem-based learning (PBL), also known as inquiry-based learning, is an educational practice which is increasing in popularity. Educators believe that PBL leads to improved learning and that facilitation sessions driven by inquiry are more likely to stimulate deep learning than those learned by other methods as they are learned on a high cognitive level and are, therefore, more likely to result in abilities that are high on Bloom's Taxonomy. With PBL, the final product may be the answer to a single stated problem (usually with a detailed explanation), a poster, a presentation, or any number of activities. Additionally PBL can be the statement of 'messy' problems with no simple answer (better suited for the higher levels of learning) to stimulate the student's critical thinking and integration of all concepts learned previously. In essence, PBL is a form of cognitive learning in which the student constructs meaning based on experiences orchestrated or facilitated by the lecturer. Whatever the case, PBL deals with authentic problems and therefore is ideally suited to expose the student to the type of problems which need to be solved in the workplace.

Ideally, a facilitation session should begin with posing a question or a problem. This question or problem should be properly explained by the lecturer. Students, almost always divided into groups, should then decide on a strategy for resolution of the problem. Depending on the level of the students, the lecturer may provide varying levels of support for the student groups. The important result of PBL is that by solving the stated problem, students learn something new or discover a new way to use knowledge they already had (Problem-based Learning: What is PBL? 2012:Online). When stimulating the use of higher cognitive thinking, the solving of a problem should pose a challenge to the student. By posing a challenge, the student will engage all prior knowledge and experiences, as well as new knowledge, to solve the problem.

Although there are plenty of real-life problems around us, identifying a suitable problem to guide and direct students in their learning can be challenging. Sockalingam, Rotgans and Schmidt (2010:Online) acknowledge that often lecturers who are new to PBL find it challenging to go about designing problems. Questions which are often asked are: "How do you design a problem for PBL?"; "Do you try and find an interesting article/case study that is relevant to your learning objectives and pose relevant questions?"; or "Do you identify the learning objectives and pose questions on them?"; "Is there a systematic way of designing problems?" (Sockalingam, Rotgans & Schmidt 2010:Online). The above authors endeavoured to clarify some of the uncertainties surrounding the design of PBL activities by presenting eleven characteristics of PBL. According to them, these eleven characteristics are classified into two categories, namely *feature characteristics* and *function characteristics*. Feature characteristics are design elements of the problem. Function characteristics are the desired outcomes of the problem. They suggest that in designing problems, the characteristics to be manipulated are the feature characteristics, namely: problem clarity, problem format, problem difficulty level, problem familiarity and problem relevance (Sockalingam, Rotgans & Schmidt 2010:Online). Other than with the feature characteristics, it is important to consider the function characteristics in designing problems. The function characteristics are the extent to which the problem leads to the intended learning issues and promotes self-directed learning, stimulates critical reasoning, stimulates elaboration, promotes teamwork, and triggers interest.

In designing problems for problem-based learning, one should first start by analysing the students' characteristics, including their prior knowledge. In other words, what content/context they are familiar with (this is likely to provide information on problem familiarity, difficulty and relevance), their learning styles (which will provide information for problem format), and comprehension capabilities (which will provide information on problem clarity). This content of the PBL activity should then be framed in a relevant and realistic context that students can relate to and apply in other modules in the course or in other areas of their lives. In addition, one needs to focus on what is expected from the students as a result of working on the problem. Overall, in designing problems for problem-based learning, function characteristics/learning outcomes (not just content but also what behavioural skills, such as self-directed learning and critical thinking) need to be considered and the issues should be framed in the appropriate context and presented using the optimal feature characteristics/user interface (Sockalingam, Rotgans & Schmidt 2010:Online).

Requiring students to work individually on something for a short time during the lecture

Another way of stimulating deep learning is to engage students in thinking critically or creatively about their own learning. This can be achieved by giving the students a brief exercise to express their ideas through writing and by reflecting upon their own learning experiences (Eison 2010:Online). Individual activities can be done in class or at home and can be supplemented with the use of technology tools such as an electronic learning platform or the World Wide Web. It is important to note when using this learning strategy that the lecturer should spend a greater proportion of time helping students develop their understanding and skills (in other words, promoting deep learning) and a lesser proportion of time transmitting information (i.e. surface learning) (Eison 2010:Online). Additionally, activities should be well structured to stimulate reflection and cognition on the higher levels of Bloom's taxonomy. By doing this the lecturer will stimulate the ability to think critically and to analyse the own learning process more effectively. In addition, the lecturer should provide opportunities for students to apply and demonstrate what they have learned and should ascertain immediate feedback from peers and/or the instructor.

Requiring students to work in groups and to share responses

The advantages of group work are appropriately summarised in the following quotes: "More hands make for lighter work"; "Two heads are better than one"; and "The more the merrier". These quotes unequivocally speak to the potential group work has for more productive, creative, and motivated students than when they work exclusively on their own (Teaching Excellence and Educational Innovation [s.a.]:Online). As summarised by Caruso and Wooley (2008:253) and Mannix and Neale (2005:36), group projects can help students develop and attain a wealth of skills that are increasingly important in the professional world. The advantages of group work are further emphasised by Tinto (1987:254) who argues that positive group experiences have been shown to contribute to student learning, retention and the overall success at university.

Oxnevad (2012:Online) promotes deep learning experiences and the development of 21st century skills by encouraging collaboration amongst students. The author suggests that students should be motivated to discuss issues in class, to present ideas, to consider points of view, and to make decisions in order to increase their part in their own learning.

Collaborating with other students on the same topic or issue makes learning more personal and relevant (Oxnevad 2012:Online).

2.6.1.2 *Teaching media*

According to Oxnevad (2012:Online), technology is a powerful tool for learning that can be used effectively to help students develop the skills necessary to succeed in school and beyond. Students can develop transferrable knowledge and skills as they engage in learning experiences that require them to construct knowledge. In order to facilitate these types of deep learning experiences, an adjustment in traditional instructional practices is necessary.

With increased internet connected portable learning devices in our schools and universities, access to information is readily available in a variety of formats and often in the palms of our students' hands. While it is safe to say that many universities are wired, it is time to combine digital tools with innovative instructional practices to get our students 'plugged in'. Many electronic strategies are available to lecturers to support the idea of shifting instructional practices by using technology as a tool for learning rather than as an addition to a traditional unit of study. A few such electronic teaching media are PowerPoint, the internet, Blackboard Moodle, Facebook, Skype, and video recordings.

The electronic teaching media has a number of advantages for teaching and learning, including simple updating of courseware and slide manipulation, professional visual presentations, sophisticated three dimensional graphics and animations, interactivity, immediate availability of learning material, wide access, and rapid review of the learning material (Bradley 1993:8). James (1994:121) points out that one of the critical factors in the success of the electronic classroom is the degree of forward planning by lecturers. Certainly, planning of learning facilitation and assessment involves a lot of time, and the significant cost involved in purchasing these electronic teaching systems should not be underestimated. Therefore it is imperative to train programmers, designers, educators and mentors to have a common perception of the necessity for the use of these new technologies.

It is important to remember, however, that the use of electronic teaching aids should be combined with functional and reliable educational principles, including clear aims and objectives, assessment criteria and the use of a range of learning modes (Gibbs

1988:156). As stated by James (1994:120), best practice in electronic teaching implies the use of leading edge technologies which are made available to lecturers and students.

2.6.1.3 *Curricular modalities (learning modes) for work-integrated learning*

Curricular modalities or learning modes refer to learning opportunities or the facilitation of learning relevant to the stated learning outcomes for a unit of learning which will assist students to achieve the set learning outcomes (Brown 2001:4).

Work-directed theoretical learning (WDTL)

WDTL refers to academic or theoretical learning which is structured by focusing on what the student needs to know to be able to function sufficiently in the workplace. Naturally, all WIL programmes will include theoretical subjects and components of learning which should be aligned with their practice-based components. Therefore, teaching and learning activities for WDTL should be aligned to bring theory and practice together in meaningful ways (CHE 2011:16). It is important to note that the design of WDTL activities aligns the disciplinary demands with workplace relevance so that students understand the necessity of having a sound knowledge base in preparation of what will be expected of them in the workplace.

In order to ascertain the link between the theoretical and workplace components of learning, it is advised that guest lecturers from the workplace or professional practice be invited to present students with real-life experiences and insights in certain contexts. The use of real-life case studies from the world of work when compiling learning and assessment tasks and the use of assessors from the workplace are some ways to ensure that the link between classroom learning and what is happening in the workplace stays intact (CHE 2011:17).

Because WDTL is usually taking place at the university, a variety of teaching and learning activities can be utilised to facilitate learning for this curricular modality for WIL. The important aspect is to align the chosen teaching and learning activity with what is going to be expected from the student in the end. Derived from the above, it has become clear that the teaching and learning activities to be utilised to facilitate WDTL in WIL should include, for example, formal lectures where students are exposed to new concepts for the first time. New knowledge should thus be transferred and concepts should be explained.

Tutorials, demonstrations and simulations are handy ways to facilitate learning because a link between the theory and practice can be established by utilising laboratories where a real-life setting is replicated. Lastly, peer learning in groups and structured interactive sessions can be utilised in order for student to learn from one another and to stimulate critical thinking and the formation of links through the sharing of knowledge and experiences. Biggs (2003:13) states that students can work collaboratively and in dialogue with both peers and teachers because good dialogue elicits those activities that shape, elaborate and deepen understanding.

In the section below, the researcher endeavours to shed some light on the two facilitation methods, PBL and Project-based Learning (PjBL), by reflecting on information from current literature. These two methods to facilitate learning are often mentioned as if they are exactly the same because both have to do with a specific case/problem/scenario posed to the student in order to stimulate and integrate learning. PBL and PjBL are instructional approaches that situate learning in a meaningful task such as case-based instruction and project-based learning (Hmelo-Silver 2004:236). In both PBL and PjBL, students learn by solving problems and reflecting on their experiences.

To distinguish between these two learning facilitation methods is not easy, but maybe one should consider that PBL is used to bring about radical change so that 'problems' rather than academic subjects are the organising structure of the curriculum (CHE 2011:17). In other words, PBL always has to do with solving a specific problem by using the essential knowledge and skills required to do so. PjBL involves learning through the compilation of projects. Such projects usually involve elements of research (discovery or inquiry learning) and the supervision of the lecturer and/or the workplace supervisors/mentor. So, PjBL does not have to be founded in a specific problem, but can take the format of discovery learning where the student has to compile a project about a specific concept while including a number of aspects related to this concept.

Problem-based learning (PBL)

In the Stanford University's newsletter on teaching, they describe problem-based learning (PBL) courses as courses where students work with classmates to solve complex and authentic problems that help develop content knowledge as well as problem-solving, reasoning, communication, and self-assessment skills (Stanford University 2001:1). The authors of this newsletter point out that these 'problems' also help to maintain students'

interest in their course material as they make students realise that they are learning the skills needed to be successful in the specific field of study. PBL instructional approaches are used to situate learning in a meaningful task, such as case-based instruction and project-based learning. PBL also ensures that the students understand the context in which they are mastering specific content better and this enhances their learning experience significantly (Petersen, 2013). Noteworthy is the statement in the newsletter that almost any course can incorporate PBL and that both staff and students consider the benefits of PBL to be substantial (Stanford University 2001:1).

What makes PBL ideal for the facilitation of WIL is the fact that PBL begins with the assumption that learning is an active, integrated, and constructive process influenced by social and contextual factors (Barrows 1996:5). In the health sciences environment, the problem to be solved is often influenced by social and contextual factors to which the students might not have been sensitised if the problem had not been known from the start. This point was raised years back by traditional educationists such as Kilpatrick (1918:323, 1921:285) and Dewey (1938:32) who advocated PBL approaches as important strategies for practical and meaningful experiential learning. Since then PBL has become well suited to helping students become active learners because it places learning in context by making use of real-world problems and it makes students responsible for their learning.

When using PBL to facilitate learning, learning becomes 'student centred' because the students are given the freedom to study those topics that interest them the most and to determine how they want to study them (Gallager 1997:336). Wilkerson and Gijselaers (1996:17) state that PBL ensures a framework for learning because the emphasis is on a student-centred approach where the teacher/lecturer becomes the facilitator of learning rather than the disseminator of knowledge. The open-ended problems in PBL further stimulate the development of students' interest in the subject matter and such problems stimulate understanding as opposed to requiring mere knowledge recall. PBL additionally promotes group work and assists students to become self-directed learners. Differently stated, PBL is a way of facilitating learning which makes students conscious of what information they already know about the problem, what information they need to know to solve the problem, and the strategies to use to solve the problem. Being able to articulate such thoughts helps students become more effective problem solvers and self-directed learners (Stanford University 2001:1). Thus, utilising PBL as a facilitation method for WIL in Radiography will assist in putting the need to acquire specific knowledge and

develop specific skills and capabilities in context for the student by presenting the problem to be solved upfront.

Derived from the above, it has become clear that the teaching and learning activities to be utilised to facilitate PBL in WIL should include, for example, the presentation of real-world problems; integrated learning (where students should endeavour to integrate all prior knowledge and skills to solve the problem); discovery learning (where students should consult different sources of information to complete the task); self-directed learning (where students have to think critically and reflect on prior knowledge and experiences); and peer learning in groups (where students collaborate to find solutions to the posed problem).

Project-based learning (PjBL)

Project-based learning is any learning environment in which the execution of a project drives learning (Howard & Jorgensen 2006:2). These authors point out that while there are a number of interpretations of PjBL, they all have the following points in common:

- The problem or project is structured so that the students discover that they need to learn new knowledge before they can solve the problem/project;
- Students learn by engaging in investigation; and
- The problem/project is the context for learning.

According to Howard and Jorgensen (2006:2), PjBL is ideally suited to professional practice oriented programmes such as programmes in the health professions, as it places students in a problem solving role as they would be in the real world of work. Differently stated, in PjBL students go through an extended process of inquiry in response to a complex question, problem, or challenge. While allowing for some degree of student 'voice and choice', rigorous projects are carefully planned, managed, and assessed to help students learn key academic content; practise 21st century skills (such as collaboration, communication and critical thinking); and create high-quality, authentic products and presentations. Thus PjBL is a curriculum design and teaching/learning strategy that simultaneously develops generic skills and the disciplinary knowledge base of the student (Howard & Jorgensen 2006:2).

In their companion paper, Jorgensen and Howard (2005:11) report that only part of the aim of better preparing students for the workplace of the 21st century was achieved with the cooperative education part of the engineering programme at their institution. Their investigation indicated that some fundamental problems existed within the traditional way of teaching their students. These problems included the promotion of rote or surface learning by excessive course workloads and a reliance on closed book examinations; the development of a fragmented knowledge base in traditional course units; students finding it extremely difficult to integrate knowledge in the workplace environment; students possessing poor problem solving skills; and students had a poor understanding of professional attitudes and values. Based on the results from their investigation, the authors determined, *inter alia*, that problem-centred or project-based curricula would provide the best solution to the problem. They concluded that PjB curricula would provide an environment which would reflect the professional workplace and a meaningful context in which the fundamentals of a profession could be studied. Ostergaard (1989:731) agrees that PjBL has the following advantages:

- It takes account of the way in which students learn; the learning style is active, deep and contextual;
- It provides for enormous improvements in student motivation to learn more;
- First year attrition rates can be as low as a few per cent;
- It develops a high level of generic and self-learning skills;
- It supports the integrated view that most professionals have of their profession; and
- PjBL produces highly valued professionals in the workplace setting.

Howard and Jorgensen (2006:2) foresee that a programme with a strong PjBL component will have many advantages which would include the following outcomes for the students: 1) the integration of knowledge and skills; 2) motivation and enthusiasm; 3) problem solving in context; 4) teamwork; 5) interpersonal skills; 6) lifelong learning skills; 7) proactive, critical thinking; 8) self-directed learning skills; 9) communication skills; and 10) professional practice (i.e. making reasoned decisions in unfamiliar situations).

Derived from the above, it has become clear that the teaching and learning activities to be utilised to facilitate PjBL in WIL should include, for example, clinical practice projects where students need to compile projects about a certain concept while doing their WPL in clinical practice. This would involve real-world learning, which is focused on how things are happening in the real world of work, and guided practice, because students should be

able to ask for guidance and assistance from lecturers and workplace supervisors/mentors while learning at the same time. Noteworthy is the resemblance the abovementioned teaching and learning activities have with those for PBL.

Workplace learning (WPL)

In the light of their specific outcomes, some qualifications are designed to incorporate periods of work experience (real-life learning) that is integrated with academic study (Groenewald 2009:75). Groenewald (2009:75) notes that WPL is more and more undertaken in a wide variety of higher education institutions, including traditional universities and UoTs. Moreover, it is progressively viewed as a valuable, and increasingly essential, component of the learning experience of both the undergraduate and postgraduate student. However, as confirmed by Brodie and Irving (2007:11), in many educational programmes the development of rigorous pedagogies to underpin WPL and the assessment thereof have not yet been well established.

In their criteria for institutional audits, the CHE (2004b:24) defines 'work-based/place learning' as a component of a learning programme that focuses on application of theory in an authentic, work-based context. It addresses specific competencies identified for the acquisition of a qualification which relates to a development of skills that will make the learner employable and will assist in developing his/her personal skills. A simplified definition for WPL is "learning which takes place when students are placed in the work environment for the purpose of learning" (CHE 2011:19). WPL therefore entails the involvement of students in the planning, implementation and evaluation of and reflection on activities carried out in the workplace (CHE 2011:19). Reflection on activities during WPL is crucially important to assist students to improve on actions when the same activities are repeated in future. A paragraph that appears in the HEQF of SA, which is gazetted as policy in terms of the Higher Education Act by the DoE, states: "It is the responsibility of institutions which offer programs requiring WIL credits to place students into WIL programs. Such programs must be appropriately structured and properly supervised and assessed" (DoE 2007:9; HEQSF 2013:11, Groenewald 2009:75) (cf. 1.1). According to Groenewald (2009:76), the two sets of HEQC criteria with specific reference to WPL can be summarised as follows:

- WPL as part of WIL should be effectively managed and coordinated with clear delineated responsibilities for all role players and an adequate provision of resources

to ensure quality of learning;

- WPL as a part of WIL should be properly structured to accomplish the outcomes and learning agreements;
- A system of good communication should be established between the organisations where students will be placed for WPL, the training, the institution and the students;
- To ensure that the intended outcomes for WPL are achieved, a mentoring system should be established (supervision in the workplace) that enables the students to recognise their strengths and weaknesses and to develop abilities and gain knowledge of work practices; and
- To assess the progress of the students in the achievement of the outcomes for WPL, a well-established monitoring and recording systems should be in place.

For students' workplace experience to be successful, they should have the opportunity to work in various areas in the workplace to provide them access to a breadth and depth of experiences. It is important, however, that an experienced staff member be designated as the supervisor to mentor the students and to monitor the learning process (Martin & Hughes 2009:9). The authors of *Work-integrated Learning: Good Practice Guide* (CHE 2011) argue that effective WPL is unlikely to occur without a strong theoretical learning foundation. In other words, WPL should be included in discipline-based knowledge and students should be able to understand the links between the knowledge production systems of the discipline and the extra-academic contexts (CHE 2011:21).

Derived from the above, it has become clear that the teaching and learning activities to be utilised to facilitate WPL in WIL should include, *inter alia*, the placement of students in the workplace and in work-based learning (cf. 2.2.1.5).

2.6.1.4 *Generic skills/graduate attributes and work-integrated learning*

Similar to WIL, the terminology used to refer to generic skills has suffered definitional confusion. The range of terms includes: *key competencies, soft skills,* or *employability skills* (Australia); *key skills* or *core skills* (United Kingdom); *essential skills* (New Zealand); and *necessary skills, employability skills* or *workplace know-how* (United States of America) (Clayton, Blom, Meyers & Bateman 2003:14). However, Costin (2002:5) considers the attainment of generic skills of such importance that he states that "the appropriate and skilful application of hard skills is soft-skills dependent". He categorises hard skills as being those skills associated with the product and the individual, while he

refers to soft skills as those of practice and community. Numerous studies have been conducted across the world to define the most important nontechnical competencies needed by a graduate (Fleming, Zinn & Ferkins 2008:146). Results from these studies indicate the most commonly desirable attributes for a graduate to possess as: 1) the ability and willingness to learn; 2) the ability to prioritise tasks and organise effectively; 3) the ability to take responsibility and make decisions; 4) the ability to solve problems; 5) the ability to communicate interpersonally; and 6) the ability to work as a team.

As stated earlier, a key purpose of WIL is the notion of providing graduates with a comprehensive skill set desired by potential employers (cf. 2.3.1; Coll *et al*. 2009:Online). A report by Bell *et al.* (2003:11) on graduate recruitment in the leisure industry in Australia highlights that a strong knowledge base alone does not guarantee a new graduate employment and that the personal attributes and capabilities of the graduate are considered to have a greater influence on success in the workplace. This attribute of WIL is seen as a key benefit for educators because it seems to be problematic for training institutions to provide students with such a comprehensive skills set through classroom learning only. According to Coll and Zegward (2006:42), it has been frequently reported that universities do not sufficiently emphasise the development of behavioural skills (i.e. generic skills) to prepare graduates for professional life. To support the statement by Coll *et al.* Dressler and Keeling (2005:212) point out that WIL experiences within a curriculum have been shown to support the development of behavioural competencies.

The question could thus be asked, "To what degree does WPL, as part of WIL, contribute to the development of generic skills and abilities in students?" Based on the findings of their investigation, Bell *et al.* (2003:14) acknowledge that there is strong support for university work placements as an important contributor to graduate skills development for employment. In corroboration, 82% of the respondents comprising graduates of the Leisure Management program at Griffith University agreed that university work placements provided sufficient opportunity to develop generic skills and abilities.

In SA, the seven critical cross-field outcomes as formulated by SAQA in 1997 and which were to be reflected in all educational programmes are listed below:

Critical cross-field outcomes

- Identify and solve problems in which responses demonstrate that responsible decisions using critical and creative thinking have been made;
- Work effectively with others as a member of a team, group, organisation, or community;
- Organise and manage oneself and one's activities responsibly and effectively;
- Collect, analyse, organise and critically evaluate information;
- Communicate effectively using visual, mathematical and/or language skills in the modes of oral and/or written presentation; and
- Use science and technology effectively and critically, showing responsibility towards the environment and health of others.

In order to contribute to the full personal development of each learner and the social and economic development of the society at large, SAQA also identified five developmental outcomes which were defined as follows:

Developmental outcomes

- Reflecting on and exploring a variety of strategies to learn more effectively;
- Participating as responsible citizens in the life of local, national and global communities;
- Being culturally and aesthetically sensitive across a range of social contexts;
- Exploring education and career opportunities; and
- Developing entrepreneurial opportunities.
  (Van Schalkwyk, Herman & Muller 2010:2)

2.7 ASSESSMENT FOR WORK-INTEGRATED LEARNING

As is the case with assessment in any learning environment, the assessment of WIL should also form an integral part of the learning process and should be well planned and conducted in a constructive way. According to the CHE (2004c:14), the term *assessment* refers to "the process of identifying, gathering and interpreting information about a learner's achievement in order to assist the learner's development and improve the process of learning and teaching." Additionally, assessment is concerned with the systematic evaluation of a student's ability to demonstrate the acquisition of the intended

learning outcomes in a curriculum. Brown (2001:4) firmly believes that for assessment methods and tasks to be effective, these methods and tasks should be related to the learning outcomes and the methods of learning. In other words, the assessed WIL activities should not be seen as an 'add-on' to the learning in the course (Gravett & Geyser 2004:90), but as part of it. Biggs (2003:13) emphasises that the use of ill-conceived and urgent assessments is counterproductive. The assessment then becomes a matter of dealing with the test, not with engaging in the task deeply.

The alignment of assessment with other aspects of a course is the basis to course design and is imperative for effective assessment. The main aim of assessment in the WIL environment should be to assess a learner's level of understanding within a content area and therefore the organisation of the learner's cognitive structures. Differently stated, the constructivist view proposes that the extent to which learners construct meaning of experiences depends heavily on the context in which they are; therefore, learning is 'situated' in a particular context (Wertsch 1991:74). The three main purposes of assessment as indicated by Brown (2001:6) are:

- to give a licence to proceed to the next stage towards graduation;
- to classify the performance of students in rank order; and
- to improve the students' learning.

2.7.1 Assessment for Work-integrated Learning in Radiography

To assess WIL in the Radiography environment, good practice would be to adopt the philosophy of Gravett and Geyser (2004:97) as embraced by Du Toit (2009:425), which states that assessment is the most powerful lever an educator can use to influence the way the students learn. Despite the general agreement about the importance of well-structured and constructively-aligned assessment activities, the assessment of WPL in Radiography training (often referred to as the practicum) remains problematic. In the absence of clear objectives for workplace assessment, assessment could produce misleading outcomes. Forbes (2003:14) says that the complexity of workplace assessment has to be acknowledged and that any attempt to propose a simple pass/fail system would be in conflict with the spirit and objectives of an outcomes-based approach to assessment. The outcomes for WPL assessment should first of all be negotiated with the employer in order to select which outcomes can best be achieved in the work environment and which could be achieved at the university. Additionally, agreement

should be reached on associated assessment criteria, assessment instruments and outputs of evidence for each assessment activity (Forbes 2003:15). He suggests that when assessment activities for WPL are designed, a multi-model arrangement should be considered between the stakeholders for WPL which may include, according to Forbes (2003:14):

- The employer's views on the quality and competence of students' performance;
- Student records on reflective understanding and the integration of work experience with their academic learning; and
- The preparation of assignments and portfolios.

Forbes (2003:15) advocates the outcomes-based approach to curriculum design to create a platform for the allocation of credits for the different aspects of WIL as derived from the curriculum design process of the whole qualification. He suggests that a learning area (e.g. imaging of the bony thorax) be selected and that statements should then be made of specific goals of achievement along with the assessment standards for the achievements of these goals. The assessment standards should include:

- the assessment criteria;
- the level of complexity (level descriptors); and
- the evidence of outputs.

2.7.1.1 *Assessment types*

Formative assessment

Formative assessment provides feedback to students during the course so they have opportunity to improve (Brown 2001:6). This type of assessment thus ensures that both the facilitator and the students know how the learning is proceeding (Biggs 2003:141). According to the Glossary of Terms for Educational Reform (2013:Online), formative assessment refers to a wide variety of methods that lecturers use to conduct in-process assessments of students' comprehension, learning needs, and academic progress during a lecture, learning unit, or course. Formative assessments assists lecturers in identifying concepts which students struggle to understand so that assistance can be given to those students. In other words, the general goal of formative assessment is to collect detailed information that can be used to improve instruction and student achievement. Thus

formative assessment is contrasted with that which is used to evaluate students' learning progress. From the above, it is safe to say that formative assessment is ideally suited for the assessment of student progress in WIL; specifically the WPL component of WIL where students need to be guided often towards improvement of a skill or competency through assistance and constructive feedback from the lecturer or workplace supervisor/mentor.

Summative assessment

Summative assessment contributes to the marks for a module, level or degree (Brown 2001:6). Differently stated, the results from summative assessment are used to grade students at the end of a unit or period of time (Biggs 2003:141). As stated in The Glossary of Terms for Educational Reform (2013:Online), summative assessments are used to evaluate student learning, skill acquisition, and academic achievement at the conclusion of a defined instructional period - typically at the end of a project, unit, course, semester, program, or year. Differently stated, summative assessments are defined by: 1) the tests, assignments, or projects that are used to determine whether students have learned what they were expected to learn; 2) summative assessments are given at the conclusion of a specific instructional period, and therefore they are generally evaluative, rather than diagnostic or formative; and 3) summative assessment results are often recorded as scores or grades that are then factored into a student's permanent academic record. Therefore summative assessment in the WIL environment should be used to grade the student's performance at the end of a certain portion of learning.

2.7.1.2 *Principles for assessment*

For the assessment of WIL to be authentic and successful, a few basic principles that are also applicable to assessment in general should constantly be considered and reflected on during the compilation of assessment activities. Brown (2001:6) outlines these principles as follows:

- Assessment drives learning, so if you want to change the learning, first consider how you should change the assessment;
- Match the assessment criteria to the learning activity and outcomes;
- Keep the assessment criteria simple;
- Be fair, reliable and valid in your marking; and
- Provide meaningful, timely feedback on assessment activities.

According to the CHE (2004a:119), assessment is valid when: 1) assessment procedures are effective in measuring student attainment of the intended learning outcomes; 2) a range of assessment tasks and methods is employed to ensure that all the learning outcomes are validly assessed; and 3) there is at least one integrated assessment activity which is a valid test of the key purpose of the programme.

Groenewald (2009:76), in his paper entitled *Lessons derived from a work-integrated learning monitoring pilot study at a distance higher education institution*, summarises the assessment principles adopted from Grant (2007:Online) to be always kept in mind when assessing WIL: *"The primary purpose of assessment is to improve performance and not [to] audit it. Good assessment requires being clear about the outcomes and goals to be attained. The desired standards and the criteria by which you would measure success should be explicit and available to the student. In other words, assessment is about measuring what matters (i.e. if you assess what you value, others will value what you assess). To accomplish the latter it almost always requires planning backwards. Good assessment that improves performance requires a variety of measures and structured formative feedback. And last but not least, good assessment is on-going and is thus about continuous improvement".*

Woolfe and Yorke (2010:6) recommend some principles for the assessment of student learning in the WPL environment. Some of these were adopted as being applicable to the WPL environment in the South African context:

- Be clear about what you expect your students to achieve;
- Ensure that there is a good match between learning activities and the assessment of student achievement during WPL (i.e. select methods of assessment that are the best 'fit' for what you want students to demonstrate;
- Ensure that the assessments, taken together, provide adequate coverage of the achievements you expect of your students;
- Make sure that you are focusing assessment primarily on the most important of the intended learning outcomes;
- Be clear about how you will deal with the variations in the different clinical contexts in which students will be undertaking their WPL (e.g. government practice vs. private practice) and about how these variations will be incorporated into the assessment activities;
- Take considerable care to ensure that students understand what is expected of them,

and don't assume that the statement of intended learning outcomes is sufficient. Examples help students to appreciate what is really expected of them;

- Be clear about the role(s) that assessments are performing (e.g. diagnostic, formative, or summative);
- Ensure that the technical quality of your assessments is adequate for their purpose;
- Develop the capabilities of the assessors who will be involved in the assessment of student achievement (academic staff and employers); and
- Be clear about what is expected of the various quality assurance activities (e.g. double [or peer] marking, moderation, and external examining).

2.7.1.3 *Assessment methods*

Brown (2001:4) stipulates very clearly that effective assessment methods and tasks are directly related to the learning outcomes and the methods of learning. Brown (2001:10) also reiterates that the closer the cognitive demand of the assessment method is to the lower levels of Bloom's taxonomy (recall or knowledge) or a well-defined solution is available to a certain stated question, the more reliable the method is; but it may not be that valid. Table 2.1 provides examples of assessment methods to demonstrate this statement by Brown:

TABLE 2.1: EXAMPLES OF ASSESSMENT METHODS
(table continues on next few pages…)

Writing essays		
Cognitive demand	**Advantages**	**Disadvantages**
Application of knowledge, analysis, problem-solving and evaluation skills	Short cases are relatively easy to mark	More complex cases take about as long to mark as assignments and report
Keeping of journal/diary entries		
Cognitive demand	**Advantages**	**Disadvantages**
Understanding Application Analysis	High validity if structure matches the learning outcomes	Training in reflection recommended for students Time consuming for students Requires a high level of trust between the assessor and the student Measuring reliability is difficult
Presentations		
Cognitive demand	**Advantages**	**Disadvantages**
Knowledge Understanding	Test the soft skills of preparation, the capacity to structure information,	Variation between assessors can occur, or variation for the same

Analysis	communication, responding to questions and the managing of a discussion Feedback opportunities from self, lecturer and peer Potentially reliable Marking for grading fast and based on simple criteria	assessor can be high Subjective judgement may influence the scoring
OSCA		
Cognitive demand	**Advantages**	**Disadvantages**
Knowledge Understanding Application	Particularly useful to quickly assess certain practical skills and competencies Effective to assess generic skills such as communication and team work Easy to score and to provide feedback Group OSCAs useful for teaching, feedback and developmental purposes Can be used either to provide feedback on the attainment of certain skills or to test performance against outcomes Reliability, validity and manageability fairly high Less labour intensive than some other forms of marking	Marking for feedback is very time consuming Variation between assessors can occur, and variation for the same assessor can be high Fairly hard to design and organise, may be a time-consuming process May require several assessors
Cases and problem scenarios		
Cognitive demand	**Advantages**	**Disadvantages**
Understanding, Synthesis evaluation	Relatively easy to set Marking for grading is fast	Marking for feedback is very time consuming Variation between assessors can occur, and variation for the same assessor can be high
Reporting on observations		
Cognitive demand	**Advantages**	**Disadvantages**
Application of knowledge, analysis, problem-solving and evaluation skills	Ideal for immediate feedback, especially when feedback is constructive Can be used for feedback purposes, but also for assessment purposes Reliability, validity and manageability are fairly high	The presence of the observer can change the performance Training is required for high reliability
Presenting posters		
Cognitive demand	**Advantages**	**Disadvantages**
Knowledge Understanding Analysis	Test the soft skill of presenting information succinctly, visually and attractively Simple criteria needed for scoring Fast feedback potential from lecturer, self and peers Marking for grading is fast	Danger of focusing unduly on presentation methods Use of criteria reduces variability Variation between assessors can occur, and variation for the same assessor can be high
Portfolios		
Cognitive demand	**Advantages**	**Disadvantages**

Application of knowledge Analysis	Very useful for developmental purposes May be the basis for oral assessments Reach potential to develop reflective skills if students are trained in these techniques May be high on validity if structure measures objectives of training	The presence of the observer can change the performance Training is required for high reliability Requires a high level of trust between the assessor and the student Measuring reliability is difficult
Orals		
Cognitive demand	**Advantages**	**Disadvantages**
Knowledge Understanding	Test ability to think quickly under pressure Immediate feedback possible Marking for grading fast Test the soft skills of communication and the presentation of information	Standardisation needed for scoring to ensure reliability and validity
Projects		
Cognitive demand	**Advantages**	**Disadvantages**
Knowledge Understanding Application Analysis Synthesis Evaluation	Testing a wide range of practical, analytical and interpretive skills Soft skills of project and time management, teamwork skills and leadership can be measured Marking for feedback can be reduced through peer- and self-assessment and presentations Learning gains are high in the form of reflective learning	Marking for feedback and grading is very time consuming Variations and bias between assessors possible Use of set criteria for marking reduces variability Variation of challenge can affect reliability
Computer-based assessments		
Cognitive demand	**Advantages**	**Disadvantages**
Knowledge Understanding Application	Marking very fast High reliability	Time-consuming to set validity (matching with outcomes) requires careful attention Expensive computer software required
Modified Essay Questions (MEQ's) (sequence of questions based on a case study)		
Cognitive demand	**Advantages**	**Disadvantages**
Reflection Analysis	Relatively easy to set May be used in teaching or assessment Can be computer- or paper-based Can encourage reflection and analysis Potentially high reliability, validity and manageability	Structure should be carefully considered Biased marking in absence of structured assessment rubric
Multiple choice		
Cognitive demand	**Advantages**	**Disadvantages**
Understanding Analysis Problem solving skills Evaluation	Can sample a wide range of knowledge quickly Wide variety of formats Easy to mark Useful for self-assessment and screening High reliability, validity and	Time consuming to design Danger of testing only trivial knowledge

	manageability Feedback to students is fast	
Work-based assessments (practicals, clinical practice projects, reflections)		
Cognitive demand	**Advantages**	**Disadvantages**
Knowledge Understanding Application Analysis Synthesis Evaluations	Measurement of integration and application of disciplinary knowledge Student achievement immediately available for practical assessments	Variation between assessors can be high without structured rubrics Methods are often over-used Portfolios and projects are time consuming to assess
Simulated interviews		
Cognitive demand	**Advantages**	**Disadvantages**
Communication skills Reflection Integration	Ideal for assessing communication skills Develop ways of giving and receiving feedback on performance Peer- and self- assessment can be used	Insensitive oral feedback not good motivation for improvement Assessors, including students, should be trained May be biased without well-constructed rubric
Written tests		
Cognitive demand	**Advantages**	**Disadvantages**
Analysis Application Problem solving Evaluation	Assess essential theoretical knowledge needed to construct meaning	Potential to assess only lower level knowledge
Continuous practical assessments		
Cognitive demand	**Advantages**	**Disadvantages**
Knowledge Understanding Application Analysis Integration Evaluation	Measures the attainment of practical and generic skills Marking and grading on the spot Immediate constructive feedback Reassessments to ensure improvement after feedback can be scheduled	Biased without properly structured rubrics Possibility of variation between assessors Method sometimes over-used

(Adapted from Brown, 2001:42–45)

2.7.1.4 *Measuring instruments for assessment and grading*

According to Brown (2001:15), instruments of assessment can vary from the use of a holistic approach to very detailed checklists. He suggests that the criteria for assessment be well structured and well thought through. In the WIL environment, and more specifically when the WPL of the student is assessed, the use of rubrics and checklists is advised. Rubrics are based on criterion referenced assessment and usually allows for a scale of grading. Students should have insight in the criteria set for a specific assessment

activity and the scale of grading should be explained to them before they embark on the assessment activity. Brown (2001:16) states that good criteria: 1) match the assessment task and the learning outcomes; 2) enable consistency of marking; 3) can pinpoint areas of disagreement between two assessors; and 4) assist students in achieving the learning outcomes.

One big advantage of rubrics is that the marking can be fast; thus, when students are assessed in the workplace while performing practical assessment tasks, formative feedback can be given directly after the assessment activity (Brown 2001:15). According to Brown (2001:15), checklists are also quite reliable and can be used successfully for the assessment of sequential tasks, specifically at the lower levels of Bloom's taxonomy.

When designing a measuring instrument for assessment and grading, Brown (2001:16) suggests the following key aspects to be considered:

- Decide on the essential criteria for the specific assessment activity;
- Ensure that the criteria on the checklist or rubric are simple to use;
- Supply the criteria to the students before they do the assessment activity;
- If possible, involve students in the design of the criteria and the checklist or rubric; and
- Encourage students to constantly keep the criteria in mind when doing the assessment to guide them towards the compilation of a better end product (e.g. an assignment).

2.7.1.5 *Formative feedback and reflective practice in work-integrated learning*

As for all types of learning and also in the WIL environment, formative feedback and reflective practice are both powerful methods to enhance the learning experience and to ensure that deep learning occurs. The purpose of feedback is primarily to motivate students. The role of feedback is equally important in the WIL environment where feedback should be intended to inform the student on his/her performance and how to act to improve for the next assessment (Brown 2001:17). Brown (2001:17) emphasises that feedback should be timely, relevant to the assessment task, and encouraging the student to improve to be successful.

Reflection is specifically useful in the WIL environment as it allows students to return to the experience, attend to feelings connected with the experience, and re-evaluate the experience through recognising the implications and outcomes of the experience (Boud, Cohen & Walker 1993:13). Boud, Keogh and Walker (1985:19) define reflection as an action taken to assess intellectual and emotional activities in which individuals engage to explore their experiences in order to lead to new understandings and appreciations. Stated differently, this implies that in the WIL environment, with specific application to WPL, reflection can be used very successfully to facilitate learning from experience (Boud, Cohen & Walker 1993:13). According to these authors the essence of reflection in WIL is that learning from experience can be enhanced through both reflection in action (reflection which occurs while at the workplace), and through reflection after an event (reflection on action when the student is back at the training institution).

The role of educators and mentors/supervisors for WIL in the reflective process cannot be emphasised enough. To stimulate the student to reflect on learning before being placed in the workplace, during experience in the workplace, and after completion of the experience, educators and mentors/supervisors alike should draw upon their training as educators, their personal experiences and research to ensure the integration of existing knowledge through WIL (Martin & Hughes 2009:14). The authors describe the different phases of reflection in WIL as follows: reflection 'on-action' requires reflection after the event; reflection 'in- action' means to think about what one is doing whilst one is doing it; and reflection 'before action' is preceded by reflection 'on action' and reflection 'in-action'.

Gibbs (1988:66) emphasises the importance of stimulating reflection in the students on their WPL experiences to stimulate a deep understanding and the integration of knowledge, skills and competencies. He advises the following six-step process:

1. A description of the event, where students describe in detail the event they are reflecting on - what they were doing; what other people were doing; what the context of the event was; what happened; what their role was; what parts did the other people play; what the result was;
2. Feelings and thoughts, the notion of self-awareness. At this stage, students try to recall and explore those things that were going on inside their heads. In other words, how they were feeling when the event started; what they were thinking about at the time; how did it make them feel; how did other people make them feel; how they felt about the outcome of the event; and what they are thinking about it now;

3. Evaluation occurs when students try to evaluate or make a judgement about what has happened, and they consider what was good about the experience and what was bad about the experience or what did or did not go so well;
4. Analysis occurs when students try to break the event down into its component parts so that they can be explored separately. Students may need to ask more detailed questions about the answers to the last stage, including what went well; what did they do well; what did others do well; what went wrong or did not turn out how it should have been done; and in what way did they or others contribute to this;
5. Conclusion and synthesis occur in the evaluation stage, in that now students have explored the issue from different angles and have a substantial amount of information on which to base judgement; and
6. Formulation of an action plan - during this stage, students should think forward to encounter the event (or similar event) again and to plan what they would do – would they act differently or would they be likely to do the same?

Martin and Hughes (2009:37) suggest that Bloom's Taxonomy (1956) should be considered when educators structure reflection sessions for their students. Naturally, the verbs used for such sessions should deploy the verbs of Bloom's Taxonomy appropriate for the specific level of learning (e.g. first, second or third year level). The authors suggest that during a reflection session knowledge should recall factual information; comprehension should show an understanding of the information; application should indicate the recall of some previous service learning learned knowledge; analysis should indicate that the student is able to break information into parts to explore understandings and relationships; synthesis should show that the student is able to put together ideas in a new or unique product; and evaluation should show that the student is able to judge the value of materials or ideas on the basis of set criteria.

2.8 MANAGEMENT AND COORDINATION FOR WORK-INTEGRATED LEARNING

A key to successful WIL is a three-way partnership between the student, the workplace organisation, and the university. This partnership requires that all parties in the relationship accept definite responsibilities, perform specific functions, and achieve benefits as a result of the involvement (Martin & Hughes 2009:8). According to Forbes (2003:3), the success of WIL programmes, and in particular the WPL of the students, is directly related to the educational management and coordination of such programmes

that support the environment and allow the student to develop knowledge, skills/competencies and attitudes that enhance their employability profile. Forbes (2003:3) accentuates that the success of a WIL programme is dependent on the meaningful interaction of the role players (students, higher education institution, and industry).

2.8.1 Management and Coordination for Work-integrated Learning in Radiography

Concerning the WPL of students as part of WIL, it is crucially important that the lecturer/s concerned with WIL at the training institution or, in some cases, students themselves, negotiate a realistic schedule of placements and responsibilities within the workplace prior to placement for WPL. The frequency of placement for WPL may differ from programme to programme. For example, students for some learning programmes will first complete a period of academic learning (12 – 18 months) and then do a period of workplace learning (e.g. engineering). Conversely, students from other learning programmes might be placed for WPL on an alternating basis for short periods of time such as one week class and the next week WPL (e.g. Radiography) (CUT 2014:300, 398). Although most learning programmes have a very specific policy regarding the frequency of WPL placements, the important aspect is that the WPL component of WIL should add to the preparation of the student for his/her role in the workplace.

Aside from the pre-organised schedule for WPL, students should also be prepared to take on voluntary duties outside the boundaries of the pre-determined schedule. Martin and Hughes (2009:9) suggest that for students' WPL to be successful, the organisation where the students are placed for WPL should offer them the opportunity to work with various staff members and in various areas of the profession to provide them access to a breadth and depth of experiences. They further suggest that one experienced staff member should be designated as the coordinator/supervisor of the WPL taking place in the specific workplace environment.

2.8.1.1 *Partnership and coordination*

During WPL, the supervisory commitment of the organisation where the student is placed is very important and this supervisory ability should be constantly assessed by the training institution (Martin & Hughes 2009:9). Close contact between the student, the workplace

and the academic supervisors should thus be maintained during the placement to allow for quality learning during WPL. Martin and Hughes (2009:20) identified four key groups of people positioned to help the learner to maximise their WIL experience, namely: 1) the program administrator; 2) the learners themselves; 3) the academic supervisors; and 4) the workplace supervisors/mentors.

Programme administrators

There seems to be three models for the administration of WIL at universities in SA (Jacobs 2013:Interview). According to Jacobs (2013:Interview), the administration of students registered for WIL modules at a university can be done by: 1) a WIL central office at the university; 2) the faculty where the student is enrolled for the course; or 3) the learning programme itself. This may differ from one university to another and it also depends on the type of learning programme the student is enrolled in (e.g. Engineering or Radiography). However, in most cases there should be constant liaison and good communication amongst the aforementioned bodies to ensure a well-managed administrative process.

In programmes where the WIL central office is responsible for the management and administration of the WIL, the central office is primarily concerned with the placement of students for WPL and the record keeping of the required periods of work placement of the students. Staff at the central office might also be responsible for visitation and assessment of the students during their work placement periods, but this depends solely on the type of programme the student is enrolled in and whether the staff at the WIL central office is qualified to do such assessment. However, in cases like this, it stays the responsibility of the academic staff to provide the students with the outcomes/objectives to be achieved during the placement period. Additionally, the WIL central office staff should be informed what is expected from them during visitation and assessment of students (Jacobs 2013, Interview; Wessels 2012, Interview).

When the faculty is responsible for the management and administration of the WIL modules, the faculty administration usually takes over the role of the WIL central office concerning the record keeping of periods of WPL. However, the visitation and assessment of students then mostly become the responsibility of the lecturers/WIL coordinators in the programme.

In Health Sciences Education it seems to be the managers of the learning programme themselves who are primarily responsible for the placement, monitoring and assessment of the students during WPL. These programmes usually have an appointed lecturer or lecturers to coordinate the WIL module in the learning programme. This coordinator, with the assistance of the other lecturing staff, is then responsible for the management and administration of WIL in the programme. In cases like that, the WIL central office is only responsible for keeping a data base of students registered for WIL and is mainly acting in a support capacity to the programme.

Whatever model is used at the university, the following responsibilities should be assumed to ensure good management and administration of the WIL module in any learning programme, whether it is done by WIL central office staff, faculty management staff, or the lecturers in the programme:

- Find work placements, and liaise with students during placements;
- Liaise with current and potential employers;
- Maintain close contact with organisation supervisors and students in the field;
- Determine if the workplace supervisor is qualified to help the students, based on considerations including length of employment, experience with students, matched with the students' areas of interest; and
- Offer assistance, encouragement, support and professional direction to the students during this experience, particularly in helping to select an organisation that meets their needs and professional goals, as well as one that meets the criteria for participation in the course.

In their Cooperative Education Policy of 2007, SASCE recommends an integrated approach to the management of WIL (Forbes 2007:8). This would mean a centralised unit with specific key performance areas as well as decentralised implementation into the faculties and learning programmes. Although this policy is not prescriptive on resource allocation and logistical arrangements, SASCE suggests that the management and coordination of WIL should be negotiated between faculty, the central WIL office and the learning programme. They advise that final arrangements be decided by all stakeholders. Ultimately, the most important criterion is how best the WIL learning outcomes can be delivered and supported in ways that will ensure quality and institutional accountability (Forbes 2007:8).

Academic supervisors/mentors

Student satisfaction with work placement is closely linked to the mutual support provided by both academic and workplace supervisors (Fleming & Martin 2007:119). This is because working together in the design of WIL, the academic and workplace supervisors are able to plan and facilitate appropriate learning experiences that link the workplace and university contexts (Bell *et al*. 2003:16), making WIL an *integrated* experience. Many studies confirm that the effectiveness of WIL depends to a major extent on the role of the academic and workplace supervisors. Supervisors are able to assist students to obtain professional employment by monitoring the difficulty of allocated tasks and helping them to anticipate their mistakes through discussion, modelling of appropriate behaviours and the provision of good formative feedback. Additionally, supervisors have an important role in ensuring that students have the capacity to deal with a variety of situations typical to a specific profession or vocation.

According to Jancauskas *et al.* (1997:1), a key element of WIL is that each student should have both an academic and workplace supervisor. They emphasise that these supervisors play a crucial role in the learning experiences of students and, specifically, in the integration of university and workplace experiences while on the job. Without them WIL becomes what it is not intended to be, as it becomes little more than just 'work experience'. Unfortunately, many studies have shown that, in many instances, both academic and workplace supervisors are poorly prepared for their roles in creating a stimulating environment for the facilitation of WIL. In fact, few workplace supervisors have been exposed to the pedagogical activities of academic learning programmes such as mentoring, performance assessment and conflict resolution (Jancauskas *et al.* 1997:1).

In the context of WIL, the **academic supervisor** assumes an important role as coordinator. During the WIL experience, students need appropriate supervision and support to understand the purpose of WIL and are able to develop the capabilities necessary to be a reflective practitioner (Fleming & Martin 2007:119). Rather than leaving the student unclear about what to learn during a work placement, institutions need to specify learning outcomes that focus the students' learning and encourage reflection about what they have learned (Moon 2004:73). However, students may not always believe that effective academic supervision is critical in assisting them to engage in a constructive reflective process. For example, students may not realise that the most

disastrous experience often provides the best learning opportunity. It is thus the role of the academic supervisor to assist them in mastering this reflective process (Fleming & Martin 2007:119).

According to Martin and Hughes (2009:25), there are limitations when academic supervisors assume an integral role in WIL which includes the transfer of learning between university and workplace contexts. This requires that the university and the workplace need to make a commitment that can be both time consuming and resource intensive for both parties (Bell *et al*. 2003:17). Another limitation is that academics are often not motivated or able to develop employability skills among students because most lecturers have been concerned with academic content during their careers and not with vocational matters. Moreover, there is a debate among some academics as to whether their role is to further academic knowledge or to prepare students for employment (Sleap & Reed 2007:52).

Jancaukus *et.al* (1997:2) suggest the following key responsibilities for academic supervisors in WIL programmes:

- Facilitating the setting of learning outcomes for student learning (in collaboration with the workplace requirements);
- Establishing effective lines of communication between the student and the employer (to ensure that quality feedback is being provided to both parties);
- Assisting students to develop their self-learning skills and strategies (as part of the 'soft skills' students need to be successful);
- Identifying and helping to resolve conflicts (the academic supervisor many times have to act as mediator);
- Assessing students' workplace performance (either together with the workplace supervisor or as part of a summative assessment activity);
- Monitoring the employer's performance (oversees that the employer is complying with the requirements for accreditation as a training facility); and
- Assisting students to develop their personal goals.

A responsibility of the academic staff or WIL coordinators is the visiting of students during periods of WPL to ensure that their learning experience meets the expectations of all parties. It is also advised that the students and the WIL mentors/supervisors form clinical practice discussion groups and that the academic staff members often meet to discuss the

progress of the students. Although frequent visits are advisable, the frequency of visits will depend on the geographical location of the WPL site, costs and other related factors (Forbes 2007:14).

Workplace supervisors/mentors

Equally important in the successful implementation of a WIL programme is the role of the **workplace supervisors** during periods of WPL. As can be seen from the suggested role of workplace supervisors, it is clear that this role is also a multifaceted one (Jancauskas *et al.* 1997:2): The authors suggest the following key responsibilities for any workplace supervisor:

- Orientating the student into the work environment;
- Setting clear work outcomes for the student. These outcomes are usually aligned with the work outcomes applicable to all staff in the specific organisation. Suggested good practice is to meet with the student prior to the placement to define the expected work outcomes;
- Assisting in setting clear learning outcomes. This should be done in collaboration with academic supervisors and the workplace supervisor should be empowered to assist students in the attainment of the agreed learning outcomes. To appropriately attain these outcomes for WIL, the student should ideally be exposed to a variety of learning experiences - constructive rather than tedious little tasks;
- Organising appropriate training/learning opportunities for the students by scheduling their work responsibilities and monitoring all activities;
- Monitoring the students' workplace performance. Formative assessment activities should be conducted by workplace supervisors. Yet it is still of crucial importance that these supervisors are trained appropriately to provide the student with constructive criticism, on-going feedback, guidance and instruction – discuss with the student their performance on a regular basis.

  Assessment forms should be completed and submitted to academic supervisors/programme managers as required. Additionally, academic supervisors should be informed on a regular basis about the students' performance in the organisation, particularly if any issues or concerns occur which cannot be resolved with the student in the workplace;
- Allow the student the opportunity to grow professionally and to accept appropriate responsibilities in the workplace; and

- Identifying skill deficiencies. If skills deficiencies are identified during formative assessment activities, the workplace supervisors should implement remedial action and perform a re-assessment to ascertain whether the deficiency has been addressed.

From the above discussion of the very important but equally complex roles of the academic and workplace supervisors in WIL programmes, it can be derived that the training of these supervisors to fulfil these roles is crucially important. Currently, academic and workplace supervisors in many professional and vocational programmes are not well prepared for their roles. More need to be done to help supervisors understand how to reinforce the application of learning outcomes and the development of generic skills. Moreover, they need to be equipped to help students reflect upon and evaluate their own learning. Fleming and Martin (2007:118) observe that one limitation may be that it takes time for some students to establish an effective relationship with their supervisors and to gain confidence to share their experiences so that the benefits can be achieved.

The students themselves

According to Martin and Hughes (2009:9), students are expected to exercise their professional, ethical and technical skills judgment to the best of their ability when being placed for WPL. The authors suggest that, as a member of the tri-party partnership and to ensure the success of the WPL experience, there are certain things that students 'should do' and 'should not do' (Martin & Hughes 2009:10). The authors suggest that students should:

- be loyal to the training institution;
- recognise their responsibilities to the employer and the client/patient, the public, and fellow employees;
- disclose any financial or other interest that they may have which may impair their professional judgment when dealing with their employer or client;
- maintain high standards of professional behaviour during placements. This includes meeting the ethical expectations of the training institution, especially with regard to confidentiality and discretion in comments to third parties;
- be punctual in the daily routines of the workplace, as professional practice requires that a framework of routine be set and maintained; and

- meet the standard of dress required by the workplace. (If a student is unsure of dress expectations, he/she should ask.)

They further suggest that students should NOT:

- conduct themselves in a manner which may prejudice the professional stat or reputation of the training institution;
- make comparisons with, or statements about, other members, that are not based on verifiable facts;
- disclose any confidential information or matter related to their work or the business of their client without the expressed authority of their employer or client/patient;
- entertain or accept any covert reward, profit, use (for personal gain) or any information obtained in their professional capacity; and
- misrepresent their competence nor, without disclosing its limits, undertake work beyond it (Martin & Hughes 2009:11).

Martin and Hughes (2009:26) summarise students' responsibility towards WPL as follows: *"Students should take responsibility for own their learning which will be primarily self-directed; students should develop their decision making and self-management skills by using their own initiative; students should arrange a placement through the university supervisor or contacts and complete a contract in conjunction with the academic and workplace supervisor/mentor prior to commencing the placement; students should strive to meet the objectives and conditions agreed to in the learning contract and should maintain a reflective journal of activities throughout the placement; students should follow the policies and duties outlined by the workplace by fulfilling all scheduled commitments and arrangements agreed upon with the organisation and thus maintaining a high standard of professional excellence; students should maintain regular contact with the university supervisors and consult with the workplace supervisor when confronted with problems that cannot be solved independently; and lastly students should conduct themselves in a professional manner at all times during the workplace experience".*

2.8.1.2 *The training of mentors/supervisors in clinical practice*

Supervision of students in clinical practice can be defined as: "The formal provision by senior/qualified health practitioners of an intensive, relationship-based education and training that is case-focussed and which supports, directs and guides the work of

supervisees" (Milne 2007:440). The importance of supervision in the clinical environment has grown in prominence internationally, due to the emergence of government policies regarding high-quality care and the improving commitment of professional bodies to promote evidence-based health care to all.

In Skills for Care (2007:Online), clinical supervision is defined as "an accountable process which supports, assures and develops the knowledge, skills and values of an individual or group of people" (Skills for Care 2007:Online). Differently stated, supervision in the clinical environment should provide a safe and trusted environment for students to progress towards being well-trained professionals while being allowed to reflect on and discuss their experiences while working in the clinical environment. The focus should thus be on supporting students in developing personally and professionally by reflecting on their own practices. By reflecting on their work experiences, students will succeed in integrating their experiences with the academic lessons learnt in the classroom with what they are learning in the workplace. Thus students will succeed in conceptualising their learning so that they are able to ultimately bring together the work and the academic experience to solve problems in future unfamiliar environments (Weisz & Smith 2005:605).

As was clearly stated previously in 2.8.1.1, the supervision of students during WPL in clinical practice is a key element of WIL. Sadly, as reported by (Jancauskas *et al.* 1997:1), numerous studies have shown that both academic and industry supervisors are, in general, poorly prepared for their roles in the supervision of students in the work environment. The general deficiencies which have been identified in the capabilities of clinical supervisors are: 1) few of them have had any previous experience in the delivery, monitoring and assessment of educational programmes; 2) few of them have been adequately orientated to the academic environment to which the students are exposed, normally prior to being placed in clinical practice; 3) few of them have been trained in core supervision skills such as mentoring, performance evaluation, conflict resolution, and critical reflection; and 4) few of them have been sensitised to the full spectrum of learning opportunities that can be exploited while the students are working in industry, such as the development of the much required generic, graduate skills (cf. 2.6.2.2).

It is thus crucially important to train WPL supervisors for their important role of supervising students towards attaining a complicated set of skills. When working in the workplace, students are looking at the workplace supervisor as a mentor who will assist

them in the transition from the classroom to the work environment. Because the WPL experience of the student is an extension of the learning process, it is the duty of the supervisor to provide opportunities to bridge the two experiences. A supervisor who has been properly prepared for his/her role will be able to provide leadership to students in an unfamiliar environment and motivate them to utilise each opportunity as a learning experience. Moreover, they will be able to guide students to learn the skills of delegation and good communication, and they will be able to develop and train students towards the application of knowledge and skills in clinical practice and ultimately assess their progress and the achievement of the outcomes set for the WPL component of the WIL module for the qualification (True 2002:17).

2.8.1.3 *Quality assurance for work-integrated learning*

In his quality assurance (QA) model for the assessment of work-integrated learning at higher education institutions in South Africa, Forbes (2003:6) explicitly states that the integrity of any learning programme is achieved through the auditing and review of quality learning provision. According to this author, QA and programme delivery represent an ongoing cycle of continual growth and development. Therefore, to ensure quality in a learning programme, a process of implementation, accountability and review should be adopted in pursuit of excellence. Forbes suggests the following distinctions between the different aspects of the QA process:

- A Quality Management System refers to a combination of processes to ensure that the degree of excellence as specified, is achieved;
- Quality Assurance refers to the sum of activities/elements that assure the quality of products and services;
- Quality Audit refers to the activities undertaken to measure the quality of products and services; and
- Quality Control is the process which is undertaken by the persons who deliver the service (Forbes 2003:6).

Because the NQF is aimed at transformation at the level of programme delivery, it has become necessary for HEIs to demonstrate programme delivery in line with NQF principles. To ensure programme delivery in the area of WIL, Forbes (2003:7) advises that the following questions be asked to guide the quality control process of programme delivery: 1) What are the learning components (modules) that make up the WIL

programme? 2) How is learner centredness ensured in the delivery of the WIL programme? 3) How are learners given constructive feedback on their performance? 4) Do the programme outcomes ensure that the learner is able to integrate the knowledge theory through workplace linkages?

For the purpose of this study and to set a framework for the assessment of the quality of WIL programmes at South African universities, the researcher drew heavily on the findings by Smith (2012:248) as reported in his paper *Evaluating the quality of work-integrated learning curricula: a comprehensive framework*. Smith's (2012:250) new evaluation framework divides the WIL curriculum structurally and conceptually into six important domains for the quality assessment of WIL curricula, namely:

- authenticity;
- the importance of the alignment of teaching and learning activities with integrative learning outcomes;
- the importance of the alignment of assessment activities with integrative learning outcomes;
- integrated learning support;
- supervisor access; and
- a proper induction and preparation processes prior to the placement of students for WPL.

The justification for these six domains and their corresponding interrelationships will each be briefly discussed below.

Authenticity

According to Smith (2012:250), authenticity is at the heart of all workplace learning. Although most WIL curricula endeavour to provide students with experience in a real-life work environment, authenticity in WIL is not only associated with *physical authenticity* (i.e. working in the workplace), but it also refers to *cognitive authenticity*. Cognitive authenticity implies that students encounter, engage and/or participate in meaningful and relevant learning activities within a particular disciplinary framework. Smith (2012:250) further points out that for WIL curricula to succeed, they should also have the following characteristics: They must occur in authentic environments and contexts that will expose the students to real work settings and situations where they can be observed, where they

can interact with other professionals, and where they can respond to the particular context as found in the workplace setting. Differently stated, WIL curricula should include authentic activities with complexities that match those in real practice.

The importance of authenticity is further highlighted in the quality of work placements where students can have 'real-world' work experiences. As Keogh, Sterling and Venables (2007:522) note, real-world problems require increased engagement and are more motivational to student learning. These authors point out that when students are working with real patients/clients, they are motivated to achieve real results and are free to learn from their mistakes. Noteworthy is that authentic work experiences involve more than just an absence of tedious tasks, but they should allow students to feel that they are engaging in work that is relevant to the preset outcomes that would be required when they are allowed to work alone and that the work they do is important and consequential (Smith 2012:251).

Alignment of teaching, learning and assessment with integrative learning outcomes

Smith (2012) bases his alignment of WIL curricula on Biggs's (1996) notion of the constructive alignment of learning outcomes with teaching and learning activities and assessments. For the purpose of WIL, Smith (2012:251) advises that learning activities be structured to ensure that students engage in integrative learning. In this manner they will develop their ability to integrate their theoretical knowledge with practical skills and competencies. This will enable them to discern what, when and how such integrated knowledge could be applied in the world of work.

Also important when assessing WIL curricula is the alignment of the teaching and learning activities with the assessment activities. These assessment activities should not just assess the connection of the theoretical knowledge of students with their practical skills and competencies, but should also assess the ability of students to use this integrative knowledge at the right time and in the right situation. However, to achieve this integrative learning is not easy. Thus it must be deliberately designed into curriculum activities and assessments (Dewey 1939:19). Therefore Smith (2012:252) suggests that learning outcomes and activities meet the following conditions:

- Leaning outcomes and activities should target the development of students' professional identity and abilities;

- Leaning outcomes and activities should emphasise linkages between theory and practice. To ascertain the achievement of these linkages, emphasis should be placed on reflection on the integration of theoretical knowledge with the skills and competencies achieved in the workplace; and
- Leaning outcomes and activities should allow for transfer of learning from university to the workplace and back to university (Dymock & Gerber 2002:25; Duignan 2003:338).

Integrated learning support

Although very seldom explicitly recommended in the curriculum design for WIL, integrated learning support is highly desirable for the quality delivery of WIL programmes. Most universities supply administrative structures to provide a range of social, psychological and learning support systems to students in the form of, e.g. counselling, welfare, and library and study advisory services (Smith 2012:252). Because students doing WPL are typically not at their training institutions for periods of time, the recommendation is that curriculum designers, as far as possible, deliberately make explicit use of appropriate support structures available for staff at the workplaces to ensure proper delivery of the WPL curriculum to their students. In many cases support structures exist for staff members such as counselling, debriefing, new employee inductions, or even media support such as libraries. Supporting students during WPL is crucially important and therefore support services for WIL, and specifically for WPL, at the training institution and at the workplace should be assessed for quality to help alleviate the stress of students and to improve the learning process (Keogh *et al*. 2007:532).

Supervisor access

The importance of having access to academic or teaching support during the WPL component of a WIL course is of crucial importance. Supervisor access refers to the communication channels maintained between the academic/university (WIL) coordinator, the student supervisor/mentor in the workplace, and the student. The primary purpose of such contact is typically feedback on learning, support throughout the experience and educational supervision (Smith 2012:252). The constant support of academic and workplace supervisors cannot be over emphasised as it is highly conducive to the quality of learning during WPL experiences (cf. 2.8.1.3).

Induction and preparation processes

Although all university curricula require administration, a process that is acknowledged to be an extra burden on academics in charge of WIL curricula is the tasks around preparing students for placement in the workplace in both pedagogical and practical senses. All university curricula require administration (cf. 2.8.1.1). The preparation of students for placement in the workplace can be summarised as follows: relationships with industry partners; keeping records; maintaining contact with students and workplace supervisors; addressing risks; maintaining occupational health and safety; and addressing ethical issues related to placements (Smith 2012:253). Many authors, as cited by Smith (2012), confirmed that if WIL curricula are poorly administrated. The consequences may be significant and may include:

- weakly integrated (or not integrated) disciplinary and practical learning (Ryan, Toohey & Hughes 1996:368);
- unorganised experiences for students (Ryan *et al.* 1996:368);
- ill-prepared and poorly motivated students (Abeysekera 2006:12);
- ill-prepared academic and workplace supervisors (Ryan *et al.* 1996:369);
- ill-prepared workplaces;
- uncooperative and indiscreetly utilitarian industry or community partners (Hughes, 1998:212); and
- stressful experiences of abandonment (Freestone, Williams, Thompson & Trembath 2007:353).

2.9 CONCLUDING SUMMARY

In this chapter a literature study was done to conceptualise and contextualise WIL in the South African context, and more specifically in HPE. As part of this framework, an overview was given of what the literature states on the following aspects:

- Work-integrated learning in context - the clarification of the different concepts connected with 'learning at work' (cf. 2.2; 2.2.1);
- Curriculum design and development for work-integrated learning (cf. 2.4 & 2.5);
- Teaching and learning for work-integrated learning (cf. 2.6 & 2.6.1);
- Assessment for work-integrated learning (cf. 2.7 & 2.7.1); and
- Management and coordination for work-integrated learning (cf. 2.8 & 2.8.1).

The literature review was conducted with the aim of constructing a solid theoretical framework to support the empirical part of the study.

In the next chapter, Chapter 3, entitled ***Research design and methodology***, the methods used to conduct this study will be discussed

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

As mentioned in Chapter 1, the aim of this study was to develop a work-integrated learning education and training programme for Radiography at higher education institutions in SA. This chapter begins by providing theoretical perspectives on the research design and methods selected for use in this study. This is followed by a detailed explanation of the research process and the research instrument, which comprised three questionnaires. The chapter concludes with a discussion on the validity, reliability and ethical issues applicable to this study.

Leedy (s.a.]:Online) points out that everywhere in the world knowledge is incomplete and problems are waiting to be solved. The only way to address these unresolved problems is by asking relevant questions and seeking answers to them. The role of research is thus to provide a method for obtaining those answers through inquiry and studying the evidence within the parameters of a scientifically based research method.

This research study emulated Leedy's views on the research process. The researcher endeavoured to obtain an understanding of the current practices for WIL in Radiography by asking selected participants a number of questions about the educational practices within the WIL component of their study programmes. Additionally, the research involved the development of an education and training programme for WIL in Radiography, something that had not existed at the commencement of the study. It is my contention that the proposed programme will contribute towards best practice in the WIL component of Radiography programmes when training professionals for the future.

3.2 THEORETICAL PERSPECTIVES ON THE RESEARCH DESIGN

3.2.1 Theory Building

Selecting an appropriate research design is a critical component of any research process. The research design for this study embraced the principles of phenomenology. Phenomenology aims to understand and interpret the meaning that subjects give to their

everyday lives (De Vos, Strydom, Fouché & Delport 2002:41). According to Creswell (1998:97), a phenomenological study describes the meaning of experiences or phenomena as they exist for various individuals. Multiple individuals who have experienced a particular phenomenon should be identified, where after data are systematically collected and meanings, themes and general descriptions of experiences emanating from the data are analysed within a specific context (De Vos *et al*. 2005:42).

For this study a survey was conducted by making use of three quantitative questionnaires administered to three distinct groups of respondents (Radiology students, university coordinators, workplace supervisors) to accumulate the data. According to Babbie and Mouton (2001:230), survey research may be used for descriptive, explanatory, and exploratory purposes. They further advocate survey research as being so popular because it is primarily used in studies that have individual people as the units of analysis (Babbie & Mouton 2001:231). Similarly, survey research is also excellent for measuring attitudes and orientations in a larger population. In survey research the investigator selects a sample of subjects and administers a questionnaire or conducts interviews to collect data to describe the attitudes, beliefs and opinions of people (McMillan & Schumacher 2001:33).

For the purpose of this study, a cross-sectional survey design was adopted where the researcher collected data at one point in time and not over a period of time, as is the case in longitudinal survey designs. The collection of data took place over a period of six weeks in total, from distribution of the questionnaires to receiving them back for analysis. Leedy (1985:134) describes the basic structure of a survey as follows:

- It is a technique of observation/enquiry by means of which data can be collected;
- It involves a carefully selected population; and
- It requires careful attention to the research design to limit the influence of bias and a systematic way of organising and presenting the data so that valid and accurate conclusions can be drawn.

The general aim of the survey was to summarise the current educational practices in the WIL component of Radiography programmes in SA as perceived and experienced by three distinct role players, namely university lecturers/coordinators, final year Radiology students, and workplace supervisors. Clearly, the exploratory path had to be taken for the purposes of this study because the researcher wanted to explore certain trends

among the identified role players.. Summaries were used to describe the demographic data of the respondents, the profile of the organisations where the respondents were employed, the educational and professional background of the respondents, and respondents' views on the current educational practices in the WIL component of their programmes.

3.2.2 Quantitative Research

Creswell (1994:354) describes survey research design as "procedures in quantitative research in which investigators administer a survey to a sample or an entire population in order to describe the attitudes, opinions, behaviours, or characteristics of the population." Through surveys, researchers collect quantitative, numbered data using questionnaires; the data are subsequently statistically analysed to describe trends that are illuminated through the responses to questions as well as to test the research questions or hypotheses. Creswell (1994:354) advises that surveys can be used successfully to describe trends, to determine individual opinions, to identify important beliefs and attitudes of individuals, and to provide useful information to evaluate educational programmes. However, he emphasises that to obtain valid and reliable data one must ensure that the measurement procedures and the measurement instruments have acceptable levels of reliability and validity, as these will have a significant effect on the trustworthiness of the research. The latter will be discussed in more detail in sections 3.3 and 3.4.

3.3 RESEARCH METHODS

The main research methods used in this study were a literature review and a questionnaire survey. In this section information on the sampling, data collection, data analysis, ethical considerations and the validity and reliability will be discussed. Figure 3.1 displays the research process that was followed.

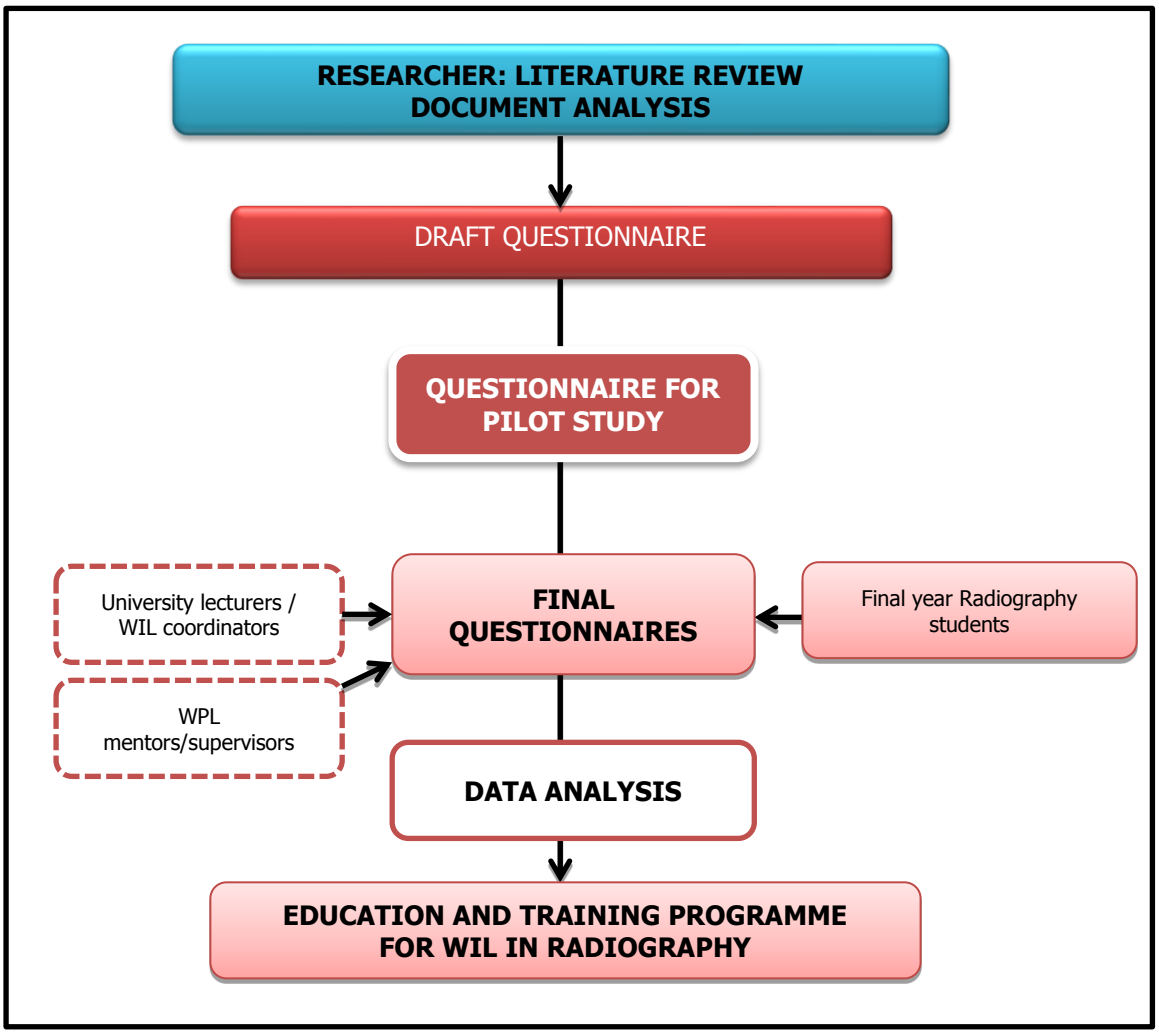


FIGURE 3.1: SCHEMATIC OUTLINE OF THE SEQUENCE OF THE RESEARCH METHODS

3.3.1 The Literature Review and Document Analysis

Singleton and Straits (1999:544) state that the aim of a literature review is to contextualise a problem against related theory and research while ensuring that the researcher is sufficiently knowledgeable about the subject of study. Mouton (2009:87) states that a literature review is not a collection of texts, but a body of accumulated scholarship. In other words, the intention of a literature review is for the researcher to learn from other scholars in order to improve practices in his/her own field of study.

As was indicated in Chapter 1, a number of articles and documents were perused about the practices of WIL in general, but those articles concentrated mainly on monitoring and coordinating and the challenges surrounding the process of placement of students for periods of workplace learning. No evidence could be found of an existing education and training programme for WIL in Radiography in SA where aspects related to the teaching and learning for WIL were addressed. This was the conclusion after an extensive

literature search on the website of the National Research Foundation (NRF) and the Nexus Database System. In educational research, a document analysis is the systematic examination of instructional documents such as syllabi, assignments, lecture notes, and course evaluation results, in order to identify instructional needs and challenges and describe an instructional activity. The focus of the analysis should be a critical assessment of the documents. Document analysis works best when the purpose is to gain insight into an instructional activity or approach; in this study the approach was WIL in higher education institutions in SA. The use of a thorough document analysis with the purpose as summarised below was fully applicable to the requirements for this research study. The purpose was five-fold, as suggested by Instructional Assessment Resources (2011:Online):

- To gain insight into an instructional activity or approach;
- To examine trends, patterns, and consistency in instructional documents;
- To provide a preliminary study for an interview, survey, or observation;
- To inform interview questions, survey questions, or an observation checklist; and
- To evaluate aspects of a course.

In this study, the literature review and document analysis had the specific aim of contextualising WIL and describing the best practice for WIL in higher education, and more specifically in Health Professions Education in tertiary institutions in SA. Documents published by relevant bodies such as the HEQF, CHE, SAQA, the HEQC, and the DoE that address aspects regarding higher education and the implementation of sound educational practices were scrutinised. The information from the literature and the analysed documents that were perused provided the necessary background to and context for the stated problem and formed the basis for the development of the questionnaires and, eventually, the WIL education and training programme for Radiography in SA that was designed. Additionally, the review of the literature and related documents improved the researcher's knowledge of and insight into the topic under investigation.

3.3.2 The Questionnaire Survey

To provide the necessary information on the perceptions of and current practices among educationists, employers and Radiography students regarding WIL, a questionnaire survey was considered appropriate for this research.

3.3.2.1 *Theoretical aspects*

According to McMillan and Schumacher (2001:34), questionnaire surveys are used frequently in educational research to describe attitudes, beliefs, opinions and other types of information. It has become apparent that questionnaires, as a quantitative method of data collection, are especially useful in gaining information on the nature of the needs of a specific target population. Questionnaires are especially useful as they allow for respondents to remain anonymous. They can be distributed and returned in ways that will make respondents feel confident that their identities are secure.

The use of questionnaires was further confirmed by the viewpoint of Walonick (2004:144). He summarises the advantages of the use of questionnaires as a research tool as follows:

- Questionnaires are very cost and time effective when compared to face-to-face interviews. This is especially true for studies involving large sample sizes and large geographic areas;
- Questionnaires are easy to analyse. Data entry and tabulation for nearly all surveys can be easily done using one of many available computer software packages;
- Questionnaires are familiar to most people. Nearly everyone has had some experience completing questionnaires and they generally do not make people apprehensive;
- Questionnaires reduce bias. There is uniform question presentation and no middleman bias. The researcher's own opinions will not influence the respondent to answer questions in a certain manner. There are no verbal or visual clues to influence the respondent; and
- Questionnaires are less intrusive than telephone or face-to-face surveys. When a respondent receives a questionnaire in the mail, he/she is free to complete the questionnaire according to his/her own timetable. Unlike other research methods, the respondent is not interrupted by the research instrument.

However, Suskie (1995:52) emphasises that a reliable questionnaire should elicit consistent responses. Unfortunately, an absolutely, perfectly reliable questionnaire is impossible to create. Many factors are beyond the control of the researcher, for example variations in mood, fluctuations of the human memory, unpredictable fluctuations in attention accuracy, health, fatigue, room conditions, and momentary distractions.

Moreover, according to Scholtz (2000:27), methodological constraints due to a questionnaire survey can lead to a reduction in the validity of the research. Professionals are social beings with differences. These differences may lead to differences in the interpretation of questions and responses. A specific shortcoming of questionnaires is that the responses to questions cannot be controlled. Some questions may be misinterpreted due to language constraints; the layout may lead to a reduction in sample size; terms may be misleading; and the length of the questionnaire may discourage participants from completing the survey.

Conversely, there are factors over which we may have some control to ensure the reliability of the questionnaire. These are: controlling inaccuracies in scoring (especially with open-ended questions), motivation, familiarity and comfort with the item formats we use, the order in which the questions are asked, how clear the directions are, how clear the questions are (whether they will be interpreted by every participant in the same way), and how long the questionnaire is (Suskie 1995:53).

A questionnaire can be defined as a list of questions which is answered by the respondents. The answered questions should give a direct measure of the variables under investigation (Katzenellenbogen, Joubert & Karim 1999:82). Questions can be asked by means of a questionnaire or an interview. In a self-administered questionnaire, the respondents complete the questionnaire by themselves and in their own time. According to Katzenellenbogen *et al.* (1999:82-89), there are ten important steps to consider when developing a questionnaire:

1. List the variables to be measured;
2. Formulate the questions. The questions may be open-ended or closed. Closed questions have the advantage that they are quicker to answer and present a standardised form of data collection. However, such questions may limit the responses of the participants. Conversely, open-ended questions allow the respondent to give an opinion;
3. Decide on the detailed, practical logistics of the questions, for example if it is necessary to explain the questions;
4. Carefully consider the sequence of the questions;
5. To keep the questionnaire as uncomplicated as possible, the layout and design should be carefully planned;
6. The scale of measurement of the variables should be considered;

7. The collection of the data should be coded when the questionnaire is complete;
8. The data analysis should be considered – whether it will be done by hand or by using a computer programme;
9. The questionnaire needs to be piloted to improve the quality of the questions and to eliminate bias; and
10. After the pilot study, changes should be made as suggested by the participants where applicable.

The questionnaires for the study were designed to evaluate current practices regarding WIL in Radiography training. The development of the questionnaires for this research followed all ten of the steps described above. Quantitative data were collected by means of three self-compiled, semi-structured questionnaires (Appendices E1, E2 & E3). The questionnaires were designed in such a manner that the above listed disadvantages of questionnaires were eliminated or kept to a minimum. Efforts were constantly made by the researcher to minimise any aspect that could impact negatively on the results of the study. By means of the questionnaires, the researcher strove to obtain data that would give accurate and empirically-based views regarding existing practices in WIL in Radiography based on the participants' own perceptions of what they had been or were experiencing, what they wanted to achieve, and what they expected from an education and training programme for WIL in Radiography.

3.3.2.2 *The questionnaires for the survey*

The questionnaires were compiled in English because English is one of the two languages of tuition at higher education institutions in SA. However, Radiography courses are offered only at some universities in SA where the language of instruction is primarily English. Questionnaires were distributed to the following participants:

- lecturers of and coordinators of WIL in Radiography programmes at higher education institutions in SA;
- selected employers of students placed for WIL; and
- selected final year Radiography students in Radiography programmes at higher education institutions.

The questionnaires administered to the lecturers/coordinators and the mentors/supervisors in clinical practice were circulated electronically, with a return date

specified. The questionnaires administered to the final year students were made available to the participants in hard copy. When compiling the questionnaires, efforts were consistently made by the researcher to minimise any aspect that could impact negatively on the results of the study by keeping the questions as simple as possible and, wherever applicable, by supplying extensive or detailed information in a glossary of terms to explain difficult concepts (cf. Appendix F). Questions were arranged in such a manner that they did not appear cluttered. The questionnaires were coded to facilitate easy calculation of the responses offered by the participants.

The format of the questionnaire originated from a WIL benchmarking project conducted by the Faculty of Business of the University of Tasmania (UTAS) in Australia (UTAS 2011:Online), as well as from my own experiences when participating in the STEPS process at the CUT in 2011. The majority of the questions in the questionnaire administered to the lecturers/coordinators of WIL and the employers mentors/supervisors of in WPL in clinical practice were formulated in such a manner that these participants could assess their own practices as used in their current programmes (cf. Appendix E1). The questions were designed to obtain specific information to enable comparison of current WIL practices across participating institutions (UTAS 2011:3). The section of the questionnaire to be completed by the final year students mainly investigated their experiences regarding WIL as it was currently presented and managed at their various institutions of study.

The **ratings** for the probing for current WIL practices were between Level 1 and Level 3, where Level 1 was seen as ***essential*** to the success of the WIL component of the Radiography programme at the institution (***Yes,*** *effective strategies are implemented successfully across the programme*) and Level 3 was seen as ***not needed*** for the success of the WIL component of the programme (***No,*** *effective strategies are not addressed, addressed only in isolated pockets, or notionally addressed, but major barriers to implementation exist*). Level 2 indicated existing strategies as ***useful***, but that some limitations existed towards the sound implementation of these strategies *(Strategies are in place, but* ***some limitations exist*** *and some further work is needed)* (UTAS 2011:3). To augment the information gained from a response when Level 2 was selected in answer to the question, participants had the opportunity to comment. The comment was used to identify areas for improvement in the WIL component of Radiography programmes in SA.

Responses from the questionnaire survey were utilised to determine current WIL practices regarding curriculum and pedagogic strategies (effective alignment of WIL practices with educational requirements and outcomes) in Radiography training.

3.3.2.3 *Sample selection*

Bowling (2002:187) articulates that sampling methods for research can be divided into two main groups which are those for quantitative research purposes and those for qualitative research purposes. According to Bowling (2002:187), the two groups can be further divided into random and non-random sampling. Random sampling would include such methods as unrestricted random sampling, simple random sampling, systematic random sampling, cluster sampling, and other sampling with slight variations to the listed methods. For the purpose of the questionnaire survey in this study, the researcher did purposive sampling of the educationists, WIL mentors/supervisors, and random sampling of the final year Radiography students from the target population.

The target population

According to De Vos *et al.* (2005:56), a target population should consist of a group of individuals who possess and share certain specified characteristics. The target population for questionnaire administration comprised educationists/coordinators for WIL in Radiography programmes at higher education institutions in the SA, employers accredited for the training of Radiography students under the auspices of the different higher education institutions, and final year Radiography students.

The survey population

The survey population consisted of professionals with expertise in the fields of Radiography, higher education and WIL, as well as final year students studying towards a National Diploma in Radiography. The professionals participating in the study had to have a minimum qualification of an appropriate degree in their field of expertise (educationists, radiographers, employers) with at least five years' experience in the clinical practice of Radiography.

Description of sample

Professionals with expertise in the fields of Radiography, higher education and WIL, as well as final year Radiology students, were selected from all higher education institutions offering Radiography training in SA. These universities were: the Central University of Technology of the Free State (CUT), the Cape Peninsula University of Technology (CPUT), the Nelson Mandela Metropolitan University (NMMU), the Durban University of Technology (DUT), the University of Pretoria (UP), the Tshwane University of Technology (TUT), the University of Johannesburg (UJ), and the University of Limpopo (UL).

Sample size

A total of 32 lecturers/coordinators at universities (including programme directors/managers) and 44 WPL mentors/supervisors connected to WIL in Radiography programmes were purposively selected from the eight tertiary institutions (total 76). A total of 146 final year Radiography students were sampled randomly from each of the eight Radiography programmes offered at the listed universities to participate in the study. Thus, 222 questionnaires were distributed for accumulation of data.

The pilot study for the questionnaire

A pilot study was conducted to ensure that the questions were clear, unbiased and unambiguous; that the questionnaire was well structured; and to determine the amount of time needed for completion of the questionnaire. To achieve this, the questionnaire was administered to four lecturers in the Department of Clinical Science at the CUT, four qualified radiographers (involved in the supervision of students in clinical practice) at accredited training institutions under the auspices of the CUT, and four final year Radiography students in the Radiography programme at the CUT. These individuals did not take part in the completion of the final questionnaire.

Data collection

Data were collected by means of questionnaires, which were in English (Appendices E1, E2 & E3). The questionnaires were designed to allow for electronic distribution and return to facilitate easy distribution and collection. Participants were identified by contacting a lecturer in Radiography at each of the universities to request the e-mail addresses of **a minimum** of four Radiography lecturers (including programme

directors/managers) and three WPL mentors/supervisors. For distribution of the questionnaire to the students, a third year lecturer was contacted at each of the universities to arrange for distribution and collection of the hard copy questionnaires during class time. The questionnaires were sent to the specific lecturers by courier service and a return courier envelope was included in each package to ensure the return of the questionnaires. Hard copies of the questionnaire for the students seemed to be a very effective way of accumulating the data from the student sample because the questionnaires could be distributed to and collected from the 128 students included in the study during contact sessions at each university. Clear instructions for the completion of the questionnaires accompanied them as a covering letter (cf. Appendices A & B). The participating individuals were allowed four weeks for completion and return of the questionnaires.

Data analysis

The data were analysed with the assistance of a statistician. Data gathered by the questionnaire survey were organised, summarised and grouped by making use of descriptive statistics (Lues 2011:112). The collected data were integrated, summarised and displayed in tabulated form. The correctness of the analysed data was verified by the researcher's supervisor.

Data interpretation

Fossey, Harvey, McDermott and Davidson (2002:730) state that, when interpreting data, it is important to provide a coherent account which should include giving a description of interaction and examples and discussing the meaning and importance of the data. Similarly, Taylor-Powell and Renner (2003:Online) advise the use of quotations or the direct words of respondents to illustrate meaning, specifically when interpreting and reporting on the comments to open-ended questions (cf. Chapter 4).

Data interpretation, according to Taylor-Powell and Renner (2003:Online), is "the process data undertaken to attach meaning and significance to the analysed data". In this study the data interpretation was based on the information gained from the review of the literature together with the quantitative data collected from the questionnaire survey.

3.4 VALIDITY AND RELIABILITY

3.4.1 Validity

According to Babbie (2004:156), validity in quantitative research refers to the extent to which an empirical measure accurately reflects the concept it is intended to measure. In addition, as stated by Gravetter and Forzano (2003:87), the validity of a measurement procedure "is the degree to which the measurement process measures the variable it claims to measure". Therefore, validity should measure the concept in question, and the concept should be measured accurately. Thus the measure lacks validity if an observer or instrument measures the characteristic in the same individual or group repeatedly higher or lower than the real value. According to Katzenellenbogen *et al.* (1999:92-93), there are different levels of validity, namely *face validity* and *content validity*. Face validity refers to the extent to which the stated questions make sense, whereas content validity refers to the inclusion of all the elements of variables when measurement takes place.

The validity of the questionnaire survey was enhanced by the fact that it was pilot tested beforehand. Aside from the four students who received the pilot questionnaire, the programme directors/managers and the WPL mentors/supervisors used in the pilot study were considered to be knowledgeable on the topic of WIL and experienced in the coordination and supervision of students in the WIL environment. Their feedback on the questionnaire thus added to the validity of the measuring instrument.

3.4.2 Reliability

Reliability refers to "the degree of similarity of information obtained when the measurement is repeated on the same subject or the same group of people" (Katzenellenbogen *et al.* 1999:90). Differently stated, the same value should be arrived at every time the measurement is taken. This means that the values should not vary a great deal on repeated administration. The reliability of a measurement procedure is the stability or consistency of the measurement. This means that if the same variable is measured under the same conditions, a reliable measurement will produce identical (or nearly identical) measurements. In other words, it refers to a measuring instrument's ability to yield consistent numerical results each time it is applied (De Vos *et al*. 2005:12 & 61). More important, however, is that reliability is concerned not with what is being measured, but with how well it is being measured. In this research, reliability was

ensured by enquiring about the same aspects related to WIL at the different universities and across the included groups of participants. Additionally comparisons were made between the responses about the same aspects among the different participating groups at the respective institutions.

To further improve the reliability of the results the research endeavours to improve the response rate for the questionnaires to the lecturers/WIL coordinators and the mentors/supervisors at the hospitals/practices by sending numerous reminders for completion and return of the questionnaires. This was done because a low survey participation rate could have a definite impact on the value of the information obtained and its perceived usefulness for this investigation.

Finally, my own critical self-reflection regarding the processes of data analysis and interpretation, coupled with adequate engagement in data collection, also contributed toward ensuring validity and reliability in this study (Merriam 2002:27).

3.5 ETHICAL CONSIDERATIONS

3.5.1 Ethical Approval

Written approval for the research project was obtained from the Ethics Committee of the Faculty of Health Sciences at the University of the Free State (UFS), as well as from the Deans of the Faculties at the higher education institutions included in the study (cf. Appendix B, D & G).

3.5.2 Informed Consent

Written consent was obtained from all the participants as well as from the Deans/Directors/Managers at the participating universities (cf. Appendices C & D). A short overview of the study and its purpose was provided to the participants with an explanation of what was required of them, including details regarding the questionnaire, where applicable. Participation was completely voluntary and a written guarantee was included in the informed consent form that all information would remain confidential and anonymous to anybody except the researcher and her supervisors. My contact details and those of my supervisor were provided in the form.

3.5.3 Right to Privacy

The questionnaires were coded using a number system to ensure the confidentiality of the participants' responses. No names or personal identifiers appeared on any data sheet that was sent for statistical analysis. All information was managed in a strictly professional and confidential manner.

3.5.4 Minimising of Potential Misinterpretation of Results

The researcher is convinced that all possible measures were taken to ensure that the study complied with high ethical standards which included all the required cross-referencing and scientific referencing.

3.6 CONCLUDING SUMMARY

This chapter provided theoretical perspectives on the research design and methods used to conduct the study. These methods included a literature review and documentary analysis. The chapter also provided information on the procedures for the questionnaire survey that had been conducted. The chapter was concluded with a discussion of the validity, reliability, trustworthiness and ethical issues applicable to this study. The following chapter presents the results from the questionnaire survey.

In the next chapter, Chapter 4, entitled **Data Analysis, interpretation and discussion of the results**, the data collected are presented and discussed.

CHAPTER 4

DATA ANALYSIS, INTERPRETATION AND DISCUSSION OF THE RESULTS

4.1 INTRODUCTION

In this chapter the results obtained from the research are presented in tables and graphs and discussed accordingly. Data for this study were collected utilising two processes, namely a literature review and a questionnaire survey. The empirical phase of the study consisted of the administration of three different questionnaires to lecturers, WPL mentors/supervisors in clinical practice and students in Radiography respectively. The discussion of the results obtained from the questionnaire analysis (i.e. a combination of quantitative and qualitative analyses) includes the geographical distribution of the respondents and expositions of the response rates per question. The demographic data of the respondents and their educational background are also discussed. Furthermore, the discussion includes information regarding the respondents' respective positions in their organisations. The results from the open-ended comments section included for some of the questions in the questionnaires (i.e. qualitative data) are also discussed. A discussion regarding the constraints or obstacles concerning the implementation of WIL at the institutions included in the investigation forms the final part of the discussion on the results of the research.

The overall goal of the study was to conduct a critical analysis of the current status of WIL in Radiography training at higher education institutions in SA with the aim of developing an education and training programme for WIL in Radiography. This chapter deals with the analysis of the data gathered during the questionnaire survey to assess the above.

4.1.1 Summary of the Methodology Used for the Investigation

A comprehensive questionnaire survey was conducted to obtain an in-depth understanding of the perceptions and current practices of WIL in Radiography training. Appropriately designed questionnaires were administered to the three main role players in the WIL environment, namely educationists (Radiography lecturers), WPL mentors/supervisors and final year Radiography students (cf. 2.8).

The in-depth literature study focused on investigating the suggested best practice for WIL as proposed in legislative documentation from the DoE in SA and from research published on the topic by a number of authors. The information from the literature review assisted in the compilation of the questions for the questionnaire survey. The questionnaires for all three participating parties consisted of different categories as applicable, namely: 1) biographical information of the participants (all three groups); 2) the current status of curriculum design for WIL (only the lecturers); 3) the current curricular modalities/learning modes used for teaching and learning of WIL (lecturers and students); 4) the current assessment practices for WIL (all three groups); and 5) the current management and coordination practices for WIL at the different institutions (students and WPL mentors/supervisors).

The closed questions in all three questionnaires were statistically analysed by a statistician and the results are presented in tables and graphs in this thesis report to facilitate easy interpretation. The qualitative data derived from the open-ended responses, or 'comments' sections in the questionnaires administered to the university lecturers and the WPL mentors/supervisors, were summarised and are discussed in synthesis with associated quantitative data. The qualitative data derived from the open-ended or 'comments' sections in the questionnaires administered to the final year students were also summarised and additionally categorised in themes due to the wealth of comments received from the student participants. These data are also discussed in synthesis with the relevant quantitative data to ensure consistency in reporting of the different parts. When reporting the results obtained from the survey, the researcher did not only depend on information gathered from the literature review, but I also searched for new data about the topic emerging from the results of the questionnaires. As was mentioned in Chapter 3, the questionnaires were pilot-tested prior to distribution. The criticisms from the pilot sample were utilised to assess the clarity of the questionnaires prior to distribution. An analysis of the pilot respondents' comments indicated that the questionnaire could be both improved and shortened by revising or deleting certain items. Consequently, some questions were shortened, revised or deleted altogether.

The electronic questionnaires, using the EvaSys electronic survey system, were distributed on 18 June 2013 to 32 lecturers/WIL coordinators at the universities and 44 WPL mentors/supervisors (total 76). Hard copies of the student questionnaire were distributed to 146 final year students in the Radiography programmes at seven of the eight identified institutions. Regrettably, three of the 146 student survey questionnaires received back

from the universities were totally blank and were thus eliminated, leaving a total of 179 questionnaires for analysis.

Unfortunately, one of the universities where Radiography training is offered in SA never responded to any request to participate in the research or to send the contact details of lecturers and WPL mentors/supervisors for distribution of the electronic questionnaires. Thus, after numerous e-mails had been sent to the Head of Department of that specific university without any response, I was forced to continue with the survey without any input from this institution.

The following section presents the results of the questionnaire administered to university lecturers involved in WIL programmes for Radiology.

SECTION A: QUESTIONNAIRE TO UNIVERSITY LECTURERS

To limit any negative feelings associated with the completion and return of the questionnaire, the researcher explained the importance of assessing the current practice of WIL in Radiography training in SA in the covering letter accompanying the questionnaire (Appendix A). To establish the benefit of participation, it was stated that the results would be used to develop an education and training programme for WIL in Radiography to the benefit of the profession and other health related professions.

The aim of this questionnaire was to gather information-rich data from the university lecturers about their perceptions of WIL and the current practices of WIL in the Radiography programme at their specific institution.

4.2 ANALYSIS OF THE DATA FROM THE QUESTIONNAIRE TO THE UNIVERSITY LECTURERS

In this section, the results from the questionnaire administered to the university lecturers (Appendix E1) are discussed in detail.

4.2.1 Response Rate (n=32)

The response rate for this questionnaire was 44% (Table 4.1). A higher response rate had been anticipated because the questionnaire was electronically distributed and

collected, thus eliminating the effort for the respondents to return their completed questionnaire by mail. Additionally, six e-mail reminders were sent two weeks apart from 15 July till 09 September 2013 to the lecturers by myself and the administrator of the electronic survey system to remind and encourage them to complete and return the questionnaire. However, the achieved response rate was still deemed adequate although Armstrong and Ashworth (2000:479) advise response rates of 60% or more as a necessity to ensure reliability of the results. Possible reasons for the somewhat lower than expected response rate (44%) from the university lecturers may be found in the impact of variables on the research. One such variable may be the extremely high workload of academic staff which leaves little time to engage in the completion of a questionnaire in electronic format.

TABLE 4.1: RESPONSE RATE FOR THE QUESTIONNAIRE ADMINISTERED TO THE UNIVERSITY LECTURERS

INSTITUTIONS	NUMBER DISSEMINATED	NUMBER OF RESPONSES	% RESPONSE
Central University of Technology	6	6	100%
Cape Peninsula University of Technology	5	0	0
Durban University of Technology	6	1	17%
Nelson Mandela Metropolitan University	3	1	33%
University of Pretoria	3	3	100%
University of Johannesburg	6	2	33%
Tshwane University of Technology	3	1	33%
University of Limpopo	0	0	0
TOTAL	32	14	**44%**

4.2.2 Demographic Data (Biographical Information) (Q 1 – 3)

Most of the respondents were female (93%). The age group that was best represented was 41 – 50 years of age (50%). Only one participant fell in each of the age groups 20 – 30 years and 31 – 40 years. The remaining participants (36%) fell in the age group 51 – 60 years of age.

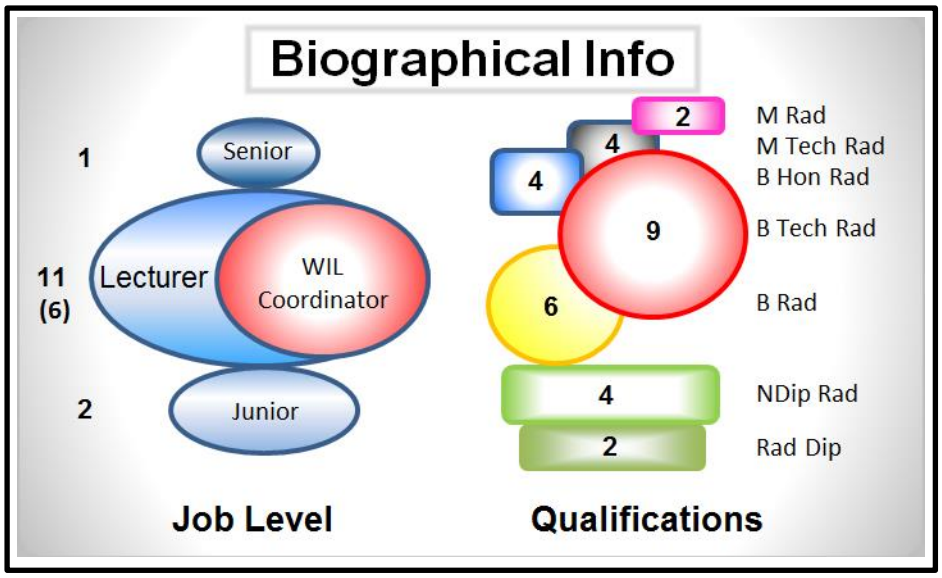


FIGURE 4.1: JOB LEVELS AND QUALIFICATIONS OF THE UNIVERSITY LECTURERS

The largest portion of the participants from the universities included in the study held the position of lecturer (11 participants) with two junior lecturers and one senior lecturer (Figure 4.1). These participants held a variety of qualifications, including a 2-year Diploma in Radiography (2 participants), a National Diploma (N. Dip) in Radiography (4 participants), a Baccalaureus degree in Radiography (B. Rad) (6 participants), a Baccalaureus Tegnologiae degree (B.Tech) in Radiography (9 participants), a Baccalaureus Honours degree in Radiography (B. Rad. Hons) (4 participants), a Master of Tegnologia degree (M. Tech) in Radiography (4 participants) and a Master of Radiography (M. Rad) degree (2 participants).

In the open-ended comments allowed for this question regarding other qualifications acquired, the following qualifications were indicated by some participants in addition to their Radiography qualification/s: National Diploma in Radiation Therapy, B. Tech degree in Radiation Therapy, Advanced Diploma in Teaching, Bachelor of Commerce, B. Rad Hons in Radiation Therapy, National Diploma in Nuclear Medicine, B. Admin, M. Tech in Education, BA in Economics, and an Honours degree in Economics (Figure 4.1). Two lecturers indicated that they had completed modules in learning facilitation, assessment and service learning to upgrade their teaching skills.

4.2.3 Curriculum Design and Development for Work-integrated Learning

The questions in the questionnaire to the university lecturers were designed with reference to information in legislative documentation published by the DoE in SA. The questions intended to explore lecturers' views on best practice for WIL in SA. The most

informative document used to compile the questions in this section was the CHE's *Work-integrated learning: good practice guide* (2011). In this section of the questionnaire the researcher endeavoured to enquire about the general design of WIL, including the following aspects: whether WIL formed part of another module in the curriculum (e.g. Clinical Radiographic Practice) or whether it had been designed as a module on its own; whether WIL in the programme was carrying its own credits; how many notional hours were attached to WIL, and whether the students received clear information on the outcomes for the WIL component of the course. Additionally, enquiry was made about the alignment of the teaching and learning activities for WIL with the set outcomes and the HEQF level descriptors.

4.2.3.1 *Credits, notional learning hours, learning outcomes and alignment* (Q 6, 7, 8, 9, 10, 11, 13 & 14)

Credits and notional learning hours

According to 8 (62%) of the university lecturers who completed the questionnaire, WIL had been designed as a module on its own. In the open-ended 'comments' section of this question concerning the nature of the module WIL was forming part of, the lecturers indicated either the module Radiographic Practice or Clinical Radiographic Practice, which are both concerned with the teaching of radiographic principles and the application thereof in clinical practice. This WIL module carries mostly 24 credits (240 notional learning hours) in the first and second years of study. For the third (final) year of study, a variety of credits were indicated as two institutions reported 24 credits (240 notional learning hours) for the third year WIL module, 2 institutions reported 36 credits (360 notional learning hours) for the third year WIL module, and 3 institutions reported 48 credits (480 notional learning hours) for the third year WIL module. Five lecturers (38%) indicated that WIL formed part of another module in the course.

What was interesting to note from the results was that a wide variety of credits and associated notional learning hours were assigned to WIL in the programmes where WIL formed part of another module. In the first year of study the assigned credits varied between 7, 20, 24 and 25 credits. In the second study year the credits varied between 9, 21, 24 and 27 credits. The third study year showed the biggest variety of credits assigned to the WIL component of the programme, namely 10, 20, 26, 36 and 48 credits.

Discussion

Although the micro design of a learning module is the prerogative of the learning programme presenting the qualification, the allocation of credits for the WIL part of a qualification should certainly be carefully considered in future, with specific reference to the Radiography profession in SA, because the profession is in the process of being recurriculated to a 480 credits Bachelor degree (cf. 2.4). Although most lecturers indicated a number of credits assigned to WIL which, cumulatively from year one to three, met the minimum requirement of at least 50% of the credits at the qualification's exit level in the field of structured learning in the workplace or, differently stated, a minimum of 60 credits (600 notional hours) for WIL as prescribed by the CHE (2009:36), the lecturers from one institution reported a credit allocation for WIL of seven credits in year one, nine credits in year two and ten credits in year three for a total of 26 credits assigned to WIL over the three years of study. What should be kept in mind when assigning credits and associated notional learning hours to WIL in a learning programme is that notional learning hours are a unit used to indicate the approximate time it would possibly take an average learner to achieve a defined learning outcome (cf. 2.5.1.3).

The main goal of WIL in Radiography training is certainly to develop a comprehensive skills set in a student which might include knowledge of the professional subject matter, skills and competencies to perform the tasks required by the profession, and attitudes to function as a well-equipped professional in the real world of work (cf. 2.3.1). To allow for enough time for an average student to achieve such a comprehensive skills set, enough time should be allowed in the WIL component of the course.

<u>Learning outcomes and alignment</u>

All fourteen lecturers who participated in the survey answered the questions on existing learning outcomes for WIL and the alignment of these outcomes with the teaching and learning activities in the programme and with the HEQF level descriptors.

TABLE 4.2: LEARNING OUTCOMES AND ALIGNMENT

	Number of responses answering **'Yes'**	**% Response**
Students provided with clear outcomes for WIL	13	93%
T & L activities* are aligned with outcomes for WIL	12	86%
T & L activities are aligned with the specific level (year of study)	14	100%
T & L activities are designed to integrate knowledge and skills	12	86%
T & L activities are aligned with the HEQF level descriptors	13	93%
T & L activities are designed to develop the needed skills for professional practice	13	93%

*T & L activities = Teaching and Learning activities

As can be seen from Table 4.2, the lecturers answered mostly in favour of existing, clear outcomes for the WIL component of their respective programmes (93%). In the open-ended section about the learning outcomes for WIL, one lecturer responded as follows: "Outcomes set for the clinical training (WPL) part of the module [at the specific training institution] are not vigorous enough to ensure clear guidance of what the student should achieve during WPL". The majority of lecturers indicated positively that the outcomes for WIL were designed to integrate knowledge and skills (86%) in order to develop the skills needed for professional practice upon graduation (93%). Although the integration of knowledge and skills in the design of the outcomes for WIL was indicated as 86% in the quantitative part of the results, one lecturer commented in the open-ended part of the question that although a general integration of knowledge and skills existed, at that particular institution WIL was not aligned to every specific HEQF level descriptor.

Equally important from the quantitative results was that, according to the lecturers, the outcomes for WIL in their programmes were mostly aligned with teaching and learning activities (86%), the level (year of study) (100%), and the HEQF level descriptors (93%). However, two lecturers pointed out in the open-ended part of the questions related to the above that limitations existed in terms of dedicated staff and facilities to facilitate certain learning activities at an institution that did not have a Radiography-specific skills lab for training. Similarly, simulations to prepare students for practice were not regarded as important at all the institutions where Radiography students are trained. Another lecturer commented that appropriate activities to integrate knowledge and skills might be neglected because lecturers did not have their fingers on the pulse of new developments. The consequence of this was summarised by one lecturer in the open-ended section of question 14: "Students in practice are not work ready and follow the bad habits from the qualified radiographers". Despite the high percentage indicated for alignment of the WIL

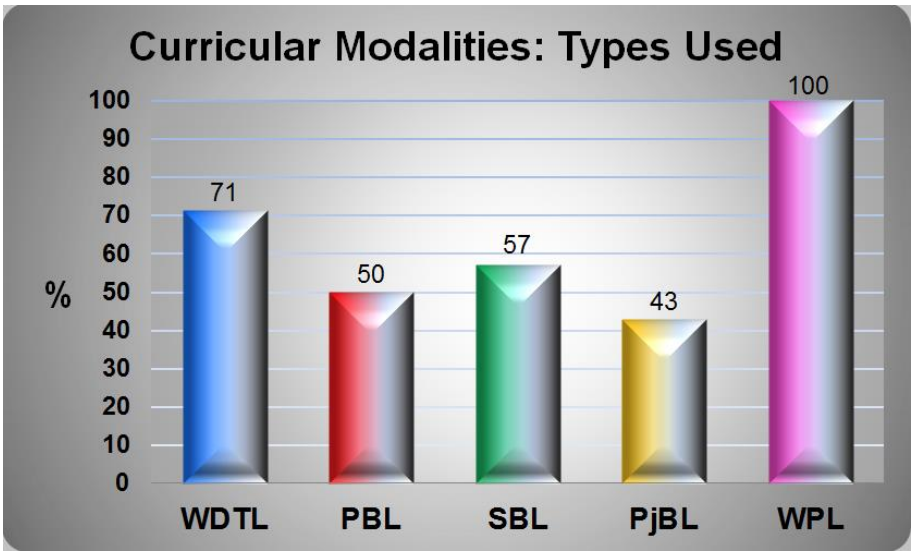
outcomes with the HEQF level descriptors (93%), one lecturer indicated that thorough alignment with the HEQF level descriptors had not been implemented in the present curriculum, but the person stated that a comprehensive exercise would be conducted when the new 4-year degree qualification was planned.

Discussion

Alignment of the set outcomes with the level descriptors and the exit level outcomes for a qualification is crucially important to the success of teaching and learning in any programme (cf. 2.5.1.1 & 2.5.1.2). Because WIL entails the re-contextualisation of disciplinary and professional knowledge and the alignment of what is learned in the classroom with what is happening in the workplace, the alignment of the learning outcomes for WIL with teaching and learning activities and assessment strategies is of essence to the quality of the learning that is taking place (cf. 2.6.1). When developing a curriculum, the principle of alignment should ensure that the teaching and learning activities and assessment tasks directly address the specified outcomes for each unit of learning. Consequently, when re-curriculating a learning programme, it is important to give attention to the processes of design, implementation, evaluation and adjustment (CHE 2011:13) to ensure that the principles of alignment are adhered to. A new curriculum can thus not just be implemented to work perfectly. There should be a culture of reflecting on what works and what should be changed and re-implemented to improve the quality of learning.

4.2.3.2 *Curricular modalities/learning modes for work-integrated learning* (Q 12)

Question 12 was formulated to assess which of the curricular modalities/learning modes, as suggested by the CHE in their *Work-integrated learning: good practice guide* (2011), are used by the lecturers in Radiography at the participating institutions when teaching the WIL component of their programmes.



*WDTL=Work Directed Theoretical Learning
*PBL=Problem-based learning
*SBL=Scenario-based learning
*PjBL=Project-based learning
*WPL=Workplace learning

FIGURE 4.2: TYPES OF CURRICULAR MODALITIES/LEARNING MODES USED AT THE PARTICIPATING INSTITUTIONS

As can be seen in Figure 4.2, WPL was indicated as the curricular modality/learning mode utilised by all lecturers in the Radiography programmes (100%). This can be explained by the fact that the Professional Board for Radiography and Clinical Technology had, in the past, prescribed a certain amount of hours students had to be placed in clinical practice. In other words, the utilisation of this modality was compulsory. WDTL was utilised by 71% of the lecturers. In courses where WIL is part of another module, a high percentage of WDTL learning can be justified as WDTL refers to the disciplinary or theoretical knowledge which is structured by focusing on what the student needs to know to be able to function sufficiently in the workplace (cf. 2.6.1.3). However, in courses where WIL is designed as a module on its own, WDTL should not be used more than the other modalities such as PBL and PjBL, because the theory connected to the outcomes in the WIL module is usually covered in another theoretical module (e.g. Radiographic Practice) related to the WIL module. Stated differently, the WIL module should be focused on real-life problems to assist students in forming the necessary links between what has been learned in the classroom and what is happening in the workplace. As indicated in 4.2.3.1, 62% of the university lecturers specified that WIL had been designed as a module on its own in their learning programmes. This makes this high percentage of WDTL somewhat worrisome.

Curricular modalities/learning modes such as PBL and SBL, which are perfectly suitable for teaching in the WIL environment, were indicated as being used with PBL (50%) and SBL

(57%). These are quite low percentages for utilisation of these curricular modalities/learning modes in the WIL environment as these modalities are well suited in helping students become active learners because they place learning in context by making use of real-world problems and they serve to make students responsible for their own learning (cf. 2.6.1.3). This is very much the case in Radiography training where the delivery of WIL is focused on assisting students to make the link between their theoretical knowledge and the application thereof in the world of work.

Forty three per cent (43%) of the lecturers indicated the use of PjBL to facilitate the learning process in WIL. The lower percentage of utilisation of this curricular modality/learning mode compared to the others may be attributed to the fact that projects are mainly used at the higher levels of learning (e.g. the third and fourth years of study). As pointed out in Chapter 2, PjBL places students in a problem- solving role as they would be in the real world of work or, differently stated, in PjBL students going through an extended process of inquiry in response to a complex question, problem, or challenge (cf. 2.6.1.3). Likewise, lecturers might feel that students at the lower levels of learning (e.g. first year of study) are not yet well enough equipped to solve the related problems/challenges used in this curricular modality/learning mode.

From the results of the open-ended part of question 12, it became clear that confusion existed amongst the lecturers regarding the term *curricular modality/learning mode*, because all four lecturers who commented in this section confused the term with the teaching and learning activities and assessment activities which can be utilised for the different curricular modalities/learning modes (cf. 2.6.1.3). The comments included the following: "They are simulations and demonstrations with phantoms in a clinical setting, prior to students engaging with patients in WPL"; "Formative assessments are performed on every student with feedback"; "Practical sessions are performed using the skeleton - these are done on campus to allow students to gain skills without compromising the patient's safety"; "OSCEs, case studies, reflection sessions, videos groups, demonstrations and role play are used".

Discussion

As was stated in Chapter 2 (cf. 2.6 & 2.6.1), learning is based on two main theories namely phenomenography and constructivism. Where phenomenography is based on the impression that the student's own perception outlines what is learned, constructivism, on

the other hand, signifies that knowledge is created through what the learner has to do to learn better. In the WIL environment these theories converge in the way lecturers facilitate learning. As was confirmed by Biggs (2003:12; cf. 2.6), good teaching is the ability to change the student's perception or the way the student sees the world (Biggs 2003:12). In other words, when enrolled for a module in WIL, it is what the student does that makes deep learning take place and not what the lecturer does (cf. 2.6).

From the above results it became clear that WPL was still the required curricular modality/learning mode utilised in Radiography training (100%). Also noteworthy is that a large percentage of the lecturers also utilised WDTL (71%) when teaching for WIL. Conversely, the use of PBL/SBL and PjBL was indicated across the spectrum of participating lecturers as being average (i.e. ranging between 43% and 57%). It can be argued that the results were skewed by the noted confusion about the term *curricular modality/learning mode* from the open-ended part of question 12, as was discussed above. Nevertheless, the importance of the use of PBL/SBL and PjBL in the WIL environment to stimulate the integration of theoretical knowledge with workplace skills development cannot be over emphasised and should therefore be addressed when the WIL component of new learning programmes is developed (cf. 2.6.1.3).

4.2.4 Teaching and Learning for Work-integrated Learning

Question 15 in the questionnaire administered to the university lecturers was aimed at enquiry regarding the teaching and learning activities utilised under each of the curricular modalities/learning modes in the WIL component of the course at the respective universities. The section below depicts the results as indicated by the participating lecturers regarding the current use of the different teaching and learning activities for the respective curricular modalities/learning modes when teaching for WIL in their programmes.

4.2.4.1 ***Teaching and learning activities for work-integrated learning*** (Q 15)

Work-directed theoretical learning

The types of learning activities for WDTL which were explored in this investigation are: formal lectures, tutorials, simulations, peer learning in groups, demonstrations, and structured interactive sessions.

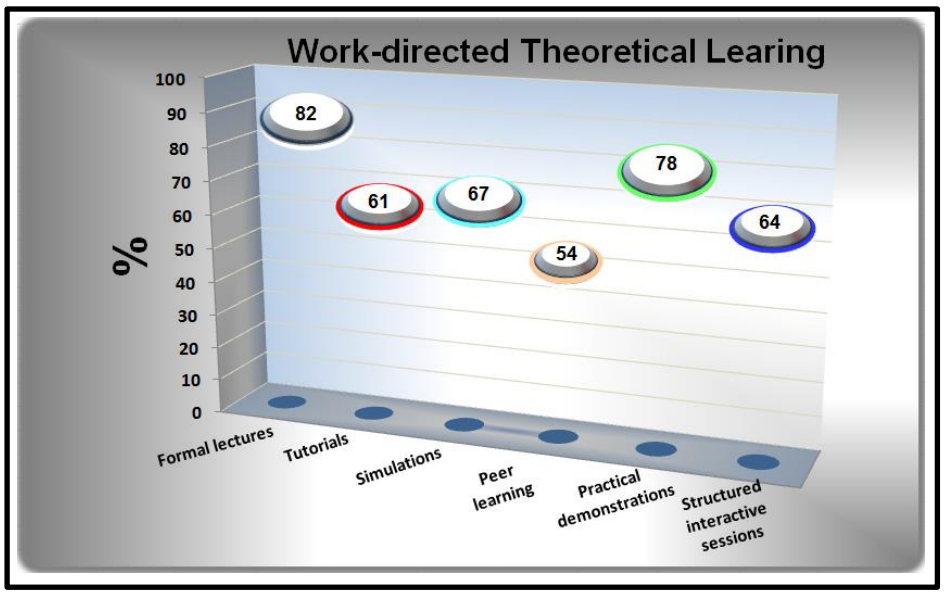


FIGURE 4.3: LEARNING ACTIVITIES FOR WORK-DIRECTED THEORETICAL LEARNING

Figure 4.3 depicts the popularity according to which the different learning activities for WDTL were utilised by the participating university lecturers. The results show that formal lectures (82%) topped the list of learning activities for this learning mode, followed by practical demonstrations (78%). Tutorials (61%) and simulations (67%) were almost equally popular as learning activities for WDTL. The lecturers rated the use of peer learning in groups at 54% and structured interactive sessions at 64%.

Discussion

Activities to facilitate learning for WDTL should focus on the theoretical knowledge a student requires to be able to function sufficiently in the workplace (cf. 2.6.1.3). The high percentage for formal lecturing (82%) for this learning mode had been expected because WDTL is the learning mode in which the lecturer needs to dispense the disciplinary knowledge upon which students should construct/build their practical skills and competencies for the workplace environment. Differently stated, students are exposed to a new concept for the first time. Thus new knowledge should be transferred and concepts should be explained.

The popularity of practical demonstrations as a learning activity for WDTL (78%) can be validated by the fact that most training institutions for Radiography have their own fully equipped laboratories (e.g. anatomy laboratory and X-ray room facility) on campus. In the absence of such a laboratory on campus, practical sessions are commonly organised at a hospital/medical practice where the students are placed for WPL. Thus lecturers often

deliver the theoretical content of the learning unit followed by a demonstration of the application of this knowledge in one of the laboratories or at a clinical training facility.

Tutorials and simulations are handy ways to facilitate learning because a link between theory and practice can be created by utilising laboratories where real-life settings are replicated (cf. 2.6.1.3). Peer learning in groups (54%) and structured interactive sessions (64%) can be utilised in order for students to learn from one another and to stimulate critical thinking and the formation of links through the sharing of knowledge and experiences. A structured interactive session can follow the delivery of theoretical content in a class session with the lecturer posing some questions to stimulate discussion. Similarly, working collaboratively in groups can elicit those activities that shape, elaborate and deepen understanding of a specific component of content (cf. 2.6.1.3).

Problem-based learning

The types of learning activities for PBL which were explored in this investigation are: the presentation of real-world problems, integrated learning, discovery learning, self-directed learning, and peer learning in groups.

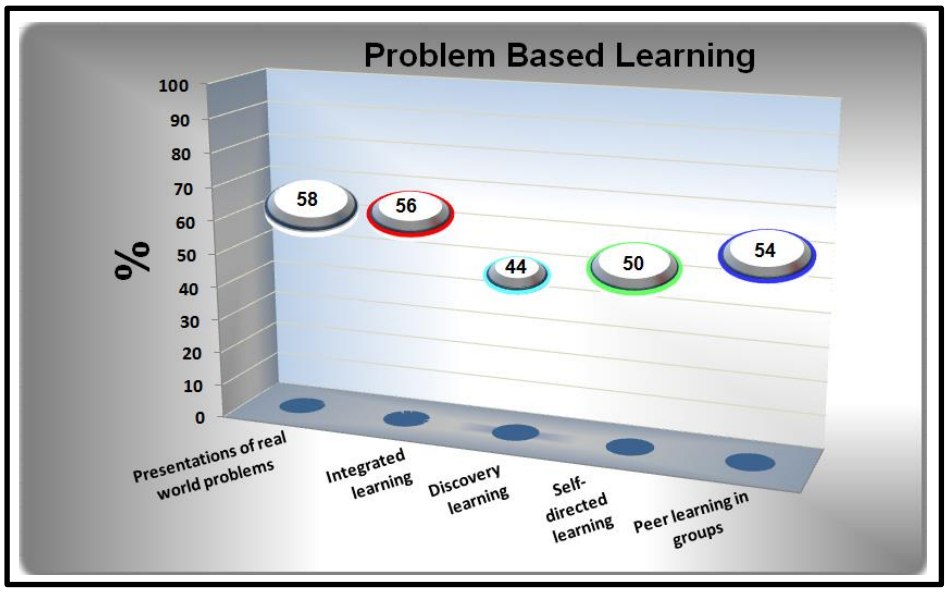


FIGURE 4.4: LEARNING ACTIVITIES FOR PROBLEM-BASED LEARNING

Figure 4.4 indicates that the highest percentage rated for the utilisation of a PBL learning activity was 58% for the 'presentation of real-world problems'. This is followed by integrated learning (56%), peer learning in groups (54%), self-directed learning (50%), and discovery learning (44%).

Discussion

As clearly stated by the CHE (2011:17), PBL should be used to bring about radical change in students' learning by posing 'problems' associated with real-life situations to the student, and not by introducing only academic subjects (cf. 2.6.1.3). In other words, PBL always has to do with solving a specifically posed problem by using essential knowledge and skills required to do so. The low average percentage (52%) of learning activities used for PBL when compared to WDTL is of great concern. This concern is validated by the fact that the learning activities for PBL are considered to be ideal in ensuring that the students understand the context in which they are mastering specific content, while simultaneously enhancing their learning experience significantly (cf. 2.6.1.3), especially in the WIL environment. Thus, utilising the learning activities for PBL in the WIL environment for Radiography training will assist students in acquiring specific knowledge and developing specific skills and capabilities to solve problems in real-world contexts. The low percentages allocated for the utilisation of teaching activities for PBL may be further attributed to reluctance on the part of the lecturers to use PBL activities for students at the lower levels of learning (first and second years of study) because the facilitation of PBL in these larger classes is in many cases very challenging.

Project-based learning

The types of learning activities for PjBL which were explored in this investigation are: clinical practice projects, real-world learning, and guided practice.

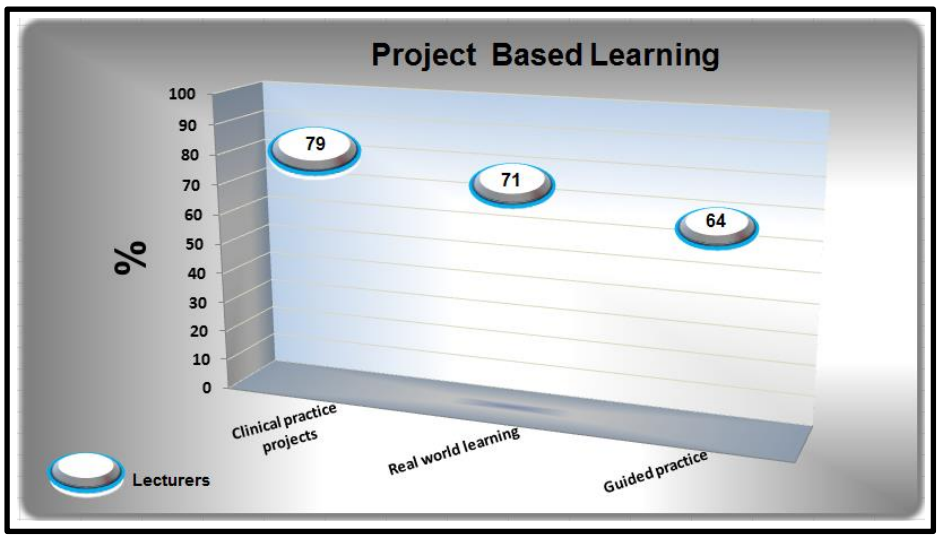


FIGURE 4.5: LEARNING ACTIVITIES FOR PROJECT-BASED LEARNING

For this curricular modality/learning mode, clinical practice projects (79%) seemed to be the most popular learning activity amongst the participating lecturers teaching in the WIL environment. Almost equally popular in demand was real- world learning (71%), followed by guided practice (64%).

Discussion

PjBL is ideally suited to teach in professional practice oriented programmes such as Radiography. This is because PjBL exposes students to the problem solving environment in the real-work situation which they will be exposed to when employed as qualified professionals (cf. 2.6.1.3). The popularity of using clinical practice projects (79%) when teaching for WIL is not surprising because clinical practice projects are an ideal learning activity to stimulate the integration of theory and the practical application of this theory in the workplace. Differently stated, clinical practice projects provide an ideal environment which reflects the professional workplace and a meaningful context in which the fundamentals of a profession could be studied (cf. 2.6.1.3).

So, when students work on a project in clinical practice, they need to revisit all their prior knowledge related to the topic of the project (e.g. Anatomy, Pathology, or Radiography) to be able to complete the project successfully. At the same time students are enabled to construct links between their theoretical knowledge on the topic and the application thereof in real-world settings. In addition, students acquire many other generic competencies to develop a comprehensive skills set desired by potential employers (cf. 2.3.1, 2.6.2.2) while engaging in the execution of projects in a clinical practice setting. Closely linked to the learning that is taking place while engaging in clinical practice projects are real-world learning (71%) and guided practice (64%) as learning activities for PjBL, because students are being exposed to what is happening in the real world of work while being guided by a qualified professional (such as a qualified radiographer acting as a tutor/mentor) in the clinical context of the profession.

Workplace learning

The types of learning activities for WPL which were explored in this investigation are: work placement and work-based learning.

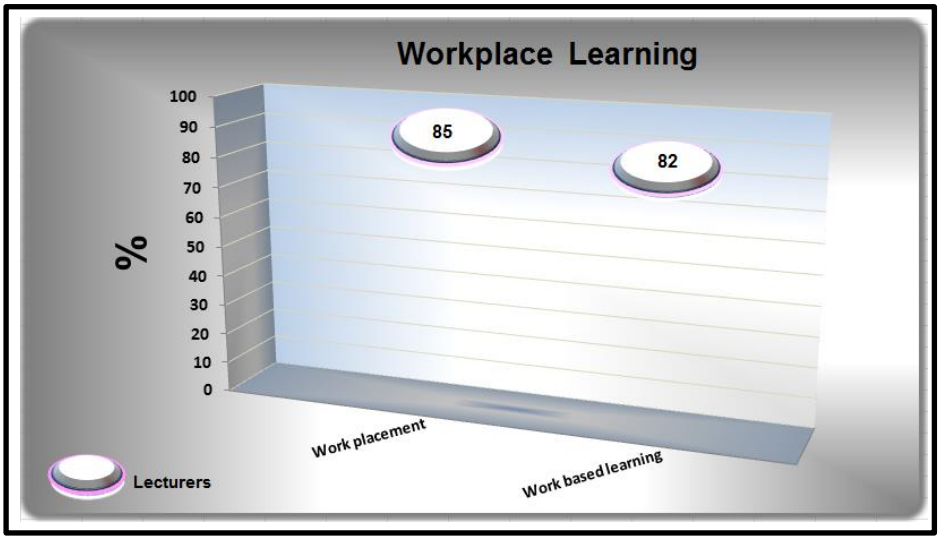


FIGURE 4.6: LEARNING ACTIVITIES FOR WORKPLACE LEARNING

As was discussed in 4.2.3.2, WPL topped the list of curricular modalities/learning modes used in the training of Radiography students. Because the placement of students for work and work-based learning is considered to be almost the same thing, Figure 4.6 illustrates that the utilisation of these two learning activities for WPL in the training of Radiography students is very high in demand, with work placement at 85% and work-based learning at 82%. Strange the percentages for the responses acquired from the participating lecturers/WIL coordinators at the respective institutions about the WPL/WBL part of WIL is not 100% since, as stated earlier, WPL is compulsory for radiography training in SA. This response can unfortunately not be explained by the researcher thus the presentation of the results in Figure 4.6 is a true reflection of the results for this question from the participating lecturers/WIL coordinators at the respective institutions.

Discussion

As stated earlier (4.2.3.2), many professional bodies are prescribing a certain amount of hours which students should spend in a workplace setting. Because this is currently still the case with the Radiography profession where the Professional Board for Radiography and Clinical Technology stipulates that a student should accumulate 2 500 hours (N. Dip) and 3 200 hours (B. Rad) of clinical practice exposure to qualify for graduation, the high utilisation rate of the learning activities for WPL is quite clear. However, the allocation of hours spent in clinical settings should be revisited by professional bodies in the light of the development of new qualifications to include WPL as a component of WIL and not as the sole modality where students acquire workplace competencies. In other words, professional bodies should acknowledge WIL as the overriding pedagogy for a number of

curricular modalities of which WPL is but one. (Other modalities for WIL as discussed in Chapter 2 include WDTL, PBL and PjBL). As was clearly stated by the CHE (2011:21; 4.2.3.2), WPL should be included as part of the discipline-based knowledge of the qualification and students should be able to understand the links between the knowledge production systems of the discipline and the extra-academic contexts. For this reason it is important to remember that WPL, as a part of WIL, should aim at developing specific competencies to be acquired in the workplace setting for the acquisition of a qualification which closely relates to the development of skills that will make the learner employable and will assist in developing his/her personal skills. However, when developing new qualifications, curriculum developers should recognise that WPL is not the only way to acquire these skills.

As discussed in Chapter 2, good teaching can stimulate qualities conducive to learning such as the need to know, curiosity, and building on prior knowledge, whereas bad teaching can discourage students from making the necessary links to construct their own knowledge for better understanding (cf. 2.6.1). A fundamental concern when teaching for WIL is how to teach for the transfer of knowledge. In the WIL environment the knowledge acquired in the classroom will need to be applied within the workplace context and should be relevant to solve problems encountered in the workplace, promote interaction and collaboration between professionals, develop individual accountability, and instil self-assessment abilities in the student (CHE 2011:31). To teach in the WIL environment to develop graduateness requires much more than subject knowledge. Teaching for WIL requires the lecturer to stimulate the transfer of implicit knowledge to knowledge of the workplace setting and associated structures in which the students will be employed. To achieve success in the teaching and learning for WIL, lecturers should utilise a wealth of teaching and learning activities within each of the curricular modalities/learning modes, as discussed above.

4.2.4.2 ***Actions to stimulate active/deep learning*** (Q 16)

WIL is one of the educational streams where the deep approach to learning can effectively be applied (cf. 2.6.1.1). However, a deep approach to learning should normally be stimulated in the student as it does not happen naturally. Question 16 in the questionnaire administered to the university lecturers therefore probed for information on the actions used by the lecturers to stimulate deep learning in their students.

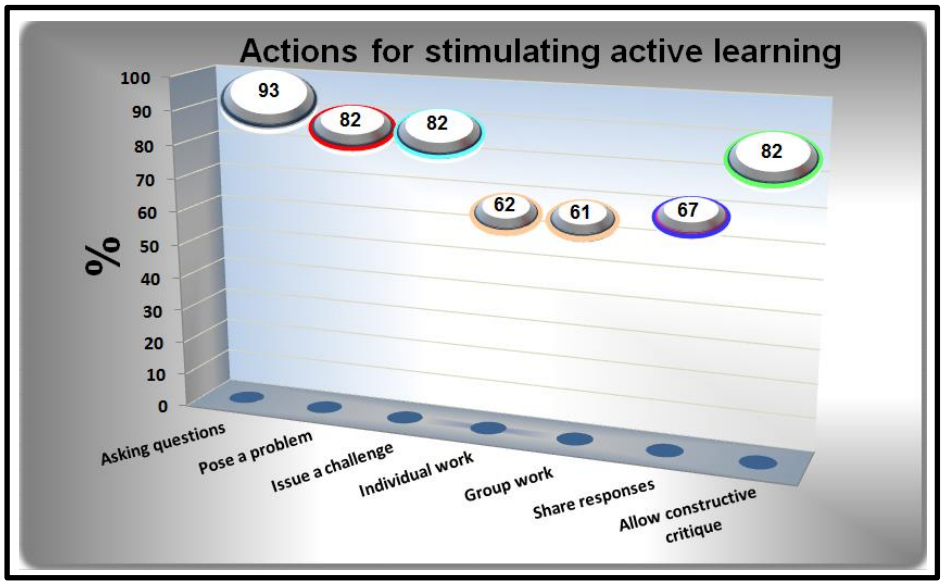


FIGURE 4.7: ACTIONS TO STIMULATE ACTIVE/DEEP LEARNING

The results from question 16 show that the lecturers in Radiography used a variety of actions to stimulate active or deep learning in their students such as asking questions, posing a problem, issuing a challenge, allowing for individual work during a class session, allowing group work, sharing of responses, and allowing constructive critique. The most popular activity to stimulate deep learning seems to be the asking of questions (93%) during a facilitation session. Also popular amongst the lecturers to stimulate deep learning were posing a problem and setting a challenge that their students had to solve (both rated 82%). In Radiography training it is popular practice to allow for constructive critique during a practical demonstration or during a film/image assessment session (82%). A student then has to demonstrate a given positioning or film critique technique while the other students are allowed to give constructive inputs. This is most probably the reason why constructive critique was indicated as another popular action to stimulated active or deep learning in the students. Group work (61%), individual work (62%), and the sharing of responses (67%) were all indicated as being used quite often by some of the lecturers, although they were not as popular as the formerly mentioned four actions.

Discussion

As was stated explicitly by Atherton (2013:Online), the WIL environment is ideally suited for the stimulation of deep learning as it focuses on "what is meant by the learning"; it relates previous knowledge to new knowledge; it relates knowledge from different modules in the course; it relates theoretical ideas to everyday experiences; it relates and

distinguishes evidence and argument; it organises and structures content into a coherent whole; and its emphasis is internal, from within the student. The lower utilisation of group work, individual work and the sharing of responses (63%) to stimulate deep learning may be justified by the fact that many lecturers are teaching large groups of students with a time limitation to complete the syllabus for a specific year group. The popularity of other actions to stimulate deep learning such as asking questions, posing a problem, and allowing for constructive critique may be justified by the fact that these actions can be easily used during the delivery of a class or practical session and they do not require any extra assessment and marking.

4.2.4.3 *Electronic teaching media for work-integrated learning* (Q 17)

The student population we are teaching currently demands the use of technology as teaching media. Also in the WIL environment, and specifically in the training of Radiography students, the use of teaching media is a powerful tool that can be used effectively to help students develop the skills necessary to succeed at university and beyond (cf. 2.6.1.2). Question 17 enquired about the utilisation of different electronic teaching media when teaching for WIL in Radiography training. Only the most commonly used electronic media used when the researcher is teaching were included in the inquiry. These were PowerPoint, the internet, Blackboard, Skype, and videos.

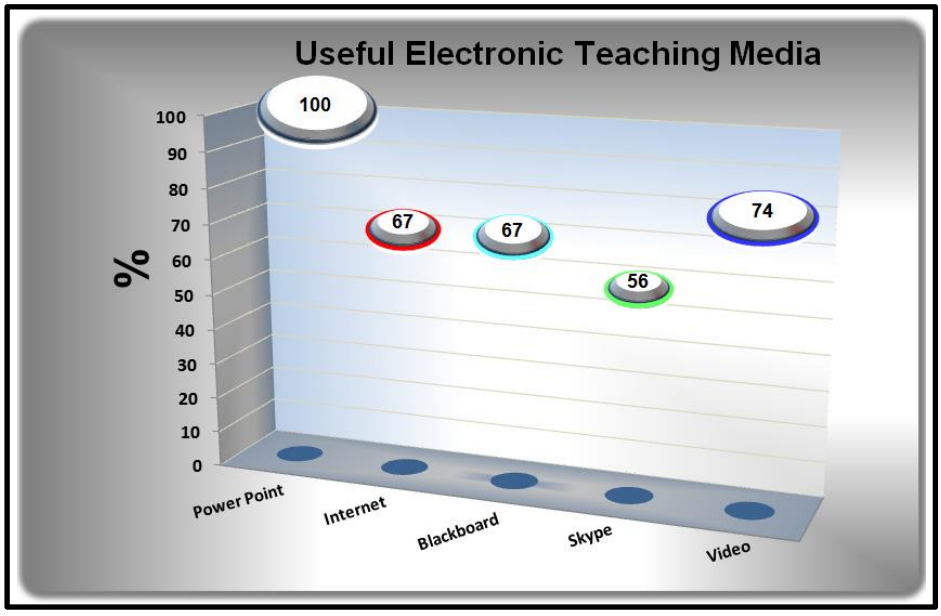


FIGURE 4.8: USEFUL ELECTRONIC TEACHING MEDIA

Not surprisingly, PowerPoint as a teaching medium was indicated as used by all the lecturers at the participating institutions (100%). Quite surprisingly, the use of video as

an electronic teaching medium was indicated as the second most popular (74%) when teaching in the Radiography environment. The above two teaching media were followed by the use of internet and Blackboard, both with an utilisation of 67%, with Skype the least utilised electronic medium used by the lecturers (56%).

Discussion

In an era where laptops, data projectors and internet connection have become part of our daily lives, it has become inevitable that digital resources should become part of a student's learning experience. The use of electronic teaching media has many advantages (cf. 2.6.1.2), but the most significant one when teaching in the health sciences environment is the availability of online teaching material which lecturers could not develop themselves. Many authors have confirmed that the use of digital resources supports teaching and learning in higher education. As stated by White and Manton (2011:1), students value the use of digital resources by their lecturers which, alongside other forms of teaching support, help to steer them through the potentially overwhelming volume of work they have to master. It has thus become imperative that facilitators empower themselves to use electronic teaching media. This is even more relevant in the teaching of the health professions such as Radiography where the use of online libraries and other electronic teaching tools has become available at the click of a button.

4.2.5 Assessment for work-integrated Learning

This section in the questionnaire administered to the university lecturers assessed the current assessment activities in relation with WIL at the participating universities. The analysed results for this section of the questionnaire are diagrammatically illustrated and discussed in the following section.

4.2.5.1 *General design for the assessment of work-integrated learning*

(Q 18, 19, 20, 21, 25, 26, 27)

Important general aspects regarding assessment for WIL were explored, including enquiry into the following: the alignment of assessment activities with the intended outcomes for WIL; whether assessment was done at the correct HEQF level; the alignment of assessment activities with the utilised curricular modalities/learning modes for WIL; and whether current assessment activities were preparing students for their professional roles. Additionally, the researcher the enquiry explored some basic assessment characteristics

such as the types of assessment used for WIL, assessment principles, assessment methods, and the use of rubrics during the assessment for WIL. The final part of this section of the questionnaire probed for information regarding the practices surrounding formative feedback as an essential component of the assessment process.

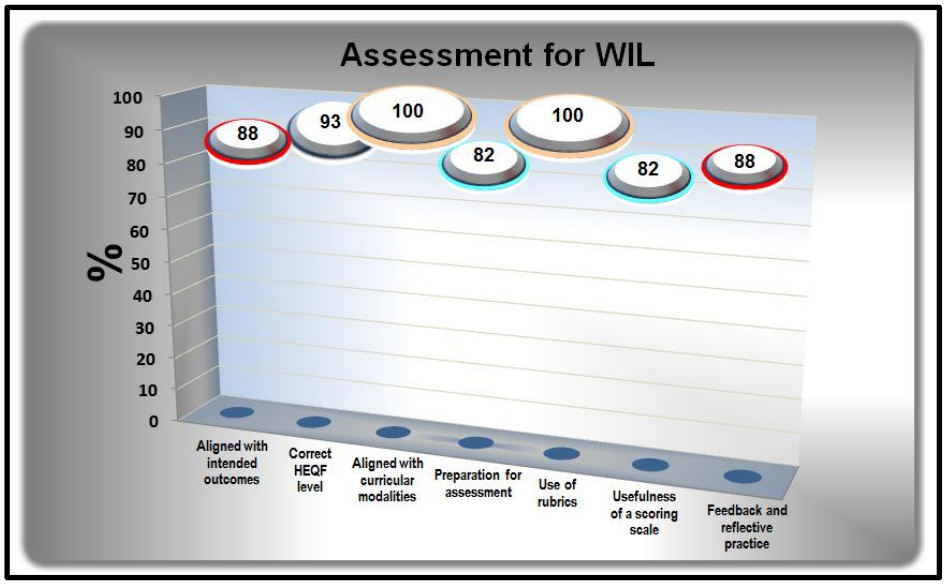


FIGURE 4.9: GENERAL DESIGN FOR ASSESSMENT IN WORK-INTEGRATED LEARNING

Figure 4.9 displays the results from the university lecturers for the general aspects of assessment for WIL as they were applied at the time of the study. The results show that the university lecturers were mostly feeling satisfied about the general aspects of assessment for WIL in their respective learning programmes. The lecturers in general felt that assessment activities were aligned with the outcomes for WIL (88%) and that assessment was conducted at the correct level for each year group (92%). However, one lecturer reported in the open-ended section of Q19 that the possibility existed that moderators did not pick up discrepancies in alignment. Despite these high scores for the alignment and level of assessment activities, some lecturers commented in the open-ended parts of the related questions that there were limitations in terms of the procedures applied or the examinations that would be used to assess students in the WIL component. For example, few skull X-ray examinations were done due to the fact that CT (computed tomography) was the preferred manner of examination instead. Another lecturer indicated that it was difficult to cover the whole curriculum in the limited time available for the programme. A third lecturer reported that the alignment of WIL with the correct HEQF level had not been done as a comprehensive exercise for the current 3-year Diploma curriculum at the particular institution. He stated that this would be done when the new 4-year qualification course was developed.

All lecturers indicated that assessment activities were aligned with the curricular modalities/learning modes which were currently being utilised in the programme (100%). However, in the open-ended part it was reported that in some instances the volume of work and limited time might influence a positive outcome regarding this aspect of assessment.

The use of rubrics as a measuring instrument for assessment of WIL was rated 100%, but not all lecturers agreed on the usefulness of the scoring scale used in the rubrics (82%). This slight discontent with the scoring scales for rubrics as used in the WIL environment was reported in the open-ended part of this question as follows: "The challenge comes when assessors tend to just tick all the high scores, but this does not always give a true reflection of the learner's conduct or performance". Another comment was: "We find that when radiographers assess students, they score them with very high marks, but when the university lecturers assess the students, we are much stricter and marks are lower. We have conducted assessment workshops and the situation has improved slightly, but it is still a problem."

The preparation of the students for their professional roles through using current assessment activities was rated 82% successful in the quantitative part of the questionnaire. Deficiencies in this area were reported in the open-ended part as one response stated: "Qualified radiographers in the hospitals are not all willing to help students and direct them correctly. Students pick up bad habits in the hospitals. These are difficult to correct on-campus." Another comment was: "Lack of manpower and unwilling qualified radiographers in practice to assist with day-to-day assessment may prove negative."

Finally, 88% of the lecturers indicated that they were using formative feedback during assessment for WIL at their respective institutions. A lecturer commented that it was difficult for one lecturer to have individual discussions with a large class, a comment which made me question the understanding of this lecturer regarding the real nature of formative feedback.

Discussion

Although the results on the general aspects of assessment for WIL showed that most of the lecturers were generally satisfied with the current practices at their institutions, some

limitations did exist. As was stated in Chapter 2, it is essential that assessment tasks be aligned to the intended learning outcomes to ensure an effective learning process (cf. 2.7). One of the limitations that were identified from the quantitative and qualitative results of this section was that discrepancies in the alignment of assessment activities with the outcomes for WIL might have been missed by the moderators. In many cases this is caused by a lack of knowledge regarding the importance of this alignment in assessment because many programmes are making use of the assistance of qualified professionals in clinical practice to act as moderators for WIL-related assessment activities. These professionals have not always received training in educational assessment aspects such as alignment. Because many Radiography programmes are currently in the process of being recurriculated from a 3-year National Diploma to a 4-year Bachelor degree, it is an ideal opportunity to consider the alignment of teaching and learning activities and assessment activities with the HEQF level descriptors when planning the new programmes.

As was indicated by some lecturers in the qualitative comments for this set of questions, the volume of work to be covered in a certain period of time is in many cases inhibiting the implementation of sound assessment practices. This also applies to the utilisation of some of the curricular modalities/learning modes available to teach WIL. Again, educationists are now having an ideal opportunity to reconsider the necessity and the amount of content in the curriculum for each year group considering WIL when planning their new programmes. Regarding the unavailability of some general X-ray examinations, such as for the skull, lecturers should keep in mind that competencies need not be taught and practised (practiced + USA) in the clinical environment only. Because WIL includes a variety of teaching and learning activities, infrequent examinations can be successfully augmented by utilising other teaching and learning activities such as simulations, problem solving, demonstrations, and e-learning.

The use of rubrics in assessment for WIL seems to be well utilised. However, the universal problem of subjective scoring has surfaced even in the WIL environment. Forbes (2003:14; 2.7.1) acknowledges the complexity of workplace assessment. He also points out that an attempt to propose a simple pass/fail system (as is many times the case with rubrics) would be in conflict with the spirit and objectives of an outcomes-based approach to assessment (cf. 2.7.1.4). Thus the training of assessors, and specifically in the clinical practice environment, is of utmost importance (cf. 2.8.1.2). In the WIL environment, the implementation of formative assessment, where the student is allowed a

second chance to improve on previous performances, is advocated by many of the authors of numerous articles and papers (cf. 2.7.1.1). This also emphasises the importance of formative feedback during assessment for WIL (cf. 2.7.1.5), because formative feedback is a powerful tool to enhance the learning experience and to ensure that deep learning occurs. However, it is imperative that feedback should be given timely and that it be relevant to the shortcomings of the student. In other words, formative feedback should encourage the student to improve in order to be successful.

Another limitation in the general assessment process as currently employed in the WIL environment is the unwillingness of professionals in clinical practice to assist with assessment. Equally discouraging in many clinical instances is the unwillingness of qualified professionals to set good examples which, in the end, has a negative impact on the outcome of assessment in the clinical setting. The role of WPL mentors/supervisors cannot be emphasised enough (cf. 2.8.1.1). In the WIL environment in Radiography more training, specifically in the assessment of WIL, needs to be done to motivate and empower WPL mentors/supervisors for their important role in the training of the students.

4.2.5.2 ***Assessment principles for work-integrated learning*** (Q 22)

This question enquired into lecturers' perceptions regarding the application of the basic principles for assessment in higher education and, specifically, in the WIL environment at their respective institutions.

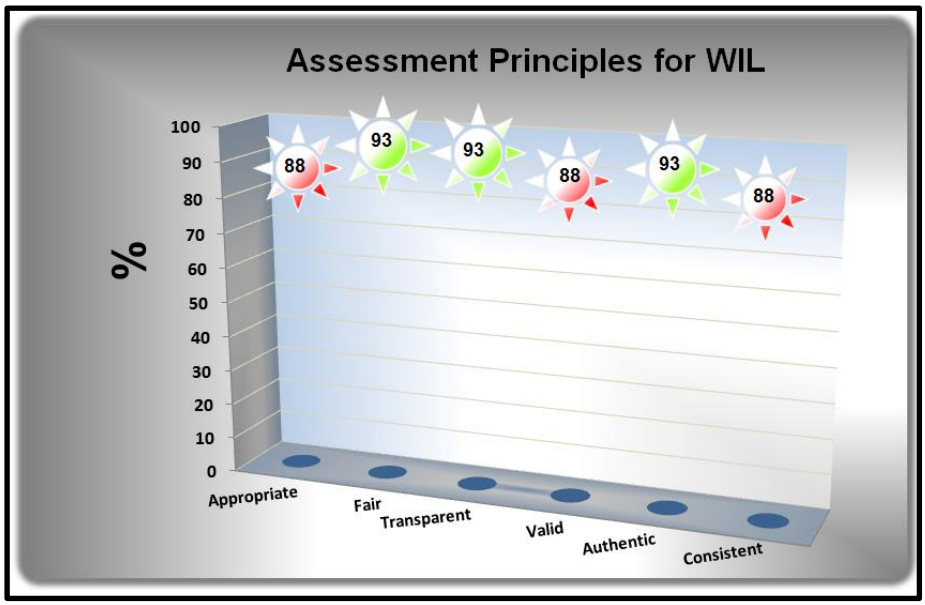


FIGURE 4.10: APPLIED ASSESSMENT PRINCIPLES FOR WORK-INTEGRATED LEARNING

Figure 4.10 clearly depicts that the lecturers felt quite certain that they were applying the basic principles of assessment when assessing WIL in their programmes. The application of fairness, transparency and authenticity of the assessment for WIL was rated 93% effective, whereas the application of appropriateness, validity and consistency of assessment in WIL was rated 88% effective.

Discussion

As a practitioner in the field, the researcher is of the opinion that most lecturers strive to apply sound assessment principles. However, it is important that lecturers always keep in mind that for assessment to be valid, they should ensure that: 1) assessment procedures are effective in measuring student attainment of the intended learning outcomes; 2) that a range of assessment tasks and methods are employed to ensure that all the learning outcomes are validly assessed; and 3) that assessment is focused on measuring the ability of the students to integrate all acquired knowledge and skills at a certain level (cf. 2.7.1.2).

4.2.5.3 *Types of assessment used for work-integrated learning* (Q 23)

The bulk (86%) of the participating lecturers indicated that they used both formative and summative assessment in the WIL component of their programmes. One lecturer reported that only formative assessment was used and one lecturer reported that only summative assessment was used.

4.2.5.4 *Assessment methods used for work-integrated learning* (Q 24)

The decision about which assessment methods to include in the questionnaires was informed by information from the CHE's *Work-integrated learning: good practice guide* (2011) and other related literature. Assessment methods for the different curricular modalities/learning modes for WIL (cf. 2.6.1.3), as advised by many authors and from own prior experiences, were included in the enquiry. Table 4.3 summarises the findings for the methods that were investigated.

Table 4.3 clearly indicates that the participating lecturers used some assessment methods often and some very seldom when teaching the WIL component of their programmes. The assessment methods always used by all the participating lecturers were to perform a

practical assessment (100%) and to do an OSCA (100%). Assessment methods seldom or never used by the lecturers were the compilation of video diaries (0%), creating a blog (4%), and compiling annotated bibliographies (4%). Assessment methods that were also popular amongst the lecturers were to present a case study, to take part in a demonstration, and the compilation of portfolios, which were all rated at 82%. Some assessment methods that were less utilised but applied across the spectrum of participating lecturers were to write a test, to analyse a problem scenario, to let students take part in role play, and to let students do presentations, which were all rated at 64%. Less popular assessment methods utilised by the lecturers in descending order were: reporting on an observation in clinical practice (59%), writing reports (54%), writing academic essays (43%), making journal entries (39%), presenting posters (39%), keeping a journal (36%), writing a research proposal or report (29%), writing an article review or summary (21%), and producing a glossary of terms (11%).

TABLE 4.3: ASSESSMENT METHODS USED BY LECTURERS

	Q24-1	Q24-3	Q24-4	Q24-5	Q24-6	Q24-7	Q24-8	Q24-9	Q24-10	Q24-11	Q24-12	Q24-13	Q24-14	Q24-15	Q24-16	Q24-17	Q24-18	Q24-19	Q24-20	Q24-21	Q24-22
#	Writing reports	Compiling video diaries	Producing a glossary of terms	Writing an academic essay	Writing a test	Making journal entries	Creating a blog	Presenting a case study	Write an article review/summary	Performing a practical assessment	Doing an Objective Simulated Clinical Assessment (OSCA)	Analysing a problem scenario	Taking part in demonstrations	Taking part in role-play	Presenting posters	Reporting on an observation in clinical practice	Compiling a portfolio	Presentations	Keeping of a journal	Annotated bibliographies	Writing of research proposals & reports
""	29	29	21	29	14	21	29	7	29	0	0	29	14	21	21	14	14	21	21	36	21
Yes 1	43	0	7	36	64	29	0	71	7	100	100	57	79	57	36	43	79	57	21	0	21
Some 2	21	0	7	14	0	21	7	21	29	0	0	14	7	14	7	29	7	14	29	7	14
No 3	7	71	64	21	21	29	64	0	36	0	0	0	0	7	36	14	0	7	29	57	43
% Response	71	71	79	71	86	79	71	93	71	100	100	71	86	79	79	86	86	79	79	64	79
% Usage	54	0	11	43	64	39	4	82	21	100	100	64	82	64	39	57	82	64	36	4	29

Discussion

The use of different assessment methods might be influenced by many extrinsic factors such as the availability of human, physical and other resources at a specific university. Obviously, online assessments will not be possible if the electronic environments to conduct such assessments (e.g. Blackboard & Moodle) are not available. Assessment using electronic media can also only be successful if teaching staff is supported by e-learning experts. However, the reluctance to use some assessment methods may stem from a reluctance to accept change, which is a common human quality. In the WIL environment, a variety of assessment methods can be utilised with success such as role play, simulations, demonstrations, and online portfolios. In the digital era that we are teaching in, facilitators should be motivated to experiment with new assessment methods which will stimulate the integration of disciplinary knowledge with what is required in the workplace. In the profession of Radiography, the use of other than the usual assessment methods in the area of WIL and WPL has become easily accessible with the fast development of technology. Certainly it remains the prerogative of the facilitator of a WIL module to decide which assessment methods are suited best to measure the achievement of certain outcomes/objectives by carefully considering the advantages and disadvantages of each method (cf. 2.7.1.3).

SECTION B: QUESTIONNAIRE ADMINISTERED TO THE FINAL YEAR RADIOGRAPHY STUDENTS

The aim of this questionnaire was to gather information-rich data from the final year Radiography students at the universities included in the study about their perceptions of WIL and the current practice of WIL at their respective institutions. Additionally, the researcher aimed to compare the results from the final year student population with the results from the lecturers regarding certain important aspects related to WIL.

4.3 ANALYSIS OF THE DATA FROM THE QUESTIONNAIRE ADMINISTERED TO THE FINAL YEAR RADIOGRAPHY STUDENTS

In this section, the responses of the final year Radiography students (Appendix E2) are discussed in detail.

4.3.1 Response Rate (n=146)

The response rate for this questionnaire can be said to be 100% (Table 4.4). This can be validated because although the researcher initially requested that 16 final year Radiography students be sampled from each of eight participating universities (a total of 128), some of the lecturers who assisted the researcher with the distribution of the hard copy questionnaires allowed additional students to complete the questionnaire as they indicated that they also wanted to take part in the survey. Therefore, although not all eight of the identified universities participated in the study, the number of returned questionnaires fulfilled the requirement for student participation.

TABLE 4.4: RESPONSE RATES OF FINAL YEAR RADIOGRAPHY STUDENTS PER UNIVERSITY

INSTITUTIONS	NUMBER OF RESPONSES	% OF TOTAL RESPONSE RATE
Nelson Mandela Metropolitan University	25	17%
Durban University of Technology	16	11%
Tshwane University of Technology	24	16%
Central University of Technology	30	21%
University of Johannesburg	14	10%
University of Pretoria	11	8%
Cape Peninsula University of Technology	26	17%
University of Limpopo	0	0
TOTAL	**146**	**100%**

Although in total 146 questionnaires were received back from the students participating in the survey, an uneven number of questionnaires was received from the different universities (cf. Table 4.4 for number and percentage of responses from each university).

4.3.2 Demographic Data (Biographical Information) (Q 1 – 3)

Table 4.5 below shows a female dominant student population with 26% male participants and 74% female participants. This is not surprising because the Radiography profession is known to be a female dominant profession. The bulk of the participating students fell within the age group of 21 – 25 years (76%), with 13% in the age group 18 – 20 years and 11% in the age group 26 years and older.

TABLE 4.5: DEMOGRAPHIC DATA (BIOGRAPHICAL INFORMATION) OF THE FINAL YEAR RADIOGRAPHY STUDENTS

INSTITUTIONS	GENDER		AGE		
	% Male	% Female	% 18-20	% 21-25	% 26-older
NMMU	8	92	20	64	16
DUT	38	63	38	50	13
TUT	21	79	4	92	4
CUT	43	57	0	93	7
UJ	21	79	7	36	7
UP	9	91	18	73	9
CPUT	31	69	15	65	10
TOTAL	**26**	**74**	**13**	**76**	**11**

4.3.3 General Aspects of Work-integrated Learning (Q 4 – 6)

Table 4.6 indicates in which year of study the participating students started with the WPL component of WIL at their respective institutions. The results confirmed that the bulk of the students commenced with WPL in their first year of study (96%). A small percentage indicated that they started in their second study year (1%) and 3% indicated that they started WPL only in their third study year. Surprisingly, one student indicated the category 'none of the above', but as this question did not contain an open-ended part, the reason for this response could not be determined.

TABLE 4.6: YEAR OF STUDY WHEN WORKPLACE LEARNING COMMENCED

Inst n=	NMMU 25		DUT 16		TUT 24		CUT 30		UJ 14		UP 11		CPUT 26		TOTAL n=146
Q4	Number of responses	% Response from inst	Number of responses	% Response from inst	Number of responses	% Response from inst	Number of responses	% Response from inst	Number of responses	% Response from inst	Number of responses	% Response from inst	Number of responses	% Response from inst	% Response TOTAL
1st year	**24**	**96**	**16**	**100**	**24**	**100**	**28**	**93**	**12**	**86**	**11**	**100**	**25**	**96**	**95.9**
2nd year	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**4**	**0.7**
3rd year	0	0	0	0	0	0	**2**	**7**	**2**	**14**	0	0	0	0	**2.7**
None of above	**1**	**4**	0	0	0	0	0	0	0	0	0	0	0	0	**0.7**

4.3.3.1 *Frequency of placement for work-integrated learning* (Q 5)

The frequency of placement for WPL as part of WIL seemed to differ across institutions. However, the bulk of the institutions, namely TUT, UJ, UP and CPUT (all 100%) and DUT (88%), implemented a rotational system of two class weeks followed by two weeks WPL in clinical practice (Figure 4.11). At NMMU, WPL was scheduled on a quarterly rotational system (95%) (one full quarter of class attendance followed by one full quarter of WPL) while at CUT students were scheduled for class and WPL on a weekly rotation system (one week class, one week WPL). At DUT, two students indicated that they were placed for WPL only each alternative quarter. This might be explained by the comments in the open-ended section of this question where one student replied that s/he was scheduled to assist qualified radiographers in clinical practice during after-hour shifts while another student indicated that s/he was at 'varsity' for four weeks three times a year and for the rest of the year she was receiving training at a hospital.

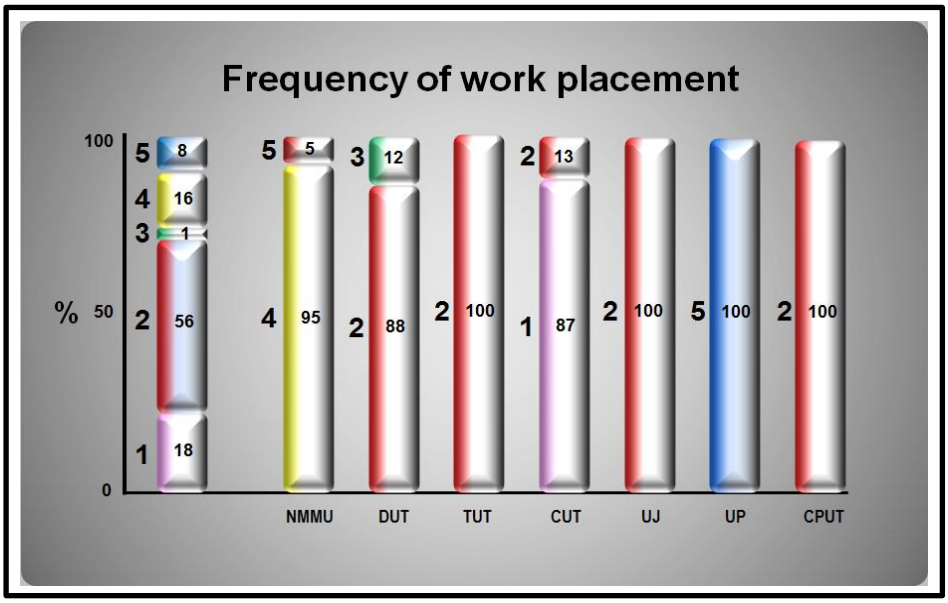


FIGURE 4.11: FREQUENCY OF PLACEMENT FOR WORKPLACE LEARNING

The overall popularity of rotational systems at the participating institutions can thus be summarised as follows: each alternative week (18%), each alternative fortnight (56%), each alternative quarter (1%), and each alternative semester (16%). The remaining 8% was indicated as 'none of the above' which might be assigned to students who did not understand the question correctly or who were doing additional WPL sessions for reasons the researcher was unable to determine.

4.3.3.2 *Student perceptions of the effect of workplace learning on academic performance* (Q 6)

The data presented in Figure 4.12 reveal that students seemed to have different opinions on whether WPL was having an effect on their academic performance. The results for question 6 show that 54% of students felt that the WPL they had to do was having an effect on their academic performance. Forty two per cent (42%) of the students felt that WPL was only sometimes affecting their academic performance and only 4% felt that WPL was not affecting academic performance at all.

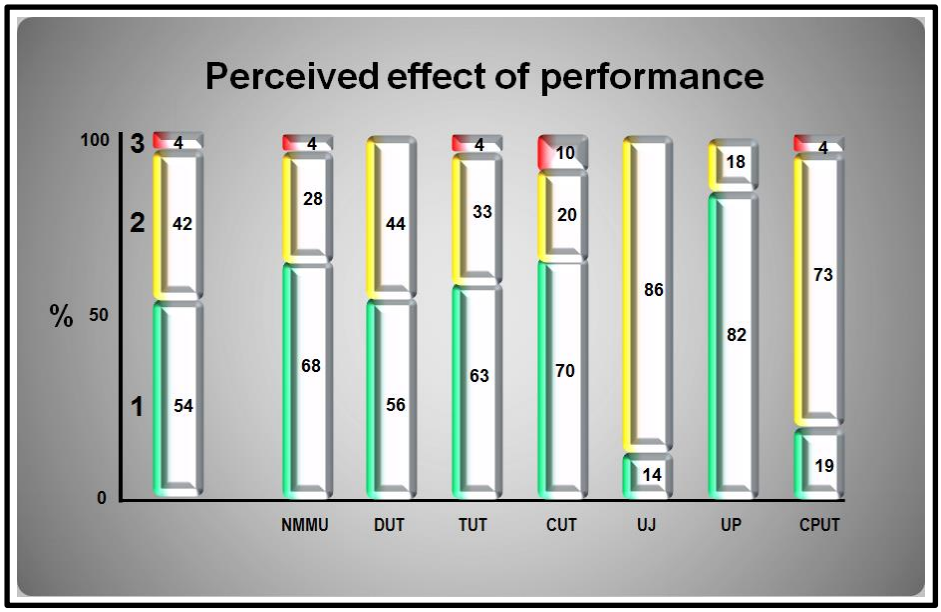


FIGURE 4.12: PERCEIVED EFFECT OF WORKPLACE LEARNING ON ACADEMIC PERFORMANCE

A wealth of qualitative comments was received on this aspect from the participating students. The comments were sorted into categories to streamline the reporting on this aspect of the student results (cf. Appendices G2 & G3). The analysis revealed that some of the categories emerging from the open-ended comments had either a negative or positive effect on the academic performance of students. On the positive side, one student indicated that WPL was complementing his/her academic performance because at his/her training institution "learning in the workplace and theoretical learning are complementing each other and [this] makes the understanding of both better". Other positive comments from students were that WPL and the assessment strategies at the university were well-aligned; that WPL was complementary to the understanding of case studies; and that "more practice makes perfect".

A predominant aspect related to WPL which was indicated to have a negative effect on academic performance seemed to be a struggle to balance the demands of academic learning with those of WPL. Linking with this seemed to be the incapability of some students to manage their time properly. In addition to this, having to prepare for assessments scheduled for forthcoming class weeks while working in clinical practice seemed to be daunting. Other aspects indicated as negatively contributing to academic performance were indicated by some students as "…frequency of placement" and the fact that theory and practice did not always correlate with each other. Group work also seemed to be a challenge during periods of work placement because students from the same year group were placed at different clinical sites for WPL.

Discussion

The frequency of placement for WPL in Radiography training should be the prerogative of each training institution. Placement frequency can be influenced by many factors; for example, human resources capacity (lecturers at the university and WPL mentors/supervisors in clinical practice) and the availability of placement positions in clinical practice. Whatever the case, the important consideration should be that the frequency of WPL is aligned with the set outcomes in order for students to be able to achieve what is expected of them for a specific year group or level of study (cf. 2.6.1.3, 2.7.1, 2.8.1).

Understandably, the perceived influence of WPL on academic performance will differ from student to student (cf. 2.2.1.3). As discussed in 4.3.3.2, for some students the influence of WPL on their academic performance will be positive and for some it will be negative. To further complicate this phenomenon, students differ vastly in the way they learn and in their ability to manage their own time and resources, all of which might have an influence on how they perceive the success of the WPL component of WIL. It is thus important that students be properly informed at the beginning of a course about the logistical aspects of WPL (e.g. frequency of placement and assessment schedules) and the importance of achieving the set outcomes during the placement period/s in order for them to plan ahead. What should also be emphasised is the importance of constantly reviewing and monitoring student progress in the WIL components of programmes in order to identify students with challenges and to put remedial steps into action.

4.3.4 Students' Perceptions on Teaching and Learning for Work-integrated Learning

In this section of the questionnaire administered to the final year students the researcher endeavoured to enquire about the students' perceptions on the teaching, learning and assessment for WIL at their respective institutions. The questions on teaching, learning and assessment in the student questionnaire were structured to coincide with the questions on the same aspects in the questionnaire administered to the university lecturers with the aim of comparing the results from the student sample with the results from the lecturer sample. The researcher therefore used similar themes of enquiry to determine students' and lecturers' perceptions on aspects of WIL, such as the general design of WIL, aspects related to teaching and learning, and aspects related to assessment practices for WIL.

4.3.4.1 *General aspects of teaching and learning for work-integrated learning* (Q 7, 8, 9, 10 & 11)

The perceptions of the participating students on the general aspects related to WIL at their respective institutions are reported in this section (Table 4.7). In general, most of the students (81% - 100%) reported that WIL was designed as a separate module at their respective institutions. The exception was the students from UP who indicated that WIL was structured as a separate module (31%). At this latter university it seemed that WIL was perceived by the students as an integrated model (44%), which was in contrast with the 62% of lecturers who reported WIL as a separate module.

The students reported mostly in favour of clear outcomes/objectives received for WIL in their respective programmes with the highest percentage at CUT (100%) and the lowest percentage at UP (63%). The same trend was observed for the results on question 9 which enquired whether the learning activities in the programme were designed to integrate disciplinary knowledge with practical skills and competencies. Again, 100% of the students at CUT reported in favour of learning activities structured to stimulate integration, whereas only 56% of the students from UP reported in favour of learning activities to stimulate integration. In the open-ended part of this question, some students from one of the universities commented: "There is a difference between what is taught and what is done in clinical practice". A student from another university reported as follows: "Integration is dependent on practice exposure", and some students remarked that "expectations for clinical experience are not always clear".

TABLE 4.7: STUDENT RESULTS ON THE GENERAL ASPECTS OF WORK-INTEGRATED LEARNING

	n=	Q7 Separate		%	Q8 Outcomes		%	Q9 Activity design		%	Q11 Prepare		%
NMMU		Does not know	4	16	Yes	23	92	Yes	23	92	Yes	16	64
		WIL separate module	21	84	Some	2	8	Some	2	8	Some	8	32
		WIL integrated	0	0	No	0	0	No	0	0	No	1	4
	25	Pos response %	84			100			100			100	
DUT		Does not know	0	0	Yes	13	81	Yes	12	75	Yes	12	75
		WIL separate module	15	94	Some	2	13	Some	3	19	Some	3	19
		WIL integrated	1	6	No	1	6	No	1	6	No	1	6
	16	Pos response %	100			100			100			100	
TUT		Does not know	0	0	Yes	20	83	Yes	22	92	Yes	22	92
		WIL separate module	24	100	Some	3	13	Some	2	8	Some	2	8
		WIL integrated	0	0	No	1	4	No	0	0	No	0	0
	24	Pos response %	100			100			100			100	
CUT		Does not know	0	0	Yes	16	100	Yes	16	100	Yes	16	100
		WIL separate module	15	94	Some	0	0	Some	0	0	Some	0	0
		WIL integrated	1	6	No	0	0	No	0	0	No	0	0
	30	Pos response %	100			53			53			53	
UJ		Does not know	4	25	Yes	14	88	Yes	14	88	Yes	10	63
		WIL separate module	13	81	Some	0	0	Some	0	0	Some	3	19
		WIL integrated	1	6	No	0	0	No	0	0	No	1	6
	18	Pos response %	78			78			78			78	
UP		Does not know	1	6	Yes	10	63	Yes	9	56	Yes	7	44
		WIL separate module	5	31	Some	1	6	Some	1	6	Some	5	31
		WIL integrated	7	44	No	0	0	No	0	0	No	1	6
	11	Pos response %	91			100			91			118	
CPUT		Does not know	0	0	Yes	16	100	Yes	15	94	Yes	13	81
		WIL separate module	14	88	Some	0	0	Some	1	6	Some	3	19
		WIL integrated	2	13	No	0	0	No	0	0	No	0	0
	26	Pos response %	100			62			62			62	

The students seemed to have mixed opinions about whether the training they received at the university was preparing them for the challenges in the profession. At CUT 100% of the students reported in favour of this, followed by CPUT with 81%, TUT with 92%, DUT with 75%, NMMU with 64%, UJ with 63%, and UP with 44%. A wealth of open-ended comments was received from the student sample on this question. On the positive side, two students remarked that frequent exposure to practice was preparing them properly and that the qualified radiographers sometimes taught easier ways to perform certain examinations. More students however seemed to have doubts about whether the training they received would prepare them well for the challenges in the workplace. This is confirmed with comments such as: "...We are under-prepared for many examinations which are not being done in clinical practice anymore; for example additional projections (also due to new technologies e.g. CT)". Two students from the same university remarked respectively that the "…frequency of placement for specific skills areas should be more" and "we are not well enough prepared in certain areas, e.g. pattern recognition, contrast media, and interventional work". Another student commented that not all relevant topics which were needed for practice were covered in class. Other comments from the student sample included: "…too little time to master everything that is expected to know for clinical practice, e.g. some views are not often practised"; "...we receive no exposure to darkroom development of films due to new technology"; "...the difference in imaging protocols between the university and from one practice to another is very confusing"; and "…we are not being taught to handle tough situations".

Discussion

The general design for teaching and learning in the WIL environment seems to differ from one institution to another. However, a high percentage of students indicated that WIL was designed as a separate module at their respective institutions. As mentioned in 4.3.2.1, the structuring of WIL as a separate module or as part of another module cannot be prescribed unless careful consideration is given to the amount of credits assigned to the WIL component in that module. A little worrisome is the fact that some students did not seem to realise that WIL was being presented as a separate module; the students of only one institution all agreed that WIL was presented as a separate module.

The existence of clear learning outcomes for WIL as a moderation tool across institutions is highly desirable because clear and attainable learning outcomes are an essential element that focuses learning on the attainment of essential outcomes (cf. 2.6.1).

Moreover, the absence of such clear learning outcomes may pose a challenge in the delivery of a good WIL programme. The trend that was observed in the students' responses to the question whether the learning activities were designed to integrate knowledge and skills implied a contradiction. Students from the majority of institutions reported limited or no integration, whereas students from only one institution gave less than average positive feedback (44%) about this requirement. Maybe some students struggled to understand what integration actually entails. This aspect should thus be given attention because integration is crucial for students to be successful in the WIL part of any learning program (cf. 2.3.1.1).

Students' mixed opinions about whether their training was preparing them properly for the world of work may have many reasons. One reason may be the fast manner in which technology evolves in the profession. The fact that many Radiology practices have changed from analogue to digital departments may explain the comments from students about not getting exposed to wet film development anymore. Equally influential may be the availability of more specialised imaging modalities such as CT and MRI which have replaced many routine imaging examinations as first in the line for diagnosis. Fast-changing technology can in some instances also be blamed for the differences in imaging protocols from practice to practice, because the protocol for imaging certain pathology is dependent on the type of imaging modalities available at the specific practice. Additionally, many government hospitals do not have trauma departments where serious trauma cases are managed, which may have prompted the comment by one student that they "are not trained to handle tough situations".

4.3.4.2 ***Suggestions for change in work-integrated learning practices*** (Q10)

Question 10 in the student questionnaire was open-ended in order to probe for suggestions by students regarding changes to WIL practices at their institutions to improve the transferral of knowledge and skills from the university to the workplace, and *vice versa*. The wealth of comments received was summarised and grouped into categories. To simplify the reporting on the results of this question, the comments were grouped under the categories *teaching- and learning-related changes*, *assessment-related changes*, and *WIL management- and coordination-related changes* (cf. Appendices G2 & G3).

Suggested teaching- and learning-related changes

Students in general seemed to find the alignment of the theory taught at university with what is expected from them when placed for WPL in clinical practice a challenge. This is confirmed by comments such as: "The lecturer should ensure that theoretical content and examination protocols in clinical practice are the same"; "…[there is a] need [for] a balance between academic and clinical sessions", "Improve the alignment of theory delivery and clinical exposure"; and "…more class time at the university prior to placement in clinical practice". Suggestions for improvement regarding aspects related to the teaching and learning for WIL included more emphasis on computer literacy in the first year and revisiting of the relevance of the content of some of the modules in the course (e.g. Anatomy and Physics). Suggestions towards improvement concerning the teaching and learning of more practical aspects of WIL included requests for more skills laboratory sessions at the university, more positioning and exposure charts for guidance in clinical practice, and more lectures and practical demonstrations in clinical practice.

Discussion

The delivery of theoretical content to coincide directly with what the student will be exposed to when working in clinical practice in a profession such as Radiography is indeed a daunting task. This mal-alignment experienced by some of the students is complicated by the fact that students in the same year group (i.e. level of study) are doing their WPL component of WIL at different clinical institutions (some government and some private practice). Unfortunately, the type of imaging examinations requested at the different clinical institutions cannot be prescribed or regulated by the university. Also, some of the routine examinations taught to students at university are often not being done in clinical practice anymore because of advancements in imaging technologies such as computer tomography, ultrasound, and magnetic resonance imaging.

In an effort to decrease the confusion on the students' side, lecturers should ensure that the outcomes, or what is expected of students to achieve during each placement period, are explicitly stipulated prior to commencement of a placement period (cf. 2.6.1). However, students should know that they should not avoid exposure to any examinations not yet in their syllabus for the level of study – surely any learning is worthwhile - but that they should concentrate more on attaining the set outcomes for the examinations which have already been covered at university.

The request for more emphasis on computer literacy in the first study year can be explained by the fact that Radiography is a technologically driven profession and that computer technology is part of the state-of-the-art imaging machines used in the profession. Moreover, students are increasingly required to compile assignments and to search for information on the internet.

The importance of integration between what is learnt at the university and what is learnt in the workplace was explicitly stated in Chapter 2 (cf. 2.2.1.1, 2.2.1.3, 2.3.1, 2.3.1.1, 2.5.1, 2.6.1, 2.6.1.3, 2.7.1, 2.7.1.5, 2.8.1.1 & 2.8.1.3). Because the integration of knowledge across theoretical modules and integration between the university and clinical practice is a difficult concept for many students, it is not surprising that some students suggested that the relevance of the content of some modules should be revisited. Surely this is a comment that should not be lightly regarded; lecturers should constantly ask themselves whether the content of modules in a syllabus is indeed relevant to the specific level of study and to what is expected of the student to achieve in the specific study year. The request for the delivery of more lectures and demonstrations in clinical practices can also be attributed to the fact that students in general struggle to integrate theory with practice. This is further emphasised by the request for more demonstrations in clinical practice and more skills laboratory sessions at the university.

Suggested assessment-related changes

Suggestions for the improvement of assessment practices for WIL mainly included the scheduling of assessment, the consistency in assessors for assessment in clinical practice, and "….more structured feedback on performance when doing a clinical examination".

Discussion

Because students are hugely concerned with the outcome of assessment activities, practices related to fair assessment will always be of consideration to them. Therefore it is imperative that lecturers, as far as possible, adhere to the principles for good assessment when assessing the different aspects of WIL in their respective programmes (cf. 2.7.1.2). Although it is no easy task to schedule assessments in clinical practice due to many impacting factors such as the availability of patients for specific examinations, lecturers should try to keep to a pre-arranged assessment schedule, at least for the part of WIL which will be assessed at the university.

Consistency of assessors in clinical practice is another challenging aspect in clinical assessment due to human resources restrictions, the high work load of clinical mentors/supervisors, and a limited number of willing and trained WIL coordinators to perform these assessments. It is nevertheless advisable that dedicated WPL mentors/supervisors be appointed to perform the scheduled formative assessment activities and that the university lecturer responsible for the WIL component in the specific year perform the summative assessment activities. This will decrease the anxiety on the students' side regarding differences in expectations from one assessor to the next.

In the WIL environment, formative feedback on assessment as part of the learning process cannot be over emphasised (2.7.1.5). The request for "more structured feedback" from some students is thus quite valid with regard to the improvement of assessment strategies for WIL. Lecturers should keep in mind that structured feedback has more value the sooner it occurs after the assessment activity. It is thus suggested that students get structured feedback on their performance directly after assessment activities for WPL especially, and that assessors doing these assessments be informed about the important role of formative feedback in the assessment process.

Suggested management- and coordination-related changes

An area where there seemed to be a huge lack in the training of students in WIL, and specifically in the WPL environment in Radiography training, was confirmed by the request for a "dedicated clinical mentor in practice for guidance and tutorial sessions". Additionally, some students suggested that these mentors be constantly informed about changes in the syllabus which might occur at the training institution. To ascertain this, students suggested that "a good communication system be established between the university and the mentors in clinical practice".

There was also a common request by students from the different training institutions for "a bigger presence of university lecturers in clinical practice".

A variety of opinions emerged from the student population regarding the frequency and sequence of placement for WPL. This can be explained by the fact that training institutions decide individually about the frequency and sequence of the placement of students for WPL, resulting in different frequencies and sequences of placement from one institution to the next.

Other comments from the student participants in relation to the management and coordination of WIL included that all students be exposed to government and private practice, that there should be more exposure to specialised imaging modalities, and that students should not be misused (i.e. as cheap labour) due to staff shortages in clinical practice.

Discussion

The supervision of students during WPL is critically important to the success of learning in many practice-orientated professions (cf. 2.8.1.1). This supervisory role should be undertaken by both the academic supervisors/mentors (i.e. university lecturers) and the clinical supervisors/mentors. A system of good communication between these role players is of essence to ensure good management and coordination of the learning that is intended to take place during periods of WPL (Martin & Hughes 2009:20). It is important that academic supervisors show a constant presence in clinical practice to allow students to feel confident that there is a well-established link between what they learn at the university and what they learn in the workplace. Many studies report that students confirmed that the presence of these role players during periods of WPL had a huge effect on how they perceived these experiences and how successfully they had completed their periods of placement (cf. 2.8.1.1). Sadly, this supervision is in many cases jeopardised by the fact that many WPL mentors/supervisors are poorly prepared for their role in the supervision of students during WPL (cf. 2.8.1.2). The training of these WPL mentors/supervisors is thus crucially important to the success of the intended learning which should take place during periods of work placement.

As derived from Figure 4.9, a variety of frequencies for placement in clinical practice of Radiology students exists among the various universities. Student complaints regarding the frequency and sequence of WPL are thus not at all easy to address. This is because not one institution follows the exact same frequency and sequence for WPL as the next. Although the frequency of being placed every fortnight for WPL was rated highest amongst the participating students (56%), some students clearly indicated in the open-ended comments section that this frequency of placement did not satisfy them at all (cf. 4.3.3.1). In the literature that I perused not one specific frequency and sequence for the placement of students was outlined. This might be because the frequency and sequence of placement is influenced by factors such as the availability of placement positions and the availability of human resources, together with other related factors. It thus remains

the prerogative of the training institution to decide on the frequency and sequence of work placement - as long as the quality of learning during these experiences is not compromised in any way.

The request by some students that all students be exposed to both government and private practice is not always possible. This is because students who are being placed in private practice usually are employed at and remunerated by a specific practice as student radiographers and they are thus not allowed to do WPL at another institution. Additionally, the accredited number of placements allowed per training facility is prescribed by the maximum number of students allowed to be placed at any facility. The request for more exposure to specialised imaging modalities is also dependent on the availability of placement positions. Depending on the number of students who need to rotate at these places, it might happen that each student will have only one or two chances to be placed in these areas.

The comment that students not be misused as "cheap labour" in cases of staff shortages is not at all misplaced and should not be ignored. Although students should be stimulated to learn as much as possible while working in clinical practice, programme administrators and the WIL coordinators at the university should ensure that the intended outcomes for each placement period are clearly outlined in terms of what is expected of students to achieve during the specific placement period (cf. 2.6.1, 2.6.2.2). Therefore, students should not be taken out of specific placement areas to fill a gap in another area because of staff shortages or the absence of permanent staff without liaison with the university coordinator to approve this action.

4.3.4.3 ***Comparison of teaching and learning activities for WIL*** (Q 12)

Question 12 in the questionnaire to the final year students was formulated to coincide with the same question in the lecturer questionnaire with the aim of correlating the utilisation of learning activities for the different curricular modalities/learning modes for WIL as perceived by the students with the results from the university lecturers.

Work-directed theoretical learning

Figure 4.13 shows the use of the learning activities for WDTL as reported by the participating students compared to the results on a similar question posed to the university lecturers.

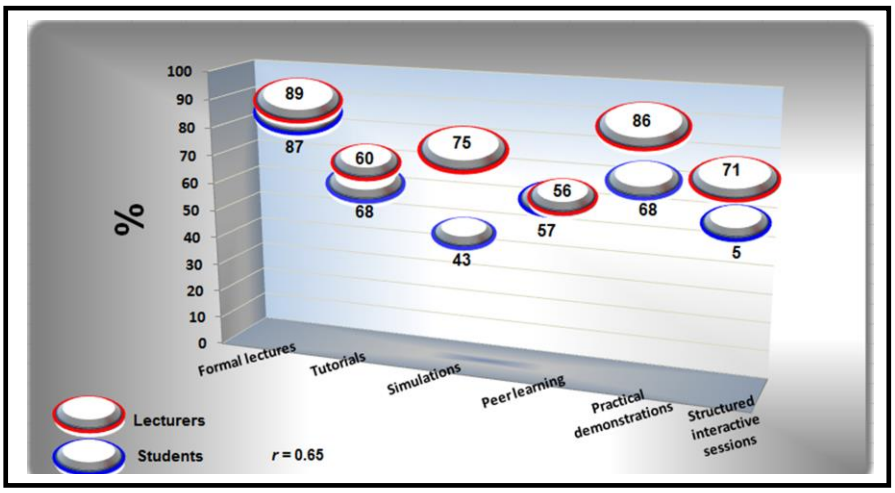


FIGURE 4.13: COMPARISON OF TEACHING AND LEARNING ACTIVITIES USED FOR WORK-DIRECTED THEORETICAL LEARNING

Similar to the results from the participating lecturers (87%), the majority of final year students (89%) indicated formal lectures as the most popular learning activity in this curricular modality/learning mode. Formal lectures are followed in popularity of utilisation by tutorials and practical demonstrations, both rated at 68% by the students. Peer learning and structured interactive sessions were indicated as being moderately preferred (57% and 56% respectively), with the least popular learning activity indicated by the students as simulations (43%). The biggest differences between the results from the university lecturers and the final year students were reported for the use of simulations (lecturers 75% and students 43%) and structured interactive sessions (lecturers 71% and students 56%). The correlation between the lecturers' and the students' responses with regard to the use of the different learning activities for WDTL is *r=0.65*.

Discussion

The discrepancy between the perceived use of simulations and interactive discussions between the lecturers and the participating students should be regarded as a matter of concern. It is possible that the students misunderstood the concepts *simulation of learning* and the role of *interactive discussion* in the classroom. Simulation and interactive discussion are ideal for the stimulation of learning to arouse the constructed meaning of what is happening in the real world of work (cf. 2.6). According to Biggs (2003:16), the successful application of teaching and learning activities in WIL programmes is at the heart of successful implementation of such programmes (cf. 2.6.1).

<u>Problem-based learning</u>

Figure 4.14 shows the results when comparing the feedback from the lecturers and the participating students regarding the learning activities used for PBL at the participating training institutions.

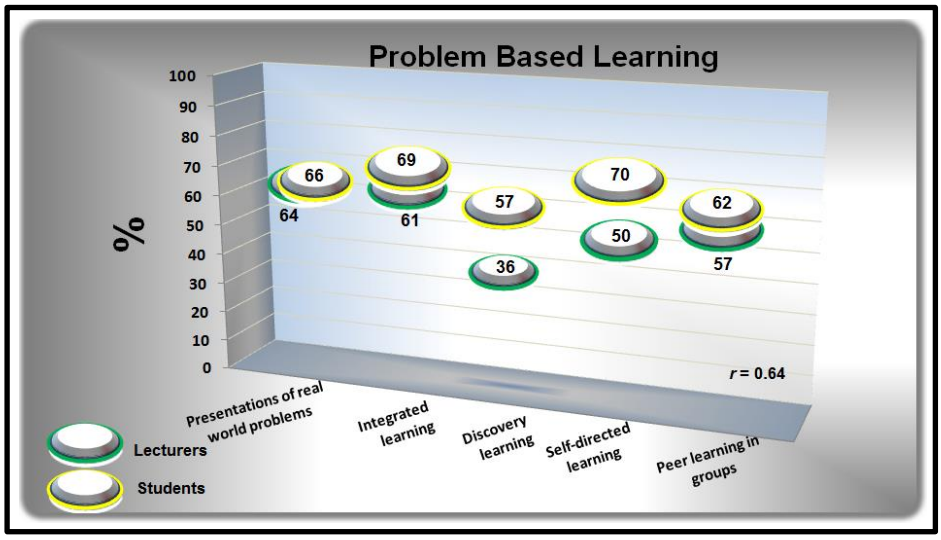


FIGURE 4.14: COMPARISON OF TEACHING AND LEARNING ACTIVITIES USED FOR PROBLEM-BASED LEARNING

According to the participating students, the learning activity for PBL mostly utilised by them is self-directed learning (70%). This is followed in descending order by integrated learning (69%), the presentation of real-world problems (66%), peer learning in groups (62%), and discovery learning (57%). The correlation between the lecturers' and the students' responses with regards to the use of the different learning activities for PBL is *r=0.64*.

Discussion

The low correlation value (*r=0.64*) was caused by the inconsistency in the reporting about the use of self-directed learning (lecturers 50% and students 70%) and discovery learning (lecturers 36% and students 57%). Clearly the bulk of the students were of the opinion that when a problem was posed to them, they were capable of directing their own learning, while the lecturers did not experience this to the same extent as the students. Also, for discovery learning in the PBL environment, the students indicated a higher use of this learning activity as was perceived by the lecturers. To stimulate deep learning, students should be encouraged to engage with the suggested activities required for PBL (cf. 2.6.1.1). The difference in opinion between the students and the lecturers might be explained by the students' results for assessment activities which have to reflect the utilisation of these activities in a positive manner.

Project-based learning

The student questionnaire explored similar learning activities to those explored in the lecturer questionnaire for the teaching of PjBL. Figure 4.13 shows the results when the students' responses were compared with those of the lecturers.

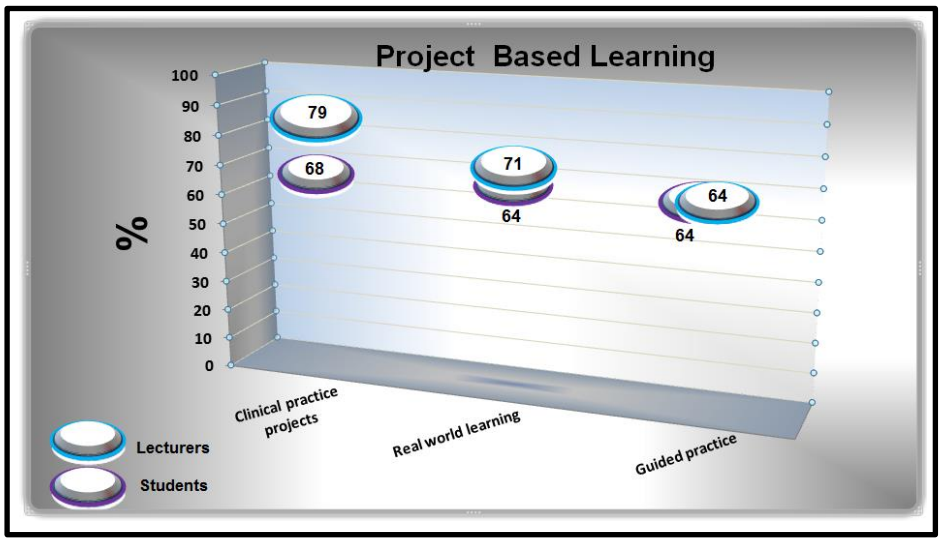


FIGURE 4.15: COMPARISON OF TEACHING AND LEARNING ACTIVITIES USED FOR PROJECT-BASED LEARNING

Real-world learning and guided practice were both indicated by the student sample as being used regularly (64%). Again, there was disagreement between the lecturers and the students about the frequency of the use of clinical practice projects for PjBL. The lecturers indicated the use of this learning activity for PjBL as 79% while the students indicated it as 68%.

Discussion

The difference in opinion between the lecturers and the students regarding the use of clinical practice projects might be attributed to the fact that there is a tendency to use clinical practice projects more for learning at the higher levels (Years 2 and 3) than at the lower levels. For PjBL students need to go through an extended process of inquiry to solve a complex question, problem or challenge. To be able to do this, a solid knowledge foundation about the concepts involved to solve a specific problem is required (cf. 2.6.1.3). It is therefore more likely that students will have this required knowledge in their second and third years of study than in their first year of study. What should however be kept in mind is that small clinical practice projects can be utilised with success also at the lower levels of learning. This will require that such projects be carefully

planned and that students are in no doubt as to what knowledge should be mastered prior to solving the problem. The advantage of using this learning activity at the lower levels of learning is that it simultaneously develops some required generic skills in the student (Howard & Jorgensen 2006:2). The slight difference in opinion about the use of real-world learning is not a matter of concern because the perception of real-world learning might differ from one individual to another. For example simulation, which is increasingly becoming a popular learning activity in the teaching of practice-oriented professions, might be seen by the lecturers as exposure to the real-world environment while the students do not consider this as real-world learning.

The consensus of lecturers and students on the use of guided practice is not surprising because, in Radiography training, it is a requirement from the professional body that students should work under the guidance of a qualified professional when engaging at any level with activities in clinical practice (cf. 2.3.1.2).

Workplace learning

Both the lecturers' and the students' questionnaires enquired about the use of work placement or work-based learning as learning activities for WPL.

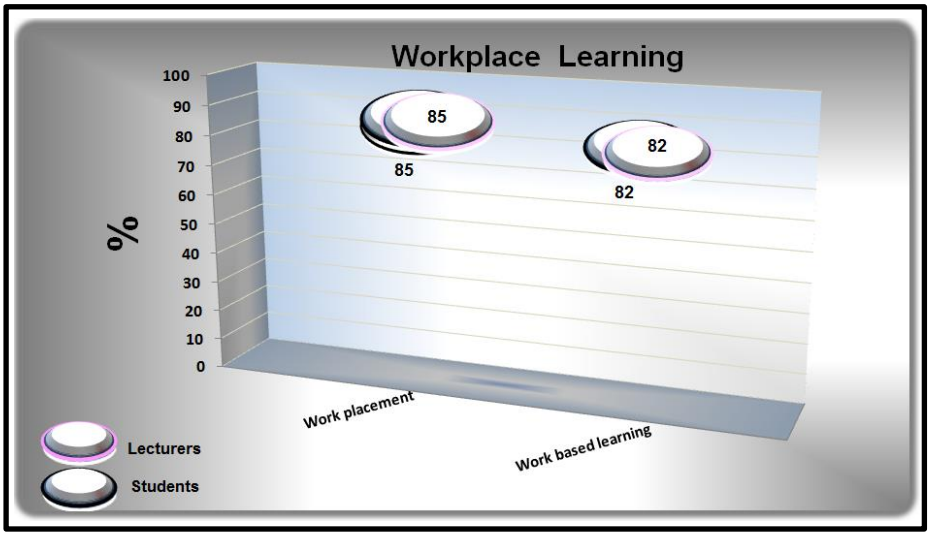


FIGURE 4.16: COMPARISON OF TEACHING AND LEARNING ACTIVITIES USED FOR WORKPLACE LEARNING

Figure 4.16 shows consensus between the lecturers and students about the use of the learning activities work placement (lecturers and students 85%) and work-based learning (lecturers and students 82%) for the learning mode WPL. Not surprisingly, these learning activities were indicated to have a high utilisation rate in the training of Radiography students (85% and 82% respectively).

Discussion

The popularity of WPL as a learning mode in Radiography training as indicated by the student sample correlates with the results about the use of the different curricular modalities as depicted in Figure 4.2. As discussed in 4.2.4.1, WPL is prescribed by the governing bodies of many professions with specific requirements regarding the number of credits assigned to this learning mode or the amount of hours spent in the workplace (cf. 2.3.1.2, 2.6.1.3). What should however be emphasised is that WPL should not only be about the placement of students in the workplace for certain periods of time. As is clearly stated by Groenewald (2009:76; cf. 2.6.1.3), WPL should be effectively managed and coordinated with properly structured learning outcomes, learning activities and assessment activities. Curriculum developers should thus give special attention to the integration of WPL as part of the curriculum for a qualification to prevent that it is being offered, as was the case in many learning programmes in the past, as an add-on to students' learning experience (cf. 2.2.1.5, 2.5, 2.6.1.3).

4.3.4.4 *Comparison of actions to stimulate active/deep learning* (Q 13)

Question 13 in the students' questionnaire enquired about their perspectives on the use lecturers' actions to stimulate deep learning.

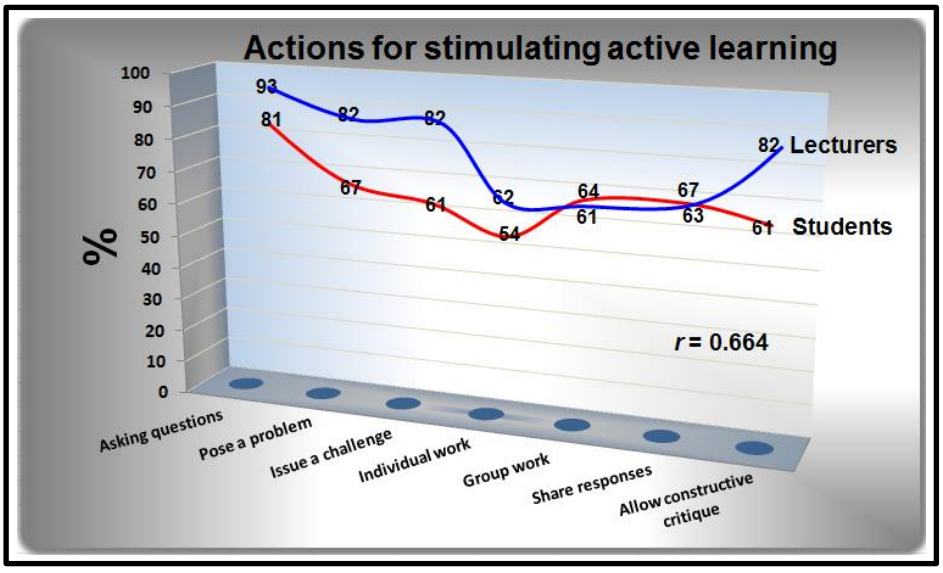


FIGURE 4.17: COMPARISON OF ACTIONS TO STIMULATE ACTIVE/DEEP LEARNING

Figure 4.17 shows that the lecturers and students were close in agreement on only three actions to stimulate deep learning in the WIL environment. These are individual work (lecturers 62% and students 54%), group work (lecturers 61% and students 64%), and sharing responses (lecturers 63% and students 67%). For the other actions to stimulate

active learning there was a difference in opinion between the lecturers and students varying from a 12% (asking questions – lecturers 93% and students 81%) to a 21% difference (issuing a challenge and allowing constructive critique – lecturers 82% and students 61%). The difference between the lecturers and the students regarding the posing of a problem to stimulate deep learning was 15% (lecturers 82% and students 67%). The correlation between the results from the lecturers and the results from the students on the use of actions to stimulate deep learning is thus *r= 0.664.*

Discussion

Clearly, the lecturers and students who participated in the survey differed in opinion regarding the use of some of the actions to stimulate deep learning. Maybe the students were just not aware of the objective of these activities as intended by the lecturers and consequently did not perceive some of the activities as an effort on the side of the lecturers to help them to revert to deep learning instead of superficial learning. It is important to note that WIL is an educational pedagogy which is ideally suited to applying actions to stimulate deep learning (cf. 2.6.1.1). Also noteworthy is that many extrinsic factors might influence the use of the actions selected by the lecturer to stimulate learning in the students. These include aspects such as the size of the class, the level of learning, the availability of physical and electronic resources, and the availability of human resources.

4.3.4.5 *Comparison of electronic teaching media used for work-integrated learning* (Q 14)

An area where a big discrepancy existed when comparing the responses from the lecturers and the students is the use of the different types of electronic teaching media (Figure 4.18). According to the participating lecturers, PowerPoint was the medium mostly used when teaching WIL (100%), followed by video (74%), the internet and Blackboard (67%), and Skype (56%). The correlation between the responses from the students when compared to those of the lecturers only coincided for the use of PowerPoint at 94% (students) and 100% (lecturers). The students indicated the use of video in teaching for WIL as 45% followed by the internet (46%), Blackboard (52%) and Skype only as 34%. The correlation between the results from the lecturers and the students was calculated as $r = 0.664$.

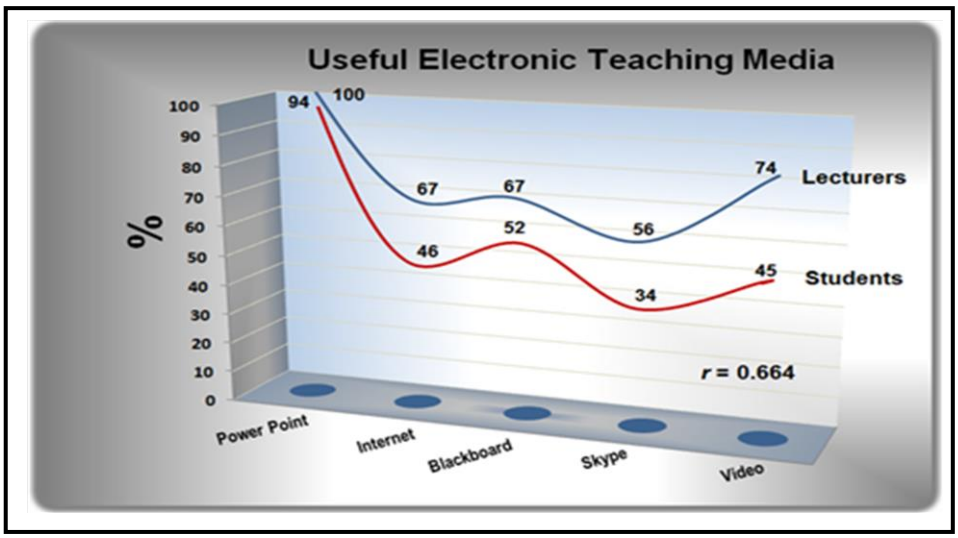


FIGURE 4.18: COMPARISON OF ELECTRONIC TEACHING MEDIA USED FOR WORK-INTEGRATED LEARNING

Discussion

The use of electronic teaching media in the digital era where we are educating students is promoted by many authors. As stated by Oxnevad (cf. 2.6.1.2), electronic teaching media create an ideal environment to stimulate the construction of knowledge in the student. Such media also assist the student to convert more easily to deep learning. In the WIL environment, electronic teaching media are excellent teaching tools to stimulate the integration of disciplinary knowledge with the application thereof in clinical practice. In the WIL environment, electronic teaching media can be used successfully at the university to facilitate learning modes such as demonstrations and simulations to prepare students properly prior to placement in clinical practice.

4.3.5 Students' Perceptions on Assessment for Work-integrated Learning

This section of the student questionnaire was aimed at enquiring about the students' perception of the assessment practices for WIL in their programmes with the aim of correlating the results with those from the university lecturers.

4.3.5.1 *General aspects of assessment of work-integrated learning*

(Q15, 16, 18, 19, 20 & 21)

Figure 4.19 presents the results on the general aspects of the assessment practices for WIL for the entire student sample, not per university. In general, the students felt that

the learning activities for WIL prepared them well enough for assessment because 86% reported in favour of this statement and only 12% said "No" (Q15).

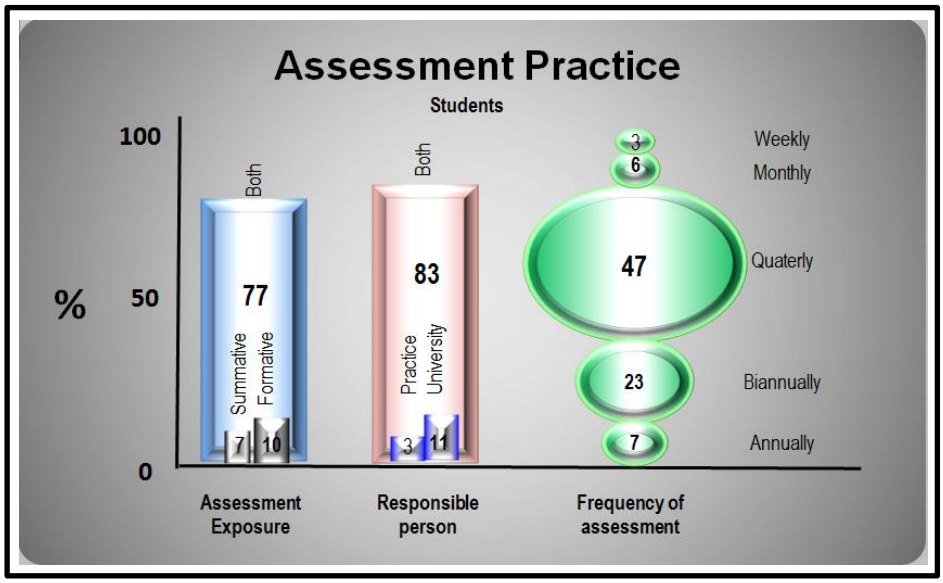


FIGURE 4.19: STUDENT PERCEPTIONS ON THE GENERAL ASPECTS OF ASSESSMENT FOR WORK-INTEGRATED LEARNING

Seventy seven per cent (77%) of the students reported that they were exposed to both formative and summative assessment in the WPL component of their programmes and 83% reported that they were assessed by both the university lecturers and clinical supervisors (Figure 4.19). Only 11% indicated that they were assessed for WIL only by the university lecturers and 3% said that they were assessed only by their clinical supervisors. Most of the students were being assessed for WPL on a quarterly basis (47%) while 3% reported weekly assessment and 6% reported monthly assessment for WPL. Twenty three per cent (23%) said that they were assessed for WPL only biannually and a small percentage (7%) said that they were only annually assessed for WPL. In the open-ended comments for question fifteen a student remarked that there was not always alignment between the university syllabus and what was done in clinical practice. Another student commented as follows: "There are too many placements for areas such as theatre and mobile units instead of areas to prepare us for assessment (e.g. general screening)". Two students from different universities indicated respectively that clinical expectations were sometimes not well explained and that clinical tutors were sometimes not well informed regarding expectations for WPL. Another comment was that although they received tutorials before assessment, not enough time was given between tutorials and assessment. Another student remarked: "Not enough guidance is given about the life skills needed for clinical practice".

Discussion

Again, the varied opinions of students on the general aspects of assessment make one wonder if students are always well informed about the practices followed in the learning programme; for example, it is highly unlikely that the students were assessed only once per year for WPL. Maybe these respondents referred to only a summative practical assessment at the end of an academic year and did not consider other smaller assessments during the year, which might be done either at the university or in clinical practice. The person doing the assessment for WPL could be either the university lecturer/WIL coordinators or the designated WPL mentors/supervisors in clinical practice. However, it is important that the clinical mentors are being trained properly to perform such assessments (cf. 2.8.1.2). The frequency of assessment for WPL is also important. Ideally, an assessment activity should be done after each learning unit or after a cluster of learning units across some modules. This practice emphasises the importance of alignment between the different modules in the syllabus (cf. 2.8.1.3). Noteworthy is that some students indicated that the expectations for WPL had not been well explained, a comment which again places the focus on a well-structured WIL component for each year of study with clear learning outcomes for each unit of learning. Important to consider in the assessment for WIL is to also assess for the attainment of generic skills (or life skills); therefore clinical mentors should also be informed regarding the importance of this aspect of assessment.

4.3.5.2 *Comparison of assessment methods used for work-integrated learning*

Table 4.8 presents a comparison of the results from the participating lecturers with those of the participating students regarding the assessment methods used for WIL at the training institutions.

TABLE 4.8: COMPARISON BETWEEN THE VIEWS OF LECTURERS AND STUDENTS ON ASSESSMENT METHODS USED FOR WIL

Assessment methods		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		Writing reports	Compiling video diaries	Producing a glossary of terms	Writing an academic essay	Writing a test	Making journal entries	Creating a blog	Presenting a case study	Write an article review/summary	Performing a practical assessment	Doing an OSCA*	Analysing a problem scenario	Taking part in demonstrations	Taking part in role-play	Presenting posters	Reporting on an observation in clinical practice	Portfolios	Presentations	Keeping of a journal	Annotated bibliographies	Writing of research proposals & reports
Students	""	5	8	9	9	4	9	10	7	7	6	4	8	9	11	9	8	6	5	9	11	9
	1	32	4	13	20	82	16	1	40	24	75	72	32	31	11	21	29	44	53	13	9	19
	2	49	7	39	36	8	26	9	45	39	15	16	51	49	30	39	47	22	35	18	20	35
	3	12	78	36	32	3	47	78	6	28	1	5	7	9	46	29	13	25	4	57	58	34
Response	*%*	93	89	89	88	93	89	87	91	91	91	93	89	88	87	89	89	91	93	88	87	89
n =	***150***																					
Usage %	*1x2x0.5*	**56**	**8**	**33**	**38**	**86**	**29**	**5**	**62**	**43**	**82**	**80**	**57**	**55**	**26**	**41**	**53**	**55**	**71**	**22**	**19**	**37**
Lecturers	""	29	29	21	29	14	21	29	7	29	0	0	29	14	21	21	14	14	21	21	36	21
	1	43	0	7	36	64	29	0	71	7	100	100	57	79	57	36	43	79	57	21	0	21
	2	21	0	7	14	0	21	7	21	29	0	0	14	7	14	7	29	7	14	29	7	14
	3	7	71	64	21	21	29	64	0	36	0	0	0	0	7	36	14	0	7	29	57	43
Response	*%*	71	71	79	71	86	79	71	93	71	100	100	71	86	79	79	86	86	79	79	64	79
n =	***14***																					
Usage %	*1x2x0.5*	**54**	**0**	**11**	**43**	**64**	**39**	**4**	**82**	**21**	**100**	**100**	**64**	**82**	**64**	**39**	**57**	**82**	**64**	**36**	**4**	**29**
	r =	**0.832**																				

The assessment methods mostly utilised for WIL, according to the participating students, were writing a test (86%), performing a practical assessment (82%), doing an OSCA (80%), and doing a presentation (71%). The assessment methods which were least utilised, according to the participating students, were the compilation of video diaries (8%), creating a blog (5%), compiling annotated bibliographies (19%), and the keeping a journal (22%). Other assessment methods which were not often used were producing a glossary of terms (33%), writing an academic essay (38%), making journal entries (29%), taking part in role-play (26%), writing an article review/summary (43%), presenting a poster (41%), and writing a research proposal and reports (37%). Used on average were presenting a case study (62%), analysing a problem scenario (57%), taking part in demonstrations (55%), reporting on an observation in clinical practice (53%), and the compilation of portfolios (55%).

When compared, the correlation between the lecturers' and students' results is r=0.832. The biggest discrepancies in reporting on the assessment methods used for WIL occurred for the following assessment methods: writing a test (students 86% and lecturers 64%), presenting a case study (students 62% and lecturers 82%), taking part in demonstrations (students 55% and lecturers 82%), taking part in role-play (students 26% and lecturers 64%), and the compilation of portfolios (students 55% and lecturers 82%).

Discussion

Understandably, not all available assessment methods can be utilised in a study year. However, sometimes facilitators are not familiar with the application of all the available assessment methods. Moreover, not all the assessment methods are suitable for the assessment of all learning units. Which assessment method to use thus remains the facilitator's choice. It is important to remember, however, that the assessment method should stimulate self-centred learning in the student and the integration of knowledge and skills in the WIL environment. Also, many of the assessment methods used either on average or often, as indicated by the students, are ideally suited for the assessment of generic skills and should be considered for use in the WIL component of training programmes. A matter of concern is the differences in reporting between the participating lecturers and the students for the use of assessment methods such tests, case studies, demonstrations and portfolios, because these methods are commonly used in the WIL environment. Again, one wonders if all the information regarding expectations

and the purpose of using these assessment methods were well communicated and explained to the students.

4.3.6 Students' Perceptions on the Management and Coordination of Work-integrated learning

Section D of the students' questionnaire enquired about their perceptions on the management and coordination of WIL. Some of the results were compared to the same aspect being investigated among the WPL mentors/supervisors at various Radiology practices.

4.3.6.1 *Comparison of the frequency of visitation*

(Q22, 23, 24, 25, 26, 27 & 32)

Figure 4.20 displays a comparison between the results from the participating students and WPL mentors/supervisors regarding the frequency of visitation by any university lecturer. The correlation between the results from the two groups was weak (r=0.337). The weak correlation was caused by the varied responses from the students and the WPL mentors/supervisors about the visitation by university lecturers on a quarterly basis (students 26% and lecturers 9%), on a biannual basis (students 16% and lecturers 23%), and other frequencies of visitation (students 6% and lecturers 27%).

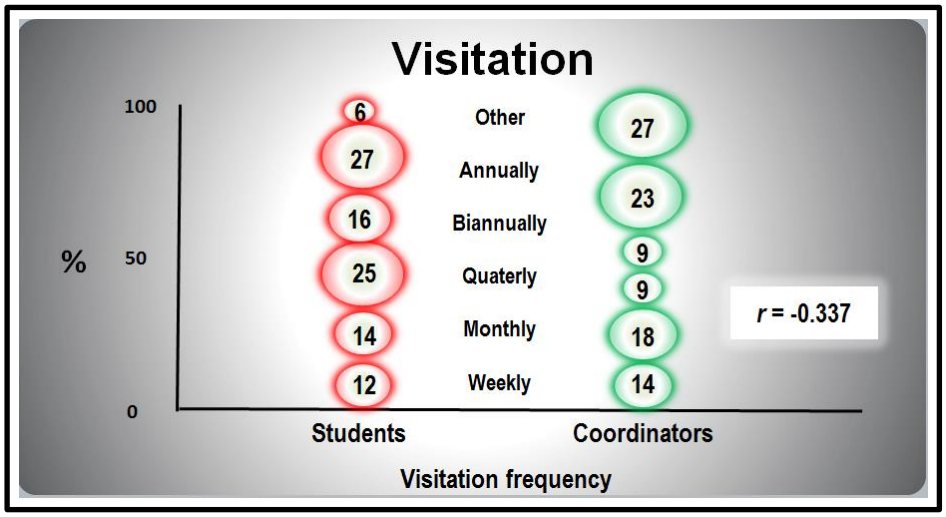


FIGURE 4.20: COMPARISON OF VISITATION FREQUENCY FOR WORKPLACE LEARNING

Discussion

Because many factors such as human resources, cost, and distances to travel can influence the frequency of visitation of students placed for periods of WPL, the visitation of students during placement periods stays one of the biggest challenges in the WPL component of WIL. It is advocated by many authors that students should be visited as frequently as possible by a lecturer from the university where the student is enrolled. The visitation of students by a university lecturer ensures that their progress is monitored and that steps for remedial action are implemented timely if challenges occur (cf. 2.8.1.1). As reported by Nduna (2012:238), it was found during an investigation at a specific university in SA that 20% of the students in a specific learning programme had never been visited during WPL and that, in some other programmes, the non-visitation frequency was even higher. To ensure quality learning during WPL, no student should have to report that s/he was never or only annually visited by a university lecturer. It is advisable that the developers of learning programmes include in their planning the visitation of students and, where possible, that they seek assistance from the WIL central office at the university if extrinsic factors such as human capacity and cost hamper the visitation of students.

4.3.6.2 Students' perceptions on the attainment of generic skills (graduate attributes) in work-integrated learning (Q28, 29, 30, 31)

Table 4.9 summarises the results for Q 28, 29, 30 and 31. Students indicated the attainment of generic skills (graduate attributes) during the WPL component of WIL as follows (Table 4.9 & Figure 4.21): professional and ethical behaviour (88%), communication (with patient, peers and managers, 91%), critical thinking/problem solving (86%), integration of theoretical knowledge and practical skills (84%), teamwork (84%), and the use of technology (85%). The standard deviation for the attainment of generic skills during the WPL component of WIL is 4,11.

TABLE 4.9: SUMMARY OF RESULTS FOR QUESTIONS 28, 29, 30 & 31

		q28.1	q28.2	q28.3	q28.4	q28.5	q28.6	q29	q30	q31
Generic skills										
	""	2	1	3	3	2	2	3	3	2
	1	82	87	77	75	73	75	94	73	73
	2	11	8	18	19	21	19	1	19	18
	3	2	1	0	1	1	1	0	2	5
Response	%	95	96	95	95	95	95	95	94	95
n =	150									
Usage %	1x2x0.5	**88**	**91**	**86**	**84**	**84**	**85**	**94**	**82**	**82**
	SD =	4,11								

Students rated the importance for a health professional to develop generic skills/graduate attributes in order to work effectively in a health profession at 94% (Q29). In the comments section for this question a student remarked that the attainment of generic skills were important because "you need skills to be able to do your work sufficiently". Another student commented: "It is important to attain generic skills since, trust me, you will be competent in the real world". Another comment was that the attainment of generic skills was important to ensure "…the ability to work professionally in the work environment and with various types of people". Eighty two per cent (82%) of the students confirmed that they were being assessed on the attainment of generic skills in the WIL component of their programmes (Q30). When asked whether the employer created sufficient opportunities to develop skills and abilities in the workplace, 82% of the students answered that they did (Q31).

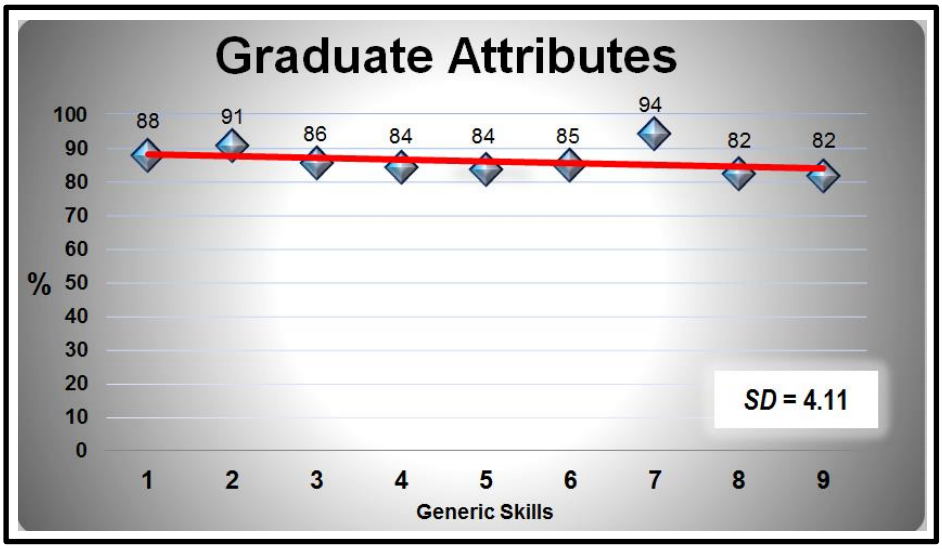


FIGURE 4.21: STUDENTS' PERCEPTIONS ON THE ATTAINMENT OF GENERIC SKILLS

Discussion

Because a key purpose of WIL is to provide graduates with a comprehensive skills set desired by potential employers (cf. 2.6.2.2), it is encouraging to note that students thought that it was important to acquire generic skills; hence they reported mostly in favour of the attainment of generic skills in the WIL component of their programmes (Figure 4.21). Also encouraging is that most students reported that they were assessed for the attainment of generic skills in the WIL component of their programmes and that they had enough opportunities in the WPL programme to develop these skills. The importance of the development and assessment of generic skills as part of the Radiology training programme is comprehensively discussed in Chapter 5 (cf. 5.3.1.1 & Table 5.1).

SECTION C: QUESTIONNAIRE ADMINISTERED TO APPOINTED WPL MENTORS/SUPERVISORS IN CLINICAL PRACTICE

4.4 ANALYSIS OF THE DATA FROM THE QUESTIONNAIRE TO THE WPL MENTORS/SUPERVISORS IN CLINICAL PRACTICE

In this section, the results from the questionnaire administered to the WPL mentors/supervisors (Appendix E3) are discussed in detail.

4.4.1 Response Rate (n=44)

The response rate for this questionnaire was 50% (Table 4.10). Similar to the questionnaire to the university lecturers, six additional e-mail reminders were sent two weeks apart from 15 July till 09 September 2013 to the WPL WPL mentors/supervisors by the administrator of the electronic survey system in collaboration with the researcher to remind and encourage them to complete and return the questionnaire. As with the university lecturers, the relatively low response rate might have been caused by variables such as a high workload in clinical practice. Additional variables which might have had an influence on the response rate from the WPL WPL mentors/supervisors are that teaching and supervision are not their main responsibility where they are employed. Furthermore, they might not have been fascinated by the development of an educational programme because education is not their primary area of interest.

TABLE 4.10: RESPONSE RATE FOR THE QUESTIONNAIRE ADMINISTERED TO THE WPL MENTORS/SUPERVISORS

INSTITUTIONS	NUMBER SENT OUT	NUMBER OF RESPONSES	% RESPONSE
CUT	6	5	24%
CPUT	5	2	9.5%
DUT	6	7	33%
NMMU	3	3	14%
UP	3	1	5%
UJ	6	2	9.5%
TUT	3	1	5%
UL	0	0	0
TOTAL	44	21	**50%**

4.4.2 Demographic Data (Biographical Information) Q 1 – 3

Ninety five per cent (95%) of the respondents were female. This is not a strange phenomenon in the Radiography profession which is traditionally a predominantly female profession. The age groups for the WPL WPL mentors/supervisors varied from 21 - 30 years of age (9%) to 51 - 60 years of age (32%). The age group that was best represented was 41 - 50 years of age (36%), with only 23% falling in the age group 31 - 40 years of age. The trend seemed to be that older, qualified professionals with more experience in clinical practice would be appointed to act as WPL mentors/supervisors for WPL (i.e. the majority fell in the age group 41 – 60 years of age) (Figure 4.22).

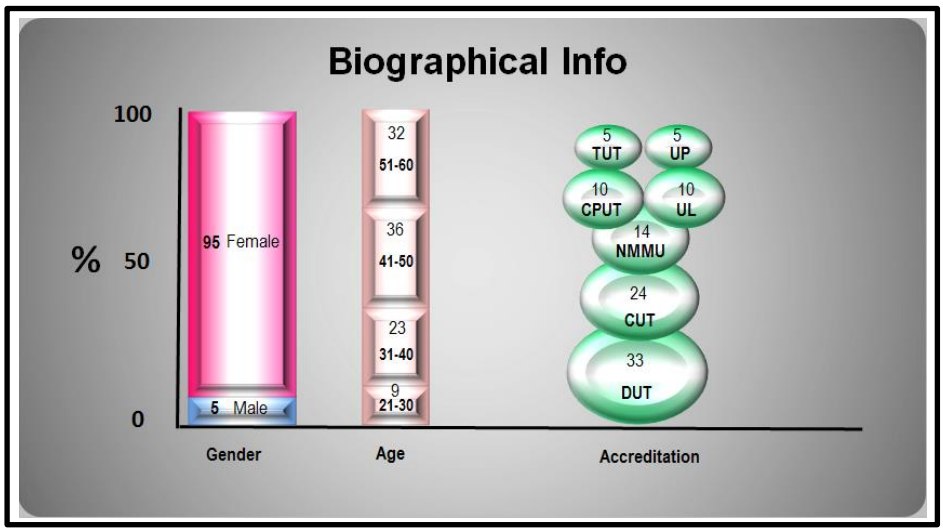


FIGURE 4.22: DEMOGRAPHIC DATA (BIOGRAPHICAL INFORMATION) OF THE WPL MENTORS/SUPERVISORS

Figure 4.22 illustrates that all the WPL WPL mentors/supervisors who participated in the survey (CUT=5, CPUT=2, NMMU=3, DUT=7, TUT=1, UP=1 and UJ=2) were employed at

a clinical training site which was accredited by the training institution for the training of Radiography students.

4.4.3 Management and Coordination of work-integrated learning

Because good management and coordination of WPL is key to the successful implementation of WIL in any learning programme, section E in the questionnaire that was administered to the WPL mentors/supervisors enquired about the general management practices of WIL at the respective training institutions.

4.4.3.1 *General management of work-integrated learning in the programme* (Q4, 5 & 6)

Figure 4.23 clearly depicts that the management and coordination of WIL in Radiography training was primarily controlled by the Radiography programme at the university (55%) in collaboration with the WPL mentor/supervisor in clinical practice (55%). Management and coordination of the WIL practices of students through the WIL central office at the participating universities was indicated as 23%, while the role that the faculty played in the management of WIL was indicated as a mere 9%. The remaining 14% ('other') was indicated in the comments section as "the human resources senior manager", "other radiographers in the department" and the "chief of the specific department where the student is placed in clinical practice".

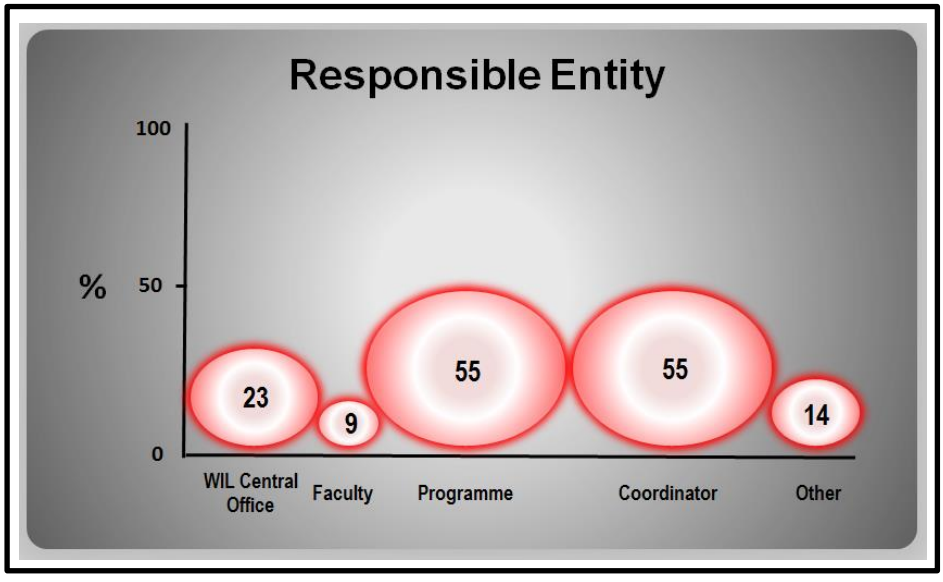


FIGURE 4.23: RESPONSIBLE ENTITY

Discussion

The responsible body or bodies for the management of WIL in a learning programme cannot be prescribed. As can be seen from the results in Figure 4.23, responsibility for managing such a programme varies widely. As indicated by Forbes (2003:3, cf. 2.8.1), the success of a WIL programme is dependent on the meaningful interaction of all the role players (students, higher education institution and industry). In other words, it is not important who the manager(s) of the WIL component of the programme is/are, as long as it is a collaborative action between the WIL central office, the programme WIL coordinator/s, the WPL mentors/supervisors in clinical practice, and the students. Certainly good communication is one of the most important aspects in ascertaining collaboration among the role players who need to communicate expectations about outcomes, assessment practices and monitoring.

To emphasise the important role of communication in the management of WIL, the lines of communication as reported by the participating WPL mentors/supervisors are illustrated in Figure 4.24.

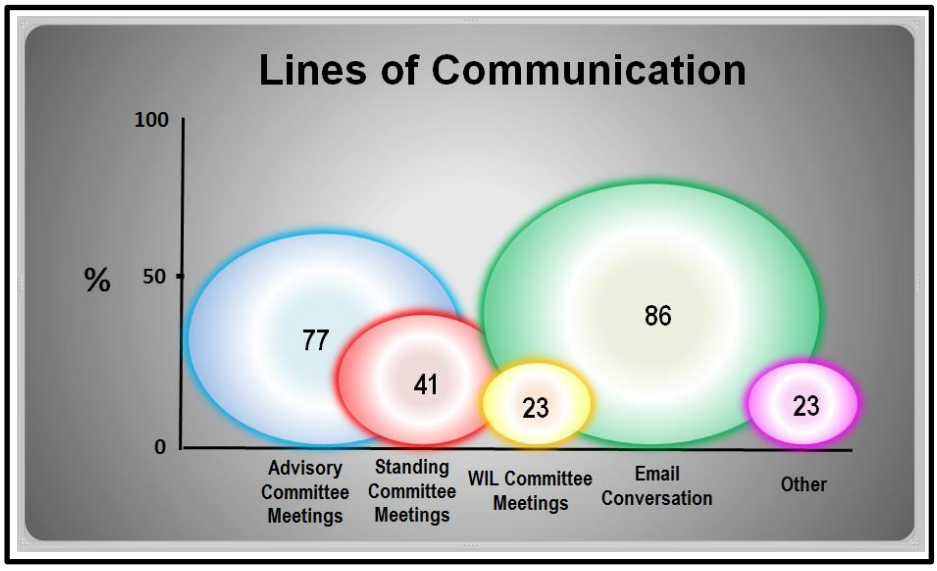


FIGURE 4.24: LINES OF COMMUNICATION

Because the successful management and coordination of WIL, and very specifically the WPL component of WIL, is heavily dependent on good communication between the involved parties, the researcher endeavoured to establish whether lines of communication existed between the university and the WPL mentors/supervisors in clinical practice at the institutions that participated in the survey. From the results (Figure 4.24) it was clear that e-mail conversation is the preferred line of communication between the coordinator/s

at the university and the WPL mentors/supervisors at the clinical training institutions (86%). Advisory committee meetings were indicated as the second most utilised avenue for communication about WIL and WPL-related matters (77%), followed by standing committee meetings (41%). Some universities indicated WIL committee meetings as the line of communication between the involved parties (23%). Another 23% indicated that other avenues were followed for communication between the different parties. In the comments section of this question, telephonic conversations seemed to top the list of 'other' ways to communicate about WIL and WPL-related matters.

The meeting frequency, as mentioned in the previous paragraph, is displayed in Table 4.11. As can be seen from the results, the frequency of the different types of meetings varied across the participating institutions. It is apparent that e-mail communication had the highest frequency (73%) and occurred quarterly. The 23% quarterly frequency of 'other' types of meetings was indicated by some of the WPL mentors/supervisors in the open-ended part of this question mainly as telephonic conversations.

TABLE 4.11: THE FREQUENCY OF MEETINGS AS LINE OF COMMUNICATION

Advisory committee meetings	Standing committee meetings	WIL committee meetings	E-mail conversation	Others	
23	0	18	0	5	**Annually**
50	23	9	9	0	**Biannually**
9	9	14	73	23	**Quarterly**
0	0	0	0	0	**More frequently**

Discussion

The avenues for communication between the different role players for WIL can also not be prescribed. Similarly, the frequency of meetings is not of much importance. What is important is that proper and timely communication occurs between the role players to ensure quality of learning in the WIL environment. The types of communication used by the different institutions will be determined to a large extent by factors such as electronic infrastructure, the number of students placed, and the number of practices accredited for training. For example, at a smaller university it might be possible to schedule more frequent meetings, but at a large university in a large city like Johannesburg, it might be difficult to travel frequently for meetings. In the latter case other lines of communication such as e-mail and telephone conversations might be preferred.

4.4.3.2 *Involvement of WPL mentors/supervisors and visitation of lecturers* (Q 7, 8 & 9)

In question seven the researcher aimed to establish whether the WPL mentors/supervisors in clinical practice were involved in the development of learning outcomes and learning material for the WIL component of Radiography training at their institutions. Only 50% indicated positively towards such involvement. Twenty seven per cent (27%) indicated 'No, not at all' and the other 23% indicted that they did have some involvement in the development of outcomes and learning material for the WIL components of the training (Figure 4.25). Most of the open-ended comments confirmed these results with comments such as "…the clinical tutors only [sic] do the practicals"; "…most of the planning is done by the university; the mentors simply implement and comment"; "…the outcomes expected and the reality is [sic] not always in balance. The outcomes may be to apply good radiographic technique, but the how to achieve this is not clearly defined"; and "…our suggestions and proposals are taken into account, but the final WIL procedures are compiled by the university". Only one WPL mentor/supervisor commented that all mentors/supervisors in clinical practice attended an annual 2/3-day workshop where the practical training for the following year would be discussed and developed in line with the prescribed syllabus.

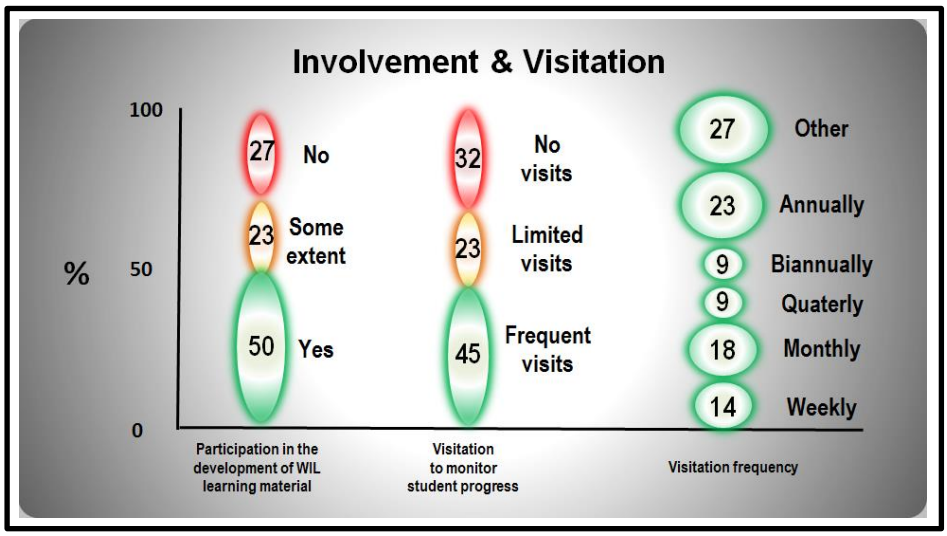


FIGURE 4.25: INVOLVEMENT AND VISITATION

As lecturer visits to students placed in clinical practice is one of the key elements of student progression monitoring, it is worrisome to note that 32% of the participating WPL mentors/supervisors indicated that they were not visited at all by the university lecturers (Figure 4.25). Only 45% of the WPL mentors/supervisors indicated frequent visits and

the remaining 23% reported only limited visits. Comments from the participating WPL mentors/supervisors supplementing the relatively low frequency of visitation included the following: "As the training centre is in East London and the university in Port Elizabeth, visits are limited to four visits per year"; "I do not think there is enough visitation by the lecturers. The lecturers leave all monitoring and supervision of the students to the department and not all lecturers are involved with the students"; "Only one of our lecturers frequently visits our students"; and "The visits take place when there are rostered clinical sessions. Other than that the visits are very infrequent". A comment by one of the WPL mentors/supervisors that raised concern was: "Normally students are only evaluated on chest X-rays and mobiles while in the department. Different staff members complete forms supplied by the university, but no detail is supplied as to how to evaluate. We go on gut feeling as no standards are given." On the positive side, one WPL mentor/supervisor mentioned the following: "In the past, visitation was a challenge due to time constraints. However, recently more clinical instructors have been employed to improve this".

In terms of the frequency of visitation, visitation only once a year (i.e. annually) by a university lecturer/WIL coordinator was rated at 23%. The frequencies of biannual and quarterly visits were both rated at 9% while monthly and weekly visits were rated at 18% and 14% respectively. In the comments section of the question the frequency of visitation in the 'other' category (rated at 27%) was varied: "three times per week"; "one visit at the beginning of the year"; "three visits in the second half of the year"; "only for assessment purposes"; and "only when students are in the department and the university lecturer/WIL coordinator is scheduled for a lecture or clinical session".

Discussion

Frequent visitation of students while doing WPL is one of the success factors for effective WPL (cf. 2.8.1.1). As mentioned in the previous section, many logistical factors can influence visitation and the frequency thereof, such as distances to travel, the number of training facilities accredited, and the number of lecturers/WIL coordinators at the university. The frequency of visitation cannot be prescribed, but frequent visitation by a university lecturer stimulates a culture of trust amongst all role players in the WIL environment. If visitation is not frequently possible, it is important to ensure that clear guidelines regarding student monitoring and assessment are available to WPL

mentors/supervisors. In this event, it is even more imperative to properly train WPL mentors/supervisors than where frequent visitation is possible.

4.4.3.3 *Training of WPL mentors/supervisors and preparation of students prior to placement for workplace learning* (Q10 & 11)

Because the training of WPL mentors/supervisors and the preparation of students prior to placement in clinical practice are being widely advocated in many literature sources to ensure the success of a WIL programme, questions 10 and 11 in the WPL mentors'/supervisors' questionnaire enquired about the existence of these aspects from their perspective.

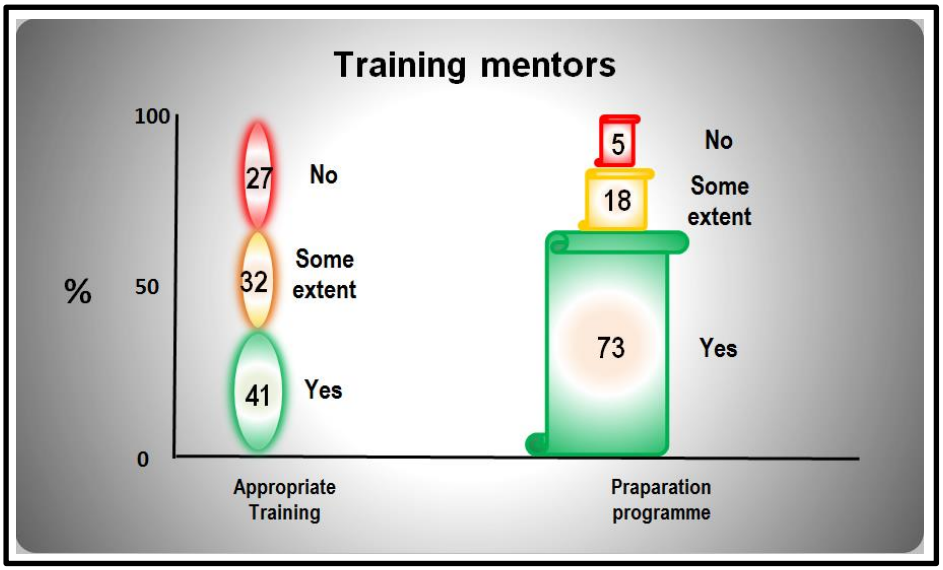


FIGURE 4.26: TRAINING OF WPL MENTORS/SUPERVISORS AND PREPARATION OF STUDENTS PRIOR TO PLACEMENT

A heart-warming fact is that at least 41% of the WPL mentors/supervisors indicated that they had received some kind of training from the training institution for their important role as WPL mentors/supervisors of the students who are placed for WPL in clinical practice. However, a significant number of WPL mentors/supervisors (59% in total) indicated only some training (32%) and no training at all (27%).

The lack of training of WPL mentors/supervisors evolved in the open-ended comments to this question. Comments that raised concern were the following: "The WPL mentors/supervisors are all qualified radiographers, but very little guidance or training is given in terms of the training of students and roles are not clearly defined. Also, communication of standards and expected outcomes is minimal"; "mentors/supervisors

don't get official training but the university always assists whenever something is unclear and there are guidelines stipulated in the WIL manual which is distributed at the beginning of a year"; "Standardisation of evaluation should take place for the different practical sessions"; "The mentors are not always on a par with the latest clinical practices. However, the clinical application often becomes the responsibility of the radiographers working in the departments"; "In our department, there is no specific clinical mentor. The mentors/supervisors do the theory and the practical assessments or outsource some of the practical allocations to some clinical radiographers"; "There is a mixture of clinical mentors/supervisors, some of whom have a lot of experience while others have little or no experience - each mentor/supervisor should have proper training"; "There is no formal training available. You learn by your own and others' mistakes"; "Not all mentors are aware of departmental regulations as not all lecturers have trained at this university. This is causing continuous controversy and mixed messages are going through to the students"; "Clinical mentors are ordinary radiographers with mostly a B-Tech qualification - no formal training is done. They sometimes attend workshops at the university to help with the training of the students"; "The mentors/supervisors are doing [sic] the job for many years, but need the help of qualifieds in the clinical area"; "Although the mentors have had some training, they are not always 100% dedicated to this 'additional' duty".

As indicated by the WPL mentors/supervisors, the methods which are used by the universities where some training of WPL mentors/supervisors is done are varied and in some cases vague. The comments in this open-ended part of the question are reported in the following section:

"At the institution where I work, I use the assessment forms to train the mentors in the supervision of student radiographers. I also have a list of the things the students need to know when in clinical practice and this is distributed to the mentors in the weeks that students are allocated to them"; "I can only give an indication of how I was trained before and not of how the new mentors are trained"; "I was trained 15 years ago and worked closely with the university lecturer at that stage. I was one of her students so I also knew how her system worked. I did clinical sessions with her for two years as well as assessments on the students under her supervision. Support was always provided and I was allowed to develop my own teaching style"; "No formal training exists. However, workshops are planned when requested"; "On-the-job training is done by the chief clinical supervisor and as a junior radiographer, you first watch before you are allowed to work on your own"; "Radiography road shows, WIL manuals and information during meetings";

"The clinical supervisors at the hospitals are mentored by the Radiography department at the university in learning how to give clinical tutorials. Clinical supervisors at the hospitals are also shown how to assess students. The university's clinical head is always available for advice"; "The mentors will come to the clinical setting and hands-on training is arranged with the radiographers"; "The university sends the WPL mentor/supervisor to the hospital for approximately one week to do on-site training of the new practice mentor and the new mentor shadows the existing on-site mentor for 6 - 12 months until deemed competent to train students alone"; "We had a workshop where we were trained. Now someone comes to our monthly meetings to keep us updated on [the] changes they want to make"; and "Some have attended workshops or road shows and the rest have been spoken to by the university lecturers".

Related to the preparation of students prior to placement for WPL in clinical practice, the WPL mentors/supervisors indicated in favour of such pre-placement training (73%). The remaining 27% indicated no pre-placement training programme for WPL at all (8%) and some pre-preparation training (18%). Clinical mentors reported on the existing preparation of students prior to placement as follows in the open-ended comments: "Students usually only visit a practice for a day due to time constraints, but this will not give them the full picture of their future job"; "There is no formal programme - but prospective students are required to attend an information session and [are] encouraged to spend at least a morning in the department observing"; "There is only an information session with questions and answers"; "No prior training"; and "Students are unable to apply their theory in real-life settings - as they are exposed to WIL at the university, they become accustomed to what is expected in the workplace".

Discussion

As discussed in Chapter 2, Jancauskas *et al.* (1997:1; cf. 2.8.1.2) state that numerous studies have shown that both academic and industry supervisors are, in general, poorly prepared for their roles in the supervision of students in the work environment. When I consulted the literature, I found numerous studies that reported that supervisors and mentors had not been well trained for their important roles in the supervision and assessment of students being placed for WPL. The importance of supervision during WPL cannot be over emphasised, especially in an environment where policies and regulations about professional practice and human rights govern what should and should not happen with the patient. Because assessment is an important part of learning, it is a matter of

grave concern to learn that in many cases the people performing this assessment are not being trained to do so. Additionally, phrases such as "mentors learn by their own mistakes"; "continuous controversy"; "mixed messages going to the students"; and "communication of standards and expected outcomes are minimal" make one wonder about the quality of learning which is taking place during WPL at some training institutions. Recommendations regarding the importance of the training of clinical mentors are made in Chapter 7 (cf. 7.6).

Regarding the preparation of students prior to placement, it is important to note that aside from training the students regarding logistical matters such as record keeping of experiences in clinical practice, the modern demanding work environment requires that students possess skills (also called generic skills) such as professionalism, communication skills, being able to work in groups, critical thinking skills, and problem solving skills. Because students studying Radiography in SA have up to very recently been placed for WPL shortly after they started their university studies, the development of these skills have not received much attention. At many universities the inclusion of a core curriculum is now compulsory. This has been done in an effort to fill the gap in generic skills acquisition. Thus, by keeping the first year students at the university a little longer before placement for WPL, many of these skills can be stimulated in the delivery of the normal module content in the learning programme. Whatever the case, it has become increasingly important that programme developers give consideration to the development of 'soft' skills during a preparation programme at the university prior to the placement of students in clinical practice.

4.4.3.4 ***Student assessment for workplace learning*** (Q12, 13 & 14)

In order to compare existing assessment practices in WIL with the results from the participating lecturers and students in the study, a few questions on assessment were added to the questionnaire to the WPL mentors/supervisors, and these are discussed in the following section.

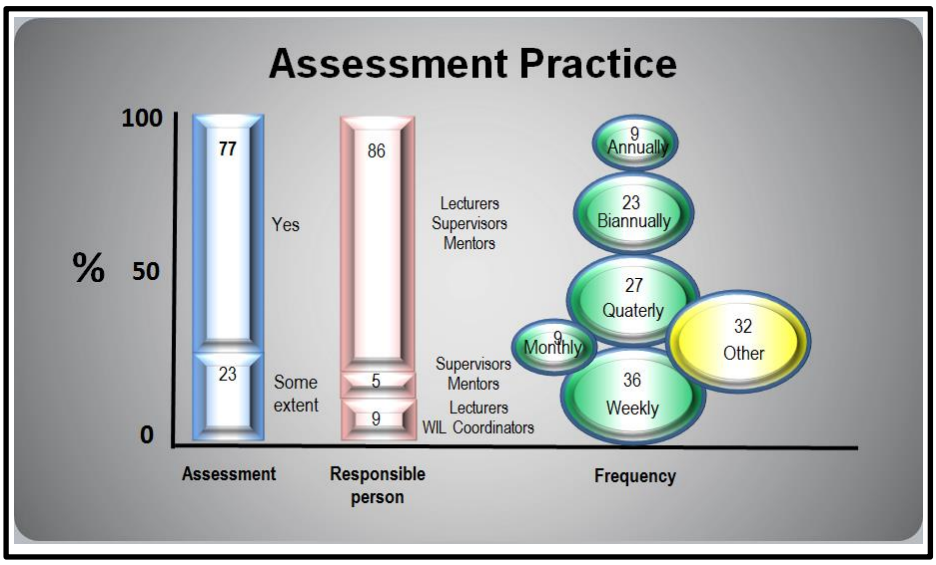


FIGURE 4.27: ASSESSMENT PRACTICE FOR WORKPLACE LEARNING FROM THE PERSPECTIVE OF CLINICAL MENTORS/SUPERVISORS

Upon enquiry, 77% of the WPL mentors/supervisors indicated that the students were being assessed during clinical practice. Eighty six per cent (86%) reported that such assessment was done either by a lecturer or the designated WPL mentor/supervisor in clinical practice. Five per cent (5%) indicated that students were assessed only by the designated WPL mentors/supervisors in clinical practice and 9% reported that students were assessed only by a lecturer from the university (Figure 4.27). In the comments section, the designated WPL mentors/supervisors in clinical practice commented rather negatively on the assessment of students in clinical practice. Such comments were: "To do only five practical evaluations in practice does not give you a true picture of what a student is capable or not capable of doing"; and "Constant monitoring is not possible". Participating WPL mentors/supervisors were also of the opinion that although students were assessed during practical exams by the lecturers, the examinations chosen were not always discussed with the clinical department and that such examinations were thus not necessarily appropriate for the year group. One WPL mentor/supervisor noted about the practical assessments which were performed: "Too much focus is placed on marks for patient care and the Radiography image seems to be of lesser importance." Another practitioner reported that in many cases the qualified radiographers were too busy to attend to the students as they should because of staff shortages. Also, due to the workload in some departments, it was reported that an X-ray room could not be allocated for student assessment for too long. Some WPL mentors/supervisors felt that because students were in many cases assessed by different staff as they rotated through the different areas, there was a lot of inconsistency in assessment practices. Regarding the frequency of assessment (Figure 4.27), 36% of the clinical mentors reported that

students were assessed in clinical practice on a weekly basis, 27% reported quarterly assessment, 23% said that their students were assessed only biannually, and 9% indicated that their students were assessed in clinical practice only once per annum. Among the 32% who reported 'other' frequencies of assessment, one comment was that the students were assessed "when necessary" and that students were assessed "according to their assessment dates as indicated by the institution". Another mentor strongly suggested that tutor posts should be re-introduced and that these tutors "should receive proper training". One mentor felt that students were being disadvantaged by a system where there was no ownership of the training programme and further commented that those radiographers who were already struggling in an over-burdened system saw students as an added, unwelcome burden. This person concluded: "This does not do the system justice!"

A variety of other frequencies for assessment were reported as follows: "At the end of the learners' rotation through an area, an assessment is done"; "Sometimes weekly, sometimes after two weeks"; "The learners have two assessments for the year done by the mentors"; "Most clinical assessments take place from mid-year onwards, once the students have had sufficient time in the various areas of training"; and "The WPL mentors/supervisors perform two or three sets of assessments per year and the university lecturer performs one set of assessment on each student each year continually as on the forms supplied by the university". One of the clinical mentors reported that some students did not take assessment in clinical practice seriously. This person commented: "Students always have excuses [as to] why they did not do their assessments such as no one wanted to help them and the qualified radiographers were rude to them when they needed to be assessed."

Discussion

Whether assessment of WPL is done by university lecturers or WPL mentors/supervisors is not the issue. The important issue is whether the assessment of WPL is aligned with what is delivered in the academic curriculum and consequently whether the assessment activities are measuring the achievement of pre-set outcomes/objectives for WPL (cf. 2.7 & 2.7.1). As suggested by Nduna (2012:243), all persons who are involved in assessment should receive proper training to prepare them for this important responsibility. Some other suggestions towards improvement of assessment in WPL are that practice mentors/supervisors should frequently liaise about assessment in the workplace.

Additionally, assessment of WPL should be closely monitored and moderated by the university programme. Whatever the argument, the assessment of WPL should form an integral part of learning and should be well planned, well-structured and closely monitored.

4.5 IDENTIFIED AREAS OF GOOD PRACTICE AND AREAS FOR IMPROVEMENT

From the results of the questionnaire survey amongst the role players in WIL for Radiography training, the following areas of good practice and areas for improvement were identified:

4.5.1 Areas of Good Practice

The following areas of good practice were identified for the teaching, learning, assessment and general management of WIL:

- The bulk of university lecturers reported positively that they supplied students with clear learning outcomes for WIL. Although some discrepancies were noted between the students' and the lecturers' reporting on the implementation of some general aspects of WIL (cf. 4.3.4.1), the lecturers further confirmed that teaching and learning activities in their respective programmes were well aligned with the outcomes for WIL, the specific year of study, and the HEQF level descriptors (cf. 4.3.2.1 & Table 4.2).
- Similar to the learning outcomes for WIL, some discrepancies were noted in the reporting from the lecturers and the students on the use of actions to stimulate active/deep learning (cf. 4.3.4.3 & Figure 4.17). However, most of the lecturers reported positively about the use of actions to stimulate active/deep learning in their programmes, thus this is seen as a current area of good practice in WIL for Radiography training (cf. 4.2.4.2 & Figure 4.7).
- Another area of good practice in the current delivery of WIL programmes in Radiography was identified from the students' reporting on the assessment of graduate attributes (generic skills) as part of WIL (cf. 4.3.6.2 & Table 4.9).
- Regarding the general management of WIL, it was noted that the WPL mentors/supervisors were well informed about who was responsible for the general management of WIL at their institutions (cf. 4.4.3.1 & Figure 4.23). Moreover, well-established lines of communication existed between all the universities and their

clinical sites, although a variety of communication systems was used (cf. 4.4.3.1 & Figure 4.24). Also, the frequency of meetings and meeting dates were clearly communicated.

4.5.2 Areas for improvement

Regarding the teaching and learning for WIL, the following areas for improvement were identified:

- Although lecturers reported positively on the alignment of outcomes for WIL with the teaching, learning and assessment thereof (cf. 4.5.1), the students reported some existing challenges in this regard (cf. 4.3.4.1).
- The students also indicated under-preparedness for a number of examinations during WPL and requested more emphasis on the integration of concepts in the area of WIL (cf. 4.3.4.1 & 4.3.4.2).
- Lecturers should make less use of WDTL to teach in the area of WIL and should rather revert to curricular modalities/learning modes such as PBL and PjBL (cf. 4.2.3.2 & Figure 4.2). The results also indicated reluctance amongst the participating lecturers to use some of the teaching and learning activities related to the aforementioned curricular modalities/learning modes (cf. 4.2.4.1, Figure 4.4. & 4.5). Another matter of concern was the weak correlation between the use of the different curricular modalities/learning modes for WIL, with the exclusion of WPL, as reported by the lecturer and student samples, (4.3.4.3, Figures 4.13, 4.14 & 4.15).
- In terms of the use of electronic teaching media in the delivery of WIL, the correlation between the lecturer and student samples was also weak regarding the use of PowerPoint as an electronic teaching medium (cf. 4.2.4.3, 4.3.4.4 & Figure 4.18).
- It was noted that WPL was still being considered as the only modality/learning mode in WIL to prepare students properly for their role in the workplace (cf. 4.2.4.1 & Figures 4.6 & 4.16). It also became clear from the results that the hours prescribed by the professional body were, in many instances, still driving the attainment of WPL and not the attainment of specified outcomes. Also, in many instances the facilitators of WIL still appeared reluctant to utilise other curricular modalities/learning modes such as PBL and PjBl to facilitate teaching and learning in the WIL environment.

Regarding the assessment of WIL, the following areas for improvement were identified:

- Although lecturers were in general satisfied with the general aspects concerning the assessment of WIL, some challenges were identified. One challenge regarded the availability of certain imaging examinations (e.g. the skull) for assessment purposes and another was the unwillingness of qualified radiographers, in some instances, to assist with the supervision and assessment of students due to many factors (cf. 4.2.5.1). Moreover, inconsistencies in grading using rubrics and a variety of assessors conducting assessments were questioned (cf. 4.2.5.1 & 4.4.3.4).
- The results also revealed that facilitators were reluctant to utilise 'new' assessment methods which have become well suited for the assessment of WIL (e.g. simulations) (cf. 4.2.5.4 & Table 4.3). Of concern was the weak correlation between the lecturers and the final year students regarding the use of assessment methods for WIL (cf. 4.3.5.2 & Table 4.8).

Regarding the management and coordination of WIL, the following areas for improvement were identified:

- More frequent visitation by university lecturers to ensure the monitoring and progress of the students is a requirement for effective WIL programmes (cf. 4.4.3.2, 4.3.6.1, Figures 4.20 & 4.25).
- The training of WPL mentors/supervisors was identified as one of the most urgent requirements for improvement in the WIL environment. The lack of training of these role players evolved throughout the analysis of current practices and was shown to have a negative influence on many aspects of the quality of teaching, learning and assessment, specifically in the WPL component of WIL (cf. 4.3.4.2, 4.3.4.4 & Figure 4.26).

4.6 CONCLUDING SUMMARY

The use of a quantitative mode of inquiry supplemented by some qualitative components proved to be particularly valuable in this study. The overall goal of the study was to conduct a critical analysis of the current status of WIL in Radiography training at higher education institutions in SA with the intention of developing an education and training programme for WIL in Radiography.

The reporting of the results in this chapter, with cross-referencing to the conceptual framework that underpinned the study as illuminated in Chapter 2, confirmed the achievement of the overall goal and three of the set objectives for the study, namely: 1) to benchmark best practice for WIL in Radiography at higher education institutions globally and in SA with reference to relevant literature; 2) to gain a thorough insight into the current state of WIL in Radiography programmes at higher education institutions in SA; and 3) to identify areas of good practice and areas for improvement in the WIL component of Radiography programmes in SA (cf. 1.4.1 & 1.4.3).

In Chapter 5 and Chapter 6 the proposed **WIL education and training programme for Radiography at higher education institutions in SA** will be presented and discussed (objective 5). To achieve the fourth objective of the study, suggestions towards improvement of identified shortcomings will be made in Chapter 7.

CHAPTER 5

AN EDUCATION AND TRAINING PROGRAMME FOR WORK-INTEGRATED LEARNING FOR YEAR 1 AND 2 OF THE BACHELOR DEGREE OF RADIOGRAPHY IN DIAGNOSTICS

5.1 INTRODUCTION

The aim of Chapters 5 and 6 is to address the overarching research question as presented in Chapter 1, namely: *What important fundamentals for teaching, learning, assessment and monitoring should be portrayed by an education and training programme for WIL in Radiography at higher education institutions in South Africa?* In order to address the set research question, subsidiary questions were set to provide important information regarding the current status of the delivery of WIL in Radiography training in SA. In Chapter 2 a comprehensive study of the available literature on WIL provided information for the development of a conceptual framework which was used to support the research that was conducted in this study. Chapter 3 comprehensively addressed the research methodology that was followed to conduct this research and in Chapter 4 the data that had been gathered from the important role players to assess the current delivery of WIL in Radiography training were presented and discussed. In Chapters 5 and 6 the findings about the current delivery of WIL in Radiography training, together with information from the literature, are used to present a proposed education and training programme for WIL in Radiography from Years 1 to 4. By combining the findings from the collected data with my own knowledge and experiences in the field of Radiography, particularly with regard to WIL training and higher education, the researcher was able to design and validate an education and training programme for WIL in Radiography training for South African universities and, in doing so, to accomplish the aim of the study.

To address the identified shortcomings and areas where the correlation between the lecturers' and students' understanding of the different concepts related to WIL were weak (cf. 4.5.2), one needs to start with the design of a WIL programme at a programme level with specific focus on the curriculum for that particular programme. In the section that follows, suggestions are made towards the design of a WIL education and training programme for Radiography at the universities offering Radiography training in SA. To facilitate clarity and progression, the proposed WIL programme was designed in two separate parts, namely for Years 1 and 2 (Chapter 5) and Years 3 and 4 (Chapter 6). The

rationale for this decision was that in Years 1 and 2, WIL programmes focus on the attainment of generic skills and competencies as well as basic knowledge, skills and competencies for routine imaging examinations to prepare the students for placement in clinical practice, whereas the WIL programmes for Years 3 and 4 focus on the attainment of knowledge, skills and competencies for more advanced and specialised imaging examinations.

5.2 WORK-INTEGRATED LEARNING MODULES FOR YEARS 1 AND 2

5.2.1 Curriculum Design

As stated by the CHE in their *Good practice guide for WIL*, an aligned curriculum implies that students should be provided with clear outcomes/objectives at the beginning of each piece of learning and that teaching/learning activities and assessment should be aligned with these outcomes and be appropriate for a specific level of learning (CHE 2011:13, 14). In addition, assessment activities should be well designed with explicit assessment criteria to guide proper feedback to students regarding their performance.

Whether WIL is designed as a module on its own or as part of another module remains the prerogative of the designers of the learning programme, as long as the crucial aspects related to the design of an effective curriculum are adhered to (cf. 2.5, 4.2.3.1). With reference to the identified areas for improvement in the current components of Radiography programmes in SA (cf. 4.5.2) as well as the information garnered from the literature, the researcher firmly believe that it is best to design WIL as separate modules in the Radiography learning programmes. This will allow for a definite structure for each part of learning which will communicate all information about the part to the student at the start of the each separate learning unit. Providing structure to the delivery of each learning unit will not only provide direction to the students, but will simultaneously direct the facilitators (i.e. university lecturers and the WPL mentors/supervisors) towards a clear understanding of what needs to be achieved in each learning unit. As the focus of WIL is primarily on developing skills and competencies (generic and practical) in the student, the WIL module should be offered concurrently and be aligned with a theoretical module addressing the same learning units in order to equip students with the necessary disciplinary knowledge required for each learning unit in the WIL module. An example of modules in an aligned curriculum is attached as Appendix H.

Because those persons who design each learning programme will be in the best position to make decisions about the credits and notional learning hours to assign to the WIL module for each study year and to the different learning units in a specific module, the number of credits and notional learning hours cannot be strictly prescribed. It is important, however, that the learning programme abides by the minimum requirements for WIL (60 credits – 600 notional hours) as stipulated by the CHE (cf. 2.5.1.3). In order to ensure that specific parts of the learning programmes are conducive to teaching and learning, programme designers should be cognisant of the required credits and notional hours.

The learning outcomes for the WIL module and the specific learning outcomes for each learning unit in a module should be aligned with the level descriptors for the specific year of study and to the exit level outcomes for the qualification (2.5.1.1, 2.5.1.2, 4.2.3.1). Furthermore, it is important to ensure alignment between the outcomes, the learning activities and the assessment activities and each learning unit in a module (cf. 2.6, 2.6.1, 4.2.3.1). Equally important to keep in mind when designing a curriculum for WIL is to focus on the purpose of the qualification (cf. 2.5.1.2). Because the purpose of the qualification in Radiography is to deliver a work-ready graduate with the required generic attributes to function as an independent health professional in Radiography practice, the integration of the theory with what is required in the workplace is of crucial importance (cf. 2.6.2.2, 4.2.3.1 & 4.3.4.1). Thus it is suggested by the CHE that, when designing WIL curricula, the following aspects should be considered: the nature and current state of knowledge in the discipline, the nature and current state of professional practice, philosophies of education such as the curricular modalities/learning modes to facilitate WIL (cf. 2.6.1.3), and the role and forms of assessment and feedback (cf. 2.7, 2.7.1.5, CHE 2011:14).

To assist all the role players in the delivery of WIL, it is advisable to provide, at the beginning of each study year, a guide which comprehensively displays the role-out of WIL for each study year. The proposed modules for WIL from Year 1 to Year 4 for the Bachelor of Radiography (Diagnostic) degree as presented in Tables 5.1, 5.3, 6.1 & 6.2) were designed while keeping all the important aspects of curriculum design referred to previously in mind. Bloom's taxonomy of learning was applied when designing the curriculum for WIL from Year 1 to Year 4 in order to scaffold the learning according to increasing complexity as required by HEQF level 5 to HEQF level 8 (cf. 2.5.1.4).

It is important to note is that all categories, with the exception of the level descriptor categories, the exit level outcomes and the associated assessment criteria as prescribed by SAQA (cf. 2.5.1.1, 2.5.1.2), may differ from one learning programme to another according to institutional policies at the university and professional practice requirements in the feeder area of the university. As stated earlier, it is not possible for all learning programmes in Radiography to present exactly the same curriculum for WIL, but the alignment of all components in the WIL curriculum should be conducive to the delivery of a well-trained graduate. Because the development of a curriculum is aimed at addressing multiple requirements and interests, it should constantly be revised through processes such as implementation, evaluation and adjustment (CHE 2011:13).

For the sake of clarity and to ensure understanding of the application of the proposed WIL curriculum for each study year in the delivery of learning, an example of a learning unit with suggested teaching/learning and assessment activities was designed for each of the WIL modules (Years 1 - 4 of the new Bachelor of Radiography degree). These examples are presented in this report.

Each module template for the proposed modules for WIL from Years 1 to 4 (Tables 5.1, 5.3, 6.1 & 6.2) displays generic information at the top such as the title of the module, the NQF level, the qualification designator, the CESM qualifier, the credits, notional learning hours, and the required prerequisite learning for the specific module. The contents of such a module are discussed in detail in the next section.

5.2.1.1 *A module for work-integrated learning for Year 1 (HEQF level 5)*

A detailed breakdown of the proposed module for the first year of study includes aspects such as the level descriptors, exit level outcomes, and associated assessment criteria as recommended for the qualification by SAQA (cf. 2.5.1.1, 2.5.1.2) for HEQF level 5. It is important to note that although all the level descriptors, exit level outcomes and assessment criteria are displayed in the module, not all of them can be attained in one module in a qualification (such as this WIL module). The attainment of all the outcomes for the qualification should thus be spread amongst all modules over the total years of study for a qualification.

To ensure clarity regarding the expectations for the WIL module in a specific study year, the module further displays information about the module outcomes for WIL for the

specific year of study. The module outcomes may differ from one institution to the next as these outcomes will be designed by each specific institution in alignment with the level descriptors and exit level outcomes to include what was decided by the lecturer/s and WPL mentors/supervisors at a specific university. Noteworthy is the extent to which the module outcomes indicate the attainment of some of the generic skills required for the qualification (cf. 2.6.2.2).

The quality control measures which should be in place to measure the quality of delivery of the learning may also differ from one institution to another according to institutional policies and procedures, with the exception of those prescribed by SAQA and the Professional Board for Radiography and Clinical Technology (Tables 5.1, 5.3, 6.1 & 6.2).

A further breakdown of information displays in more detail aspects such as the learning units for WIL included in the module, the estimated notional learning hours for each of the learning units, the curricular modalities/learning modes (cf. 2.6.1.3) which might be utilised to facilitate learning, and suggested types and methods of assessment. The latter should be aligned with the set module outcomes (cf. 2.7.1.1, 2.7.1.3). In WDTL, the focus is on the acquisition of disciplinary knowledge. Therefore active forms of learning such as group learning, demonstrations, and practical sessions are suggested when teaching in these curricular modalities/learning modes (CHE 2011:32).

The suggested methods of assessment for the proposed modules were selected to be used in alignment with the suggested curricular modalities/learning modes for the different years of study. For example, the WIL module for the first year of study suggests more WDTL utilising facilitation methods such as formal lectures, demonstrations, and simulations which are all ideally suited for the transfer of theoretical knowledge and the explanation of concepts (cf. 2.6.1.3). In alignment with these facilitation methods, the module suggests the use of assessment methods such as written tests, mind maps, pre-reading, and reporting on an observation. Whatever assessment method is used, the level of study and the module outcomes should always be considered when assessing the student (Table 5.1). Similarly, the modules for Years 2, 3 and 4 suggest curricular modalities/learning modes and assessment methods appropriate to the specific level of learning (year of study) (Tables 5.3, 6.1 & 6.2).

The forms of student support available to assist students to learn effectively are also displayed. The forms of student support may differ from one university to another depending on what is available at each respective institution (Tables 5.1, 5.3, 6.1 & 6.2).

Finally, the template displays a summary of the notional time to be spent on activities such facilitator/student contact, formative and summative assessment, and engaged learning (time spent by the student to master the module) to constitute the total notional time assigned to the module.

TABLE 5.1: FIRST YEAR MODULE FOR WORK-INTEGRATED LEARNING IN RADIOGRAPHY
(table continues on next page…)

MODULE RAP105

TITLE AND CODE OF MODULE: Work-integrated learning I (D) (WIL105)
HEQF: LEVEL 5
QUALIFICATION DESIGNATION: Medicine
CESM QUALIFIER: 0924
CREDITS: 12
NOTIONAL LEARNING HOURS: 120
PREREQUISITE LEARNING: Grade 12 - HEQF level 4

LEVEL DESCRIPTOR CATEGORIES/ COMPETENCIES	**ASSOCIATED EXIT LEVEL OUTCOMES**	**ASSOCIATED ASSESSMENT CRITERIA** *Students will demonstrate their competence in:*	**MODULE OUTCOMES** *At the end of this module, students will be able to:*	**QUALITY CONTROL**
*__Scope of knowledge__ – informed understanding *__Knowledge literacy__ - demonstrate an awareness *__Method and procedure__ – demonstrate the ability to select and apply *__Problem solving__ - demonstrate the ability to identify, evaluate and solve defined, routine and new problems within a familiar context	***An informed understanding*** of the important terms, rules, concepts, principles and theories. An ability to effectively ***apply*** essential methods, procedures and techniques of the field or discipline The ability to use knowledge to ***solve well-defined problems*** both routine and unfamiliar within a familiar context An ability to ***adjust*** an application of a solution to meet the needs of changes in the	Application of the basic terms, rules, concepts, principles and theories of the practice of Radiography Application of knowledge of Science in the context of the practice of Radiography Application of relevant patient care in a simulated environment Psychological, cultural and ethical considerations of patients and their families Respecting the rights of patients as entrenched in the Bill of Rights, the Patients Charter and relevant medical law	***Understand and apply*** the basic terms, rules, concepts, principles and theories of the practice of Radiography ***Search for, gather and analyse*** information to complete learning activities related to the practice of Radiography ***Solve, adjust to and evaluate*** well-defined problems related to the practices of Radiography ***Present*** their work using appropriate computer technologies	Accreditation and adherence to the regulations of the Professional Board for Radiography and Clinical Technology Consideration of the exit level outcomes for the specific level in the delivery of content and assessment of outcomes Alignment of outcomes and learning

*__Ethics and professional practice__ - demonstrate the ability to take account of *__Accessing, processing and managing information__ - demonstrate the ability to gather information *__Producing and communicating information__ – demonstrate the ability to communicate information reliably, accurately and coherently *__Context and systems__ - demonstrate the ability to operate in a range of familiar and new contexts *__Management of learning__ - demonstrate the ability to evaluate his or her performance or the performance of others *__Accountability__ - demonstrate the ability to account for his or her actions	problem An ability to ***evaluate*** the change using relevant evidence ***Efficient*** information-gathering, analysis and synthesis, and evaluation skills ***Presentation of skills*** using appropriate ***technological aids*** An ability to ***communicate*** information coherently in writing and verbally The capacity to ***take responsibility*** for own learning within a supervised environment Take ***decisions*** about and ***responsibility*** for actions ***Evaluate*** their own performance against given criteria	Decision-making and accountability regarding the ethical requirements of a professional medical environment Skills and knowledge of first aid	***Communicate*** properly***, behave ethically and professionally*** and ***take responsibility*** for their actions in the clinical environment ***Apply*** proper patient care as required in the clinical environment ***Manage*** computer-based patient information and patient records as required in the clinical environment ***Execute*** routine chest and abdominal X-ray examinations <u>in a controlled environment</u> at the university	and assessment activities (Programme and Faculty QC) Consideration of inputs from the Advisory Committee Radiological departments and practices Internal QC

LEARNING UNITS (C0NTENT)	**Estimated notional hours/ learning unit**	**CURRICULAR MODALITIES/ LEARNING MODES** (list not exhausted) **<u>*Work-directed Theoretical Learning</u>**	**SUGGESTED METHODS OF ASSESSMENT** (list not exhausted)	**FORMS OF STUDENT SUPPORT**
1. Fundamentals of Diagnostic Radiography, Nuclear Medicine, Radiation Oncology and Ultrasound	12 (1.2 credits)	Formal lectures Tutorials Simulations Demonstrations Peer learning in groups Structured interactive sessions	Producing a glossary of terms Writing a test (written or computer-based) Completing a pre-reading template Compiling a mind map Taking part in demonstrations Taking part in role play Reporting on an observation in clinical practice Analysing a **well-defined** problem scenario Presentations Doing an OSCA	Contact sessions Learning material Library Tutor guidance Peer support Consultations-Individual/ Groups Coaching and mentoring Blackboard support
2. Basic imaging principles	12 (1.4 credits)			
3. First Aid	12 (1.4 credits)			
4. The sterile trolley and environment	12 (1.2 credits)			
5. Hospital/ward synergy	12 (1.4 credits)			
6. Radiation protection	12 (1.4 credits)			
7. Basic room and patient preparation & examination protocol	10 (1 credit)			
8. Chest - Routine imaging	20 (2 credits)			
9. Abdomen – Routine imaging	18 (1.8 credits)			
Total Notional Learning Hours = 120 (12 credits)	**Estimated time spent on:** • Facilitator/student contact: ±57 hours • Formative assessment: ±10 hours • Engaged learning: ±50 hours • Summative assessment: ±3 hours			

5.3 TEACHING/LEARNING AND ASSESSMENT FOR WORK-INTEGRATED LEARNING IN YEAR 1 (HEQF LEVEL 5)

In the first year of study most of the focus in the WIL curriculum will be on the transfer of knowledge, an understanding of the fundamentals of the practice of Radiography, and the application thereof in clinical practice. Likewise, WDTL will be the curricular modality/learning mode most often utilised in Year 1 (Table 5.1). Although WDTL will be mostly used in the first year of study, it is not to say that it should be the only curricular modality/learning mode to be utilised for teaching in the first year; other curricular modalities/learning modes may also be utilised if the need arises. Whatever the case, it is still important that teaching strategies for WIL be aligned with the practice-based components of a specific learning unit to bring theory and practice together in a meaningful way. In other words, a sound foundation of WDTL in a professional qualification such as Radiography should ensure that the required disciplinary knowledge is aligned with the requirements for professional practice (CHE 2011:16, 24).

In 5.3.1 a proposed learning unit for WIL in the first year of study is presented. The learning unit for 'chest – routine imaging' (learning unit 8 in Table 5.1) was selected to demonstrate the application of curriculum alignment in the development of a learning unit for WIL in the first year of study. Ideally, a student should receive a study guide with structured learning units such as the example in 5.3.1 for each learning unit in the WIL module. Distribution of such a guide might be possible for some facilitators at the beginning of each study year, whereas others will opt to distribute the learning units to the students only prior to the start of a new unit of learning. Whatever the case, the purpose of such a unit is to supply structured information to the students who will then be informed of what is expected of them in each unit of learning (cf. 2.6.1 & 4.3.2.2).

5.3.1 A Proposed Learning Unit for Work-integrated Learning in Year 1 (HEQF level 5)

WIL105 - LEARNING UNIT 3

ROUTINE IMAGING OF THE CHEST

Credits: 2.0 of 12 (20 notional learning hours)

1. INTRODUCTION

This learning unit is focused on introducing you to the protocol for routine imaging of the thorax for diagnostic assessment of the lungs and the heart. Because chest radiography is one of the most frequently performed imaging examinations, it is a requirement that any diagnostic radiographer has a good mastery of all aspects related to performing this imaging examination and that s/he is therefore able to assess the consequent acquired images.

2. ASSUMPTION OF LEARNING TO BE IN PLACE

Prerequisite knowledge required for this unit is knowledge of the fundamentals of diagnostic Radiography (LU 1), knowledge of the basic imaging principles (LU 2), and knowledge of radiation protection principles (LU 6). Additionally, the disciplinary knowledge of anatomy, physiology, image recording principles and indications for imaging of the thorax is essential to master the positioning technique and to assess the acquired images.

3. LEARNING OUTCOMES

After completion of this learning unit you should be able to:

Knowledge & skills outcomes:

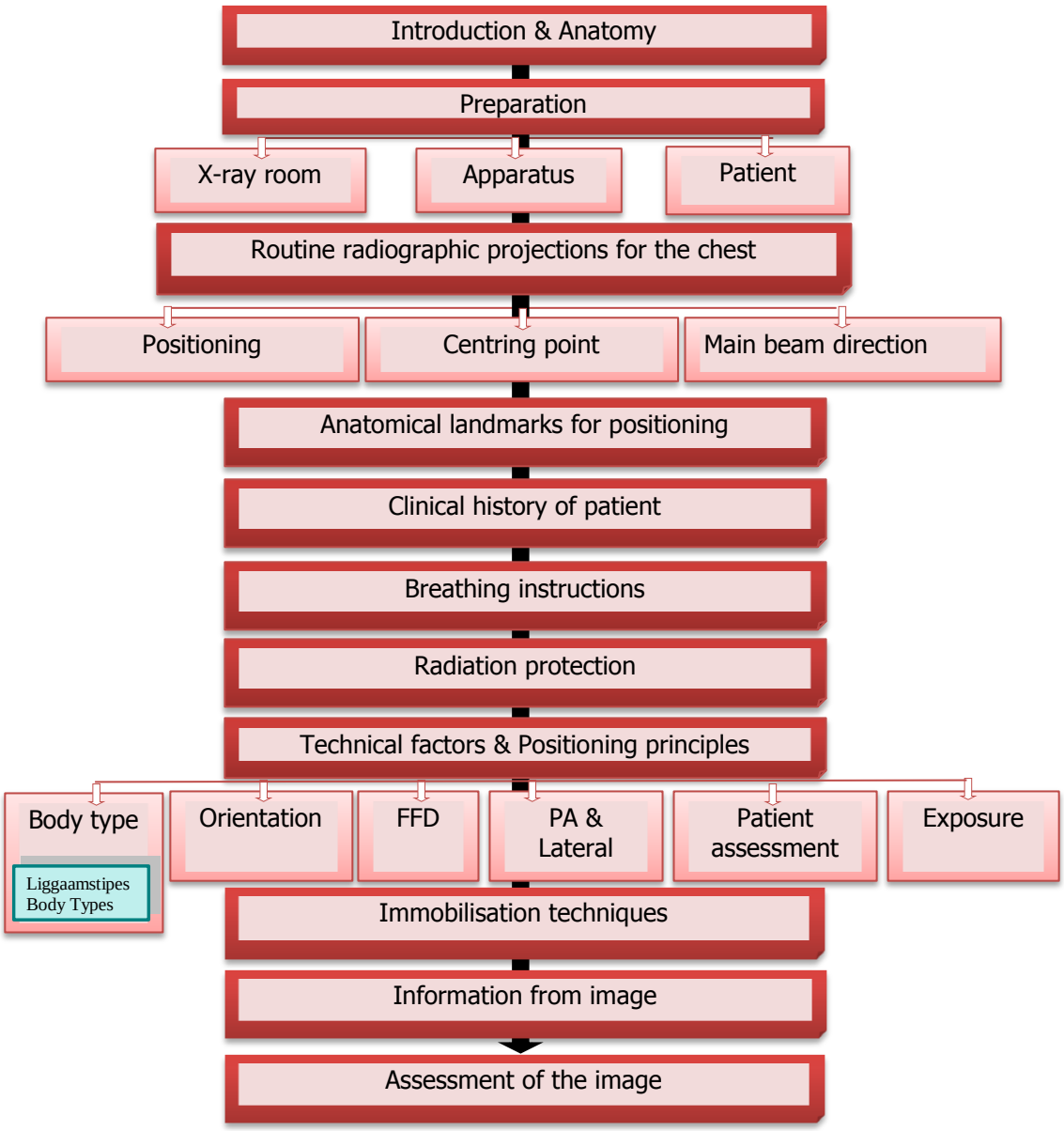
- **Locate** anatomical structures and landmarks of the chest and upper airway on supplied drawings and radiographic images.
- **Explain** the rationale for each routine projection of the chest for diagnostic purposes.
- **Explain** the patient preparation required for routine imaging of the chest.
- **Describe** the positioning technique utilised to optimally demonstrate anatomic structures in the chest, including positioning planes, centring points and mail beam directions for each projection.
- **Explain** the radiation protection measures that should be applied during each projection of the chest.
- **Recommend** the technical factors for producing an acceptable image for each projection of the chest.
- **Position the patient** for routine images of the chest according to set criteria.
- **Assess** the positioning and technical quality of routine chest images against set standards.

Generic outcomes:

- Communication skills
- Self-responsibility skills

- Problem-solving/critical-thinking skills
- Technological and environmental literacy skills
- Cultural and aesthetic understanding/skills
- Developing a macro-vision on algorithms of image modalities
- Teamship
- Learning skills
- Research skills

4. LAY-OUT OF THE LEARNING UNIT



5. LEARNING FACILITATION

Learning will be facilitated by means of formal lectures, tutorials and demonstrations, simulations, peer learning in groups, and structured interactive sessions. All activities will include individual exercises and group work.

Activity 1: Pre-reading template (knowledge)

Complete the pre-reading template below together with a peer learner and submit the completed form to your lecturer. An interactive discussion will be held in class on the day of submission.

PRE-READING TEMPLATE

<table>
<tr><td>Step 1:
List at least 10 indications for routine imaging of the chest:</td><td>Step 2:
List the most important radiographical terms in relation with the positioning of the patient for routine chest images:</td></tr>
<tr><td colspan="2">Step 3:
Indicate the important topographical positioning landmarks to use when positioning a patient for chest imaging:

Step 4:
Elaborate on the influence of body habitus and the degree of inspiration on routine chest images:

Step 5:
Describe the preparation of the patient and the X-ray room for a chest X-ray examination:

Step 6:
Elaborate on the radiation protection measure you will apply when performing chest Radiography:

Step 7:
Discuss the suggested exposure factors for optimal imaging of the chest and motivate the use thereof:

Step 8 (a):
Describe step by step how you will position a patient for a postero-anterior (PA) projection of the chest by referring to body position, part position central ray direction, and centring point:

Step 8 (b):
Describe step by step how you will position a patient for a lateral projection of the chest by referring to body position, part position central ray direction, and centring point:</td></tr>
<tr><td colspan="2">Step 9:
List all the anatomical structures of importance for diagnosis on the PA and lateral images of the chest:

Step 10:
List the radiographic criteria to be used to assess each of the above images for optimal positioning:</td></tr>
<tr><td>Step 11:
Reference the source/s you have consulted for the information:</td><td></td></tr>
</table>

<u>Activity 2: Demonstration and simulation (knowledge, understanding)</u>

The lecturer will demonstrate the positioning of a patient for routine chest imaging on a peer student in the Radiography skills laboratory on campus. The lecturer will also organise a scenario for simulation of an examination for imaging of the chest to facilitate understanding of the following aspects:

- Professional ethics, patient care and patient preparation
- The use of all imaging equipment components for imaging of the chest
- The selection of appropriate exposure factures on the control panel
- The identification and application of anatomical landmarks
- The application of body planes when positioning the patient
- The positioning of the body and part for imaging of the chest

- The respiration technique for imaging of the chest

Activity 3: Peer learning (application)

You will be divided into groups of three to practise the positioning of a patient on each other in the Radiography skills laboratory on campus. While two of you are positioning the "patient", the third one should critique the positioning techniques used.

Activity 4: Tutorial (application and assessment)

The lecturer will facilitate a session in the skills laboratory using real chest images to facilitate the assessment of chest images for optimal positioning by applying the radiographic criteria from your textbook.

6. ASSESSMENT AND ASSESSMENT CRITERIA

(dates provided serve as examples)

Assessment 1: Written test (date: 12/03/2014)
Assessment criteria: knowledge of chest anatomy, topographical landmarks, body planes, centring points and positioning procedures for routine imaging of the chest.
Weight of the assessment: 5%*.
*This activity will be assessed with the aid of a memorandum.

Assessment 2: Simulation (date: 14/03/2014)
Assessment criteria: application of knowledge and skills to position a patient for routine chest imaging.
Weight of the assessment: 5%.
*This activity will be assessed with the aid of a rubric (see rubric below).

Assessment 3: OSCA (date: 18/03/2014)
Assessment criteria: application of knowledge of anatomy and radiographic criteria on real chest images to assess the images for diagnostic value and positioning.
Weight of the assessment: 5%.
*This activity will be assessed with the aid of a memorandum

7. REFERENCES

Bontrager, K.L. & Lampignano, J.P. 2014. *Textbook of radiographic positioning and related anatomy*. 8th ed. Mosby: St. Louis - Missouri.

Ballinger, P.W., Long, B.W. & Smith, B.J. 2007. *Merrill's atlas of radiographic positions and radiographic procedures.* 11th ed., vol. 1. Mosby: St. Louis – Missouri.

7.1 Additional reading

Any additional sources can be consulted using the library, the information center or any scientific data sources on the internet.

8. STUDENT SUPPORT

Learning material, assessment tools, tips, X-ray images, web links and additional reading material for support are available on Blackboard.

5.3.1.1 *Discussion on the proposed learning unit for Year 1*

When analysing the proposed learning unit (5.3.1) from an educational view point, the following aspects are noted:

- The **credits** and **notional learning hours** are clearly indicated (cf. 2.5.1.3).
- A brief **introduction** introduces the unit of learning to the students.
- Students are informed about the **prior learning** which is assumed to be in place. The prior learning indicated is essential because it provides the 'building blocks' to achieve the outcomes for this learning unit. This prior learning may be acquired from a theoretical module on the practice of Radiography (e.g. Radiographic Practice I) and other disciplinary modules such as Anatomy, Physiology, and image recording.
- Clear and realistic **learning and generic outcomes** provide a good guide to the students of what has to be learned in the unit (cf. 2.6.1, 2.6.2.2). Note that the use of Bloom's taxonomy reflects the level of learning which is required in the first year of study (cf. 2.5.1.4).
- At a glance, a mind map **outlines** what will be covered in the learning unit.
- Students are briefly informed of the types of **learning facilitation** to expect in the learning unit. For this learning unit the facilitator opted for formal lectures, tutorials and demonstrations, simulations, peer learning in groups, and structured interactive sessions (Table 5.1). These facilitation methods were selected to assist students in achieving the set outcomes. Group learning and autonomous learning such as reading assignments and interactive discussion are effective methods to promote the alignment of theoretical learning with workplace demands. However, this may differ from learning unit to learning unit depending on what type of facilitation is required to achieve the set outcomes for the unit. Thus, although WDTL is mainly used in this learning unit, many hybrid combinations including some aspects from the other types of learning modes (PBL, PjBL, WPL) may be utilised to achieve the outcomes for a specific unit (CHE 2011:16).

  The learning activities are constructed to assist students in the acquisition of the disciplinary knowledge and skills needed for this learning unit which are also aligned with the set outcomes (cf. 5.3.1 & 2.6.1). In other words, the learning activities are aimed at assisting students to achieve the outcomes for the unit. Students are required to complete a pre-reading template consulting the textbook and/or other

sources after the delivery of a formal lecture (Activity 1 – linked to the first six learning outcomes). Activity 2 (linked to learning outcome 7) allows for a demonstration of the skills needed to position a patient for chest imaging and a situation simulating a chest X-ray examination on a real patient. Activity 3 (linked to learning outcome 7) allows students to practise their skills to position a patient for a chest X-ray examination while applying their acquired knowledge. Finally, the lecturer will facilitate a tutorial in the skills laboratory to teach the students how to assess the acquired chest images for optimal positioning and technical quality (Activity 4 – linked to learning outcome 8).

It is important to note that the selected learning activities that are indicated in the learning unit will also develop some of the generic outcomes as prescribed by SAQA, such as learning skills, research skills, self-responsibility skills, and communication skills.

During facilitation sessions, the lecturer needs to be cognisant of methods that will stimulate deep learning. Although there is a wealth of such methods available, the methods that could be used in the delivery of this learning unit would most probably include the asking of questions, the search for information to complete Activity 1, group work, peer learning, and constructive critique during the demonstration and simulation activities (cf. 2.6.1.1).

- The **assessment** activities have been constructed to be aligned with the learning activities and thus also with the set outcomes. Noteworthy is that the date for each assessment and the assessment criteria applicable for each assessment are communicated to students well in advance. In many cases assessment activities will allow for the provision of a rubric (Assessment 2) to convey the assessment criteria to the students. Clarity about assessment and the alignment of all parts in a learning unit are necessary components to ensure that the processes adhere to the principles for good assessment in the WIL environment (cf. 2.7.1.2).

  Assessment 1 is focused on testing students' acquired disciplinary knowledge about routine imaging of the chest (linked to learning outcomes 1 to 6). Assessment 2 will assess students' level of skills and understanding in performing a routine chest examination in clinical practice (linked to learning outcome 7). This type of assessment activity is usually formative (cf. 2.7.1.1) and can be repeated till the students have acquired the set outcomes. It is thus the prerogative of the lecturer

whether the first attempt mark will be used for grading or not, or whether the mark will be used for grading only if a student has acquired the required level of skills. Assessment 3 is focused on students' ability to assess the acquired chest image for correctness (linked to learning outcome 8). This assessment activity requires that student have a good mastery of the disciplinary knowledge for this unit such as the anatomy of the chest and the image recording principles for chest radiography.

- The sources used by the lecturer to compile this learning unit are indicated.
- Students are informed that material to support their learning is available on the interactive online teaching device at the institution (in this case, Blackboard).

For the learning unit used as an example (5.3.1), no WPL is required in the first year of study. The facilitation of learning, including appropriate learning activities and assessment, was done at the university. This might differ from institution to institution depending on the availability of teaching resources such as a skills laboratory, computer laboratory and software packages on campus and whether the designers of the learning programme opted to place students as early as their first year of study for WPL. In the new WIL environment, this is not a strange phenomenon because universities are increasingly focusing on other methods to facilitate learning such as demonstrations, simulations, and computer software packages, while WPL is scheduled only later in the course (cf. 2.2.1.3, 2.3.1.1).

Assessment for clinical readiness

As part of WIL in the first year of study it is suggested that, close to the end of the academic year (fourth term), an assessment for clinical readiness be done in the simulated environment of a skills laboratory on campus. The ultimate goal of this assessment is not to make the student fail or pass and is not linked to any specific learning unit, but it is to ascertain whether the first year student has been prepared appropriately at the university in a simulated environment for exposure to the real world of clinical practice concerning aspects such as generic competencies and the basic principles of routine imaging. The assessment should be rescheduled if the student is not clinically ready, and actions to assist the student towards attainment of all the outcomes for clinical readiness should be implemented.

Nowadays, the attainment of generic skills is an important part of the assessment for clinical readiness. At many universities in SA the delivery of a core curriculum consisting

of modules, such as Academic Literacy, Communication Studies, Success Skills, Digital Literacy, Personal Information Management, and Mathematical Literacy, has been declared compulsory in an attempt to equip graduates with appropriate generic skills for employment in a demanding economy (CUT Calendar 2014:415). As stated clearly by De la Harpe and David (2012:295), universities have lately been urged to develop generic skills to enable self-fulfilment and personal development. In an increasingly demanding world the intention is to equip graduates with critical analysis skills and independent thought in order to support a highly productive and professional labour force (Leong & Kavanagh 2013:2, cf. 2.6.2.2).

It is important to note that the attainment of generic outcomes can be stimulated in the delivery of all modules in a qualification. For example, in the module Patient Care and Management in the new Bachelor qualification (Psychodynamics of Patient Management in the old qualification) the theory and application of generic skills such a communication, patient care, conflict management, and interpersonal skills are covered. The WIL environment is ideal for assessing whether students have acquired those skills and are able to apply them across a number of activities to ensure preparedness for clinical placement.

Additionally, first year Radiography students can be exposed to some periods of exposure to other departments in the clinical setting, such as nursing, to attain some of the required generic skills in preparation for clinical readiness. During these placements the development of generic competencies such as the following can be addressed:

- Knowledge of the practical implications of legal and ethical responsibilities within the hospital setting.
- Practice in successful communication between the caregiver and the patient.
- Applications of general patient care.
- Practice in observation and recording of vital signs.
- Practical implementation of infection control.
- Respiratory care – oxygen administration and suction equipment.
- Introduction to catheters – gastric, urinary and chest.
- Observation of venipuncture and basic routes of drug administration.
- Relevant links from wards to the X-ray department.

Table 5.2 below displays a framework for required generic graduate skills in Radiography as was determined by Beÿer in 2007 as part of the outcomes of a Master's study on graduate skills awareness amongst Radiography stakeholders (Beÿer 2007:84). In a survey for Beÿer's study, stakeholders indicated the skills highlighted in bold in Table 5.1 as the generic skills to be achieved to indicate preparedness for placement in clinical practice. These identified skills are: ethical responsibility and professionalism, empathy, accountability, practical competence with specific reference to radiographic practice, and administrative skills (Beÿer 2007:83). When assessing the first year student for clinical readiness, the attainment of these skills can be assessed in many of the modules in the learning programme using simulated settings at the university.

TABLE 5.2: FRAMEWORK FOR GENERIC GRADUATE SKILLS IN RADIOGRAPHY

MANAGEMENT OF SELF	MANAGEMENT OF INFORMATION
Manage self with respect to learning, work and personal contexts (including time management)	Selection and integration of knowledge
Set objectives, priorities and standards	Use science and technology responsibly
Good listening skills	High level of information and computer literacy
Show intellectual flexibility	Organise, analyse, synthesise and critically evaluate information and evidence
Show entrepreneurial skills (innovation and creativity	Present information / ideas competently (orally, written, practically) i.e. communication skills
Work autonomously (CUT Teaching and Learning Plan, 2004)	Show international awareness (professional and social) (CUT, 2004)
"Thinking about" or reflection on own learning and performance	Recognition of the demands of the world of work
Cope with stress, uncertainties and challenging situations	**Administrative skills**
Show willingness to continue learning (lifelong learning)	
MANAGEMENT OF OTHERS	**MANAGEMENT OF TASK**
Ethical responsibility and professionalism	Plan / implement and manage tasks
Empathy	Identify and solve problems using creative and critical thinking
Accountability (honesty)	**Demonstrate practical competence (in its specific reference to radiography)**
Passion to work with people	
Respect / adapt to views and values (cultural sensitivity)	
Demonstrate leadership and delegation skills	
Working effectively with others in the disciplinary and educational environment	
Communicate effectively (defend / justify / negotiate / handle constructive criticism)	

(Beÿer 2007:84)

As part of clinical readiness, it is also suggested that a Radiography student should have been taught the basic principles of the imaging of some anatomical regions, such as the chest and the abdomen, prior to placement in clinical practice. The rubric below is an example of a tool to measure the attainment of the basic principles of routine imaging in a simulated environment for a student to be 'declared' ready to be placed for WPL in the second year of study. Section A in the rubric assesses the attainment of outcomes for professionalism, patient care and patient positioning, while section B stimulates the student towards engaging with the criteria for assessing the acquired images for correctness. Also noteworthy is that this rubric can be added to a portfolio of evidence which will be discussed in detail in 6.3.1.1.

NAME OF STUDENT:		**DATE OF ASSESSMENT:**			
PRACTICAL ASSESSMENT FOR CLINICAL READINESS **Lecturer present during the assessment:_____**					
SECTION A – PROFESSIONALISM, PATIENT CARE AND PATIENT POSITIONING					
	Type of X-ray examination:	Needs significant Improvement 0	Needs minor Improvement 1	Achieved 2	Comments from lecturer if marked '0' or '1'
1	Professionalism (uniform / name tag/dosimeter) First assessment INFECTION CONTROL				
2	Communication & patient care				
3	Neatness of room (clean linen/fixed room for next patient/gown for patient in cubicle)				
4	Room preparation (necessary equipment in room - no running around)				
5	Control of patient (IDx4, LMS, signature, clinical history)				
6	Tube centred to BUCKY				
7	Correct FFD for examination				
8	Measured with calliper (exposure setting before positioning)				
9	Cassette size and orientation				
10	Placement of lead marker and visibility on image				
11	Immobilisation techniques (sandbags/sponges)				
12	Beam collimation				
13	Main beam direction				
14	Radiation protection				

	measures (apron/thyroid)				
15	Positioning skills (PA & LAT)				
16	Centering point				
17	Correct focal spot setting				
18	Correct grid (BUCKY) selected				
19	Correct use of kVp and mAs- Exposure Index?				
20	Observe patient while exposing (breathing)				

Constructive comments from the lecturer towards improvement of 'weak' areas:

_____
_____
_____

Remedial action plan by the student if outcomes were not achieved in certain areas:

_____
_____
_____

Signature facilitator:_____ Signature student: _____

SECTION B - POSITIONING CRITERIA OF THE PROJECTIONS (complete this section before you do the practical assessment)			
Positioning criteria Projection 1 **Name of Projection: _____**		**Positioning criteria Projection 2** **Name of Projection: _____**	
List the radiographic criteria for this projection as indicated below		**List the radiographic criteria for this projection as indicated below**	
1. Included		**1. Included**	
2. Alignment		**2. Alignment**	
3. Centring point		**3. Centring point**	
4. Rotation		**4. Rotation**	
5. Tilt		**5. Tilt**	
6. Other		**6. Other**	

5.4 A MODULE FOR WORK-INTEGRATED LEARNING FOR YEAR 2 (HEQF LEVEL 6)

A detailed breakdown of the proposed module for the second year of study also displays the level descriptors, exit level outcomes, associated assessment criteria, quality control measures, and available forms of student support. However, the module outcomes are now constructed at a higher level of Bloom's taxonomy and will thus demand a higher cognitive level of learning from the student. Noteworthy is that, as for the first year module, the module outcomes indicate the attainment of some of the generic skills (cf. 2.6.2.2). The learning units displayed will cover the second year syllabus of the programme and are indicated together with the estimated notional learning hours for each unit of learning (Table 5.3).

The most important difference between Year 1 and Year 2 is seen with the suggested curricular modalities/learning modes and methods of assessment for WIL. The curricular modalities/learning modes now also include PBL and WPL with facilitation methods such as the presentation of real-world problems, integrated learning, discovery learning, guided practice, and WPL (cf. 2.6.1.3). The inclusion of the latter does not necessarily exclude the use of the curricular modalities/learning modes indicated in the WIL module for Year 1. It remains the decision of the facilitator to choose the learning mode most appropriate to ensure that quality learning takes place. However, the curricular modalities/learning modes added in the second year are ideal for stimulating learning at a higher level and are more focused on the integration of content, discovery of new concepts, and the application of knowledge and skills.

Similarly, the addition of practical assessments, the compilation of a portfolio of evidence and the analysis of well-defined, but unfamiliar problem scenarios allow for the assessment of some of the module outcomes for the second year of study. Because students will most probably start with their WPL component of WIL in the second year of study, practical assessments and a portfolio of evidence will assist facilitators in the assessment of the attainment of specific outcomes while students are working in clinical practice. Being exposed to the practice of the profession allows for the stimulation of integration and a better understanding of case scenarios. Thus PBL at this level should present the student with a well-defined, yet not always a familiar, case scenario to stimulate higher order thinking and deep learning (2.7.1.3).

TABLE 5.3: SECOND YEAR MODULE FOR WORK-INTEGRATED LEARNING IN RADIOGRAPHY
(table continues on next page…)

MODULE WIL206

TITLE AND CODE OF MODULE: Work-integrated learning II (D) (WIL206)
HEQF: LEVEL: 6
QUALIFICATION DESIGNATION: Medicine
CESM QUALIFICATION: 0924
CREDITS: 24
NOTIONAL LEARNING HOURS: 240
PREREQUISITE LEARNING: Radiographic Procedures I (WIL105) - HEQF level 5

LEVEL DESCRIPTOR CATEGORIES/ COMPETENCIES	**ASSOCIATED EXIT LEVEL OUTCOMES**	**ASSOCIATED ASSESSMENT CRITERIA** *Students will demonstrate their competence in:*	**MODULE OUTCOMES** *At the end of this module, students will be able to:*	**QUALITY CONTROL**
*__Scope of knowledge__ – informed understanding *__Knowledge literacy__ - demonstrate an awareness *__Method and procedure__ – demonstrate the ability to select and apply *__Problem solving__ - demonstrate the ability to identify, evaluate and solve defined, routine and new problems within a familiar context	An ***informed understanding*** of the important terms, rules, concepts, principles and theories. An ability to effectively ***apply*** essential methods, procedures and techniques of the field or discipline An ability to use knowledge to ***solve well-defined problems*** both routine and unfamiliar within a familiar context An ability to ***adjust*** an application of a solution to meet the needs of changes in the problem An ability to ***evaluate*** the change using relevant evidence	Assessment of the request for imaging for validity. Selection of an appropriate method for the production of images necessary for providing diagnostic information for a specific pathological indication. Selection and appropriate utilisation of accessory equipment and imaging systems to produce images of diagnostic quality for the anatomical areas appropriate to this level. Application of aseptic techniques for routine and specialised examinations	***Know, understand and apply*** the terms, rules, concepts, principles and theories in **a chosen** field of practice ***Critically analyse and synthesise*** information to complete learning activities related to the practice of **a chosen** field of practice ***Solve*** well-defined but unfamiliar problems related to **a chosen** field of practice ***Present and manage*** information using appropriate information technologies ***Present and communicate***	Accreditation and regulations of the Professional Board for Radiography and Clinical Technology adhered to Consideration of the exit level outcomes for the specific level in the delivery of content and assessment of outcomes Alignment of outcomes and learning and assessment activities (Programme- and

*__Ethics and professional practice__ - demonstrate the ability to take account of *__Accessing, processing and managing information__ - demonstrate the ability to gather information *__Producing and communicating of information__ – demonstrate the ability to communicate information reliably, accurately and coherently *__Context and systems__ - demonstrate the ability to operate in a range of familiar and new contexts *__Management of learning__ - demonstrate the ability to evaluate his or her performance or the performance of others *__Accountability__ - demonstrate the ability to account for his or her actions	***Efficient*** information gathering, analysis and synthesis, and evaluation skills ***Presentation skills*** using appropriate ***technological skills*** An ability to ***communicate*** information coherently in writing and verbally The capacity to ***take responsibility*** for own learning within a supervised environment Take ***decisions*** about and ***responsibility*** for actions ***Evaluate*** their own performance against given criteria	Application of radiation protection and safety measures for each radiographic technique and procedure Assessment of radiographic images of included anatomical areas for diagnostic quality according to relevant criteria Application of corrective measures to the radiographic techniques where necessary Effective communication and co-operation between all role players in order to provide an optimal service to the patient Respect for the cultural and psychological diversity of patients to ensure that a quality service is provided Application of quality assurance principles to ensure optimal results for the requested imaging	reliably and coherently using professional language and terms related to **a chosen** field of practice ***Evaluate*** own learning, ***take initiative*** to improve and ***assist others*** with learning needs ***Execute*** radiographic procedures as indicated in the content learning areas in a controlled environment at the university **and in clinical practice** of **a chosen** field of practice	Faculty QC) Consideration of inputs from the Advisory Committee Radiological departments and practices Internal QC

LEARNING UNITS (C0NTENT)	**Estimated notional hours/ learning unit**	**CURRICULAR MODALITIES/ LEARNING MODES** (list not exhausted) ***Work-directed theoretical learning** ***Problem-based learning** ***Workplace learning**	**SUGGESTED METHODS OF ASSESSMENT** (list not exhausted)	**FORMS OF STUDENT SUPPORT**
1. Routine imaging of the bony thorax	24 (2.4 credits)	Formal lectures Tutorials Simulations Demonstrations Peer learning in groups Structured interactive sessions **Presentation of real-world problems** **Integrated learning** **Discovery learning** **Guided practice** **Workplace learning**	Writing a test (written or computer-based) Completing a pre-reading template Compiling a mind map Taking part in demonstrations Taking part in role play Reporting on an observation in clinical practice Analysing a **well-defined but unfamiliar** problem scenario Presentations Doing an OSCA **Perform a practical assessment (formative & summative)** **Compiling a portfolio of evidence**	Contact sessions Learning material Library Tutor guidance Peer support Consultations - Individual/ Groups Coaching and mentoring Blackboard support
2. Mobile unit Radiography	24 (2.4 credits)			
3. Basic principles of theatre Radiography (orthopaedic trauma & laminectomy) & radiation protection	32 (3.2 credits)			
4. Revision of routine abdominal imaging & decubitus and contrast examinations	40 (4 credits)			
5. Basic routine imaging of the upper extremity (AP, lateral + oblique)	30 (3 credits)			
6. Basic routine imaging of the lower extremity (AP, lateral + oblique)	30 (3 credits)			
7. Basic routine imaging of the pelvic girdle (AP, lateral oblique + shoot-through)	20 (2 credits)			
8. Basic routine imaging of the spine (AP, lateral + oblique)	40 (4 credits)			

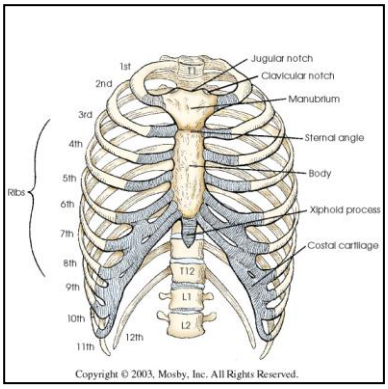
Total Notional Learning Hours = 240 (24 credits)	**Estimated time spend on:** • Facilitator/student contact: ±50 hours • Formative assessment: ±10 hours • Engaged learning: ±177 hours • Summative assessment: ±3 hours

In 5.4.1 a proposed learning unit for WIL in the second year of study is displayed presented. The learning unit for 'bony thorax – routine imaging' (Learning Unit 1 in Table 5.3) was selected to demonstrate the progression in level of learning from Year 1 to Year 2. The importance of prerequisite disciplinary knowledge and skills from the previous study year is also outlined.

5.4.1 A Proposed Learning Unit for Work-integrated Learning in Year 2 (HEQF level 6)

WIL206 - LEARNING UNIT 1

ROUTINE IMAGING OF THE BONY THORAX



Credits: 2.4 of 24 (24 notional learning hours)

1. INTRODUCTION

The bony thorax is an expandable chamber which houses two of the most important parts of the respiratory and circulatory systems, namely the lungs and the heart. The main function of the bony thorax is thus to protect these organs. The bony thorax is made up of multiple bony structures which include the sternum, thoracic spine, clavicle, and the ribs. This learning unit covers the bony thorax, with special focus on the sternum, ribs, and the sterno-clavicular joints. In a country where a large number of patients visit the trauma department at health care centres after having been involved in traumatic incidents, any diagnostic radiographer is required to have a good mastery of all aspects related to performing this imaging examination and assessing the consequent acquired images.

2. ASSUMPTION OF LEARNING TO BE IN PLACE

Prerequisite knowledge required for this unit is knowledge of the anatomy of the bony thorax, image recording principles, and indications for imaging of the bony thorax. Additionally, the student should have a mastery of the position of the patient for chest imaging, the selection of appropriate technical factors, and the assessment of chest images in a simulated environment.

3. LEARNING OUTCOMES

After completion of this learning unit you should be able to:

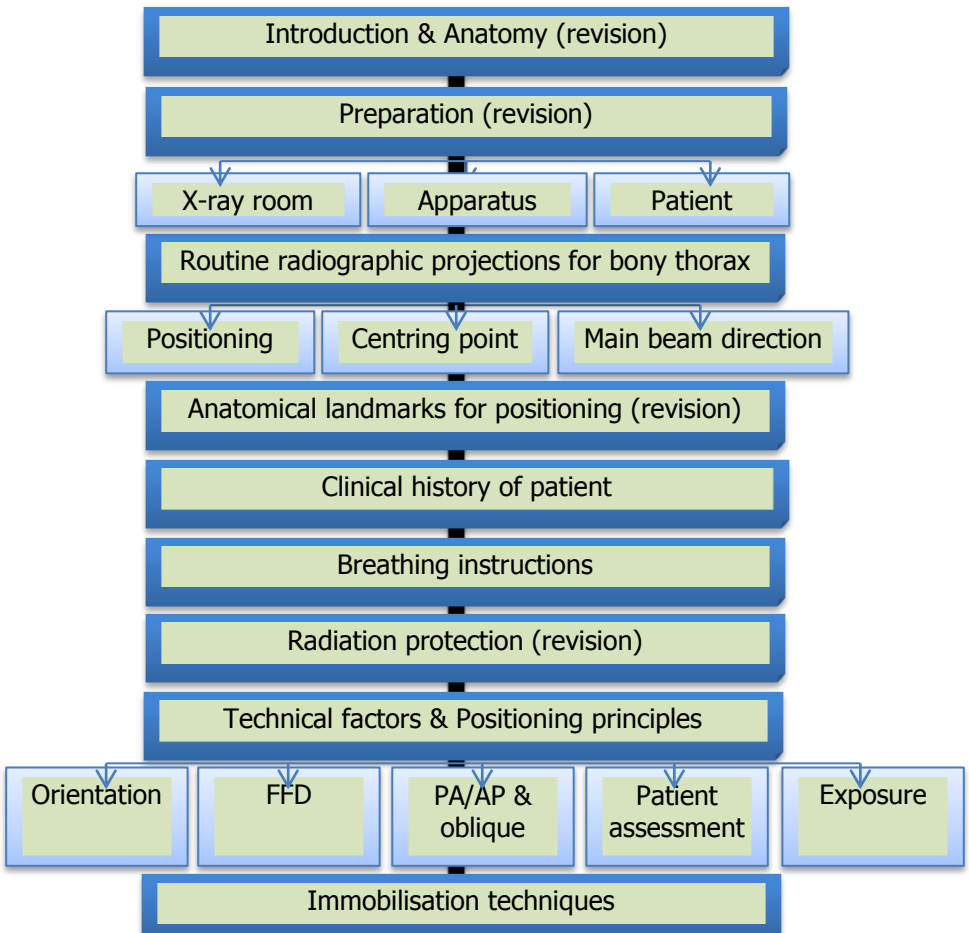
<u>Knowledge & skills outcomes</u>:

- **Identify** all aspects of the anatomy of the bony thorax on drawings, radiographs and on a dry skeleton.
- **Recall** indications for, or pathology best demonstrated on, radiographic projections of the bony thorax, as outlined in the textbook.
- **List** the basic, additional and special radiographic projections or positions which best demonstrate specific parts of the bony thorax structures.
- **Describe <u>and apply</u>** the radiographic projections of the bony thorax under the headings: patient position, part position, centering point, and central beam direction as they would apply ***in a clinical setting***.
- **Explain <u>and apply</u>** the applicable technical factors for bony thorax projections as recommended in the textbook ***for a clinical setting***.
- **<u>Operate</u>** X-ray imaging equipment correctly to acquire optimal bony thorax radiographs according to textbook guidelines, and in compliance with radiation protection principles as applied ***in a clinical setting***.
- **<u>Critique and evaluate</u>** radiographs of the bony thorax according to textbook guidelines, and where necessary **<u>recommend</u>** corrective action/s that would apply ***in a clinical setting***

<u>Generic outcomes</u>:

- Communication skills
- Self-responsibility skills
- Problem-solving/critical-thinking skills
- Technological and environmental literacy skills
- Cultural- and aesthetic-understanding/skills
- Developing a macro-vision on algorithms of image modalities
- Teamship
- Learning skills
- Research skills

4. LAY-OUT OF THE LEARNING UNIT



5. LEARNING FACILITATION

Learning will be facilitated by means of formal lectures, tutorials and demonstrations, simulations, peer learning in groups and structured interactive sessions, **the presentation of real-world problems, discovery learning, integrated learning, WPL, and guided practice.** All activities will include individual exercises and group work.

Activity 1: Anatomy identification (knowledge)

This activity is conducted in the computer laboratory. Access Blackboard and label the most important anatomy on the supplied PA and lateral images of the chest. Also label anatomy on the supplied images of the ribs and the sternum by consulting your anatomy and Radiography textbooks. Students in each group will be selectively asked to present their labelled images to the class.

Activity 2: Demonstration and simulation (knowledge, understanding)

This activity will be conducted in the Radiography skills laboratory. The lecturer will demonstrate the positioning of a patient for routine imaging of the bony thorax by asking a student to volunteer as the "patient". Thereafter, students will be selectively invited from the group to position a peer student for imaging of the bony thorax while constructive critique will be invited from the 'spectator' students.

Activity 4: Tutorial (application and assessment)

The lecturer will facilitate a session in the skills laboratory using real bony thorax images to facilitate the assessment of these images for optimal positioning by applying the radiographic criteria as presented in you textbook.

Activity 5: Workplace learning (WPL) (knowledge, comprehension, application, analysis)

You are required to perform an examination on any part of the bony thorax on at least ten patients while working in clinical practice. Record of these examinations should be submitted to your facilitator at the university together with your formative assessment rubric (cf. 5.4.1 - Assessment 4) on bony thorax imaging during your next class week.

6. ASSESSMENT AND ASSESSMENT CRITERIA

(dates provided serve as examples)

Assessment 1: Online test (Blackboard) (date: 27/02/2014)
Assessment criteria: knowledge of the bony thorax anatomy, topographical landmarks, body planes, centring points, and positioning procedures for routine imaging of the chest.
Weight of the assessment: 5%.
*This activity will be assessed with the aid of a memorandum.

Assessment 2: Case study (date: 26/03/2014) (group work)
Assessment criteria: integration of knowledge and skills for chest imaging (lungs & heart), patient care, and technique adjustments for trauma imaging.
Weight of the assessment: 10%.
*This activity will be assessed with the aid of a memorandum.

*Together with a peer class member, **do some research** to answer the questions related to this case study to the best of your ability and submit your work to your facilitator on the date as indicated. During a formative feedback session, **interactive participation** will be required from you to **share ideas** on the imaging of the bony thorax on a trauma patient with your peers.*

CASE STUDY

A 49-year-old man was struck by a van that was turning a street corner. The patient was awake and alert in the trauma resuscitation area, but complained of left hip and left-sided chest pain. His physical examination was remarkable for contusions to the left side of his face and head and palpable tenderness over the left lateral chest wall with diminished breath sounds on the left. He also complained about a shortness of breath and a feeling of suffocation. The patient is supine on the trauma trolley, but has indicated that he will be able to sit upright with assistance.

1. Consulting your textbook or some other source such as a qualified radiographer while doing WPL to determine which projection should always be performed first on request for imaging on a trauma patient. Also motivate why this projection should always be done first. (3)
2. Which radiographic image, do you think, will the trauma physician request to examine the shortness of breath and a feeling of suffocation that was indicated by the patient? (1)
3. Indicate the name of the pathological condition which is most likely causing this 'shortness of breath' and a feeling of 'suffocation' in a trauma patient with suspected rib injuries. (1)
4. Explain how you will acquire the image indicated in number 2 on a patient in the trauma department by referring to:

i) Orientation of the patient (erect or recumbent) and motivate your answer. (3)
ii) Adjustments to the positioning of the patient, if compared to a cooperating patient sent to the Radiology department for the same examination. (4)
iii) Adjustments to the technical aspects such as focal-film-distance (FFD), kilovolt (kV) and milli-ampere/seconds (mAs) selections. (3)
iv) Discuss the changes to (a) the magnification of anatomical structures in the image and (b) the exposure due to the technical changes indicated above. (5)
v) Adjustments to the centring point and the direction of the main beam. (3)
vi) Adjustment to the breathing technique for the pathological condition indicated in number 3. (2)
vii) Elaborate on the radiation protection measures you will apply to protect (a) the patient and (b) the staff working in the trauma room against ionising radiation. (5)

[30]

Assessment 3: OSCA (date: 14/04/2014)
Assessment criteria: application of knowledge of anatomy and radiographic criteria on real chest images to assess the images for diagnostic value and positioning.
Weight of the assessment: 5%.
This activity will be assessed with the aid of a memorandum.

Assessment 4: Formative practical assessment (date: when doing WPL)

NAME OF STUDENT: _____				**DATE OF ASSESSMENT:** _____
FORMATIVE PRACTICAL ASSESSMENT (qualified radiographer present during the entire examination) **Print name with signature: _____** **Mark ____/30 = ____%**				
SECTION A – PATIENT POSITIONING				
Type of X-ray examination: _____	Needs significant Improvement (fail) 0	Needs minor Improvement 1	Achieved (pass) 2	Comments from qualified if marked '0' or '1'
Room preparation:				
Tube centred to Bucky				

Correct FFD for examination				
Control of patient:				
LMS, signature, clinical history				
Exposure setting:				
Correct use of kVp and mAs				
Correct grid selected				
Correct focal spot setting				
Placement of lead marker				
Radiation protection measures:				
Full apron/thyroid shield				
Positioning skills				
Immobilisation techniques (sandbags/sponges)				
Centring point				
Beam collimation to anatomical area of interest				
Observe patient while exposing (breathing)				
Communication & Patient care				

Projection 1			
Needs significant Improvement (fail) 0	Needs minor Improvement (fail) 1	Achieved (pass) 2	Comment from qualified if marked 0 or 1

Projection 2			
Needs significant Improvement (fail) 0	Needs minor Improvement (fail) 1	Achieved (pass) 2	Comment from qualified if marked 0 or 1

Constructive comments from the qualified radiographer in order to improve:

_____
_____
_____

Remedial action plan from the student if outcomes were not achieved:

_____
_____
_____

Signature facilitator:_____ Signature student: _____

SECTION B - POSITIONING CRITERIA FOR THE PROJECTIONS (complete this section before you do the practical assessment)			
Positioning criteria Projection 1 **Name of Projection:** _____		**Positioning criteria Projection 2** **Name of Projection:** _____	
List the radiographic criteria for this projection as indicated below		**List the radiographic criteria for this projection as indicated below**	
1. Anatomy (optimally demonstrated**):**		**1. Anatomy** (optimally demonstrated**):**	
2. Rotation:		**2. Rotation:**	
3. Tilt:		**3. Tilt:**	
4. Centring Point:		**4. Centring Point:**	

SECTION C - PROOF OF SKILLS IN PRACTICE (you should have completed 5 examinations for bony thorax before the practical assessment)								
	Name of patient	Date	Study	AP/Lat/ Obl	c m	Exposure of 1 projection	EI EXI LGM	Done self (signature)
1								
2								
3								
4								
5								

7. REFERENCES

Bontrager, K.L. & Lampignano, J.P. 2014. *Textbook of radiographic positioning and related anatomy.* (8th ed.). Mosby: St. Louis - Missouri.

Ballinger, P.W., Long, B.W. & Smith, B.J. 2007. *Merrill's atlas of radiographic positions and radiographic procedures.* 11th ed., vol. 1. Mosby: St. Louis – Missouri.

7.1 Additional Reading

Rockall, A., Hatrick, H., Armstrong, P. & Wastie, M. 2013. *Diagnostic imaging.* 7th ed. Wiley-Blackwell: West Sussex: UK.

Shaw, A., Edmund, G., Singh, A. & Massoud, T. 2009. *Radiology: clinical cases uncovered*. Wiley-Blackwell: West Sussex: UK.

Any other additional sources can be consulted in the library, the information centre or any scientific data sources on the internet.

8. STUDENT SUPPORT

Learning material, assessment tools, tips, X-ray images, web links and additional reading material for support are available on Blackboard.

5.4.1.1 *Discussion on the proposed learning unit for Year 2*

When analysing the proposed learning unit (5.4.1) for Year 2 from an educational view point, the following aspects are noted:

- The **credits** and **notional learning hours**, the **introduction**, the **outline** of the learning unit, the **sources** consulted by the lecturer and the available **student support** are again presented to the student.
- At the second year level, the prior **learning assumed to be in place** includes all aspects for imaging of the chest which were learned in the first year (e.g. anatomy of the thorax, image recording principles, and indications for imaging of the thorax). Additionally, students should have mastered of the positioning of a patient for chest imaging, the selection of appropriate technical factors, and the assessment of chest images in a simulated environment.
- Again, clear and realistic **learning and generic outcomes** provide a useful guide to the student of what has to be learned in the unit (cf. 2.6.1, 2.6.2.2). Note that Bloom's taxonomy now reflects a higher level of learning for some of the outcomes than was reflected for the first year of study (cf. 2.5.1.4). Verbs such as apply, operate, critique, evaluate and recommend will demand higher cognitive responses from the student. In other words, the student is stimulated towards the integration of content from different modules in the learning programme and towards starting to think critically to find solutions to certain challenges.
- Students are informed about the types of **learning facilitation** to expect in the learning unit. For a learning unit in the second year, the facilitator should opt for learning activities which will demand a higher level of learning from students. The first activity will be conducted in the skills laboratory on campus to allow students to master the anatomy of the bony thorax. However, different from the first year, this activity is now structured to make the students revert to self-centred learning because they now have to label the anatomy of the bony thorax by consulting their anatomy and Radiography textbooks and other sources. Also, the lecturer will not present a formal lecture on the anatomy of the bony thorax, but will ask students selectively from the group to present their labelled images to the class (this is linked to learning outcome 1).

For learning Activity 2 the lecturer will, as in the first year of study, demonstrate the positioning of the patient for imaging of the bony thorax, after which students will be selectively invited from the group to position a peer student for imaging of the bony thorax while constructive critique will be invited from the 'spectator' students. This is aimed at stimulating the students to be critical about the application of positioning principles to ensure accurate positioning of the patient (linked to learning outcomes 4, 5 & 6). Activity 4 is aimed at assisting the student to achieve learning outcomes 7 and 8. In this activity students will have to apply the criteria for optimal positioning from their textbooks to images of the bony thorax during a tutorial session in the skills laboratory. Again, the students need to revert to self-centred learning because the lecturer will supply the images, but the students will need to discover and apply the criteria themselves.

Learning Activity 4 is the WPL required when the student is being placed in clinical practice. It is important to note that each learning unit in the second year of study, in this case the bony thorax, should have a structured WPL component with clearly indicated requirements. The record of the required number of patients for bony thorax done by the student can be added to the portfolio of evidence (6.3.1.1) together with the rubric for the formative assessment (cf. 5.4.1 - assessment 4) which is directly linked to this learning activity (all outcomes).

Also noteworthy is that the learning activities stimulate the development of generic skills such as learning skills, research skills, self-responsibility skills, communication skills, problem-solving/critical-thinking skills, and techno-logical skills.

- The **assessment** activities for Year 2 clearly reflect the higher cognitive demand required from the student. Assessment Activity 1 is focused on measuring students' knowledge and application abilities (linked to learning outcomes 1 - 5). However, for assessment activity 2 students will have to revert to a higher level of learning to complete the presented case study by drawing on prior knowledge and skills, by integrating knowledge from different modules, by doing some research about some concepts, and by interactively participating in peer learning and group work (linked to learning outcomes 1 - 5 and 7). Assessment activity 3 again focuses on students' ability to assess the acquired image for bony parts of the chest for correctness (linked to learning outcome 7). However, at the second year level, higher level modifiers

and verbs from Bloom's taxonomy may be used to stimulate the student to revert to a higher level of learning. Additionally, the integration of prior knowledge and skills can be included in the assessment.

For the learning unit used as an example (5.4.1), a formative assessment activity for WPL was added because in the suggested WIL programme the students are placed for WPL only from Year 2. Assessment activity 4 focuses on the skills acquired during a period of WPL. This type of formative practical assessment activity can be required from the student after completion of each learning unit. The proof of attainment of the outcomes for such an assessment activity can be added to a portfolio of evidence (cf. 6.3.1.1) for each year of study to serve as proof of the attainment of the required outcomes for WPL.

The example of a rubric for a formative practical assessment activity (cf. 5.4.1 – assessment 4) is aimed at measuring the attainment of outcomes in the clinical setting such as the application of room preparation for the examination, the control of the patient, the setting of exposure factors for the examination, the application of radiation protection, the positioning of the patient for the specific imaging examination, and the quality of the projections acquired during the examination (projection 1 and projection 2) (Section A). The assessment criteria do not only allow for grading, but also indicate whether the specific skill needs 'significant improvement', or 'minor improvement', or whether the student has 'achieved' the specific skill. An additional column allows for comments from the assessor about 'significant improvements' required or 'minor improvements' required. These comments, together with 'constructive comments from the qualified radiographer' and 'the remedial action plan from the student', allow for ample room for formative feedback and reflection, which are both powerful methods to enhance learning and to ensure that deep learning occurs (cf. 2.7.1.5). As stated by Brown (2001:17; cf. 2.7.1.5), the role of feedback and reflection is to inform the student about his/her performance during an assessment and what to do to improve before the next assessment.

Section B serves as proof that the student has consulted the textbook regarding the disciplinary knowledge required to assess the acquired images for anatomical structures shown and for correctness of the image through application of the radiographic criteria for the specific image. The student is advised to complete this

section prior to the practical part of the assessment (Section A) in order to prepare him/her to assess the images acquired during the practical assessment.

Section C serves as a record of patients examined in the clinical setting as proof of the attainment of the skills for the learning unit. Apart from the generic information such as the name of the patient, the date, and the type of examination, the rubric requires that the student also adds the exposure factors selected for one projection for each patient as well as the exposure index (EI) (which is known as log median exposure or LGM by some companies) that was displayed on one image on the computer screen. The latter was added to get the student in the habit of always reflecting on the exposure factors set to acquire an image and the EI/LGM displayed on the required image as they are directly related to each other. Both are crucially important to ascertain good image quality.

Summative practical assessment for WPL in Year 2

From Year 2 onwards, or when students start with their WPL, students should at the end of each WPL year have been exposed to a summative assessment for grading of the skills acquired in the academic year. Such an assessment is thus not linked to a specific learning unit in the study year, but is aimed at measuring the integration of knowledge gained from all learning units in the study year in order to develop the required skills and competencies to perform an imaging examination in clinical practice.

A summative practical assessment rubric was designed using the exit level outcomes and associated assessment criteria for the qualification as guidance for assessment (cf. 2.5.1.2). Additionally, certain important competencies indicated with an asterisk (*) should be achieved to pass a summative assessment. One such important competency is the correct control of the patient prior to an X-ray examination. If a patient's physical details are not correctly controlled, the wrong patient might receive an X-ray examination of an anatomical area with no pathology which implies that the patient will be exposed to unnecessary ionising radiation. Consequently, a student should not pass a summative assessment if such an important key competency was not adhered to. Other competencies considered as important in the execution of an X-ray examination are, for example, the control of pregnancy, radiation protection, correct centring of the main beam, and correct setting of the focus-film distance (FFD). The important competencies

were selected according to their importance towards the success of the examination (imaging principles) and the protection of the patient against ionising radiation.

Ideally, a student should be guided towards the section marked 'achieved' which indicates that the student successfully adhered to the assessment criteria for the specific area. A score for 'beyond expectation' will only be awarded to outstanding students. Thus only a few students might achieve this level. In cases of a student presenting serious performance challenges, the comment section must reflect those issues so that remedial actions can be put into place. The student will be expected to successfully complete the first summative assessment attempt. However, if a student fails the first summative assessment attempt due to non-adherence to one of the key competencies, a re-assessment should be granted while the student works towards the achievement of the specific key competency during the re-assessment attempt. Failure at the second attempt will result in the overall performance of the student to be discussed by the lecturers and WPL mentor/supervisor of the specific clinical training centre to decide whether another assessment should be granted or whether the student should be graded as 'not compliant' with the set WIL outcomes for the specific year of study. A suggested rubric is presented below:

WIL SUMMATIVE ASSESSMENT

NAME OF STUDENT:	**DATE OF ASSESSMENT:**
TYPE OF PROCEDURE:	**Patient condition (e.g. trauma, small child):**
Assessment attempt	**1 2 PASS / FAIL**
Criteria marked with an * MUST be achieved to pass this summative assessment	
Score guideline: The goal of this assessment is to guide the student to **ACHIEVE (2)**	

Needs significant improvement **(FAIL)** 0	Needs minor improvement **(FAIL)** 1	Achieved **(PASS)** 2	Achieved beyond expectation **(EXCEPTIONAL** 3
*Makes one or more critical mistakes and/or multiple minor mistakes which the student fails to recognise	*Student is not performing at the expected level; a few minor mistakes without recognition. Inconsistent display of knowledge and problem-solving skills	*Student is consistent in applying knowledge in most examinations on a variety of patients and with different procedures; Proceeds without prompting and without making critical mistakes; Recognises and corrects minor mistakes;	*No critical mistakes. No lead maker, collimation, patient protection or other technical errors

		Creates safe environment. **All '*' achieved**	

1. Application of the Principles of Human Rights, Ethics and Relevant Medical Law which Ensure the Wellbeing of the Patient (ELO 6).

	Needs significant improvement **(FAIL)** 0	Needs minor improvement **(FAIL)** 1	Achieved **(PASS)** 2	Achieved beyond expectation **(EXCEPTIONAL)** 3
Control of patient accuracy (ID, name, surname and birth date) *				
Control of pregnancy status (tact-ful with older patients) *				
Control of clinical history				
Explains the procedures before and after application to ensure cooperation; Effective verbal / nonverbal communication skills with patients				
Respects patient's rights (consent) and privacy.				
Radiation protection shielding*				

Overall impression:	**0**	**1**	**2**	**3**	**/ 18**
Comments:					

2. Ability to Access, Organise and Present Information Applicable to the Radiography Context in order to Record, Retrieve, and Communicate Patient Data (ELO 2).

If not applicable, do not indicate	Needs significant improvement **(FAIL)** 0	Needs minor improvement **(FAIL)** 1	Achieved **(PASS)** 2	Achieved beyond expectation **(EXCEPTIONAL)** 3
Demonstrates knowledge of PACS/workflow/retrieval of data; Image assessment: post-processing to optimise diagnostic quality				
Procedures with and without contrast media are prepared for and performed competently; Sterile techniques are demonstrated for the correct needle placement in a vein				

Overall impression:	**0**	**1**	**2**	**3**	**/ 6**
Comments:					

3. Ability to Perform Routine and Specialised Radiographic Procedures to Produce Images of Diagnostic Quality (ELO 1).

	Needs significant improvement **(FAIL)** 0	Needs minor improvement **(FAIL)** 1	Achieved **(PASS)** 2	Achieved beyond expectation **(EXCEPTIONAL)** 3
Positioning techniques (indicate number repeats ___)*				
Performs procedure as per request*				
Anatomical aspect in contact / Alignment				
Anatomical lead marker*				
Centering correct*				
Collimation (visible and tight)*				
Breathing (second suspended chest/observe breathing)				
Immobilization- (sponges/sandbags)				
FFD*				
Main beam direction*				
Correct Bucky (Grid/non Bucky selection)/(Focal spot)				
Removed any foreign objects				
Overall impression: **0** **1** **2** **3**				**/ 33**
Comments:				

4. Ability to Evaluate the Quality of Routine and Specialised Radiographic Images and to Perform Image Interpretation to Identify Normal and Abnormal Appearances (ELO 3).

	Needs significant improvement **(FAIL)** 0	Needs minor improvement **(FAIL)** 1	Achieved **(PASS)** 2	Achieved beyond expectation **(EXCEPTIONAL)** 3
Image assessment: positioning - knows when to repeat procedure*				
Positioning criteria (see space below) *				
Image assessment - exposure factors kV/ mA (choice and explanation)				
Exposure factor - calliper measurement & exposure chart *				
Exposure factor (LGM/EI) - Explanation				
Independent judgment and				

discretion in the performance of additional radiographic views is exercised where justified						
Overall impression:	**0**	**1**	**2**	**3**		**/ 18**
Comments:						

List the radiographic criteria applied by the student to assess the images for correct positioning	
Projection 1	**Projection 2**
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.

5. Ability to Perform Safe and Effective Patient Care in Accordance With the Patient's Needs and Departmental Protocol to Provide a Quality Service and to Maintain the Wellbeing of the patient (ELO 5).

	Needs significant improvement **(FAIL)** 0		Needs minor improvement **(FAIL)** 1	Achieved **(PASS)** 2	Achieved beyond expectation **(EXCEPTIONAL)** 3	
Safe patient care practices in accordance with the patient`s needs*; Optimal patient care is applied before, during and after the procedure (patient observed); Drips and other supportive devices monitored						
(not applicable to non-contrast examinations) Signs and symptoms of contrast media reaction are recognised; appropriate action taken and assistance in emergency medication following such reactions is demonstrated						
Overall impression:	**0**	**1**	**2**	**3**		**/ 9**
Comments:						

6. Application of Principles, Specific Knowledge, Skills and Values Intrinsic to the Profession (ELO 7).

	Needs significant improvement **(FAIL)** 0	Needs minor improvement **(FAIL)** 1	Achieved **(PASS)** 2	Achieved beyond expectation **(EXCEPTIONAL)** 3
Room preparation (fixing before and after procedure)				
Infection control (wash hands)				
Infection control (clean Bucky- before skull work)				
Uniform neat and no excessive jewellery/hairstyles or makeup				
Name badge				
Dosimeter on person at all times (above apron in theatre) *				

Overall impression:	**0**	**1**	**2**	**3**	**/ 16**
Comments:					

Summative assessment grading:

1 (18)	2 (6)	3 (33)	4 (18)	5 (9)	6 (16)	Total 100	%

5.5 CONCLUDING SUMMARY

It is important to note that not all outcomes for a module like WIL can be attained in one learning unit. Therefore, upon reflection on the WIL modules for Year 1 and Year 2 (Tables 5.1 & 5.3), it is clear that some of the outcomes for the module will be addressed by the learning unit on imaging of the chest and bony thorax, and some will not. However, it is most likely that all the outcomes will be addressed when all learning units in the module are well planned to work towards the required levels of knowledge, skills and competencies at the end of an academic year. The same applies for the assessment methods and instruments used in a specific learning unit. The lecturer should decide whether formative assessment is indicated to judge the achievement of outcomes, or whether grading (summative assessment) is required (cf. 2.7.1.1). Likewise, it remains the prerogative of the lecturer to choose the assessment methods for a specific learning unit. Assessment methods are measuring different cognitive levels and all have some advantages and disadvantages (cf. 2.7.1.3). The lecturer should therefore select an

assessment method that will measure the students' achievement of the set outcomes for the learning unit in a fair, reliable and valid manner (cf. 2.7.1.2).

When reflecting on the design of the modules and learning units for WIL for Year 1 and Year 2 for the Bachelor of Radiography in Diagnostics degree, it is clear that the emphasis should be on the delivery and attainment of disciplinary knowledge in Year 1 so that the student is able to revert to a deeper level of learning in Year 2. Simultaneously, students should be stimulated to develop certain generic outcomes to prepare them to function efficiently in the real world of work. In the second year of study, the learning and assessment activities should be structured to stimulate a higher cognitive demand from the student, as is demonstrated in the module provided. In the second year, learning and assessment activities are designed to also stimulate the integration of content from different modules as students are being placed for WPL from Year 2.

CHAPTER 6

AN EDUCATION AND TRAINING PROGRAMME FOR WORK-INTEGRATED LEARNING FOR YEARS 3 AND 4 OF THE BACHELOR OF RADIOGRAPHY IN DIAGNOSTICS DEGREE

6.1 INTRODUCTION

In this chapter, suggestions are made towards the delivery of WIL in Years 3 and 4 of the proposed Bachelor of Radiography in Diagnostics degree. As indicated in Chapter 5, the teaching/learning and assessment programmes for Years 3 and 4 should focus on stimulating a higher cognitive demand from the student as in the first two years, as the focus in the professional context is now on advanced and specialised imaging procedures. Also, students should be trained to function independently in sometimes demanding situations, such as with patients who suffered traumatic incidents. Additionally, a student who has achieved a level 8 NQF qualification, such as the Bachelor of Radiography degree, should be able to conduct research (cf. 2.5.1.2), as required by SAQA.

The module templates for the proposed modules for WIL for Years 3 and 4 (Tables 6.1 & 6.2) require the same generic information as the modules for Years 1 and 2, namely the name of the module, the NQF level, the qualification designator, the CESM qualifier, the credits, notional learning hours, the required prerequisite learning for the specific module, the available student support mechanisms and, at the end of the module, an estimation of the notional hours that should be spent on the different aspects in delivery of the unit.

6.2 A MODULE FOR WORK-INTEGRATED LEARNING FOR YEAR 3 (HEQF LEVEL 7)

For the third year module for WIL, a higher cognitive level of learning than in Year 2 is reflected by the exit level outcomes, the module outcomes and the associated assessment criteria. Note that reference is now made to qualities such as 'well-rounded understanding', 'critical demand of', 'well-developed' knowledge or skills, 'critical assessment', and 'scientific compilation'. The curricular modalities/learning modes for WIL also include PjBL, which is ideally suited for projects done in clinical practice. PjBL, as stated by Howard and Jorgenson (2006:2 & cf. 2.6.1.3), represents a learning environment where the project drives the learning. This is therefore an ideal way in

which students can be stimulated to make connections between disciplinary knowledge and acquired skills while working in the professional environment.

Assessment activities appropriate for use at this level include problem scenarios, but at this level these are not as well structured as at the second year level (cf. 5.4.1). Although students will still be assessed using OSCAs and formative and summative practical assessments, presentations could now be added as an assessment method. A presentation can be linked to the solving of a case scenario or to present a completed clinical practice project to the rest of the class.

Another assessment method that can be added at this level is the scientific writing of an academic essay. Academic essays might not be ideally suited for the WIL environment, but they can be utilised in other modules such as Radiographic Practice (theory) and parts of the research for the compilation of the essay can be done in clinical practice. This will assist students in linking disciplinary knowledge with the application thereof in clinical practice. Essay writing will additionally assist students in developing the specific skills they will need to write a research proposal and report in the fourth year of study. The latter is one of the exit level outcomes of the qualification (cf. 2.5.1.2). During students' progress through this year, they should continue to add evidence to their portfolio that can also be graded at the end of a semester or at the end of the academic year (cf. 6.3.1.1).

TABLE 6.1: THIRD YEAR MODULE FOR WORK-INTEGRATED IN RADIOGRAPHY
(table continues on next page…)

MODULE WIL307

TITLE AND CODE OF MODULE: Work-integrated learning III (D) (WIL307)
NQF-LEVEL: 7
QUALIFICATION DESIGNATION: Medicine
CESM QUALIFICATION: 0924
CREDITS: 24
NOTIONAL LEARNING HOURS: 240
PREREQUISITE LEARNING: Radiographic Procedures II (WIL206) - NQF level 6

LEVEL DESCRIPTOR CATEGORIES/ COMPETENCIES	**ASSOCIATED EXIT LEVEL OUTCOMES**	**ASSOCIATED ASSESSMENT CRITERIA** *Students will demonstrate their competence in:*	**MODULE OUTCOMES** *At the end of this module, students will be able to:*	**QUALITY CONTROL**
*__Scope of knowledge__ – informed understanding *__Knowledge literacy__ - demonstrate an awareness *__Method and procedure__ – demonstrate the ability to select and apply *__Problem solving__ - demonstrate the	***An informed understanding*** of the important terms, rules, concepts, principles and theories. An ability to effectively ***apply*** essential methods, procedures and techniques of the field or discipline The ability to use knowledge to ***solve well-defined problems*** both routine and unfamiliar within a familiar context An ability to ***adjust*** an application of a solution to meet the needs of changes in the problem An ability to ***evaluate*** the change	Application of the basic terms, rules, concepts, principles and theories of the practice of Radiography Application of knowledge of Science in the context of the practice of Radiography Application of relevant patient care in a simulated environment Psychological, cultural and ethical considerations of patients and their families Respecting the rights of patients as entrenched in the Bill of	***Understand and apply*** the basic terms, rules, concepts, principles and theories of the practice of Radiography ***Search for, gather and analyse*** information to complete learning activities related to the practice of Radiography ***Solve, adjust to and evaluate*** well- defined problems related to the practices of Radiography ***Present*** their work using appropriate computer technologies	Accreditation and adherence to the regulations of the Professional Board for Radiography and Clinical Technology Consideration of the exit level outcomes for the specific level in the delivery of content and assessment of outcomes Alignment of outcomes and learning and assessment activities (Programme and Faculty QC)

ability to identify, evaluate and solve defined, routine and new problems within a familiar context *__Ethics and professional practice__ - demonstrate the ability to take account of *__Accessing, processing and managing information__ - demonstrate the ability to gather information *__Producing and communicating information__ – demonstrate the ability to communicate information reliably, accurately and coherently *__Context and systems__ - demonstrate the ability to operate in a range of familiar and new context	using relevant evidence ***Efficient*** information-gathering, analysis and synthesis, and evaluation skills ***Presentation of skills*** using appropriate ***technological aids*** An ability to ***communicate*** information coherently in writing and verbally The capacity to ***take responsibility*** for own learning within a supervised environment Take ***decisions*** about and ***responsibility*** for actions ***Evaluate*** their own performance against given criteria	Rights, the Patients Charter and relevant medical law Decision-making and accountability regarding the ethical requirements of a professional medical environment Skills and knowledge of first aid	***Communicate*** properly***, behave ethically and professionally*** and ***take responsibility*** for their actions in the clinical environment ***Apply*** proper patient care as required in the clinical environment ***Manage*** computer-based patient information and patient records as required in the clinical environment ***Execute*** routine chest and abdominal X-ray examinations in a controlled environment at the university	Consideration of inputs from the Advisory Committee Radiological departments and practices Internal QC

*__Management of learning__ - demonstrate the ability to evaluate his or her performance or the performance of others *__Accountability__ - demonstrate the ability to account for his or her actions				

LEARNING UNITS (C0NTENT)	**Estimated notional hours/ learning unit**	**SUGGESTED METHODS OF ASSESSMENT** (list not exhausted)	**CURRICULAR MODALITIES/ LEARNING MODES** (list not exhausted) **<u>*Work-directed Theoretical Learning</u>** **<u>*Problem based learning</u>** **<u>*Workplace learning</u>** **<u>*Project-based learning</u>**	**FORMS OF STUDENT SUPPORT**
1. Basic imaging in theatre Radiography (urinary- & digestive system – RT scope, ERCP, cholangiography)	24 (2.4 credits)	Writing a test (written or computer-based) Completing a pre-reading template Compiling a mind map Taking part in demonstrations	Formal lectures Tutorials Simulations Demonstrations Peer learning in groups Structured interactive	Contact sessions Learning material Library Tutor guidance Peer support Consultations -
2. Urinary system & Venipuncture	24 (2.4 credits)			
3. Advanced imaging of the thorax (pattern recognition)	24 (2.4 credits)			
4. Advanced imaging of the upper extremity (additional + trauma)	24 (2.4 credits)			
5. Advanced imaging of the lower extremity (additional + trauma)	24 (2.4 credits)			

6. Advanced imaging of the pelvic girdle (additional + trauma)	24 (2.4 credits)	Taking part in role play Reporting on an observation in clinical practice Analysing **ill-defined and unfamiliar** problem scenario **Presentations** **Doing an OSCA** **Perform a practical assessment (formative and summative)** **Compiling a portfolio of evidence** **Writing an academic essay**	sessions Presentation of real world problems Integrated learning Discovery learning Guided practice Workplace learning **Clinical practice projects**	Individual/Groups Coaching and mentoring Blackboard support
7. Advanced imaging of the spinal column (trauma + spinal deformities)	24 (2.4 credits)			
8. Contrast examinations (GI, urinary & biliary)	30 (3 credits)			
9. Basic imaging of the skull & sinuses	32 (3.2 credits)			
10. Skeletal survey	10 (1 credit)			
	10 (1 credit)			
Total Notional Learning Hours = 240 (24 credits)	**Estimated time spend on:** • Facilitator/student contact: ±40 hours • Formative assessment: ±10 hours • Engaged learning: ±187 hours • Summative assessment: ±3 hours			

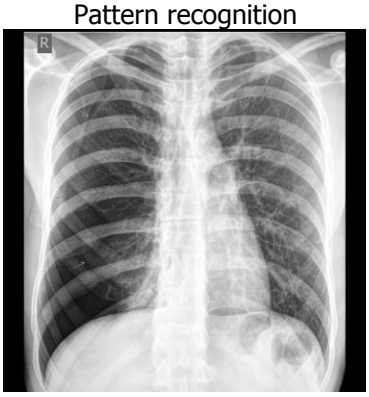
Section 6.2.1 presents an example of a learning unit for WIL for the third year of study in Radiography. The learning unit for 'advanced imaging of the thorax (pattern recognition)' was selected from the module (Table 6.1) to demonstrate the progression in level of learning from Year 2 to Year 3 and also to show the importance of the application of the prerequisite disciplinary knowledge and skills acquired in the two previous years of study.

6.2.1 A Proposed Learning Unit for Work-integrated Learning in Year 3 (HEQF level 7)

WIL306 – LEARNING UNIT 3

ADVANCED IMAGING OF THE THORAX

Pattern recognition



Credits: 2.4 of 24 (24 notional learning hours)

1. INTRODUCTION

Pattern recognition, also called image interpretation, can be described as a method of recognition and description of abnormalities in a radiographic image. It demands that a radiographer has a thorough knowledge of the basic normal anatomical patterns. In the past it was not expected of radiographers to perform pattern recognition. In the new primary health care system in South Africa, there is a definite need for radiographers to be able to perform pattern recognition. Most radiographers have little or no experience in pattern recognition and can therefore not perform the task successfully and with confidence. The aim of the learning unit is to give students guidance about the basic principles and essential elements of pattern recognition, and to familiarise them with the practical application of thereof.

"THE DIFFERENCE BETWEEN BEING GOOD AND BEING GREAT IS OFTEN ONLY A MATTER OF ATTENTION TO DETAIL" *Carlton & Adler*

2. ASSUMPTION OF LEARNING TO BE IN PLACE

The learning assumed to be in place for this learning unit is mastery of the anatomy, basic physiological processes, and the most common pathologies of the lungs, heart, mediastinum, and the pleura. Additonally, students should have mastered the skills to position a patient for imaging of the chest and to interpret the images for quality and correctness. A good mastery of the image recording principles is necessary to ensure qulity imaging, which is essential.

3. LEARNING OUTCOMES

After completion of this learning unit you should be able to:

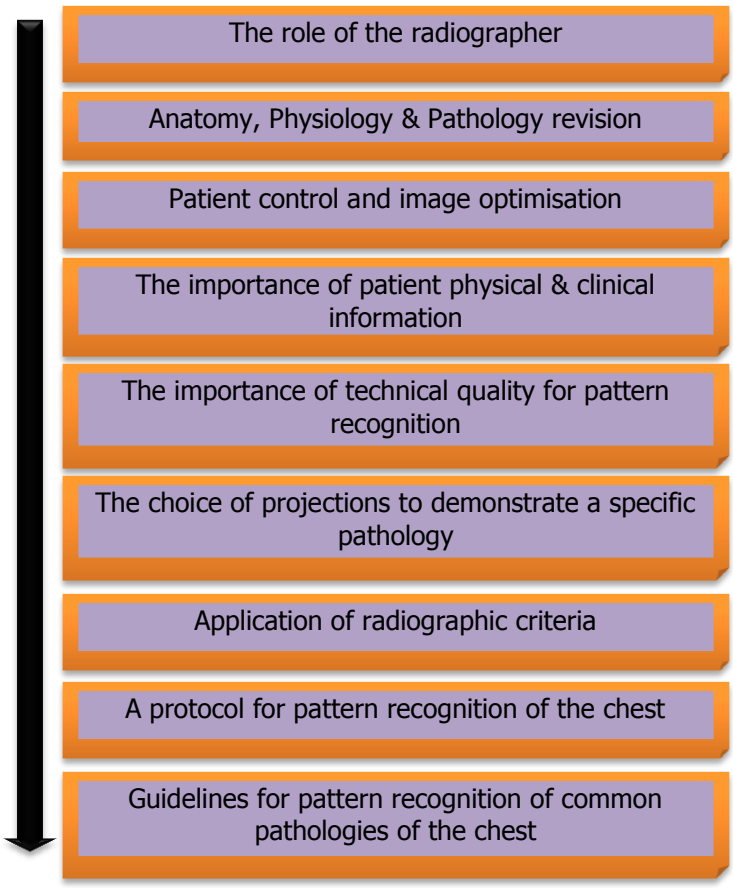
Knowledge & skills outcomes

- **Comprehensively discuss** the role of the radiographer in pattern recognition.
- **Identify** all basic anatomy on radiographic images.
- **Critically reflect** on the importance of the physical and clinical information of the patient (the X-ray request form) to perform pattern recognition.
- **Discuss in detail** the technical considerations that are of importance to ensure quality chest images for pattern recognition.
- **Evaluate** the correct radiographic density and contrast on an X-ray of the chest.
- **Differentiate** between the radiographic appearance of different pathological conditions of the chest and a normal chest image.
- **Analyse** the images of the chest for correct positioning of the patient and the presence of pathology.
- By conducting basic research of pathologies, **construct** your own pattern recognition protocol to apply to images of the chest while doing workplace learning.

Generic outcomes:

- Communication skills
- Self-responsibility skills
- Problem-solving/critical thinking skills
- Technological and environmental literacy skills
- Cultural- and aesthetic-understanding/skills
- Developing a macro-vision on algorithms of image modalities
- Teamship
- Learning skills
- Research skills

4. LAY-OUT OF THE LEARNING UNIT



5. LEARNING FACILITATION

Learning will be facilitated by means of formal lectures, tutorials and demonstrations, simulations, peer learning in groups and structured interactive sessions, the presentation of real-world problems, discovery learning, integrated learning, WPL, and guided practice. **Clinical practice projects** will guide you towards the integration of knowledge and skills acquired in the previous study years.

Activity 1: Peer learning, structured interactive sessions, integrated learning, discovery learning (knowledge, understanding, application)

Work in groups of two in the skills laboratory on campus and critically assess the chest images supplied to you on Blackboard according to the pattern recognition guidelines which were explained to you in class. You will be asked to report to the class on your findings during the scheduled interactive discussion session in the next class period.

Use the following as a map to guide you through the assessment of the images:

PROPOSED STRUCTURE FOR PATTERN RECOGNITION OF THE CHEST

1. **A** – Abdomen (also diaphragm)
2. **B** – Bones (also pleura & costophrenic angles)
3. **C** – Cardiac (heart & mediastinum)
4. **'s** – Soft tissue, supportive apparatus
5. **Lung** fields
6. **Hilar** regions

Activity 2: Peer learning, structured interactive sessions, integrated learning, discovery learning (knowledge, understanding, application, analysis)

Work with one of your peers and search for two images of the chest with interesting pathology. You can search for images at the practice where you do your workplace learning or use scientific data sources on the internet. Bring your selected chest images to class for the next class week. You and your peer will be asked to facilitate a short discussion/presentation about the pathology/ies visible on the images and how the appearance of these pathologies differs from that of a normal chest image.

Activity 3: Workplace learning (WPL) (knowledge, comprehension, application, analysis and synthesis)

While doing your workplace learning, your facilitator will provide you with a log of 20 patients with some form of pathology visible on their chest images. Supply a brief description in the spaces provided of how each of the pathologies makes the patterns on the chest image look different from the normal appearance of patterns on a chest image. Submit the completed list to your facilitator during your next class week.

6. ASSESSMENT AND ASSESSMENT CRITERIA

(dates provided serve as examples)

Assessment 1: OSCA (date: 12/04/2014)
Assessment criteria: application of knowledge of anatomy and radiographic criteria and pattern recognition principles on chest images with pathology.
Weight of the assessment: 5%*.
*This activity will be assessed with the aid of a memorandum.

Assessment 2: Clinical practice project (date: 25/05/2014) (group work)

Assessment criteria: integration of knowledge, skills, application and analysis of chest images for pattern recognition.
Weight of the assessment: 10%*.
*This activity will be assessed with the aid of a rubric.

*Together with a peer class member, **do some research** about the specific pathological condition of the chest assigned to you by your facilitator. Conduct your search at the practice where you are doing your workplace learning or use scientific data sources on the internet for an image demonstrating the specific pathology.*

1. Compile a brief literature review (600 – 800 words) supplying a background for the specific pathology. Avoid plagiarism. Supply at least three scientific sources that you consulted using the Harvard method of referencing.
2. Construct your own pattern recognition protocol that displays your assigned pathology for the chest image allocated to you.
3. Prepare a short (10 minutes) presentation in which you brief your class mates on the pathology and the application of the pattern recognition principles to interpret the appearances on the image.

Rubric for assessment of clinical practice project							
ASSESSMENT CRITERIA	ASSESSMENT SCALE						
1. Literature review	Background of pathology	**0**	**1**	**2**	**3**	**4**	**5**
	Number of sources						
	Number & format of referencing						
2. PR protocol	A						
	B						
	C						
	's						
	Lungs						
	Hila						
3. Presentation	Rapport with audience (eye contact/enthusiasm, engaged with the audience)						
	Slides (font/layout/use of colours/spelling and grammar)						
	Plan/structure of presentation (introduction/body/ discussion/conclusion)						
	Value of the content						
TOTAL:		**__ /__**				**%**	

EXPLANATION OF ASSESSMENT SCALE

SCALE		**EXPLANATION**
0	Not done/not included	Elements not included in project or not done
1	Requires revision	Elements included but do not adhere to the minimum criteria/standard
2	Acceptable but below average	Adheres to minimum standard/criteria
3	Average	Between minimum standard and good
4	Good	Exceeding the minimum standard/criteria
5	Very good/excellent	Distinction

Assessment 3: Formative practical assessment (to be conducted during WPL) (cf. 5.4.1 – assessment 4)

7. REFERENCES

Corne, J., Carrol, M., Brown, I. & Delany, D. 2000. *Chest X-rays made easy*. China: Churchill-Livingston.

WHO. 1985. *Manual for radiographic interpretation for general practitioners*. Geneva: WHO.

Lisle, A. 1996. *Imaging for students*. Connecticut: Arnold Publishers.

Corr, P. 2001. *Pattern recognition in diagnostic imaging*. Geneva: WHO.

Additional reading

Chen, Y.M. 1995. *Basic Radiology*. London: McCraw Hill.

Patel, 1998. *Radiology*. New York: Blackwell Science.

Pierro, J. A. 1989. *Manual of diagnostic Radiology*. Los Angeles: Lea & Febiger.

Nicolson, 1995. *ABC of emergency Radiology*. New York: BMJ Publishing Group.

Any other additional sources can be consulted using the library, the information centre or any scientific data sources on the internet.

8. STUDENT SUPPORT

Learning material, assessment tools, tips, X-ray images and additional reading material for support of learning are available on Blackboard.

6.2.1.1 *Discussion on the proposed learning unit for Year 3*

To prevent repetition, only the aspects which are different from the learning units in Year 1 (cf. 5.3.1) and Year 2 (cf. 5.3.2) and aspects which need to be highlighted will be analysed from an educational viewpoint in the following discussion on the proposed learning unit for Year 3 of the Bachelor degree:

- At the third year level, **learning assumed to be in place** includes, apart from the disciplinary knowledge, the acquired skills about patient positioning, image recording, and the analysis of a chest image.
- The cognitive level required from students is reflected in the use of higher level modifiers and verbs from Bloom's taxonomy in the **learning outcomes** such as 'comprehensively discuss', 'critically reflect', 'analyse' and 'construct' (cf. 2.6.1, 2.6.2.2).

- **Learning facilitation** for WIL in the third year of study may include curricular modalities/learning modes from the two previous study years. For example, the presentation of case studies can again be used to facilitate learning. However, where a case study used in the second year of study needs to be well structured in order to guide the students' thinking, a case study in the third year of study can be less structured to stimulate students to discover the necessary information independently. Again, a well-structured period of WPL forms one of the learning activities in the third year of study (activity 5). A record of the required number of patients, together with the formative practical assessment rubric for this learning unit, can be added to the portfolio of evidence (6.3.1.1). An important consideration is that learning activities in the third year of study should now be focused on the stimulation of the integration of knowledge and skills and the development of generic competencies (Activities 1 and 2). Additionally, these activities should assist the student to revert to student-centred learning while utilising both supplied and self-discovered resources.
- The **assessment** activities in the third year again include an OSCA and a formative practical assessment (linked to learning outcomes 1 - 7). Additional to the assessment of this learning unit is a clinical practice project (linked to learning outcome 8). Note that the assessment activities now focus on measuring the achievement of a higher level of learning as reflected in the learning outcomes and the attainment of many of the generic outcomes.

  As in Years 1 and 2, a formative practical assessment should ideally be done to determine students' level of achievement of the outcomes for WPL for each learning unit after a period of work placement. For this assessment, the same rubric can be used as in the second year (cf. 5.4.1 - assessment 4). The rubric for the formative practical assessment performed in Year 3 can also be added to a portfolio of evidence because it reflects the required number of patients attended to (section C of the rubric) for each required anatomical area.

<u>Summative practical assessment for WIL in Year 3</u>

As in the second year of study, each student should do a summative practical assessment at the end of the third academic year to measure the acquisition of skills and competencies for WPL. The same rubric as in the second year of study can be used for this assessment with the same procedures if a student fails a first or second attempt of the assessment (cf. 5.3.1.2 – Summative Practical Assessment).

6.3 A MODULE FOR WORK-INTEGRATED LEARNING FOR YEAR 4 (HEQF LEVEL 8)

Table 6.2 displays the proposed module for WIL at level 4 of the new Bachelor of Radiography in Diagnostics qualification, showing all the essential elements as in the modules for the previous study years.

In this module a higher cognitive level of learning is reflected by the exit level outcomes, the module outcomes and the associated assessment criteria, with reference aspects such as a 'well-rounded and systematic knowledge', 'mapping of new knowledge', 'multiplicity of right answers' , and 'dealing with unfamiliar concrete and abstract problems'. The learning facilitation for WIL now includes all the learning modes displayed in the modules from Year 1 to Year 3. As required for the qualification, a student at this level of learning should also be able to conduct sound research. Therefore students will be required to engage in mini / limited research project. This research project does not have to be done entirely in the WIL component of the programme but can be integrated with other modules in the syllabus and can thus be used for grading in more than one module. In other words, one part of the research project can be used for grading in the module Radiographic Practice, another in the module Research Principles, and another in the WIL module.

Assessment activities suitable to be used at this level should reflect students' mastery of all the knowledge and skills required as the study year progresses. The student should now reflect a critical understanding of the aspects which will ensure quality imaging and the ability to work as a trained graduate in a complex Radiology practice environment.

TABLE 6.2: FOURTH YEAR MODULE FOR WORK-INTEGRATED LEARNING IN RADIOGRAPHY
(table continues on next page…)

MODULE WIL408

TITLE AND CODE OF MODULE: Work-integrated learnings IV (D) (WIL408)
NQF-LEVEL: 8
QUALIFICATION DESIGNATION: Medicine
CESM QUALIFICATION: 0924
CREDITS: 12
NOTIONAL LEARNING HOURS: 120
PREREQUISITE LEARNING: Radiographic Procedures III (WIL307) - NQF level 7

LEVEL DESCRIPTOR CATEGORIES/ COMPETENCIES	**ASSOCIATED EXIT LEVEL OUTCOMES**	**ASSOCIATED ASSESSMENT CRITERIA** *Students will demonstrate their competence in:*	**MODULE OUTCOMES** *At the end of this module, students will be able to:*	**QUALITY CONTROL**
Scope of knowledge – demonstrate integrated knowledge *__Knowledge literacy__ – demonstrate an understanding of knowledge as contested *__Method and procedure__ - demonstrate an understanding of a range of methods of enquiry in a field	A ***well-rounded and systematic knowledge base*** in **a chosen** discipline/field and a ***detailed knowledge*** of some **specialist areas** A ***coherent and critical under-standing*** of **a chosen** discipline/field's terms, rules, concepts, principles and theories;	Selection and critical assessment of relevant patient and clinical information and data Scientific compilation of data and information Assessment of radiographic images for diagnostic quality according to relevant evaluation criteria conforming to medico-legal requirement Application of corrective measures to radiographic techniques where necessary	***Know, understand and apply*** the terms, rules, concepts, principles and theories in **a chosen** field of practice **and some specialist fields** ***Well-developed*** information retrieval and synthesis ***Solve*** unfamiliar concrete and abstract problems related to **a chosen** field of practice ***Well-developed*** *presentation skills* using appropriate information and computer technologies	Accreditation and regulations of the Professional Board for Radiography and Clinical Technology adhered to Consideration of the exit level outcomes for the specific level in the delivery of content and assessment of outcomes Alignment of outcomes and learning- and assessment activities (Programme- and Faculty QC) Consideration of inputs from the Advisory committee

*__Problem solving__ demonstrate the ability to identify, analyse, evaluate, critically reflect on and address complex problems *__Ethics and professional practice__ – demonstrate the ability to take decisions and act ethically and professionally *__Accessing, processing and managing information__ - demonstrate the ability to develop appropriate processes of information gathering *__Producing and communicating of information__ – demonstrate the ability to develop and communicate his or her ideas and opinions in well-formed arguments **Context and systems**	An ability to ***map new knowledge*** onto a given body of theory; An acceptance of a ***multiplicity of 'right' answers*** ***Effective selection*** and ***application*** of the essential procedures, operations and techniques of **a chosen** discipline/ field An ***understanding o***f the central methods of enquiry and research in a discipline/field ***Knowledge*** of at least one other discipline/ field's mode of enquiry An ability to ***deal with unfamiliar concrete and abstract problem***s and issues using evidence-based solutions and theory-driven arguments ***Well-developed*** information retrieval skills; critical analysis and synthesis of quantitative and/or	Competently perform routine and specialised radiographic techniques and procedures with and without contrast media Recognition of the signs and symptoms of contrast media reaction Conducting research in line with national needs and biomedical ethical policies and procedures	***Communicate*** reliably and coherently using **well-structured arguments** in the professional language and terms related to **a chosen** field of practice ***Effectively select*** and ***apply*** essential procedures for **a chosen** discipline/field ***Operate effectively*** in variable and unfamiliar contexts related to **a chosen** discipline/field ***Execute*** radiographic procedures as indicated in the content learning areas in a controlled environment at the university **and in clinical practice** of **a chosen** field of practice ***Accurately self-evaluate*** own learning, ***take initiative*** to improve and ***interact successfully*** with others ***Enquire*** about evolving problems in **a chosen** discipline/field using quantitative and/or qualitative methods of enquiry to supply evidence-based solutions	Radiological departments and practices Internal QC

- demonstrate the ability to manage processes in unfamiliar and variable contexts *__Management of learning__ - demonstrate the ability to identify, evaluate and address his or her learning needs in a self-directed manner *__Accountability__ – demonstrate the ability to take full responsibility for his or her work, decision-making and use of resources *	qualitative data ***Presentation skills*** following prescribed formats, using IT skills appropriately An ability to ***present and communicate*** information and own ideas and opinions in ***well -structured arguments***, showing an awareness of audience and using ***academic/ professional discourse*** appropriately A capacity to ***operate in variable and unfamiliar learning contexts*** requiring responsibility and initiative A capacity to ***accurately self-evaluate*** and identify and address own learning needs An ability to ***interact effectively*** in a learning group			

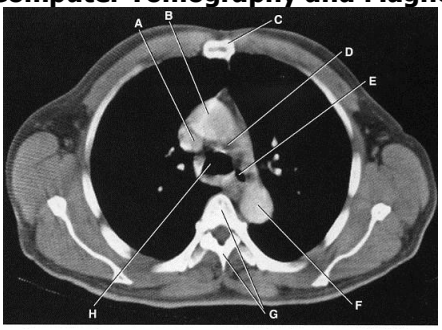
LEARNING UNITS (C0NTENT)	**Estimated notional hours/ learning unit**	**CURRICULAR MODALITIES/ LEARNING MODES** (list not exhausted) ***Work-directed Theoretical Learning** ***Problem based learning** ***Workplace learning** ***Project-based learning**	**SUGGESTED METHODS OF ASSESSMENT** (list not exhausted)	**FORMS OF STUDENT SUPPORT**
1. Advanced theatre imaging (spinal fusion, neuro and interventional	12 (1.2 credits)	Formal lectures Tutorials Simulations Demonstrations Peer learning in groups Structured interactive sessions Presentation of real world problems Integrated learning Discovery learning Guided practice Workplace learning Clinical practice projects	Writing a test (written or computer based) Completing a pre-reading template Compiling a mind map Taking part in demonstrations Taking part in role play Reporting on an observation in clinical practice Analysing a problem scenario Presentations Doing an OSCA Perform a practical assessment Compiling a portfolio of evidence	Contact sessions Learning material Library Tutor guidance Peer support Consultations-Individual/Groups Coaching and mentoring Blackboard support
2. Specialised screening procedures (sialography, myelography, HSG, arthrography, etc.)	12 (1.2 credits)			
3. Imaging of the sinuses (revision) + imaging of the facial bones	12 (1.2 credits)			
4. Introduction to specialised imaging of the chest (CT, MRI, Vascular)	14 (1.4 credits)			
5. Introduction to specialised imaging of the abdomen (CT, MRI, Vascular & Ultrasound)	14 (1.4 credits)			
6. Introduction to specialised imaging of the upper- and lower extremities (CT, MRI, Vascular & Ultrasound)	14 (1.4 credits)			
7. Introduction to specialised imaging of the pelvis (CT, MRI, Vascular & Ultrasound)	14 (1.4 credits)			

8. Introduction to specialised imaging of the spinal column (CT, MRI, Vascular & Ultrasound)	14 (1.4 credits)	**Research projects**	Writing an academic essay **Write a research report** **Write an article/review/ summary**	
9. Imaging of paediatric patients and child abuse	14 (1.4 credits)			
Total Notional Learning Hours = 120 (12 credits)		**Estimated time spend on:** • Facilitator/student contact: ±30 hours • Formative assessment: ±10 hours • Engaged learning: ±77 hours • Summative assessment: ±3 hours		

6.3.1 A Proposed Learning Unit for Work-integrated Learning in Year 4 (HEQF level 8)

WIL408 – LEARNING UNIT 1

SPECIALISED IMAGING OF THE THORAX
Vascular Angiography, Computer Tomography and Magnetic Resonance Imaging



Credits: 1.4 of 12 (14 notional learning hours)

1. INTRODUCTION

In this learning unit you will be introduced to the basic principles of specialised imaging for the chest.

Vascular Angiography

Because the various soft tissues of the body possess similar radiographic densities, a positive contrast medium must be added in order to study normal and abnormal distribution of the cardio-vascular system. Radiology departments are becoming increasingly involved in not only the diagnosis of disease in patients, but the treatment of the patients as well. Therefore you will be introduced to the performance of vascular procedures and interventional procedures which are performed in the Radiology department to diagnose and/or treat disease in the patient.

Computed Tomography

Computed tomography, commonly referred to as CT, represents a major advance in Radiography in the 20th century. This image modality is superior in the information it can provide of the anatomy of the different structures and the pathological conditions of the human body. Because of the many advantages of CT, this modality is becoming more and more the modality of choice for various pathological conditions. Even in South Africa, most private Radiology departments have a CT facility at its disposal. It is therefore important that all radiographers must know and be able to apply the basic principles and procedures of CT. Therefore you will be introduced to the basic principles and procedures of CT imaging.

Magnetic Resonance Imaging

MRI has many of the advantages offered by other image modalities without the associated disadvantages. MRI is the modality of choice especially for imaging of soft tissue structures such as the central nervous system and the brain. MRI examinations are performed by radiographers that have received special training. Therefore, the aim of this part of the learning unit is not to make you competent in performing MRI examinations, but to introduce you to the principles of this image modality and to establish basic background knowledge of the factors that can influence image quality positively or negatively and that are directly controlled by the radiographer.

2. ASSUMPTION OF LEARNING TO BE IN PLACE

The learning assumed to be in place for this learning unit is a mastery of the anatomy, basic physioligical processes and the most common pathologies of the lungs, heart, mediastinum and the

pleura. Additionally, the student should have a general understanding of the physical principles informing the functioning of each of these specialised apparatus.

3. LEARNING OUTCOMES

After completion of this learning unit you should be able to:

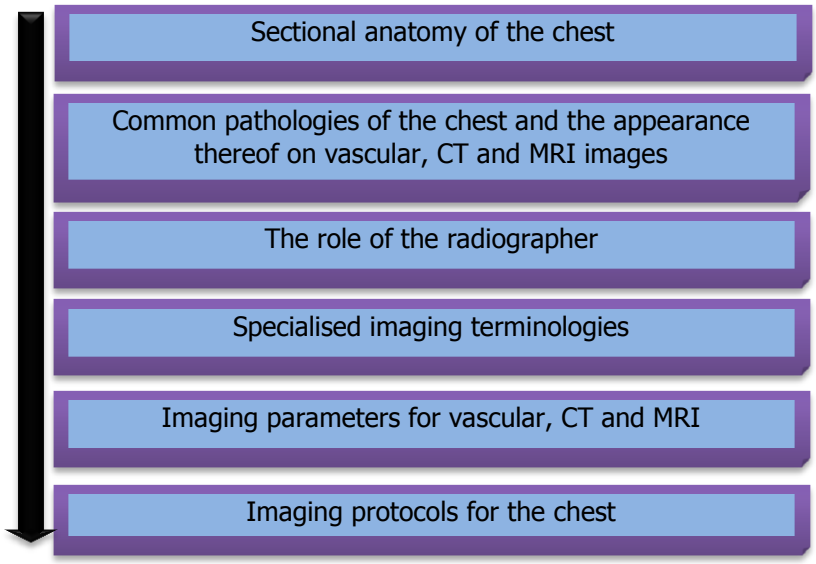
Knowledge & skills outcomes

- **Label** all important anatomical structures on vascular, CT and MRI images of the chest.
- **Distinguish** between the appearances of the most important pathological conditions of the brain on routine vascular, CT and MRI examinations of the chest.
- **Reflect** on the important role of the radiographer regarding informed consent and the short- and long-term preparation of the patient for vascular, CT and MRI examinations.
- **Define** and **briefly describe** the terms related to the formation of the image for these specialised modalities such as topogram, exposure factors, table feed, slice thickness, scan-field-of-view, display-field-of-view, image display windows and levels, algorithm, K-space, signal-to-noise ratio, contrast resolution, and Larmour frequency.
- **Distinguish** and **explain** the different imaging parameters that can influence the quality of the image and which can be controlled by the radiographer.
- **Construct** a very basic imaging protocol for a CT and MRI examination of the chest giving attention to the important imaging recording principles (e.g., slice thickness and matrix size).

Generic outcomes:

- Communication skills
- Self-responsibility skills
- Problem-solving/critical-thinking skills
- Technological and environmental literacy skills
- Cultural- and aesthetic-understanding/skills
- Developing a macro-vision on algorithms of image modalities
- Teamship
- Learning skills
- Research skills

4. LAY-OUT OF THE LEARNING UNIT



5. LEARNING FACILITATION

Learning will be facilitated by means of formal lectures, tutorials and demonstrations, simulations, peer learning in groups and structured interactive sessions, the presentation of real-world

problems, discovery learning, integrated learning, WPL, guided practice, clinical practice projects and mini/limited research projects.

<u>Activity 1</u>: Peer learning, integrated learning, discovery learning (knowledge, understanding, application)

Make sure that you are able to identify the important anatomical structures on the vascular, CT and MRI images of the chest supplied to you on Blackboard. Use your textbook as reference to label the anatomy, but other sources can also be accessed to assist you.

<u>Activity 2</u>: Structured interactive session, integrated learning, discovery learning (knowledge, understanding, application, analysis)

Work with one of your peers and compile a list of the most important pathological conditions of the chest in order to prepare you to differentiate between the different pathologies on a CT and MRI image of the chest

These pathologies and their appearances will be discussed with your facilitator in class during an interactive session.

<u>Activity 3</u>: Demonstration, tutorial (knowledge, understanding, application)

During a pre-arranged tutorial session at the Radiology practice where you do your WPL, your facilitator will demonstrate to you the following important aspects when performing specialised imaging on a patient:

- The functioning of the different parts of the apparatus (vascular, CT and MRI)
- The positioning of the patient
- The selection of appropriate imaging parameters for imaging of the chest for a vascular, CT and MRI examination
- The display of the images on the screen and the selection of appropriate contrast and windowing settings.

<u>Activity 4</u>: Workplace learning (knowledge, understanding, application, analysis, synthesis, evaluation)

At the end of the first semester, you need to supply proof that you have worked at the vascular unit, the CT unit and the MRI unit in your clinical department. You need to submit a completed rubric for each of the modalities as proof of your attendance with a list of at least ten patients you assisted with at each of the modalities.

CONTINUOUS ASSESSMENT RUBRIC SPECIAL MODALITIES		
Name:	**Practice:**	**Date:**

Rate yourself on a scale from 1 – 5 to indicate your level of competence for the following outcomes. **Also motivate your rating in the space provided.**
(5 = excellent; 4 = good; 3 = average; 2 = improvement needed; 1 = outcome not achieved)

Vascular Angiography

1. Professional conduct and work ethics (adhere to prescribed dress code, wearing of identification, punctuality, professional behaviour) _____ _____	5	4	3	2	1	**Verification supervisor**
2. Patient care and management (e.g., empathy, communication, etc.) _____ _____	5	4	3	2	1	**Verification supervisor**
3. Working in a team _____ _____	5	4	3	2	1	**Verification supervisor**
4. You should observe the following examinations: 10 x vascular procedures (any) *Briefly reflect on the following:* 1. Interesting observations _____ 2. Measures to protect the patient and staff against radiation _____	5	4	3	2	1	**Verification supervisor**

Comments from supervisor:

Comments from student:

Signature Supervisor:_____ Signature Student:_____

Signature Lecturer: _____

Proof of examinations observed

1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Reflect on your observation of the important role of imaging parameters in the appearance of the final image, e.g., exposure factors, image display windows & levels, and contrast.

_____
_____
_____

6. ASSESSMENT AND ASSESSMENT CRITERIA

(dates provided serve as examples)

Assessment 1: OSCA (date: 06/05/2014)
Assessment criteria: application of knowledge of anatomy and pathology for vascular and sectional images of the chest.
Weight of the assessment: 10%*.
*This activity will be assessed with the aid of a memorandum.

Assessment 2: Formative practical assessment (date: when doing WPL)
Assessment criteria: integration of knowledge, skills, application and analysis, specialised imaging (use rubric in 6.3.1 – assessment 4)
Weight of the assessment: 5%*.
*This activity will be assessed with the aid of a rubric.

Assessment 3: Integrated project
Assessment criteria: In this assessment activity critical understanding of aspects pathologies, a well-developed knowledge and skills base, the critical assessment of information, and the scientific compilation of a research paper will be assessed.
Weight of the assessment: 25%*.
*This activity will be assessed with the aid of a rubric.

This project will enable you to demonstrate your skills in the choice of appropriate imaging modalities relative to the chosen pathological condition that you examine. This type of evaluation is also valuable when the radiographer must act in the capacity of an advisor to other medical specialties; such support can be of special value in the new primary health care system of the country. Due to the shortage of radiologists, an advisory role is not necessarily the prerogative of only the radiologist, but the radiographer must sometimes play a more pro-active role and can only do this if he/she prepares him/herself with the necessary information and is able to present it with authority. The aim of this project is to elicit your interest in thinking critically about, and analysing and evaluating the imaging chain (algorithm) for a specific pathology.
Do research with the members in your group and compile a critical evaluation of different diagnostic imaging modalities (e.g., general routine imaging, CT, MRI, ultrasound, vascular angiography, or nuclear medicine) available in the imaging chain (algorithm) for your chosen **pathological condition,** e.g., jaundice**.**

You should report on the following:

1. The diagnostic information obtained for each imaging modality in the algorithm;
2. Specific indications and contra-indications for each imaging modality in the algorithm;
3. The patient preparation required for each imaging modality in the algorithm;
4. The advantages and disadvantages of each imaging modality in the algorithm considering the following:

- Cost
- Time it takes to perform the examination
- Patient comfort
- Sensitivity and specificity

5. The important image recording principles to consider in ensuring good quality images for each imaging modality in the algorithm.
6. Also discuss the advice you will give to a community service physician about the referral of the patient for further imaging if a patient with the specific pathological condition under investigation is admitted to a level 1 health care institution in SA.
7. Critically reflect on the generic skills you have utilised to compile this report.

Writing instructions

- Your project should be compiled according to the requirements for a scientific essay.
- You should consult at least five book sources, five articles and five web sources on the topic.
- Referencing should be done according to the Harvard method of referencing.
- Take note that you will be penalised if your project exceeds 4 000 words.
- Your project should be submitted to your facilitator in hard copy and electronic format. The electronic version should be submitted through 'SafeAssign' on Blackboard to assess for possible plagiarism.

ASSESSMENT RUBRIC FOR THE PROJECT

ASSESSMENT CRITERIA	REVISE	ACCEPTABLE	GOOD	VERY GOOD
1. **Presentation**	**0 1** Loose paper	**2 3** Papers stapled	**4 5** Booklet	
Comments:				
2. **Layout and contents**	**0 1** No logical layout; Many spelling mistakes	**2 3** Not all requirements adhered to; Spelling mistakes	**4 5** Cover page, Table of Contents, heading numbers, page numbers, neat and logical layout, no spelling mistakes	
Comments:				
3. **Introduction**	**0 1 2 3** Academic language flawed	**4 5** Adequate; Adheres to minimum requirements	**6 7** Own interpretation/ reflection added	**8 9 10** Comprehensive; Shows creative thinking skills and judgement
Comments:				
4. **Diagnostic information obtained**	**0 1 2 3** Academic Language flawed	**4 5** Adequate; Adheres to minimum requirements	**6 7** Own interpretation/ reflection added	**8 9 10** Comprehensive; Shows creative thinking skills and judgement
Comments:				
5. **Indications and contra-indications**	**0 1 2 3** Academic Language flawed	**4 5** Adequate; Adheres to minimum requirements	**6 7** Own interpretation/ reflection added	**8 9 10** Comprehensive; Shows creative thinking skills and judgement
Comments:				
6. **Patient preparation**	**0 1 2 3** Academic Language flawed	**4 5** Adequate; Adheres to minimum requirements	**6 7** Own interpretation/ reflection added	**8 9 10** Comprehensive, Shows creative thinking skills and judgement
Comments:				
7. **Advantages and disadvantages**	**0 1 2 3** Academic Language flawed	**4 5** Adequate; Adheres to minimum requirements	**6 7** Own interpretation/ reflection added	**8 9 10** Comprehensive; Shows creative thinking skills and judgement
Comments:				
8. **Image recording principles**	**0 1 2 3** Academic	**4 5** Adequate	**6 7** Own	**8 9 10** Comprehensive,

	Language flawed	Adheres to o minimum requirements	interpretation/ reflection added	Shows creative thinking skills and judgement
Comments:				
9. **Advise to community service physician**	**0 1 2 3** Academic Language flawed	**4 5** Adequate Adheres to minimum requirements	**6 7** Own interpretation/ reflection added	**8 9 10** Comprehensive, Shows creative thinking skills and judgement
Comments:				
10. **Reflection on generic skills**	**0 1 2 3** Academic Language flawed	**4 5** Adequate Adheres to minimum requirements	**6 7** Own interpretation/ reflection added	**8 9 10** Comprehensive, Shows creative thinking skills and judgement
Comments:				
11. **References**	**0 1** Not used / Inadequate; No citations in-text; flawed	**2 3** Incorrectly applied	**4 5** Harvard technique applied correctly	

TOTAL FOR PROJECT= 95 MARKS

EXAMINER **MODERATOR**

Assessment 4: Portfolio of evidence
Assessment criteria: Your portfolio of evidence should be submitted on the date agreed on in class. Your portfolio will be graded for completeness (from Year 1 to Year 4). Additionally, the required continuous assessment rubrics for specialised modalities will be graded as part of the formative assessment for WIL.
Weight of the assessment: 25%*.
*This activity will be assessed with the aid of a rubric (cf. 6.3.1.1)

7. REFERENCES

Bontrager, K.L. 2001. *Textbook of radiographic positioning and related anatomy.* 5th ed. Location: Mosby.

Ballinger, P. W. 1999. *Merril's atlas of radiographic positions and radiological procedures* . 9th ed., vol. II. Location: Mosby.

Romans, L. 2011. *Computed tomography for technologists: a comprehensive text*. Philadelphia: Williams & Wilkins.

Westbrook, C. *Handbook of MRI technique.* 3rd ed. New York: Willey-Blackwell.

Additional reading

Any other additional sources can be consulted using the library, the information centre or any scientific data sources on the internet.

8. STUDENT SUPPORT

Learning material, assessment tools, tips, X-ray images and additional reading material for support of learning are available on Blackboard.

6.3.1.1 *Discussion on the proposed learning unit for Year 4*

As for the learning unit for Year 3, only the aspects which need to be highlighted for the learning unit example ifor Year 4 will be analysed from an educational viewpoint:

- At the fourth year level, **learning assumed to be in place** includes disciplinary knowledge from all modules in Year 3 as well as the skills that should have been acquired in clinical practice during WPL.
- For this specific example of a learning unit in Year 4, the **learning outcomes** do not reflect the highest levels of Bloom's taxonomy. This can be explained by the fact that students in the fourth year of the Bachelor degree are not yet required to have an advanced knowledge of specialised imaging such as CT. As students are introduced to these specialised modalities only in Year 4, only a basic knowledge of the important aspects in relation with these modalities is required. However, higher level modifiers and verbs should be used to compile learning outcomes for learning units such as imaging of the sinus and facial bones (LU 3 in Table 6.2) in trauma situations and the imaging of children (LU 9 in Table 6.2), because by this time the students should have acquired all the required basic knowledge and skills for these areas (cf. 2.6.1, 2.6.2.2).
- **Learning facilitation** for WIL in the fourth year of study includes all the learning modes for WIL. Naturally, not all the available learning modes will be utilised in a single learning unit. It remains the prerogative of the facilitator to choose the learning mode suitable to facilitate learning in a specific learning unit in Year 4. Activity 1 assists the student in acquiring knowledge about the anatomy of the chest and the application thereof on sectional images of the chest. The activity utilises learning modes such as peer learning, integrated learning and discovery learning, and stimulates learning at the three lower levels of Bloom's taxonomy. Activity 2 focuses on assisting the student to acquire a basic knowledge of the most important pathologies of the chest that are imaged using CT. Learning modes utilised in this activity include a structured interactive session, integrated learning, and discovery learning. For this activity students need to revert to the analysis level of Bloom's taxonomy in order to differentiate between the appearances of pathology on CT and

MRI images. As most training institutions in SA do not have imaging apparatus such as a CT or MRI scanner in their skills laboratories on campus, students will be exposed to the functioning of such units during a demonstration session facilitated by the lecturer at the Radiology practice where they will be placed for WPL. A tutorial will assist in introducing the students to aspects such as image display and the manipulation of digital images. Learning activity 4 has been structured to facilitate learning during periods of WPL in the fourth year of study. At this level students are required to learn at all the levels of Bloom's taxonomy during periods of WPL. To ensure that students achieve the outcomes for WPL for each of the specialised modalities, they are required to submit proof of the required number of patients whom they assisted for each of these modalities. The rubric assesses generic skills as well as the practical skills acquired during placement periods. Note that students are required to perform a self-assessment at the end of a placement period at each of these modalities; this assessment should be verified by the clinical mentor/supervisor. To stimulate reflection on the rating of the outcomes acquired, the rubric allows space for motivation as well as space to reflect on interesting observations and radiation protection practices (cf. 6.3.1). The rubric should be signed by the student and the clinical mentor/supervisor and be submitted to the university lecturer who may then use it for formative assessment purposes. It is added to a portfolio of evidence.

- The **assessment** activities in the fourth year again include an OSCA and a formative practical assessment (linked to learning outcomes 1 - 6). As in the previous years, a formative practical assessment should ideally be done for the achievement of the outcomes for WIL for each learning unit after a period of work placement. For this assessment, the same rubric as the one used in the second year (cf. 5.4.1 - assessment 4) for assessment in the general department can be used. A rubric such as the example in learning activity 4 (cf. 6.3.1) can be used for the assessment of specialised modalities. These rubrics can also be added to a portfolio of evidence as they provide evidence of the required number of patients attended to for each learning unit.

  Added to the assessment in the fourth year and not linked to a specific learning unit in WIL are an integrated project and a portfolio of evidence. The integrated project is aimed at the achievement of exit level outcome 8 - conducting research (cf. 2.5.1.2, Table 6.2, SAQA 2013a:Online). This assessment activity is aimed at measuring a critical understanding of aspects, a well-developed knowledge and skills

base, the integration of concepts, the critical assessment of information, and the compilation of a scientific research paper. This project can be used for formative or summative assessment purposes. An example of such an integrated project follows:

The portfolio of evidence

An assessment which could be added in the fourth year is a portfolio of evidence. Recently educators in professional programmes such as Radiography have experienced an increasing emphasis on reflective, competency-based practice. This has led to an increased demand for the use of portfolios in the education of a variety of health professionals (Buckley, Coleman & Khan 2010:187). As reported by Buckley, Coleman and Khan (2010:187), several studies across different health professions have reported that the use of portfolio of evidence assists students to identify their learning needs, to improve their knowledge and understanding of concepts, and to integrate theory with practice. Moreover, the authors argue that compiling portfolios highlights students' self-awareness and encourages them to reflect on their practice. However, some authors suggest that the assessment of portfolios inhibits students' willingness to engage in honest and open reflection. For this reason portfolio content should be well structured to initiate reflection as students do not readily engage in reflection unless required to do so. Although the use of portfolios has advantages and disadvantages, portfolios can be used with success for assessment of outcomes and record keeping in WIL for Radiography training (cf. 2.7.1.3). Words of caution are offered by Brown (2001:6) who warns that although portfolios or reflective diaries of achievement can be useful during the process of learning, lecturers should be aware that if these assessment methods are used to make final judgements or recommendations for employment, students will be reluctant to report honestly on their achievements.

It is suggested that the portfolio of evidence for WIL in Radiography training be seen as a working document where evidence can be added on a continuous basis from Year 1 to Year 4. It is also suggested that the portfolio be assessed for grading at the end of each academic year; in Years 2 and 3 as part of formative assessment and in Year 4 as part of summative assessment. However, it remains the prerogative of the lecturers of the WIL modules in the learning programme whether the portfolio should be used for grading or just as a record-keeping document. As stated by Buckley, Coleman and Khan (2010:190), using the portfolio for assessment purposes acts as a major driver for portfolio completion without which students would not engage in the effort required. Because portfolios vary

widely both in content and in method of implementation (Rees 2005:436), the required content for inclusion in such a portfolio should be determined by the designers of each respective learning programme, as the contents cannot be prescribed. A comprehensive portfolio of evidence should be a document that a student can present with pride to a prospective employer. Such a portfolio should provide, at a glance from a prospective employer, information about the learning that the student engaged in from the first to the final year of study. Following is an example of a rubric for keeping track of or assessing a portfolio of evidence in WIL for Radiography. This rubric should form part of the final portfolio and can be inserted just after the front page of the document.

Rubric: Portfolio of Evidence								
Student name:_____								
ESSENTIAL ELEMENTS	**First year**		**Second year**		**Third year**		**Graduate**	
1. Summary of hours spent in WPL (as required by the Professional Board)	***Required***		***Required***		***Required***		***Required***	
2. Continuous assessment rubrics (done in clinical practice)	***Required***		***Required***		***Required***		***Required***	
	-Chest (routine)		-Bony thorax		-Theatre		-Theatre	
	-Abdomen (routine)		-Mobile Radiography		-Urinary syster & venipuncture		-Contrast examinations	
			-Theatre		-Thorax (pattern recognition)		-Skull, sinuses facial bones	
			-Contrast examinations		-Upper extremity (additional + trauma)		-CT	
			-Upper extremity		-Lower extremity (additional + trauma)		-MRI	
			-Lower extremity		-Pelvic girdle (additional + trauma)		-Vascular	
			-Pelvic girdle		-Spinal column (spine deformities+ trauma)		-Ultrasound	
			-Spine		-Contrast examinations		-Paediatric imaging	

					-Skull & sinuse (routine)			
3. Record of rubrics not submitted for assessment	**First year**		**Second year**		**Third year**		**Graduate**	
4. Computer activities (done at the university – as per learning unit)	***Ziltron Blackboard***		***Ziltron Blackboard***		***Ziltron Blackboard***		***Ziltron Blackboard***	
5. OSCAs								
6. Case studies								
7. Reflection sheets								
8. Patient record forms (as required per learning unit)								
9. Tests/assignments (2 x tests & 2 x assignments								
10. Radiation safety test mark (done in Year 1)								
11. Proof of QC tests performed (as required per learning unit)								

GENERAL DOCUMENTS								
HPCSA registration certificate		Signed Code of Conduct			First Aid certificate		Curriculum vita	
Dosimeter Bin number								
Summary of items still due:								
Handed in on time	5	4	3	2	1	0	***Comment:***	
Neatness	5	4	3	2	1	0		
General comments:								
Signature of lecturer/WIL coordinator:_____ **Signature of student:**_____								

Summative practical assessment for WIL in Year 4

As is required in the second and third years of study, each student should do a summative practical assessment at the end of the fourth academic year to measure the acquirement of skills and competencies for WPL. The same rubric as in the second and third years of study can be used for this assessment. The same procedures could also be applied if a student fails a first or second attempt of the assessment (cf. 5.3.1.2 – summative practical assessment). When assessing students' practical skills and competencies in clinical practice in Year 3 and Year 4, the focus should be more on the their critical thinking and problem solving abilities than on the application of knowledge in the clinical situation. In other words, when performing a practical assessment, student should be required to address challenges on their own (i.e. without the assistance of the assessor) and to suggest steps towards improvement of acquired images if needed.

6.4 CONCLUDING SUMMARY

It is the believe of the researcher that the design and explanation of the WIL modules for Years 3 and 4 for the training of Radiography students have shed some light on the importance of the stimulation of integration of knowledge, skills and competencies from different areas of learning in the learning programme. The delivery of WIL in these study years should stimulate students to revert to deep learning; this is only possible if they have a sound basis of disciplinary knowledge and a clear course structure that guides them towards the attainment of the set outcomes for each part of learning.

To stimulate discovery learning and enquiry learning, the learning facilitation and assessment activities designed for the modules presented in this thesis should serve as examples of how students could be encouraged towards self-centred learning. In other words, the student should self-discover and search for the needed information to successfully complete the assessment activities. The search for information and the inclusion of projects should stimulate the development of research skills which is a requirement for obtaining a qualification at this level of learning. Simultaneously, the activities focus on the development of generic skills and competencies to develop a work-ready graduate who is ready for employment in a demanding professional environment.

CHAPTER 7

CONCLUSION, RECOMMENDATIONS AND LIMITATIONS OF THE STUDY

7.1 INTRODUCTION

An in-depth study was conducted to investigate current practices in the delivery of WIL in Radiography training at selected universities in SA. The ultimate goal of the investigation was to develop an education and training programme for WIL in Radiography training by merging and incorporating the results from the survey and information from the literature on best practice for the delivery of WIL.

WIL is a relatively new jargon term that focuses attention on the integration of theoretical learning and learning in the workplace. Until recently the focus in many professional programmes has been only on WPL as part of the training of the student. Although the concept of students being placed in the workplace to get work experience is not new, the rationale behind WIL goes beyond merely providing the physical environment of a workplace as a site for students to experience work or to learn from professional practice. However, to achieve success in the delivery of any WIL programme, it is important to structure the WIL component of any learning programme diligently with regard to the constructive alignment of learning outcomes/objectives, the delivery of learning (facilitation methods), and assessment. Also important to the quality delivery of WIL is the coordination and monitoring of the learning processes and hence of student progression. In this study, these aspects in the current delivery of WIL were investigated and assessed.

The aim of this chapter is to provide a short overview of the study and to present comments and some concluding thoughts on the findings. The chapter commences with an overview of the study, followed by recommendations for a WIL education and training programme for Radiography in SA. The chapter concludes with a short discussion on the limitations of the study, final thoughts on the contribution this study will make to new knowledge in the field of Radiography training, and some concluding remarks.

7.2 OVERVIEW OF THE STUDY

The direction and thrust of this research were based on five research questions. The findings of the research served as a foundation for developing a WIL education and training programme for Radiography in SA.

In Chapter 1 (cf. 1.3) the main research question and five sub-questions which fuelled this investigation were presented. The research questions guided the study and shaped the final outcome. In the following section the main findings and the extent to which they illuminated the research question and the five sub-questions are reviewed. The final outcomes of the study are subsequently presented.

7.2.1 The Main Research Question

The main research question for the investigation was the following:

What important ***fundamentals for teaching, learning, assessment and monitoring should be incorporated in an education and training programme for WIL in Radiography*** *at higher education institutions in South Africa?*

The following objective was pursued:

To benchmark, ***with reference to the literature, best practice for WIL*** *curriculum design, WIL teaching and learning, and WIL assessment and coordination in Radiography training at higher education institutions internationally and in SA.*

This objective addressed the main research question for the investigation.

This research question was aimed at providing recommendations for a WIL education and training programme for Radiography in SA. Information on the conceptualisation and contextualisation of WIL was provided in Chapter 2 (cf. 2.2, 2.2.1.3, 2.3) where the delivery of WIL as an integrated part of the curriculum with diligently aligned outcomes, learning modes, and assessment activities was emphasised.

During the study of the literature on best practice for the delivery of WIL, it became apparent that WIL should no longer be seen as an add-on to a learning programme. The

literature suggests that WIL should form a structured component of an education programme with clearly defined outcomes/objectives, well-designed learning activities, and valid and authentic assessment activities in an aligned curriculum. Also emphasised by the literature to ensure quality delivery of WIL is the coordination of WIL between the university and the workplace as well as the monitoring of student progress in the WIL component of programmes (cf. 2.2.1.3, 2.3).

Another concept that clearly emerged from my perusal of the literature is that WIL should not be 'misunderstood' as merely WPL. The literature unambiguously states that WPL should be seen as part of WIL where the latter is the umbrella pedagogy aiming at integrating the disciplinary knowledge of the student with the skills and competencies needed to function optimally in the workplace (cf. 2.2.1.5, 2.5).

The synergy between theory and the practical application of knowledge forms the basis of the integration of concepts in the WIL environment. This synergy demands a dynamic process of planning and reflection when designing outcomes, learning activities and assessment activities for WIL. As part of this dynamic process, outlines of modules designed for WIL in Radiography training are presented in Tables 5.1, 5.3, 6.1 and 6.2. The design presented in these modules incorporates the important fundamentals of curriculum alignment with reference to outcomes, the learning modes for the delivery of learning and assessment strategies, and methods for WIL in Radiography training.

7.2.2 Sub-questions 1, 2, 3, 4 and 5

The following objective was pursued in order to answer sub-questions 1 - 5:

To gain *thorough* ***insight into the current state of WIL in Radiography programmes*** *at higher education institutions in SA concerning matters such as curriculum design, teaching/learning, assessment, and coordination with the aid of a questionnaire survey.*

Sub-questions 1 - 5 for the investigation were formulated to enquire about the current implementation of aspects regarding curriculum design, teaching/learning, assessment, and coordination in current WIL programmes for Radiography in SA. In response to sub-questions 1 - 5, the conceptualisation of the important principles ensuring best practice for the delivery of WIL was achieved with the aid of the literature review as discussed in

Chapter 2 (cf. 2.5, 2.6, 2.7 & 2.8). The results from the questionnaires administered to the three participating groups (university lecturers/WIL coordinators, WPL mentors/supervisors and students) to investigate the current implementation of the different aspects of WIL (curriculum design, teaching/learning, assessment and coordination) were presented in Chapter 4 (cf. 4.2.3, 4.2.4, 4.2.5, 4.3.4, 4.3.5, 4.3.7, 4.4.3).

The sub-questions for the investigation were formulated as follows:

Sub-question 1:

Are educationists who work in the WIL component of Radiography programmes ***sensitive towards the best practice for WIL*** *in order to deliver work-ready graduates for the Radiography profession?*

Sub-question 1 was addressed by identifying areas of good practice from the results of the three participating groups (cf. 4.5). Although areas of good practice were identified as presented in 4.5, many areas for improvement were also identified. Recommendations for the improvement of these areas are supported by information from the literature as presented in Chapter 2. These recommendations are presented in 7.3.

Sub-question 2:

Are educationalists who work in the WIL component of Radiography programmes appropriately ***equipped to engage in the design of a curriculum for WIL*** *in Radiography to align outcomes, pedagogy and assessment activities?*

The results from the questionnaire survey in answer to sub-question 2 indicated that university lecturers in general took part in curriculum design activities for WIL in their respective programmes (cf. 4.2.3). However, the results from the participating WPL mentors/supervisors indicated the involvement of only 50% of WPL mentors/supervisors in the design of a curriculum for WIL (cf. 4.4.3.2). Recommendations for the inclusion of WPL mentors/supervisors in the design of a curriculum for WIL are presented in 7.3. These recommendations are supported by suggestions from the literature regarding curriculum reform and curriculum design for WIL (cf. 2.4 & 2.5).

Sub-question 3:

Are educationists who work in the WIL component of Radiography programmes ***familiar with the different curricular modalities/learning modes*** *and teaching and learning activities to stimulate active learning in the classroom and to ensure that students acquire the necessary skills and competencies in the workplace?*

Regarding the curricular modalities/learning modes utilised for WIL in their respective programmes, the university lecturers and the students indicated preferences for some of the curricular modalities, whereas others were not often utilised. A comparison of the results from the lecturers among the different universities and between the lecturers and the students also revealed many inconsistencies (cf. 4.2.3.2 & 4.3.4.3). Recommendations for the utilisation of learning activities and assessment methods related to the different curricular modalities are offered in 7.3. These recommendations are incorporated in the design of the education and training programmes for WIL as present in Chapter 5 and Chapter 6 (cf. 5.3.1, 5.3.1.1, 5.4.1.2, 6.2.1, 6.2.1.1, 6.3.1 & 6.3.1.1). These recommendations were underpinned by the conceptual framework on teaching/learning and assessment as presented in Chapter 2 (cf. 2.5, 2.5.1, 2.6 & 2.7).

Sub-question 4:

Are educationists who work in the WIL component of Radiography programmes ***sensitive towards the principles for the assessment of WIL*** *(including formative feedback and reflective practice) as part of the learning process of the students?*

Sound assessment practices for WIL, including assessment types, principles for assessment, assessment methods, measuring instruments for assessment, grading, formative feedback, and reflective practice were conceptualised in Chapter 2 (cf. 2.7.1.1, 2.7.1.2, 2.7.1.3, 2.7.1.4 & 2.7.1.5). The results from the three participating groups regarding assessment of WIL in the respective programmes revealed areas of good practice as well as areas for improvement (cf. 4.2.5, 4.3.5 & 4.3.4.4). Recommendations for improvement in assessment practices for WIL are presented in 7.3. These recommendations are incorporated in the proposed WIL education and training programme as presented in Chapter 5 and Chapter 6 (cf. 5.3.1, 5.3.1.1, 5.4.1.2, 6.2.1, 6.2.1.1, 6.3.1 & 6.3.1.1).

Sub-question 5:

Are educationists who work in the WIL component of Radiography programmes ***coordinating their programmes*** *to ensure a good working partnership among the students, the educational institution and the employers for WIL to the benefit of all parties?*

Good practice regarding important aspects related to the management and coordination of WIL to ensure quality delivery of learning was presented in Chapter 2 (cf. 2.8). The results from the final year students and the WPL mentors/supervisors revealed a variety of models for the management and coordination of WIL at the various institutions. Additionally, many areas for improvement in the management and coordination of WIL were identified by comparing the results from the two groups on their perceptions of the management and coordination of WIL (cf. 4.3.6 & 4.4.3). Recommendation for improved practices to manage and coordinate WIL, supported by the conceptual framework as presented in Chapter 2, are presented in 7.3.

7.2.3 Objectives 1 and 2

Objective 1 was achieved by compiling a conceptual framework within which the research was conducted (cf. Figure 2.1). The conceptual framework also informed the nature and thrust of the questions that were included in the questionnaires. Objective 2 was achieved by conducting a questionnaire survey to ascertain the current practices in the delivery of WIL at the universities offering Radiography training in South Africa (cf. Chapter 2 & Chapter 4).

7.2.4 Objectives 3 and 4

Objectives 3 and 4 were achieved by analysing and comparing the results from the three participating groups on important aspects such as the general design of WIL, the learning modes for WIL, assessment of WIL, and the coordination and monitoring of WIL. Areas of good practice and areas for improvement were identified (cf. 4.5). To address the areas for improvement, action plans were suggested. These action plans were supported by information for best practice for WIL as garnered from the literature and as presented in Chapter 2. These action plans were also incorporated in the proposed education and training programme for WIL as presented in Chapter 5 and Chapter 6 (cf. 4.5.2).

7.2.5 Objective 5

Objective 5 was achieved by developing a proposed education and training programme for WIL in Radiography (cf. Chapter 5 & Chapter 6). This was done by reflecting on information from the literature on best practice for WIL and merging this information with the results from the three groups who participated in the questionnaire survey.

The proposed programme modules from Year 1 to Year 4 in the new Bachelor of Radiography degree address aspects such as level descriptors, exit level outcomes, assessment criteria, module outcomes, quality control, learning units, learning modes, methods of assessment, and forms of student support in an aligned curriculum (Tables 5.1, 5.3, 6.1 & 6.2).

The examples a of a learning unit for each year in the Bachelor degree address aspects such as assumed learning to be in place, learning outcomes, learning facilitation, assessment, and student support (cf. 5.3.1, 5.4.1, 6.2.1 & 6.3.1). Examples of learning and assessment activities and assessment instruments were presented where applicable.

Following on each proposed learning unit is a discussion supporting the inclusion of each aspect from an educational viewpoint. Where applicable, emphasis is placed on the generic skills that need to be acquired (cf. 5.3.1.1, 5.3.1.2, 6.2.1.1 & 6.3.1.1, Table 5.2). Important aspects in the assessment of WIL such as assessments for clinical readiness, formative and summative assessments, and the assessment of a portfolio of evidence are also discussed and validated (5.3.1.1, 5.3.1.2 & 6.3.1.1).

7.3 CONCLUSION

Work-integrated learning in the education and training of health care professionals is a relatively new educational tool in SA. Well-structured WIL programmes for implementation in many health profession programmes became compulsory when the new HEQF was promulgated in 2011. Moreover, the delivery of quality WIL programmes is seen as an excellent tool to equip students with the employment qualities needed in a growing and increasingly demanding economy. This study originated from the recognition that a gap exists as far as the development of an education and training programme for WIL in Radiography training in SA was concerned. To bridge this gap, the researcher developed an education and training programme for WIL in Radiography which is

intended to stimulate the inclusion of WIL as a structured part of the curriculum. Such inclusion will enhance the achievement of clinical skills and competencies in the Radiography profession. A combination of methods was used to generate data and the findings generated by the data analyses were interpreted to form the basis of the education and training programme that was designed. Theoretical perspectives, based on a literature review and linked to the contributions of various authors in the field of WIL, were used to develop a conceptual framework within which the research was located (Chapter 2).

Detailed descriptions of the results obtained from the questionnaire survey were presented in Chapter 4. The interpretation of the results was discussed in detail as scientific evidence and congregated to compile the education and training programme for WIL and the recommendations regarding the quality implementation of WIL in Radiography training (Chapter 5 & Chapter 6).

At the conceptual level, it became clear to the researcher that for the sound implementation of WIL in the Radiography curriculum, the process should be approached from an educational viewpoint supported by scientific evidence. The findings of the study that were obtained through the merging of various forms of data, as well as own experiences in the field, have convinced the researcher that the inclusion of WIL as an integrated part of the curriculum will assist students in interchanging continuously between disciplinary (theoretical) knowledge and the application of skills and competencies in clinical practice. WIL, in its intended format, provides various opportunities to develop skills and integrate theory and practice. The implementation of WIL should be a reflective and continuous process where students as well as lecturers can revisit and improve on practices to achieve excellence in teaching and learning. Additionally, WIL is an ideal pedagogy to stimulate self-directed learning and the development of critical thinking skills.

To comply with the educational needs of WIL, assessment must form an integral part of the learning process. To enhance assessment as part of the learning experience, formative feedback and reflection should be implemented for all formative assessment activities. Good collaboration between the different role players for WIL, especially with regards to assessment, should enhance students' ability to integrated disciplinary knowledge with the application thereof in clinical practice.

The development and implementation of a WIL programme must be done in a scientific way; this implies that staff members should be properly informed about the process. This will demand meticulous planning and liaison among lecturers, staff members from the different clinical training centres, and the students. Therefore, a university lecturer with expert knowledge will be needed to drive the process. An enthusiastic individual with authority, good interpersonal skills and an adequate Radiography background can play a vital role in the successful implementation of an education and training programme for WIL. As in other teaching environments, the implemented WIL programme should be often reviewed and the necessary changes should be made to ensure the quality delivery of learning.

Because WIL is a relatively new educational tool in SA, the scope for research in the field of WIL is almost unlimited, providing that persons who are adequately qualified conduct the research.

7.4 LIMITATIONS OF THE STUDY

The researcher recognises and acknowledges some limitations that impacted on the study:

- Although the study was clearly demarcated, it became a comprehensive study, generating a large amount of data.
- Although a sufficient response rate was obtained, time constraints and a heavy workload on the part of the participating university lecturers and WPL mentors/supervisors may have impacted negatively on the return rate of the questionnaires. (cf. 4.2.1 & 4.4.1). This could have influenced the results of the questionnaire survey to a certain extent.
- The student sample was limited to final year Radiography students; this means that the perceptions of students regarding current WIL practices in the first and second years of study were excluded.
- The research focused mainly on the assessment of teaching/learning, assessment and monitoring in WIL. However, drawing on experiences and the insights gained by the researcher during this investigation, as well as the literature that was consulted, the researcher believes that the focus on module content evaluation may be perceived as the most effective when it covers more than one module in a qualification.

7.5 CONTRIBUTION AND SIGNIFICANCE OF THE RESEARCH

Having provided not only recommendations but also a model for the development and implementation of a WIL education and training programme as an integrated part of Radiography curricula, this research will make a valuable contribution to new knowledge regarding Radiography training at universities in SA. This comes in handy at a time when many Radiography programmes in SA are in the process of being re-curriculated from the current three year National Diploma in Radiography to a four year Professional Bachelor of Radiography degree. By conducting a survey on the current status of WIL in Radiography training, together with the consequent development of the education and training programme with recommendations towards improvement of practice, the identified gap was bridged. The research can assist in integrating WIL into current and new Radiography curricula in order to improve the skills and competency development of Radiography students. Additionally, lecturers and curriculum developers in other health profession programmes such as Emergency Medical Care, Clinical Technology, and Physiotherapy can draw from this new knowledge to improve the delivery of WIL in their own programmes. The sound scientific approach and methodology that I followed throughout this study ensured the quality, reliability and validity of the research. However, this research study has not encompassed every element of WIL training and it may therefore be used as a springboard for further research in the many complex issues of WIL that still remain to be explored and illuminated.

The recommendations based on the research will significantly improve the delivery of WIL in Radiography training, if implemented. The recommended notion of preparing students properly prior to placement in clinical practice will significantly improve **patient care** and will address the development of professional conduct and ethics for working with real patients in real-world contexts. The suggested inclusion of teaching and learning activities other than the traditional methods as part of WIL programmes such a simulations, observations, case studies, and computer-aided activities will aid in preparing students more effectively for their professional duties prior to placement in clinical practice.

The overall goal of this study was to investigate the current state of WIL in Radiography training in SA. The results from this investigation are presented and discussed in detail in Chapter 4. The aim of the study was to develop an education and training programme for WIL in Radiography. This proposed education and training programme is presented in

Chapter 5 and Chapter 6 for the first and second years, and the third and fourth years of study respectively, and recommendations for the improvement of current WIL practices are presented in 7.6.

7.6 RECOMMENDATIONS

In order for the study to yield **significant and valuable** results, the researcher takes the liberty of recommending the following towards improvement of WIL practices in Radiography training as derived from the identified areas for improvement (cf. 4.5.2):

- The teaching and learning of WIL should be well planned and structured. To map the delivery of WIL regarding constructive alignment, the choice of curricular modalities/learning modes and assessment methods for WIL, I strongly advise that WIL be curriculated as a module on its own in the new programmes for the Bachelor for Radiography degree.
- Facilitators of WIL should take cognisance of the fact that the achievement of outcomes for WIL can also be attained in environments other than the workplace, such as in skills and computer laboratories. The use of such venues should be considered for application more specifically at the lower levels of study, i.e., the first and second years. In other words, WPL is not the only curricular modality/learning mode within which the delivery of WIL can be facilitated. The under-availability of certain imaging examinations owing to the development of technology can be effectively addressed by teaching and assessing while using a curricular modality/learning mode other than WPL.
- Facilitators of WIL should adopt new teaching and learning activities and assessment methods to stimulate the modern, technology empowered student to revert to deep learning.
- The visitation of students by a university lecturer while the students are engaged in WPL should receive urgent attention. Planning in conjunction with the available support structures at the university (e.g., the WIL central office) should be done to ensure that all students are visited as often as possible while they are engaged in WPL.
- The developers of Radiography learning programmes should give urgent attention to the training of WPL mentors/supervisors to ensure quality delivery of WIL. In this regard, the researcher suggests the delivery of a structured course carrying some continuous professional development units (CPUs) to encourage WPL

mentors/supervisors to empower themselves to assist with the supervision and mentoring of students in clinical practice.

- The researcher strongly recommends that the findings of this study be made available to all Radiography learning programmes in SA for consideration, implementation and further recommendations as a way forward in the education and training of Radiography students in the WIL environment.
- The recommendations in this report can also be customised for other health profession programmes at South African and African universities (e.g., Clinical Technology and Physiotherapy).
- The education and training programme for WIL in Radiography should play a pro-active role in stimulating the use of modern educational methods such the use of skills laboratories and e-learning activities.
- The researcher recommends that the research results be presented at national and international congresses.
- The research results should be published as articles in accredited higher education and clinical simulation journals.
- Further research is recommended to investigate specific aspects such as the training or lack thereof of WPL mentors/supervisors, the management and coordination of WIL, and the development and assessment of generic skills in the WIL environment.

The researcher is of the opinion that the research results will make a significant contribution to the body of knowledge in Radiology and in related fields and that the recommendations will contribute to the development and implementation of quality WIL education and training programmes, particularly for Radiography in South Africa.

7.7 CONCLUDING REMARKS

The introduction of an education and training programme for WIL as part of the pedagogy in Radiography training will add a new dimension to teaching and learning processes for Radiography students.

This study took cognisance of the promulgation on the delivery of WIL as part of the HEQF by the DoE in SA (2007:9) which is also explicitly stated in the revised HEQSF (2013:11): *Some qualifications will be designed to integrate theory and practice through the incorporation of work-integrated learning (WIL) into the curriculum. WIL is characteristic of vocational and professionally-oriented qualifications, and may be*

incorporated into programmes at all levels of the HEQSF. In the HEQSF, WIL may take various forms including simulated learning, work-directed theoretical learning, problem-based learning, project-based learning and workplace-based learning. The selection of appropriate forms of work-integrated learning depends on the nature and purpose of the qualification type, programme objectives and outcomes, the NQF level at which the WIL component is pegged, institutional capacity to provide WIL opportunities, and the structures and systems that are in place within professional settings and sites of practice to support student learning. Where WIL is a structured part of a qualification the volume of learning allocated to WIL should be appropriate to the purpose of the qualification and to the cognitive demands of the learning outcome and assessment criteria contained in the appropriate level descriptors. Where the entire WIL component or any part of it takes the form of workplace-based learning, it is the responsibility of institutions that offer programmes requiring credits for such learning to place students into appropriate workplaces. ***Such workplace-based learning must be appropriately structured, properly supervised and assesse****d.*

The application of a well-developed education and training programme for WIL in Radiography that entrenches sound pedagogical principles will enrich the training in undergraduate Radiography programmes at South African universities offering Radiography training. As a consequence, these programmes will produce well-equipped professional radiographers who will render a great service to patients and the community.

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