School of Applied Science

Profile of Medical Radiation Science Practitioners as Lifelong Learners: Implications for the Design of Undergraduate Programs

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Abstract

Literature has shown the importance of lifelong learning in the training of today's workforce and the crucial role of Higher Education in preparing graduates for lifelong learning. The aim of the current study is to establish the profile of Medical Radiation Science (MRS) practitioners as lifelong learners and to examine the implications of these findings for MRS undergraduate programs in Australia. The study builds on Candy et. al.'s 1994 report, *Developing Lifelong Learners through Undergraduate Education*, by drawing on the report's profile of lifelong learners and the features of the undergraduate program that promote lifelong learning. This present study used both quantitative and qualitative approaches, including collating the stakeholders' views on lifelong learning via surveys, one-to-one interviews and focus group discussion.

Findings from this study indicate that all stakeholders (MRS practitioners, Heads of MRS Departments, students and teaching staff) viewed lifelong learning to be relevant to the profession and are important attributes for MRS practitioners to attain. However, attributes that were directly related to clinical competencies were more highly valued than attributes which were perceived to be associated with learning competencies. For each of the 25 attributes surveyed, the actual level of attainment fell below the nominated level of importance. Furthermore, the workplace culture was found to be non-supportive of lifelong learning. All MRS courses in Australia promote lifelong learning as one of their course objectives. There is a general trend towards adopting teaching approaches that promote lifelong learning, while assessment methods that promote and evaluate lifelong learning attributes were lagging behind.

These findings have implications for both the MRS workplace and the MRS undergraduate courses in Australia. There needs to be greater dialogue and collaboration between the MRS employers and the universities to address the gap identified in the attributes. A conceptual model integrating lifelong learning in the context of MRS has been introduced to circumnavigate the predicament felt by most respondents that clinical competency must take precedence over all other attributes. Selection criteria by employers for graduates who are entering the workplace for the

first time serve as the vital link between the workplace and the universities. By incorporating lifelong learning attributes as an essential part of the selection criteria, students would come to see the relevance of lifelong learning in their undergraduate training. A learning portfolio can be used as a means of demonstrating that the appropriate learning has taken place. There needs to be a closer link between teaching and assessment by aligning the teaching of lifelong learning objectives and activities with the assessment methods. To this end, it is important that teaching staff must be provided with the appropriate professional support to cultivate lifelong learning attributes and to equip them with the appropriate facilitation skills, before the lecturers can be expected to adopt lifelong learning approaches. This research provides a snapshot of lifelong learning in the MRS profession and should assist in the implementation of lifelong learning strategies that would direct the future of the profession.

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In memory of my loving father Sim Huay Ang (1917-2000)

Table of Contents

Abbreviations

AAEMRS	Australasian Association of Educators in Medical Radiation Science
ACER	Australian Council for Educational Research
AIR	Australian Institute of Radiography
ASA	Australian Sonographers Association
ANZSNM	Australian and New Zealand Society of Nuclear Medicine
CEQ	Course Experience Questionnaire
CBL	Computer-Based Learning
CPD	Continuing Professional Development
DETYA	Department of Education, Training and Youth Affairs
GSA	Graduate Skills Assessment
HEC	Higher Education Council
HOD	Heads and Administrators of MRS Departments (of public/private hospitals/clinics)
HOS	Heads of MRS University Departments/Schools
IT	Information Technology
MRS	Medical Radiation Science
PAEB	Professional Accreditation and Educational Board
PBL	Problem-Based Learning
Practitioners	MRS practitioners who participated in the Practitioners' Survey
practitioners	General population of MRS practitioners
Students	MRS students who participated in the Students' Survey
students	General population of MRS students
WA	Western Australia

In order to facilitate easy reading, some repetitions are made within the thesis so that each chapter is self-contained.

System of Reference for Direct Quotation

Please note that direct quotes from participants in the study are referenced as follows:

Practitioners	denoted by the letter P
Students	denoted by the letter S
MRS academic staff	denoted by the letter A

The question number then follows the participant's category. For instance:

[P28, c7]	refers to practitioner number 28, Section C question 7.
[S6018, c8]	refers to the answer from question 8 in Section C, given by a MRS student from the 6th MRS School, student number 18.
[A2, 15]	refers to academic staff number 2's response to question 15.

Quotes from one-to-one interviews with teaching staff have an additional letter 'i', indicating that the source of data are direct quotes from interviews. eg.

[A28i]	refers to quotes from the interview with academic staff number 28.

List of Figures

List of Tables

Chapter 1

Introduction

The traditional concept of education is synonymous with formal education, with an individual learning formally during the early years and education ceasing by early adulthood (Watts and McNair, 1995; Organisation for Economic Co-operation and Development, 1996; Moursund, 1999). In contrast, lifelong learning is viewed as a continuous learning process. It is a form of conscious learning that takes place both formally and informally, and throughout an individual's life. Lifelong learning is based on the premises that individuals should not only be motivated to learn but also be capable of learning (Dolphin and Holtzclaw, 1983; Long, 1990; Candy, Crebert and O'Leary, 1994; Organisation for Economic Co-operation and Development, 1996; Maslin-Prothero, 1997; McKenzie and Wurzburg, 1997; Tight, 1998; Kearns, McDonald, Candy et al., 1999).

Overview of Chapter One

This chapter begins by looking at the reasons for the increased momentum for lifelong learning. To place the study in context, the objectives of the study are outlined. This is followed by the background and rationale for the study, by firstly evaluating the need for lifelong learning in the health professions and secondly by exploring the relationship between lifelong learning and the workplace culture. The response of the Higher Education sector to lifelong learning is also examined by focusing on the undergraduate courses for medicine and nursing. This section

therefore establishes the present study within the lifelong learning framework by profiling Medical Radiation Science (MRS) against the backdrop of health profession and the undergraduate education of the two major disciplines, medicine and nursing. This is followed by an explanation of the distinction between lifelong learning, professional and generic attributes. The research questions that this study aims to address are then presented. The chapter concludes with the significance of the study and an overview of the thesis.

1.1 Momentum for Lifelong Learning

Lifelong learning is gaining increasing momentum due to the emergence of a knowledge-based economy in an increasingly competitive globalised market (Jarvis, 1999; Kearns, McDonald, Candy et al., 1999). Continuing education becomes a necessity as rapid technological changes require a knowledgable workforce to keep pace with such developments (Knapper and Cropley, 1991; Candy, Crebert and O'Leary, 1994; Maslin-Prothero, 1997; Department of Employment, Education and Training and Youth Affairs, 1998; Duyff, 1999; Candy, 2000). In response, policy makers and educators in many countries are now focusing on lifelong learning as the key to preparing their population to cope with these rapid social, economical and technological changes (Longworth and Davies, 1996; McKenzie and Wurzburg, 1997; Kearns, McDonald, Candy et al., 1999).

The role of universities has expanded beyond simply being transmitters of knowledge (Candy, Crebert and O'Leary, 1994; Longworth and Davies, 1996). In these rapidly changing times, universities need to respond to the changing demands of workplace and technological innovations by preparing graduates for future learning (Candy, Crebert and O'Leary, 1994; Bowden and Marton, 1998; Hodgkinson, 1998; Candy, 2000). This is only possible if graduates are equipped with the appropriate lifelong learning competencies and are motivated to continue learning throughout their lives (Knapper and Cropley, 1991; Hodgkinson, 1998).

In Australia, the Higher Educational Council recognised the important role universities assume in preparing graduates for lifelong learning. In June 1993, the

Council invited submissions to conduct a study investigating the features of undergraduate courses that promote lifelong learning. This resulted in the report by Candy et al., *Developing Lifelong Learners through Undergraduate Education* (Candy, Crebert and O'Leary, 1994).

One of the major findings of this report is that lifelong learning should form an essential part of the undergraduate programs in all disciplines. Based on Candy et al's profile of a lifelong learner, the study described in this thesis, aims to develop the profile of a lifelong learner and its relevance in the context of MRS, and explore the implications for MRS undergraduate programs in Australia.

1.2 Aims of this Study

The general purpose of this study was to investigate lifelong learning in the MRS profession. Specifically, the purpose of the research was to establish the profile of a MRS practitioner as a lifelong learner and the implications for MRS undergraduate programs in Australia.

The main aims of this study were to:

- review the current status of lifelong learning in Australian Higher Education and the MRS profession;
- examine the policies and strategies in terms of lifelong learning, adopted by the Australian Institute of Radiography (AIR), the professional body of MRS practitioners in Australia;
- collect data on stakeholders' view on the importance of lifelong learning and professional and generic attributes for MRS practitioners;
- examine whether and how MRS practices and workplace culture support lifelong learning;
- establish the profile of a MRS practitioner as a lifelong learner;
- determine whether MRS students in current courses are assuming increasing responsibility for their own learning as they progress through the course;

- determine whether the main teaching strategies and assessment methods used in current MRS courses promote the development of lifelong learning attributes; and
- examine the implications for MRS programs in terms of preparing graduates for lifelong learning.

1.3 Background and Rationale

1.3.1 The Need for Lifelong Learning in the Health Professions

Change and uncertainty are features of any health care system. These are the result of technological revolutions, economic factors, changing consumer expectations and increased competition (Davies and Nutley, 2000). These are the same issues that are found in the MRS workplace, although one may argue that competition may not be as crucial an issue for the public MRS practices as compared to the private practices.

Flexibility, innovations and the capacity to manage change are keys to coping with rapid changes and uncertainty (General Practice Education: The Way Forward, 1998; Davies and Nutley, 2000). As such, the ability of practitioners to continue learning is therefore paramount (Davies and Nutley, 2000). Most professional organisations require members to continue upgrading their knowledge and skills throughout their career (Pennoni, 1993). This is certainly true for health care professionals. Lifelong learning has been endorsed as a "basic survival skill" in the health professions (Dolphin and Holtzclaw, 1983, p.10). Health professionals are expected to continue learning so as to keep up-to-date with technological changes, in order to provide the best possible health care in a safe and competent manner (Kerka, 1994; Maslin-Prothero, 1997; Henwood, 1999). The United Kingdom's National Health Service recognised lifelong learning as an important strategy in improving the country's health care system (Davies and Nutley, 2000). In Australia, the importance of lifelong learning in equipping general practitioners to cope with their future learning needs, has also been highlighted in a recent ministerial report (General Practice Education: the way forward, 1998).

Medical knowledge doubles every three years while the 'shelf-life knowledge' of nursing and dietitians is reported to be about five and three years respectively (Hotvedt and Scotti, 1996; Maslin-Prothero, 1997; Duyff, 1999). To keep the profession relevant in these rapidly changing times, physicians, nurses, pharmacists, dietitians, have all recognised the importance and the necessity of lifelong learning (Lowry, 1992; Manning and DeBakey, 1992; Fielding, 1996; Maslin-Prothero, 1997; Breedlove and Hedrick, 1998; Duyff, 1999; Leeder, 1999; Monsen, 2000).

Likewise, the dynamic and rapid advancement of technology within the MRS profession necessitates continuous learning amongst practitioners (Walker, 1995a; Smith, 1998; Australian Institute of Radiography, 1999; Brown G, 1999a). All major developments in MRS such as computed tomography, magnetic resonance imaging, Doppler ultrasound, radiation therapy and nuclear medicine have occurred within the last 30 years. Moreover, there is increasing sub-specialisation in all the above-mentioned imaging modalities and the delivery of radiotherapy treatment (Brown G, 1999a). To keep up with these technological innovations, there is a need to continue learning throughout the practitioner's working life. It is, therefore, essential to equip MRS students and practitioners with lifelong learning attributes that they may be prepared for lifelong learning.

In addition, changes in health care regulation and the increased accountability requirements to patients, the public, peers, employers and government, result in the accreditation of most health workers as being the norm (Duyff, 1999; Newble, Paget and McLaren, 1999). This trend of accreditation is also occurring in the MRS profession. The AIR has already put in place a process of accreditation for graduates, practitioners and overseas-qualified practitioners seeking employment in Australia (Australian Institute of Radiography, 1999). The Australian Sonographers Accreditation Registry has completed the process of accrediting postgraduate ultrasound courses conducted by universities and professional ultrasound associations and is currently in the process of accrediting sonographers (Australian Sonographers Accreditation Registry, 2000).

It follows that there must be some form of structured activity towards continuous learning, commonly known as Continuing Professional Development (CPD)

(Ruscheniko, 1999). CPD is therefore lifelong learning in practice (Peck, McCall, McLaren et al., 2000). CPD programs are necessary not only to meet the learning needs of individuals, but are also as a structured means of improving the entire health care system (Davies and Nutley, 2000). Thus CPD is now an essential component of many health care professions, including MRS (Fielding, 1996; Bignall, 1998; Newble, Paget and McLaren, 1999; Brown G, 2000a). The National Health Service Executive in the United Kingdom has requested that all health organisations develop a blueprint for CPD by April 2000 (CPD requirement in new NHS, 1999).

It must be noted that CPD is not restricted to the health profession. CPD is also being actively promoted in professions such as engineering and accountancy (Pennoni, 1993; Clyde, 1998; Foy, 1999; Sylar and Hayes, 1999). In the engineering profession, there are expectations that insurers would soon be offering lower premiums to engineers who have adhered to the industry regulated standard of CPD (Bignall, 1998). Connecting the issue of insurance premiums to compliance with CPD will certainly cast a different light and momentum on lifelong learning.

1.3.2 Lifelong Learning and Workplace Culture

Learning competencies, self-motivation and positive attitudes towards learning are prerequisites for autonomous learning in the workplace (Candy, Crebert and O'Leary, 1994). However, whether practitioners engage in continuous learning is also influenced by the employers' attitude towards lifelong learning and the extent to which employers support employees' learning endeavours (Leiter, Dorward and Cox, 1994). Thus, although it is the individual practitioner who engages in the learning process, the workplace culture can either encourage or impede learning activities (Davies and Nutley, 2000). Similarly, MRS workplace culture is a crucial factor in determining lifelong learning activities amongst MRS practitioners.

Much of health care is based on custom and practice (Davies and Nutley, 2000). This is certainly true of the MRS profession where many of the practices are embedded in protocols and routines. The promotion of lifelong learning, in terms of an inquisitive and critical spirit, in a workplace culture that is strongly entrenched in established

work practices is not easy. However, before any meaningful strategies can be implemented, information is required to determine practitioners' view on lifelong learning and whether and how current MRS workplace practices and cultures may or may not be supportive of lifelong learning. The present study responded to this need by investigating MRS workplace culture and collating practitioners' view on lifelong learning.

Undergraduate education plays a critical role in preparing graduates for lifelong learning (Candy, Crebert and O'Leary, 1994). The following section examines how Higher Education can assist towards the lifelong learning objective.

1.3.3 Response of Higher Education to Lifelong Learning

Knowledge is increasing at an exponential rate (Duyff, 1999). The challenge of professional education these days is the need to include an ever-expanding amount of knowledge into undergraduate courses (Candy, Crebert and O'Leary, 1994; Breedlove and Hedrick, 1999). MRS Schools are no exception, facing the same challenge of having to incorporate more content into the undergraduate curriculum.

However, there is no guarantee that increasing the amount of knowledge will lead to improved practical application or preparing students better for future learning (Neame and Powis, 1981). The role of any professional education is to provide a solid foundation on which future learning can take place (Bellack and O'Neil, 2000). Therefore, undergraduate education needs to evolve constantly to prepare students for lifelong learning (Pearson and Jones, 1997). In response, both undergraduate education in medicine and nursing have evolved significantly to include lifelong learning as one of their main course objectives (Pearson and Jones, 1997).

In keeping with the rapid changes in medicine, medical students have to be taught the skills of dealing with the uncertainty of the future workplace (Breedlove and Hedrick, 1999). In response medical schools are being encouraged to adopt a variety of teaching approaches that will prepare medical students to be lifelong learners. The main objective is to cultivate the appropriate attitudes and self-directed learning

skills in order to prepare students to work in a multi-disciplinary environment and for continuous learning beyond graduation (Neame and Powis, 1981; Cotton, 1991; Lowry, 1992; Pearson and Jones, 1997; Spencer and Jordan, 1999).
Nurses too are gradually expanding beyond their traditional role of nursing. Knowledge and technical competence are essential for nurses, but these competences by themselves are no longer adequate for preparing nursing students for a workplace that is constantly changing (Bellack and O'Neil, 2000). Some of the new functions of nurses include independent practitioners and managers of health care services (Bellack and O'Neil, 2000). Faced with the need to equip nursing graduates with the necessary lifelong learning skills for future roles, there is increasing pressure on nursing programs to broaden nursing curricula (Maslin-Prothero, 1997; Bellack and O'Neil, 2000).

Current literature indicates that both medical and nursing education are aiming to equip their students with lifelong learning attributes. The present study aims to determine if current MRS courses are moving in similar directions in assisting students to become lifelong learners.

In summary, by taking stock of the current status of lifelong learning in the MRS, the findings from this study will assist the profession in the implementation of lifelong learning strategies to cope with the rapid changes that are occurring in the MRS.

1.3.4 Lifelong Learning, Professional and Generic Attributes

Lifelong learning is about the individual's motivation and capability to continue learning (Dolphin and Holtzclaw, 1983; Long, 1990; Candy, Crebert and O'Leary, 1994; Organisation for Economic Co-operation and Development, 1996; Maslin-Prothero, 1997; McKenzie and Wurzburg, 1997; Tight, 1998; Kearns, McDonald, Candy et al., 1999). Thus lifelong learning attributes would not be simply focused on one's capabilities for future learning, such as the abilities to self-evaluate, set goals and the management of one's own learning, but would also include the attitudes of the learner such as the willingness to learn new things and being confident to

continue learning. (See Chapter 3, Table 3.1 for list of lifelong learning, professional and generic attributes.)

Professional attributes refer to the specific subject knowledge and job-related skills that pertain to a particular profession. In the MRS context, professional attributes would include knowledge of MRS discipline, being able to apply the acquired knowledge into MRS practice, clinical skills in handling patients and verbal communication skills with patients. Thus, having the necessary professional attributes would enable the graduate to perform a specific job function as a member of the profession (Boys, 1995).

Unlike professional attributes, generic skills on the other hand, are non-specific and can be applicable in any workplace and different jobs (Barnett, 1994). Hence generic skills are also commonly known as transferable skills (Hyland and Johnson, 1998). The growing emphasis on generic skills is due to the recognition that professional knowledge and skills alone are not sufficient to prepare graduates for future workplaces (Barnett, 1994). Many academics now view the acquisition of generic skills as a fundamental aspect of university learning, and have therefore often termed generic skills as core skills (Bowden and Marton, 1998). Some examples of generic skills include the social and general interpersonal skills such as teamwork skills, communication skills (written and oral) and computing skills (Chapman and Aspin, 1997; Bowden and Marton, 1998).

1.4 Research Questions

The research questions addressed in this study were divided into two categories: the Professional Sector and the Higher Education Sector.

1.4.1 Professional Sector

First Research Question:
What is the profile of a MRS practitioner as a lifelong learner?

Second Research Question:
How does the profession view lifelong learning in the workplace?

This question is sub-divided into the following questions:

(a) What do the stakeholders, ie. Practitioners, Heads of MRS Departments and Students, consider are the most important attributes of a MRS practitioner?

(b) What is the relationship between lifelong learning attributes and the attributes considered most important by the Practitioners, Heads of MRS Departments and Students?

(c) Are there any significant differences between the importance of these attributes and the perceived level of attainment?

(d) Are these differences statistically significant between the Practitioners, Heads of MRS Departments and Students?

(e) What are the selection criteria MRS employers look for in graduates?

1.4.2 Higher Education Sector

Third Research Question:
Are current MRS courses producing graduates with lifelong learning attributes?

This question is sub-divided into the following questions.

(a) How do MRS Schools actualise their commitment to lifelong learning?

(b) How do academics view lifelong learning in the MRS discipline?

(c) Are students being given increasing responsibility for their own learning as they progress through the course?

(d) What are the main teaching strategies in MRS courses?

(e) What are the main assessment methods being used?

(f) What are the factors identified by students and practitioners that are crucial in enabling both students and practitioners to become MRS practitioners?

1.5 Significance of the Study

In order to envisage the future of the profession, it is necessary first to be informed of the current status of the profession. The present study is significant, as it is the first national study conducted within the MRS discipline on lifelong learning. The study is timely as lifelong learning is currently being actively promoted in the MRS profession by the AIR and the Higher Education sector. First, the research seeks to determine which are the professional, generic and specifically the lifelong learning attributes that are valued by the major stakeholders in the MRS profession. Second, it seeks to ascertain the workplace culture in relation to lifelong learning. These findings are crucial in that they inform the major stakeholders, employers, practitioners, students, MRS Schools and policy makers of the AIR, of what the profession values. This information will facilitate future planning and assist in the implementation of strategies that will promote lifelong learning in the profession.

In this era of increasing accountability, the quality of Australian universities is a critical issue (Department of Education, Training and Youth Affairs, 1999). Many indicators are being used to assess the success of universities in inculcating the desired attributes and skills into their graduates. One of the commonly used indicators in determining successful course outcomes is the employability of graduates in the workforce (Department of Education, Training and Youth Affairs, 1999). Thus, the need to identify these demands and to respond to changing needs in the workplace is an issue that few professional educators can afford to ignore. Likewise, MRS Schools can use the data from this research to guide them in their curriculum development. Findings from this study will indicate any deficiencies of professional, generic and lifelong learning attributes. This information would assist

MRS Schools to better prepare graduates not just for lifelong learning, but also in improving the professional and generic competencies of students.

Currently, there are no national data indicating if MRS Schools in general are adopting the appropriate teaching and learning strategies for preparing graduates for lifelong learning. The ability to correlate data on teaching strategies and assessment methods will indicate any alignment/non-alignment of teaching and assessment methodologies in support of the lifelong learning objective. This is an important indicator of successful teaching, as good teaching is dependent on the extent of alignment between learning objectives, teaching and learning activities and assessment methods (Biggs, 1999a).

Students and MRS teaching staff will also find the data useful. The findings will serve to inform them about the attributes that were valued by employers and practitioners. Unless students see the need and relevance for lifelong learning, they will not fully engage in the appropriate learning activities, thereby negating any attempts by the Schools to promote lifelong learning (Candy, Crebert and O'Leary, 1994). These findings are therefore significant because of their potential impact on what students learn and the way they learn during their undergraduate study. Teaching staff can also make use of these data to align their learning activities and assessment methods to the desired attributes.

Candy et al. defined the ability to see the big picture as one of the attributes of a lifelong learner (Candy, Crebert and O'Leary, 1994). For the purpose of this thesis, it is crucial to see how the workplace, MRS Schools and the AIR are related to one another in terms of lifelong learning. This picture shows whether the three major stakeholders are working towards the same objective or diverse in their pursuit of lifelong learning objectives. The demonstration of this linkage or non-linkage is vital for the overall planning for the future of the profession. This is because there must be close collaboration between stakeholders in order for lifelong learning to be fully embedded in the profession (Candy, Crebert and O'Leary, 1994; Organisation for Economic Co-operation and Development, 1996). The findings of the study, therefore, have implications for how the three sectors, the workplace, AIR and the MRS Schools, can collaborate more effectively for the betterment of the profession.

1.6 Overview of thesis

This thesis consists of seven chapters. Chapter 1 presents the objectives, background and the significance of the current study. The research questions for this study have also been detailed in this chapter. Chapter 1 concludes with an overview of the thesis.

Chapter 2 links the three major stakeholders, Higher Education in Australia, AIR and the MRS practitioners. The first section is concerned with a review of lifelong learning in Higher Education in Australia. The second section examines the importance of lifelong learning in the accreditation process of MRS courses, while the last section of Chapter 2 details practitioners' views on lifelong learning. Chapter 2 therefore sets the stage for the commencement of the research project.

Chapter 3 describes the methodology used in this study. It describes the qualitative and quantitative approaches that have been used, and addresses issues of validity and reliability of the data.

Chapters 4 and 5 report on the results and interpretations of the professional and Higher Education sectors respectively. The data included in Chapter 4 address first and second research questions, while the data presented in Chapter 5 answer the third research question.

Chapter 6 presents the discussion of the results and the implications for both the MRS profession and the undergraduate MRS programs.

Chapter 7 outlines the strengths and significance of the study, as well as the limitations of the study and suggestions for future research. The chapter concludes with a summary of the study and the implications for both the profession and MRS programs in Australia.

Chapter 2

Literature Review

The focus of Chapter 2 is the current attitude to lifelong learning in the three major stakeholders within the MRS profession. These include Australian Higher Education, the AIR, which is the professional representation of the MRS, and the MRS practitioners in the workplace.

The first section examines the shift towards lifelong learning in Australian Higher Education and outlines how the concepts of quality, graduate outcomes and lifelong learning are linked together. This is followed by a literature review of the profile of a lifelong learner and the main features of undergraduate courses that promote lifelong learning. Congruence between the universities' mission statements and the MRS Schools' policy on lifelong learning, the universities' mission of the MRS Schools with regard to lifelong learning are also examined.

The role of the AIR in the promotion of lifelong learning is crucial. For the purpose of this thesis, only two sets of AIR policies will be presented, the accreditation and educational policies. AIR is responsible for the accreditation of all MRS

undergraduate courses in Australia. Hence, the accreditation policy will play an important role in determining the extent to which lifelong learning will be encouraged in the undergraduate programs. Similarly, the educational polices of AIR for continuing education will signal to the practitioners the importance with which the AIR views continuous learning. This section will conclude by looking at the latest development within the MRS profession, the launching of the CPD by the AIR, and its significance in relation to lifelong learning.

Lifelong learning is about the practitioners' willingness, motivation and ability to continue learning. Thus it is essential to examine the practitioners' attitude towards lifelong learning and CPD. Clinical competence is an issue that is high on the agenda of health practitioners and professional education. MRS is no exception. Thus, to complete the picture, it would be necessary to determine the relationship, if any, between lifelong learning and clinical competence.

The first three sections set the scene for the direction of this study and emphasise the reasons for posing the research questions. The chapter concludes with a focus on the main issues of the current study.

2.1 Lifelong Learning and Higher Education in Australia

Universities assume a vital role in preparing graduates for lifelong learning (Candy, Crebert and O'Leary, 1994; Beetham, 1998). This role involves designing courses that include not only the development of lifelong learning competencies, but also cultivating the attitudes of learners, so that they have the desire and motivation to continue learning. Universities are part of the larger umbrella of learning organisations in the promotion and development of lifelong learning (Longworth and Davies, 1996).

2.1.1 Quality in Higher Education

Lifelong learning appeared in the Australian Higher Education agenda in the midst of debate about the sweeping changes that are transforming Higher Education (Candy,

Crebert and O'Leary, 1994). The shift from the elite few to mass education at tertiary level has resulted in a re-examination of the role of Higher Education (Candy, Crebert and O'Leary, 1994). This, together with a drop in funding, has brought into sharper focus the issue of quality in Higher Education (Higher Education Council, 1992b).

The precise definition of quality is dependent on the views and values of the stakeholders making the judgement (Higher Education Council, 1992b). In 1992, the Australian Higher Education Council (HEC) moved away from the difficult task of defining quality, choosing instead to quantify the Higher Education process by focusing on the outcome of the process ie. the attributes of graduates (Higher Education Council, 1992b).

The outcome of any undergraduate course should be a graduate with the required generic skills and attributes, a good knowledge base and the appropriate professional and technical skills (Higher Education Council, 1992c). Although lifelong learning was not explicitly mentioned as one of the main objectives in its report, *Achieving Quality*, the HEC did mention the need for undergraduate programs to promote and develop the characteristics, which allow graduates to continue learning after graduation and throughout their lifespan (Higher Education Council, 1992c, p. 20).

The importance of equating the success of Higher Education institutions, and therefore the quality of the course, to graduates' outcomes is most evident in recent years. Aside from relying on the employability of their graduates as a benchmark for their success, universities are also relying on graduate outcomes to indicate their success in developing and instilling the desired skills and attributes in their students (Department of Education, Training and Youth Affairs, 1999).

Increasingly, the Australian Federal Government is using performance indicators as a means of providing employers and prospective students with information and forcing the universities to be more accountable for their performance (Illing, 1998; Illing, 1999c). The performance indicators used included information such as pass rates, the annual Course Experience Questionnaire (CEQ) survey conducted by the Graduate Careers Council of Australia and the latest test on generic skills by the Australian

Council for Educational Research (ACER) (Illing, 1998; Illing, 1999a; Illing, 1999c). With the possibility of relating the CEQ responses and the generic skills performance to funding allocation, universities are under increasing pressure to showcase their teaching quality and for their performance in terms of graduate outcomes and attributes (Illing, 1999b).

2.1.2 Moving towards Lifelong Learning

The focus on the outcome of Higher Education in terms of graduates' attributes was therefore timely. In 1993, the HEC invited submissions to conduct a study on 'enabling characteristics of undergraduate education' that promote lifelong learning (Candy, Crebert and O'Leary, 1994, p. xiii). The main aim of the study was to define the concept of lifelong learning, as well as to determine the characteristics of undergraduate education that enable and encourage lifelong learning attributes amongst graduates (Candy, Crebert and O'Leary, 1994, p. 5). This resulted in the 1994 report by Candy, Crebert and O'Leary*, Developing Lifelong Learners through Undergraduate Education*.

In the report, Candy and his associates made several major recommendations, three of which are presented below (Candy, Crebert and O'Leary, 1994, p. xv):

- development and promotion of lifelong learning skills and attributes should form the cornerstone of all Australian undergraduate education;
- universities should be encouraged to have explicit policies relating to the development of lifelong learners; and
- all undergraduate courses should have lifelong learning skills and attributes clearly specified in their aims and objectives.

Soon after its release, the HEC indicated that the 1994 Report would serve as a very useful platform and benchmark for examining lifelong learning in Australian Higher Education (National Board of Employment, Education and Training and its Higher Education Council, 1994).

However, the report went beyond merely serving as a yardstick for Higher Education in Australia. The recommendations put forward by Candy et al. (1994) were significant in that their implementation required a total re-examination and re-orientation of undergraduate courses. This necessitates changes from the top down; from the upper university hierarchy having explicit statements and policies relating to lifelong learning, to academic staff moving away from a teacher-centred towards a student-centred form of learning. Thus, the recommendations set a significant milestone for lifelong learning in Australian Higher Education by challenging universities and academic staff to re-think their education philosophy and teaching approaches.

An undergraduate course that successfully prepares students for lifelong learning, would have the lifelong learning attributes described as part of their graduate outcomes. The following section details the profile of a lifelong learner.

2.1.3 Profile of a Lifelong Learner

Graduates with lifelong learning attributes are much more capable and successful in adapting to changes in the work place as well as leading a more fulfilling life (Lowry, 1992; Candy, Crebert and O'Leary, 1994; Maslin-Prothero, 1997; Hodgkinson, 1998). Candy et al. (1994, p. 43) defined a lifelong learner as one who shows the following attributes:

- An inquiring mind; a learner who is propelled by the love and curiosity for learning.
- Helicopter vision; an ability to inter-relate fields of knowledge as opposed to compartmentalised learning.
- Information literacy; awareness of where and how to access information, plus the ability to critically evaluate the data collected.
- A sense of personal agency; a positive image of oneself, coupled with the capacity to manage his or her own learning style.
- A range of learning skills; having a variety of learning skills at his or her disposal.

Of the characteristics listed above, curiosity has been identified as one of the most important attributes (Scott, 2000). This is because it is the curiosity for learning that propels a lifelong learner to continue learning. A lifelong learner is always searching for learning opportunities, using past learning experience to actively change and develop (Catchpole, 2000; Cowan, 2000).

A lifelong learner must also be motivated and willing to learn, with clearly defined learning goals (Knapper and Cropley, 1991; National Board of Employment, Education and Training, 1996b). Gross (1977, p. 16) further defines lifelong learning as "self-directed growth", indicating that the individual must be capable of independent learning

The five attributes listed by Candy et al. focused on the learner-centred approach to learning. More recently, Candy has added another attribute to this profile, the interpersonal skills of the learner (Candy, 2000). From the researcher's clinical supervision experience, many senior practitioners have singled out interpersonal skills as one of the most desired attributes they wish to see in students. The ability of the learner to interact with peers and colleagues for learning and collaborative work is certainly a very important attribute in a multi-disciplinary health team.

As part of the investigation into lifelong learning in the MRS profession, the first research question will address the profile of a MRS practitioner as a lifelong learner and its relevance in the context of the MRS profession.

If Candy et al. major recommendations as outlined in Section 2.1.2 are to be effective, strategies must be put in place to develop and cultivate students' willingness, motivation, confidence and ability to be self-directed, independent learners (Organisation for Economic Co-operation and Development, 1996). The next section provides a broad overview of the essential characteristics of undergraduate courses that promote lifelong learning.

2.1.4 Features of Undergraduate Courses that Promote Lifelong Learning

Candy et al. (1994) indicated that the structure of the curriculum, course content, teaching approaches and assessment methods were all crucial factors in either promoting or discouraging lifelong learning attributes.

2.1.4.1 Structure of Curriculum

The curriculum should be structured to consist of the following features (Candy, Crebert and O'Leary, 1994, p. 110-111):

- A systematic and integrated approach to the discipline so as to provide the students with a wider perspective and solid foundation of the subject areas.
- A contextual framework by adopting a broader interdisciplinary approach with the aim of creating in students an awareness of the limitations and future of their disciplines.
- A more 'rounded education' and equipping students with generic skills. In so doing, one avoids a narrow-focused outlook and broadens the students' horizons. Having the appropriate generic skills, such as communication and information literacy skills, is an essential survival trait in today's workforce.
- Some freedom of choice and flexibility in the course structure should be made available to the students in order to cater to their needs and interest. This can be in the form of selection of subjects and/or assessment methods.
- Independent learning with an increasing component of self-directed learning as students progress through the course. This would provide the valued opportunity for students to exercise increasing degree of learning autonomy under supervision, which will be a precursor to their future learning in the workplace.

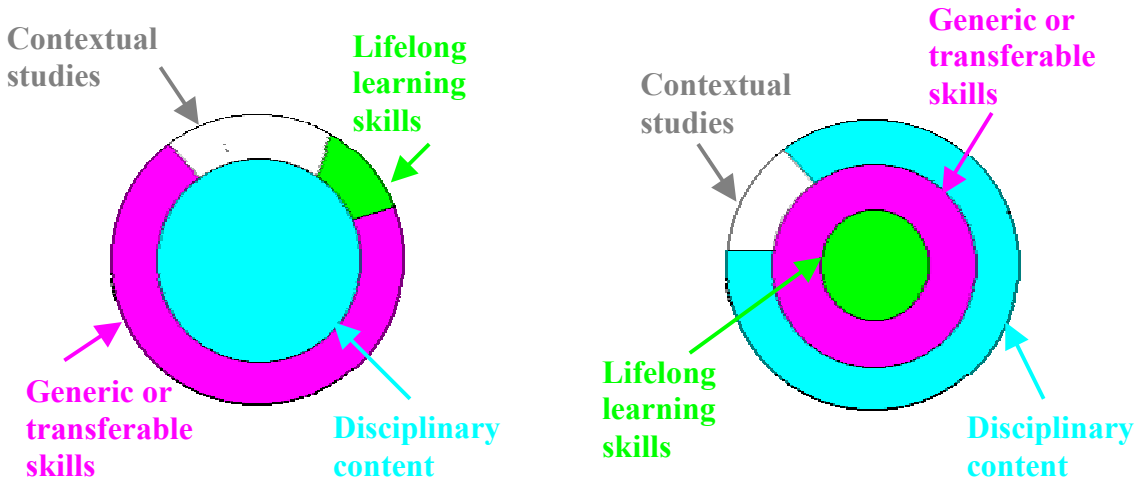
2.1.4.2 Course Content

Course content should not be restricted to disciplinary content alone, but should also include learning skills, generic skills, information literacy and Australian studies (Candy, Crebert and O'Leary, 1994, p. 97-109).

Figure 2.1 shows the different ways in which lifelong learning can be integrated into the curriculum. Model A represents the way in which most Australian undergraduate curricula are currently structured. It shows the disciplinary component occupying

most of the content, leaving generic skills, lifelong learning skills and contextual studies to the peripheral. It follows that generic and lifelong learning components are likely to receive very little attention, and are often in danger of being excluded due to the tendency of including more content in an effort to keep up to date with the latest technology (Candy, Crebert and O'Leary, 1994).

Candy et al. (1994) advocated instead that lifelong learning should form the core of the curriculum (Model B). This way, lifelong learning competencies would be given the appropriate emphasis, instead of being relegated as 'add-ons' as in Model A. Equipping students with learning competencies would prepare them adequately for future learning (Candy, 2000).



Model A

Typical Australian undergraduate curriculum whereby lifelong learning skills are taught as 'add-on'.

Model B

Candy et al. proposed that lifelong learning should be the focus of undergraduate curriculum.

Figure 2.1
Two comparative models of undergraduate curriculum: the typical model with lifelong learning relegated to the edge while Candy et al. proposed putting lifelong learning in the centre of the curriculum.

Source: (Candy, Crebert and O'Leary, 1994, p. 66).

Radloff (cited in Fox and Radloff, 1996) maintains that it is not possible to teach lifelong learning skills as a distinct subject. Instead, lifelong learning components, generic and contextual studies should be embedded within the disciplinary content so as to enable students to see how such skills can be successfully used and applied in their field of study (see Figure 2.2).

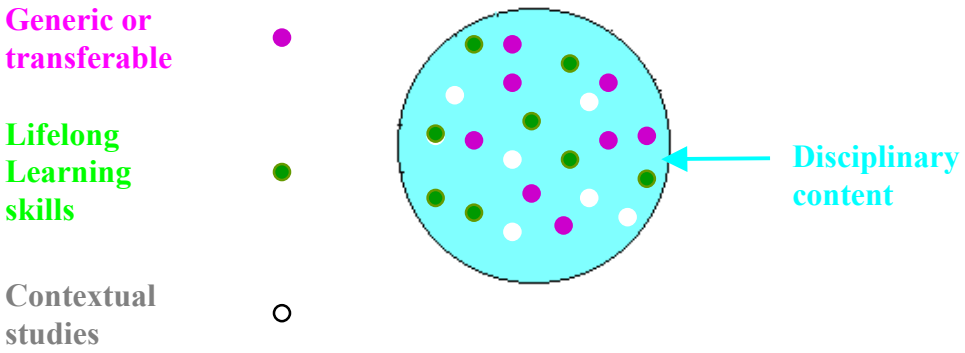


Figure 2.2
Model of undergraduate curriculum, as proposed by Radloff, with lifelong learning skills, generic and contextual studies embedded within the disciplinary content.

Source:(Radloff, cited in Fox and Radloff, 1996, p.568)

However, the promotion of lifelong learning in the undergraduate program goes beyond that of incorporating lifelong learning at the core of the curriculum and showing students how such skills can be utilised in the discipline. The successful promotion of lifelong learning in the undergraduate program is also dependent upon the extent to which students view the relevance of lifelong learning in their profession. Seeing the relevance and the importance of lifelong learning in their future career development would provide students with the willingness and motivation to acquire these skills (see Figure 2.3).

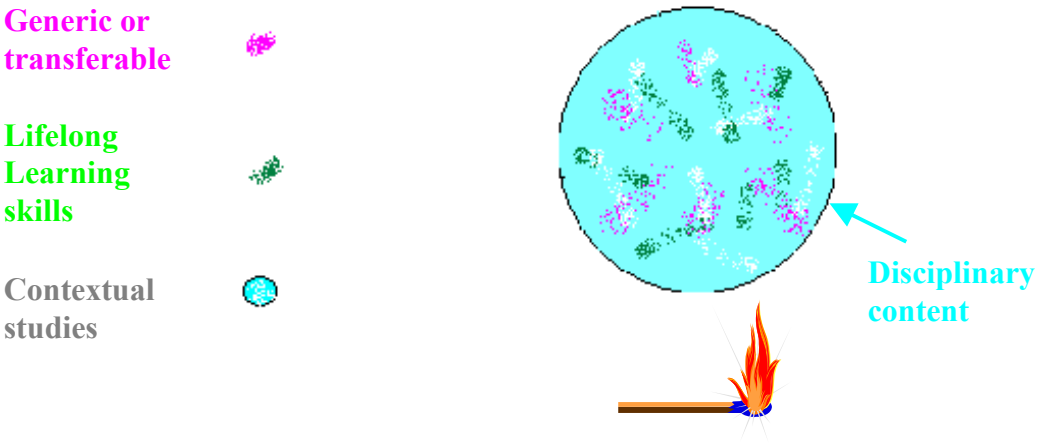


Figure 2.3
Model of undergraduate curriculum, showing a diffusion of contextual, generic and lifelong learning components into the disciplinary content.
The lighted match symbolises the willingness and motivation of students towards the attainment of lifelong learning. Thus instead of existing as distinct components embedded within the disciplinary content, the contextual studies, generic and lifelong learning components would merge and diffuse into the disciplinary contents. This is only possible if students themselves see the relevance of these skills in their discipline.

In addition, there must be no hidden curriculum; the attainment of these skills must be clearly specified in the learning objectives in order to ensure alignment and transparency in terms of learning outcomes (Biggs, 1999b).

2.1.4.3 Teaching Approaches and Assessment Methods

As the Third Research Sub-Questions (3c, 3d and 3e) are concerned with the teaching and assessment methods that promote lifelong learning, considerable attention will be directed at this feature of undergraduate programs.

This section begins by examining the teaching approaches that promote the development of lifelong learning attributes. To set the scene for the discussion on assessment methods, the current assessment trend in Higher Education is first discussed. This is followed immediately by reviewing the appropriate assessment methods that promote lifelong learning attributes and finally, the importance of assessment in relation to lifelong learning. In addition, the relationship between

teaching and assessment strategies as described by Biggs' model of constructive alignment will also be discussed. An example of aligned teaching, the learning portfolio, will be examined in length.

Teaching Approaches

What are the teaching approaches that promote lifelong learning? The answer lies in focusing on what students need to do (learning activity) to bring about effective learning and desired graduate outcomes instead of simply concentrating on what the teachers do (Biggs, 1999a).

In general, teaching approaches that encourage interaction amongst students and self-reflection are instrumental in the development of lifelong learning skills, while traditional didactic teaching, due to its passive nature, discourages students from active learning (Candy, Crebert and O'Leary, 1994). Lectures are largely teacher-centred strategies as this form of didactic teaching encourages passivity on the part of the students and does not lead to effective learning. Although it is the intention of lecturers that students should make use of this newly acquired knowledge, it does not automatically follow that students indeed will be able to apply the knowledge appropriately or at all (Lowry, 1992; Biggs, 1999a).

As pointed out by Ramsden (cited by Mintz, 1997, p. 179) "it is what students do rather than what teachers do, that ultimately determines whether changes in (student) understanding actually take place". Thus, instead of concentrating on the teacher's activities, the teaching strategies that promote lifelong learning are activities that focus on student learning (Trigwell, Prosser and Waterhouse, 1999). With student-centred approaches, students engage in the learning activities that generate the desired lifelong learning attributes. In addition, studies have shown that these student-focused teaching approaches also result in higher quality learning outcomes, with students often adopting a deeper approach to learning (Trigwell, Prosser and Waterhouse, 1999).

Teaching approaches that promote lifelong learning attributes are (Candy, Crebert and O'Leary, 1994, p. 128):

- self-directed and peer-assisted learning;

- reflective practice and critical self awareness;
- problem-based learning (PBL); and
- experiential and real world learning.

By equipping students with lifelong learning competencies during their undergraduate training, teaching staff are effectively preparing students for their future professional development (Toohey, 1999; Candy, 2000). Thus, the importance of self-directed learning (eg. learning contract), reflective practice (eg. learning portfolio) and the ability to critically evaluate oneself, are teaching strategies that enable the learner to develop different aspects of learning autonomy.

The development of **self-directed learning** skills is not just about learner-centred approach of learning. Self-directed learning also includes **peer learning** as students often learn from the exchange of ideas and experience (Boud, 1981). Group work promotes reflection, meaningful learning and develop teamwork skills by allowing active participation from students via group discussion (Clifford, 1999; Leveson, 1999). Peer learning enhances student learning as ideas are shared and discussed amongst peers, assisting students to make the vital connections between their learning experiences such as lectures, assignment writings, group presentations and clinical attachment (Wilkinson, Peters, Mitchell et al., 1998). Another example of peer learning is peer mentoring, whereby senior students may assist junior or weaker students (Candy, Crebert and O'Leary, 1994). Peer learning is highly relevant for students as it simulates the kind of informal learning and work environment found in their future workplace and is therefore an important teaching and learning strategy.

Problem-Based Learning (PBL) is becoming increasingly popular in health care education and has been cited as one of the more significant developments in professional education (Bligh, 1995; Bruhn, 1997; Spencer and Jordan, 1999; Davies and Nutley, 2000). It assists students in linking the theoretical knowledge and practical applications and simulates the kind of problems one often encounters in the working situation, therefore contextualises the learning for the student (Biley and Smith, 1999; Biggs, 1999b). As students engage in group learning, they are reported to have better communication and interaction skills (Bligh, 1995). PBL is an example of aligned learning, with the learning objectives, teaching-learning activities and the

assessment converging together. The learning objectives specify the problems to be solved, and the assessment indicates how well the problems have been solved, while the learning process develops the students' ability to problem solving (Biggs, 1999b). Through the process of solving the problems, they learn the essential skills that are needed for future learning, which include analytical and critical thinking, the ability to define their own learning goals and problem-solving skills (de Graaff, 1993; Bligh, 1995; Bechtel, Davidhizar and Bradshaw, 1999; Biggs, 1999b).

Role-play is a common example of **experiential learning**, although experiential learning may also include project work and research projects for the industry (Candy, Crebert and O'Leary, 1994; Bowden and Marton, 1998). In professional health education, much of the experiential learning takes the form of clinical practice. The latter is an effective learning strategy as it allows students to apply their theory into practice, and it increases their confidence as they develop their interpersonal skills and technical expertise in the clinical environment (Candy, Crebert and O'Leary, 1994; Brown, Bull and Pendlebury, 1997).

Assessment Methods

Just as the appropriate teaching approaches should be used to encourage the development of lifelong learning attributes, likewise, the right assessment methods must be employed to reinforce these attributes. Before examining these assessment methods, it is essential to first establish the current assessment trends in Higher Education.

Trends in Assessment Culture

Assessment provides the necessary evidence that students have indeed attained the required understanding (Simmons, 1994). It forms an essential part of student learning, informing the students how well they are doing and what they need to know (Biggs, 1999a; Brown S, 1999b). It also informs the lecturers what and how well the learning has taken place in order that they may modify the teaching approaches and learning activities to further improve student learning (Biggs, 1999a).

There has been a discernible shift in recent years in the methods of assessment in Higher Education (Brown, Bull and Pendlebury, 1997). The current assessment

culture differs from the traditional testing culture in that the latter focuses strictly on the product of student learning by stressing the amount of knowledge acquisition, while the new assessment culture places greater emphasis on students' learning process and their ability to apply this acquired knowledge (Candy, Crebert and O'Leary, 1994; Sambell and McDowell, 1998). The traditional testing culture regards instruction and testing as separate activities. In contrast, the current assessment culture views instruction and assessment as an integral part of student learning (Sambell and McDowell, 1998). Assessment should be regarded as part of ongoing instruction, since the ensuing feedback guides the students in their learning process thereby improving student learning (Simmons, 1994; Clifford, 1999).

The traditional assessment method of a written exam is increasingly being cited as an example of a once-off assessment that focuses on the end product of learning rather than on the learning process (Boles, 1999). Written exams often encourage a superficial approach to learning by requiring students to recall the facts, which are forgotten immediately after the exam (Candy, Crebert and O'Leary, 1994). Traditional testing focuses on academic grading, overlooking the important skills and attributes, which are essential for lifelong learning. The result is that the assessment tasks (written exam) fail to provide the feedback on student learning, thereby failing to assist in the development of students' lifelong learning attributes (Radloff and de la Harpe, 1999).

An effective assessment approach promotes the following lifelong learning attributes (Dochy, Segers and Sluijsmans, 1999, p. 345; Gibbs, 1999, p. 153):

- increases students' confidence in their ability to learn;
- increases their ability to reflect upon and evaluate their own learning;
- equips them with multiple approaches to learning;
- encourages students to take responsibility for their own learning; and
- enables students to become self-motivated and independent learners.

The trend is now towards student-led assessment instead of total reliance on teacher-led assessment. In the latter, the teacher alone sets the assessment tasks and does the evaluation. In student-led assessment, such as self and peer assessment and reflective

journals, students themselves participate actively in assessment activity (Brown, Bull and Pendlebury, 1997; Dochy, Segers and Sluijsmans, 1999). These assessment strategies are increasingly popular as students are encouraged to reflect upon their learning experiences, thereby developing autonomy in their learning (Brown, Bull and Pendlebury, 1997). In these instances, the assessment and learning activity are linked together, with the learning activity becoming the assessment task.

In addition, the changing goals of Higher Education have added further impetus to adopting more innovative assessment methods that would successfully develop and assess lifelong learning and generic competencies (Brown S, 1999b). Due to the rapidly changing nature of the workforce, graduates entering the workforce are required to communicate effectively, work in teams (social competencies), be able to acquire and analyse information independently, problem solve (cognitive competencies) and be capable of reflecting on their own learning (metacognitive competencies) (Dochy, Segers and Sluijsmans, 1999). Thus the role of the university education has expanded beyond the mere acquisition of knowledge and professional expertise (Radloff and de la Harpe, 1999).

The importance with which Higher Education views generic skills as part of graduates' outcomes can be seen in recent developments. In an effort to improve the generic skills of university graduates, ACER is currently conducting the Graduate Skills Assessment (GSA) trials to be eventually implemented in all Australian universities. The four areas to be assessed are (ACER, 2000a):

- critical thinking;
- problem solving;
- interpersonal understanding (abilities to understand inter-relationship principles); and
- written communication.

It is proposed that the GSA will eventually be used to assess students at the beginning and the end of their undergraduate program (ACER, 2000a). The purpose of this assessment is to allow universities to monitor the students' abilities in these areas so as to enable institutions to adopt the necessary measures to assist the weaker

students (ACER, 2000b). Despite the specified objective, concerns have been expressed in some quarters that Canberra could also use the GSA results for funding allocation (Illing, 1999b). Currently, the Australian Technology Network Universities are designing strategies to foster and assess the generic capabilities of their graduates. This is in line with the universities' commitment to promote the very same values that employers desire in their potential employees (Australian Technology Network Teaching and Learning Committee, 2000).

Successful universities are therefore those that prepare students adequately for the workforce by equipping them with the necessary social, cognitive and metacognitive competencies. Hence the methods of assessment used will need to evolve in order to assess more than just mere acquisition of knowledge. In an effort to account for graduate outcomes, plus the need to assess the attainment of lifelong learning and generic competencies, a departure from the traditional testing culture is therefore necessary (Boles, 1999; Dochy, Segers and Sluijsmans, 1999; Radloff and de la Harpe, 1999; Brown S, 1999b).

The following section examines the major assessment methods that promote lifelong learning competencies and details how the assessment forms part of the student learning activity.

Assessment Methods that Promote Lifelong Learning Attributes

Self-assessment is an effective student-centred learning strategy and is a useful form of formative assessment (Ashcroft and Palacio, 1996; Boles, 1999; Dochy, Segers and Sluijsmans, 1999). It requires the learner to be self-critical, reflecting on one's own learning experience and learning outcomes, enabling the learner to link together all aspects of his/her learning experiences (Ashcroft and Palacio, 1996; Dochy, Segers and Sluijsmans, 1999). It increases the students' sense of responsibility as a learner, as well as their competence in assessing and monitoring their own performance, all of which are essential traits of lifelong learning (Dochy, Segers and Sluijsmans, 1999; Gibbs, 1999).

However, the drawbacks of self-assessment include inexperience on the part of the student as an assessor, and the tendency for some to over-value or under-value their

own work. Hence it is crucial that self-assessment should be used in conjunction with other methods of assessment (Ashcroft and Palacio, 1996).

Like self-assessment, **peer assessment** also inculcates into students a sense of responsibility as they assume the tasks of rating their own peers (Dochy, Segers and Sluijsmans, 1999). When used together, both self and peer assessment provide opportunity for students not only to evaluate and reflect upon their own learning, but to also compare their own learning experience with their counterparts (Dochy, Segers and Sluijsmans, 1999).

Reflective journal focuses on reflection, with the student relating the learning experience to the theory acquired and analysing the learning process and the learning outcomes (Brown S, 1999a). It encourages the student to adopt a self-appraisal and analytical approach to professional practice. Using the reflective journal as an assessment method often leads to a changed perspective for the learner and is therefore a very effective means of assisting students to grow in their professional development (Lyons, 1999).

Learning contract refers to learning plans that specify the learning goals, the actions required to achieve the learning objectives and the criteria for assessment (Stephenson and Laycock, 1993). This is a student-centred form of learning as the student plays an active role, by discussing and negotiating the details of the learning plan with the assessor (Stephenson and Laycock, 1993; Clifford, 1999). Learning contract is an effective learning strategy as it empowers the students and increases their self-esteem and creativity (Clifford, 1999). By involving the students in their own learning agenda, it develops their ability for future learning.

Importance of Assessment in Relation to Lifelong Learning

The assessment methods described in the above section are regarded as major strategies in the development of a lifelong learner (Sambell and McDowell, 1998; Dochy, Segers and Sluijsmans, 1999). Good assessment practice can be regarded as an empowering tool as it involves changing learners' attitudes and values towards learning (Sambell and McDowell, 1998; Dochy, Segers and Sluijsmans, 1999). Students often view assessment as an end in itself. They see it as a means by which

they are graded and the pathway to attain their qualification. Understandably, students are assessment driven (Ashcroft and Palacio, 1996; Brown, Bull and Pendlebury, 1997; Hassall and Joyce, 1997; Dochy, Segers and Sluijsmans, 1999; Gibbs, 1999; Radloff and de la Harpe, 1999; Biggs, 1999b). Thus, the key to changing students' learning approaches is changing the methods of assessment (Brown, Bull and Pendlebury, 1997; Hassall and Joyce, 1997; Dochy, Segers and Sluijsmans, 1999). By participating in the assessment activities, students are using the same skills that they require for their future learning (Sambell and McDowell, 1998). In these instances, the assessment tasks have become the learning activities (Brown, Bull and Pendlebury, 1997; Dochy, Segers and Sluijsmans, 1999).

Involving students in the type of assessment activities that promote lifelong learning competencies will reinforce these desired attributes and increase learning competence (Brown, Bull and Pendlebury, 1997; Hassall and Joyce, 1997; Dochy, Segers and Sluijsmans, 1999). Thus, it is crucial that lifelong learning attributes be assessed. Although there is no fixed formula as to the 'correct' method of assessment, it is generally accepted that mixing a variety of assessment methods increases the level of confidence with regard to the learning outcomes (Ashcroft and Palacio, 1996).

The goals of assessment have gone beyond simply that of grading students. The focus is therefore now on students' learning activities in order that they may continue this form of continuous learning upon graduation (Sambell and McDowell, 1998). This demand for reflective practitioners and lifelong learners has resulted not only in an increasing emphasis between student learning and assessment, but also a strong linkage between learning objectives, teaching-learning activities and assessment (Dochy, Segers and Sluijsmans, 1999; Biggs, 1999b). The following section examines these linkages.

Relationship between Learning Objectives, Teaching Approaches and Assessment Methods: Biggs' Model of Constructive Alignment

Teaching and assessment should not be viewed as separate activities (Ramsden, 1992). Biggs (1999a) wrote of the need for constructive alignment; the need to align teaching (learning) objectives, with the teaching approaches and assessment tasks. In

a constructive alignment model, the objectives (eg. self-evaluation) clearly specify the criteria for the desired learning outcomes (ability to self-evaluate), which the assessment tasks (self-assessment) are then able to address. There is no hidden curriculum, as the objectives and the assessment tasks are clearly linked (Biggs, 1999b). The objectives are explicit as to what needs to be learned, while the outcome of the assessment indicates how well the students are learning (evaluating) (Biggs, 1999b).

Examples of non-aligned teaching, whereby the curriculum, teaching and assessment are not aligned, are often found in professional education. Non-alignment occurs when the objective of the professional education is professional competence but where "declarative knowledge is the output", thus the objective and the assessment criteria are not aligned (Biggs, 1999b, p. 71).

Successful teaching is therefore dependent on the degree to which the learning objectives, teaching-learning activities and assessment strategies are aligned to each other (Biggs, 1999a). Thus, if equipping students with lifelong learning skills is also one of the main course objectives, then students should also be engaging in teaching/learning activities that promote lifelong learning, while the assessment tasks should assess the attainment of lifelong learning skills (de la Harpe, Radloff and Wyber, 1999; Candy, 2000).

The learning portfolio is an example of aligned teaching (Biggs, 1999b). The following section details how the learning portfolio can serve both as a learning activity for students as well as an effective assessment tool.

What is a Learning Portfolio?

A portfolio is a methodical collection of work, put together with the intention of monitoring and demonstrating "an individual's knowledge, skills, attitudes, and potential in a specific field or knowledge" over a period of time (Wiedmer, 1998, p. 25). It is one of the many ways to assess students' performance, focussing specifically on students' learning (Courts and McInerney, 1993). Portfolios serve as a rich source of information showing the reader the breadth, depth and incremental

development of students' knowledge and skills during their undergraduate training (Black, 1996).

The use of portfolio is not new. Professionals such as photographers, models, architects and artists commonly use portfolios to demonstrate their records of career achievements (Melograno, 1996). Increasingly, portfolios are also being used for evaluation and hiring purposes, providing employers with the necessary evidence to substantiate applicants' claims of suitability (Wiedmer, 1998).

Students are given the responsibility of deciding for themselves which of their learning activities cum experiences demonstrate the attainment of the learning objectives. In this way, the learning activity itself again becomes an assessment task (Biggs, 1999b). The fact that the portfolio is collected over a period of time allows learners to communicate to others (Wiedmer, 1998):

- what they have learned;
- how they have learned;
- how knowledge and skills have increased over time; and
- how they have applied their acquired knowledge in context.

Aside from demonstrating the basic clinical and lifelong learning competencies that are expected of them, portfolios can be used to include the demonstration of other attributes such as good communication skills and effective team-working skills (Wiedmer, 1998).

In the process of compiling the portfolio, students are engaging in the very same learning processes that are features of self-directed learning. The emphasis is therefore not simply on the end product (completion of portfolio), but also on the learning process. By having students to reflect and document their learning process, students would be motivated to learn as they would see the value of clinical, generic and lifelong learning competences as valued outcomes during their undergraduate education.

Portfolios are seen as a valid and reliable assessment tool that fosters ongoing reflection by students (Fogarty, 1996). It is a student-centred form of learning activity. The focus of evaluation shifts from the teacher to the student, as the onus is now on students to demonstrate their ability to self-evaluate (Paulson and Paulson, 1996). Portfolios integrate the assessment and learning process into one single process, resulting in the following advantages (Wiedmer, 1998):

- Assuming responsibility for own learning
  The development of the portfolio encourages students to reflect upon their learning experience and identify areas of strength and weaknesses in their professional development. For the initiated students, it allows them to plan their learning agenda, building on their strengths while improving upon their weaknesses (Courts and McInerney, 1993).
- Ownership of the portfolio
  It allows the students to be actively involved in the learning and assessment process. It gives the students a sense of ownership as they decide and select for themselves what has to be included in the portfolio for final viewing (Black, 1996).
- Portfolio as a personalised document
  As each student selects his/her own materials for inclusion, portfolios are therefore highly individualised documents, with no two portfolios being alike (Paulson and Paulson, 1996).
- Assessment over time
  The portfolio provides a continuous form of assessment as opposed to the traditional tests which are measurements of students' performance at a specific place and time (Wiedmer, 1998).
- Portfolio as an empowering tool
  Portfolios increase motivation in learning by empowering the learner, resulting in increased self-confidence and improves the professionalism of students (Wiedmer, 1998).
- Portfolio as an IT assessment tool
  Electronic portfolios have an added advantage of demonstrating to the assessor the information technology skills that are in demand in today's workforce (Wiedmer, 1998). As CD-ROMs are capable of storing a large amount of data,

they serve as an ideal means of recording digital images, which is of particular relevance to the MRS discipline.

- Portfolio as an example of aligned teaching
  Last but not least, in terms of quality teaching, portfolio can be used by the School as an example of ongoing culmination of data reflecting the curriculum responsiveness to the demands and current trends of the workplace (Fitzsimons and Pacquanio, 1994). The need to align teaching objectives with learning activities and assessment strategies are now considered an essential feature of quality teaching (Biggs, 1999b). For instance, the ability to self evaluate is an important attribute of lifelong learning. By incorporating the process of self-evaluation and documenting the outcome of this process in the portfolio, one is therefore aligning the aim (of helping the student to self-evaluate) with the learning activity (continuous self-assessment) and the outcome (as evidenced in the portfolio assessment strategy).

Pitfalls of Portfolio Assessment

Portfolios can also be used by teachers as a means of evaluating and reflecting upon their own teaching (Wiedmer, 1998). However, successful implementation of portfolio hinges on the support of MRS Schools with involvement of staff from the Staff Development Centres (Courts and McInerney, 1993; Wiedmer, 1998). Implementation of portfolios must be carefully planned with clearly specified objectives and outcomes (Courts and McInerney, 1993). It is important to ensure that the portfolio does not simply become a mere assessment activity, but remains a meaningful learning reflective process as it is intended to be for students. To this end, steps must be taken to ensure that students receive regular guidance and feedback input from academic staff to guide them in the preparation of the portfolio (Miller, Imrie and Cox, 1998).

2.1.4.4 Student Support Services

It is also essential that universities provide the appropriate infrastructure to support the lifelong learning culture. The establishment of learning centres to support students' study skills, the involvement of library staff to teach and update information literacy skills and the inclusion of computer literacy skills in the undergraduate training, are all essential features to support student learning (Candy,

Crebert and O'Leary, 1994). However it is also crucial that such skills be integrated into the curriculum and that these skills are taught within the discipline knowledge. In this way, students are less likely to view these skills as 'stand-alone' (Bowden and Marton, 1998). As such it is essential that there must be appropriate staff development to assist teaching staff to integrate such lifelong learning and generic skills into their regular teaching (Candy, Crebert and O'Leary, 1994).

Although all the above mentioned features are essential in preparing graduates for lifelong learning, the most crucial factor identified as pivotal for the development of lifelong learning is the student learning environment (Candy, 2000).

2.1.4.5 Conducive Learning Environment

Lifelong learning is about the "development of individual human potential" (Longworth and Davies, 1996, p. 4). Thus, it is not only essential to equip students with lifelong learning skills, but it is just as crucial to provide them with an environment that is conducive to learning. From the researcher's perspective, the student support features are the 'easy part'. What is more difficult to achieve is the appropriate intellectual culture for lifelong learning attributes to thrive. Such a learning environment is non-intimidating, and encourages students to probe and question; a learning environment that enables students to feel 'safe' asking questions instead of being embarrassed in front of their peers. Candy et al. termed this culture as the "climate of intellectual inquiry" and this culture has been highlighted as the most significant factor in determining the success of the cultivation of lifelong learning (Candy, Crebert and O'Leary, 1994, p. 180).

The need to cultivate a positive attitude towards learning, whereby students are motivated to learn and enjoy learning, has implications for the attitude and motivation of teaching staff. The learning environment is primarily determined by the way lecturers perceive their role, a facilitator of the learning process or a "master of all". It is thus crucial that academics themselves are active lifelong learners, thereby acting as role models for students (Knapper and Cropley, 1991; Candy, Crebert and O'Leary, 1994). This brings into question the availability of resources for staff development, and most importantly, the willingness of the teaching staff to

effect that learning culture change. It requires all academic staff to share, endorse and commit to the lifelong learning concept.

Having reviewed lifelong learning in the Australian Higher Education Sector and how lifelong learning can be effectively promoted, the focus will now be directed at MRS Schools, by looking at universities' mission statements of the Schools.

2.1.5 Universities' Missions of the MRS Schools in Australia

There are currently eight universities in Australia offering MRS courses at the undergraduate level. Each university varies in its approach as to how it would like to see its lifelong learning objective accomplished. The inclusion of lifelong learning either in the form of a mission statement, goal, strategy and/or graduate outcomes, indicates that the institutions have explicitly incorporated lifelong learning into their educational philosophy, as suggested by Candy et al. (Candy, Crebert and O'Leary, 1994).

The following are extracts from the documents of the eight universities.

Table 2.1
Missions, goals and graduate attributes from the 8 Universities offering MRS Courses in Australia

Charles Sturt University	
Mission Statement	"…to produce graduates with a professional edge who are competitive in meeting the present and changing needs of society, commerce and industry."
Strategies to achieve the mission	"Balancing professional and vocational course needs with the development of skills for, and positive attitudes towards, life-long learning;"
Graduate Attributes	"Graduates of Charles Sturt University are expected to be ethical members of society with an interest in lifelong learning and valuable employees."……
Source: (Charles Sturt University, 1997; Department of Education, Training and Youth Affairs, 1999, p. 67).	
Curtin University of Technology	
Curtin's Goal	"…. the University strives for excellence in teaching and learning, developing graduates as lifelong learners who make a positive contribution to society'….
Teaching and Learning Objective 3	"To foster self-directed learning amongst students"
Source: (Curtin University of Technology, 1999).	

Monash University	
Leading the Way – Monash 2020	"…each campus of the University will be the hub of a life-long learning community in its region."
Objectives	"To improve and develop the Monash curriculum in accordance with the values and principles of *The Monash Plan*, key education policies and the major dimensions for learning namely: understanding, lifelong learning, engagement, innovation and internationalisation."
Graduates attributes	"A goal of *The Monash Plan* is that courses will enable graduates to: enhance their intellectual and cultural curiosity as a preparation for autonomous self-directed, life-long; seek the imaginative approach to problems and to attempt always to set the agenda rather than follow the well trodden path;…."

Source: (Department of Education, Training and Youth Affairs, 1999, p. 149; Monash University, 1999)

Queensland University of Technology	
Teaching and Learning Goal	"To ensure that QUT graduates possess knowledge, professional competence, a sense of community responsibility and a capacity to continue their professional and personal development throughout their lives."

Source: (Queensland University of Technology, 1998)

Royal Melbourne Institute of Technology (RMIT) University	
What's different about RMIT University?	"We're proud of our outstanding staff, students and alumni and we believe in life-long learning."
Graduate attributes	"The University's Teaching and Learning strategy 1998-2000 states that RMIT University graduates will be knowledgeable, creative, critical, responsible and employable (in a broad sense) as well as being life-long learners and potential leaders."

Source: (Department of Education, Training and Youth Affairs, 1999, p. 185; RMIT University, 2000)

The University of Newcastle	
The University values:	"pursuit of lifelong learning"
What Newcastle strives for in its graduates	"Commitment to life long learning, continued intellectual development and creativity."

Source: (The University of Newcastle, 1999a; The University of Newcastle, 1999b)

University of South Australia	
Goal 1	"To provide quality teaching which facilitates independent student learning."
A Graduate of the USA:	"Is prepared for lifelong learning in pursuit of personal development and excellence in professional practice."

Source: (University of South Australia, 1996; University of South Australia, 1997)

The University of Sydney	
Personal skills	"Graduates should have the capacity for and a commitment to lifelong learning;

Source: (Department of Education, Training and Youth Affairs, 1999, p. 304)

As shown in Table 2.1, all eight universities have indicated lifelong learning to be desired attributes in their graduates. Given that lifelong learning has been identified

as one of the core attributes listed by most Australian universities, this is not an unexpected finding (Department of Education, Training and Youth Affairs, 1999).

However, Candy et al. (1994) found that despite the rhetoric, few Australian undergraduate programs appeared to provide a learning environment and educational experiences, which fostered the development of lifelong learning. In fact, many curricular, instructional and assessment methods currently in use, actually worked against the development of lifelong learning (Candy, Crebert and O'Leary, 1994). Therefore what remains to be determined is whether the MRS Schools translate the rhetoric into action. The third research question in this study addresses this issue by seeking to determine whether current MRS courses are producing graduates with lifelong learning attributes.

There has to be a concerted effort by both the Higher Education and professional associations towards supporting lifelong learning as a cultural norm (Pearson and Jones, 1997). The following section examines the role of AIR in the promotion of lifelong learning.

2.2 Higher Education and the Australian Institute of Radiography (AIR)

The AIR serves as a regulatory body for professional and educational standards of MRS, with the aim of ensuring members function effectively as part of the multi-disciplinary health care team of Australia (Australian Institute of Radiography, 1999). The educational policy and strategy adopted by AIR play a crucial role in setting the scene for lifelong learning within the workforce and the profession as a whole. This section examines the AIR educational policy in relation to undergraduate programs and continuing education.

The AIR has put in place policies that establish the minimum standard required (Bachelor Degree award) for entry into the profession (Australian Institute of Radiography, 1999). Australia therefore has the distinction of being one of the first

countries to have the minimum entry into the MRS profession via a degree qualification (Cowell, 1999).

Professional organisations are actively involved in the accreditation and re-accreditation of university courses in Australia (National Board of Employment, Education and Training, 1996a). The AIR is no exception, acting as a link between Higher Education and the MRS profession. The Professional Accreditation and Education Board (PAEB), a sub-committee of the Council of AIR, has been given the responsibility of accrediting MRS courses in Australia. To this end, the PAEB guidelines for the accreditation of MRS courses are presented and discussed below.

2.2.1 Accreditation Guidelines for the Development of Medical Radiation Science Courses

The PAEB has established a set of guidelines for the development of MRS undergraduate courses in Australia. Briefly, these include (Australian Institute of Radiography, 1999, p. 14):

- MRS graduates should acquire the necessary knowledge, skills and attributes for current professional practice.
- The MRS course should aim to develop the following attributes in graduates:
  - communication skills;
  - problem solving skills;
  - reflective skills;
  - research skills;
  - curiosity for learning;
  - self responsibility and self-directed learning; and
  - a commitment to continuous improvement and lifelong learning (personal and professional).

Although the document classified the above characteristics as generic attributes, on closer scrutiny, with the exception of communication skills, the guidelines are directed towards the cultivation of lifelong learning. In addition, the guidelines stipulate that graduates must have a commitment towards "personal and

professional" ongoing improvement, an essential aspect of a lifelong learner (Australian Institute of Radiography, 1999, p. 14). Thus, by specifying that MRS courses should equip graduates with lifelong learning attributes, the AIR is acknowledging lifelong learning to be an integral part of MRS undergraduate programs.

In the accreditation document, the PAEB recognises the variety of teaching approaches that are currently being used in various institutions such as the traditional lecture, experiential learning, problem-based and self-directed learning. It further acknowledges the corresponding different educational outcomes and graduate attributes that result from the different teaching methods. However, producing "clinically capable graduate practitioners" has been specified as the foremost objective, irrespective of the range of graduates' attributes as a result of different courses and their educational approaches (Australian Institute of Radiography, 1999, p. 15). Thus, although lifelong learning attributes have been mentioned as one of the course objectives, clinical education has been singled out as the area that impacts upon accreditation outcome (Australian Institute of Radiography, 1999).

2.2.2 Educational Policy of the Australian Institute of Radiography

The AIR role in promoting lifelong learning amongst its members in the workforce is equally crucial.

Continuing education can be both informal and formal (Smith, 1998). In an article promoting the introduction of pilot CPD, the following activities have been defined as sign of professionalism (Brown G, 1999c, p. 1):

- journal reading;
- critically reflecting on one's performance with the aim of improving clinical practice;
- assisting peers and students in their professional development;
- giving presentations and producing articles for publications;
- engaging in research activities;
- pursuing postgraduate programs conducted by universities; and

- conducting workshops, seminars and conferences.

These activities are now formally classified as part of CPD activities (Brown G, 1999a).

Thus, continuing professional education provides the means for practitioners to upgrade their knowledge and skills and maintain their clinical proficiency (Smith, 1998). Seminars, short courses and workshops are conducted by AIR branches on a regular basis, while distance education is particularly important as it provides access to practitioners in the rural and remote areas for professional development. While encouraging its members to pursue postgraduate awards organised by universities, the AIR also recognises the value and importance of continuing research in the advancement of the profession (Australian Institute of Radiography, 1999).

Table 2.2 below indicates how the AIR addresses the educational pathways in the undergraduate, postgraduate and continuing professional development.

Table 2.2
Framework established by AIR on continuing professional development in the MRS profession

Undergraduate Education	Postgraduate Education	Continuing Professional Education & Development
Bachelor Degree Honours Degree	Graduate Certificate Graduate Diploma Masters Degree Doctorate	Short Courses and Seminars Conference Presentations Publications Fellowship Distance Education Research

Source: (Australian Institute of Radiography, 1999, p. 6)

By documenting the various pathways for continuing education, and by providing the support for branch educational activities, the AIR is assisting its members in the continuing upgrade of their knowledge and skills.

2.2.3 Continuing Professional Development as Part of Lifelong Learning in Medical Radiation Science

The appointment of a fulltime Professional Development Officer in 1998 signalled the intention of the AIR to make continuing professional development its top priority. One of the Professional Development Officer's main responsibilities includes the "development, implementation and monitoring of the AIR continuing education and professional development programs" (Brown G, 1998a, p. 8).

After extensive investigation and consultation amongst its members and university staff, a one-year CPD pilot program was introduced in July 1999 (Brown G, 1999b). Following the successful implementation of the pilot CPD, a biennial program of credit accumulation module is now in place. Practitioners participating in this biennial program are required to engage in professional development activities between July 2000 and July 2002. Upon accumulation of sufficient credit points, the practitioners will be awarded a certificate of Professional Development Compliance (Brown G, 2000a).

The AIR defines CPD as (Brown G, 1999a, p. 3):

> *the ongoing maintenance and growth of professional excellence through participation in learning activities which are planned and implemented to achieve this for the benefit of participants, patients and the public.*

As outlined in Chapter 1, CPD is part of lifelong learning. The CPD model is seen as a major step towards committing the profession to lifelong learning. The Council of the AIR "supports unreservedly the process of lifelong learning" (Brown G, 1999a, p. 4).

It must be noted that the philosophy of continuing learning and professional development and its associated activities are not new within the AIR, since CPD activities are already enshrined in the existing AIR educational policy. However, what is different is that this process of continuous learning is now set in a formal framework and that the CPD provides a means for members to document and be

recognised for the learning activities that they are already pursuing (Brown G, 1999a; 1999c).

Although participation in the biennial CPD program is voluntary, there are expectations that this form of CPD may become mandatory in the not too distant future. Compulsory CPD is already a reality for nursing. Nurses are required to show evidence of continued learning within a 5 year period, a prerequisite for registration to practice (National Board of Employment, Education and Training, 1996a). The possibility of mandatory learning has now given an added urgency to develop, cultivate and promote lifelong learning amongst MRS students and practitioners.

The AIR educational policy in relation to lifelong learning has been examined. However, policy alone is not enough to encourage practitioners to become lifelong learners, practitioners themselves must be motivated to be lifelong learners (Maslin-Prothero, 1997). The next section examines the professional sector in order to ascertain how practitioners view lifelong learning in the context of their profession.

2.3 Lifelong Learning in Medical Radiation Science Workplace

This section describes the current status of lifelong learning in the MRS profession by examining practitioners' attitude towards lifelong learning and CPD. It also explores the relationship between lifelong learning and clinical competence.

2.3.1 Practitioners' Attitudes towards Lifelong Learning and Continuing Professional Development

Lifelong learning cannot thrive on learning competencies alone. One of the greatest obstacles to lifelong learning is the attitude of the learners towards learning (Kearns, McDonald, Candy et al., 1999a). For lifelong learning to succeed the learners must have both the willingness and motivation to learn. However the following comment reflects the concerns over Practitioners' attitude towards continuous learning:

> *Most new graduates start out with enthusiasm for professional development and post graduate education but after a couple of years of hard slog in the clinics the realisation hits that this is what life is really about and they're too tired to go to lectures and seminars.*
>
> (Adams, 1999b)

The same sentiment was also echoed by a recent graduate (Garton, 1999):

> *Being quite new to the profession, I would certainly welcome and attend almost any professional seminar/workshop. But is my enthusiasm shared with the majority or minority?*

If this lack of enthusiasm towards learning is allowed to permeate through the profession, there is an inherent danger that most newly qualified graduates may lose their enthusiasm for lifelong learning soon after graduation. This would have serious consequences for the practitioners' ability to continue learning and for the MRS profession to develop and remain relevant in these rapidly changing times.

Another way to ascertain MRS practitioners' attitude towards lifelong learning can also be gauged from their responses to continuing education and the recent introduction of the pilot CPD program.

In 1995, Walker surveyed Tasmanian MRS practitioners on the issue of continuing education. In that survey, the practitioners listed keeping abreast with new techniques as one of their main objectives. They also indicated a keen interest in acquiring the new knowledge and skills for the interpretation of radiographic images (Walker, 1995b).

These same goals were also expressed in the 1997 survey conducted by AIR, and in the AIR electronic discussions, *AIRnews*, (Australian Institute of Radiography, 1997; Dixon, 1999; Garton, 1999; Rinaldi, 1999).

Dixon (1999), a member of the continuing education committee, commented on the importance of seminars and workshops:

The increasing specialisation has 'pigeon-holed' some of us to being super-specialised in a particular way while being novices in others. There is a need to identify and provide support in those areas that require it, and, to support the needs of the newer members of the profession and those who wish to gain or renew skills.

In this era of rapidly changing work environments and increasingly tight financial budgets, it is not enough to simply perform one's job well. The profession needs to seek and define new skills to move forward (Smith, 1998). The desire to increase the knowledge and skill in image interpretation therefore has been given an added impetus with the recent discussions on role expansion of MRS practitioners (Smith, 1995; Field-Boden, 1996; Field-Boden, 1997; Durrington, 1999; Hall, Kleemann and Egan, 1999). Renewed interest in learning and improved staff morale can be achieved by carving out new career pathways, which is possible only if practitioners engage in continuous learning.

Lifelong learning was not reported in the 1995 Tasmanian survey. The closest link to lifelong learning in the 1995 survey was the indication by Tasmanian respondents for the need to reflect on their own practice and to obtain feedback from other professionals as a crucial part of their learning (Walker, 1995b). In 1999, the AIR placed lifelong learning in the spotlight within the MRS community, with the introduction of the pilot CPD.

In the consultative process leading to the implementation of the CPD pilot program, members who participated in the discussions showed enthusiasm for CPD (Brown G, 1998b). A 1997 AIR survey and the recent survey of pilot CPD participants showed that a large number of respondents have expressed support for compulsory registration (Australian Institute of Radiography, 1997; Brown G, 2000a). Yet the average participation rate for the pilot CPD program in each state was only eight percent of the AIR membership per state (Brown G, 1999d). Nevertheless, the pilot CPD was a success as most participants of the pilot CPD were able to accumulate more than double the minimum credit points required, with twenty-eight credit points being the average compared to the required twelve points (Brown G, 2000b). The

most commonly reported forms of activity were education, general radiography, administration and mammography (Brown G, 2000b).

From the AIR's perspective, CPD is "about providing incentive, increasing and enhancing opportunity for learning and providing recognition" for its members (Brown G, 1998b, p. 6). The introduction of CPD undoubtedly will have an impact on lifelong learning within the MRS profession. The ability of practitioners to be self-directed learners and their willingness to engage in continuous learning are now important issues that would determine the success of CPD and the future of the profession. However, the views presented in this section represent only a minority of practitioners. The current study addresses the need to collate systematically Australian practitioners' view on lifelong learning. The second research question seeks to establish how MRS practitioners, Heads of MRS Departments and students view lifelong learning.

2.3.2 Lifelong Learning and Clinical Competence

Professional education, especially in the health-related professions, often incorporates workplace learning as part of their undergraduate program (Edwards and Knight, 1995). In such instances, it is not uncommon for stakeholders such as employers, practitioners, students and academics, to differ in their definition of the specified level of clinical competence to be attained by graduates.

This is certainly true in the MRS workplace. Employers and practitioners would like to have graduates who can work with minimal supervision and are familiar with workplace practices (Reid, cited in Chapman, 1999; Candy, 2000). There is an expectation amongst MRS practitioners that graduates are to be fully competent on the day of graduation (Ryan, 1998). In general, practitioners viewed clinical competence as the sole objective in preparing graduates for the workplace. It follows that the levels of clinical competence that can be expected from a newly qualified graduate usually fall short of the expectations of co-workers, and in some instances, of the employers.

A review of the history of MRS education may cast some further light on another possible cause of the discrepancy in expectations within the MRS community. Certificates for radiography education were issued in 1970, with the full time diploma course coming into force in 1977. Less than a decade later, the first-degree qualification for MRS started in Victoria in 1986 (Lorimer, 1994). Most other MRS Schools started producing their first degree graduates in the late 1980s and early 1990s (Smith, 1998). Thus, it is fair to say that the majority of the current practitioners are from the diploma and cadetship eras, when the majority of training time was spent working 'hands-on' in the clinical environment.

According to Ryan (1998), there was already an outcry in the diploma transition days when the clinical hours were reduced from a 3-year work experience cadetship to 2600 hours. Comparison was being made at that time between the more superior clinical capability of the cadetship style of training with the diploma holders who had reduced clinical hours (Ryan, 1998). With the upgrade to a degree program, the clinical hours were further reduced in many universities (Knights, 2000). The profession is therefore witnessing history repeating itself. The discrepancy in clinical expectations is exacerbated by the fact that the transitions between certificate, diploma and degree all took place within a short time span of 15 years. Practitioners, the majority of whom were cadet and diploma trained, are now complaining of the lack of clinical competence of the degree graduates as compared to the 'good-old-days'.

From the researcher's personal experience, many practitioners often lament the lack of clinical competence in students, insisting on the need for more clinical hours. It is inevitable that the practitioners' view on the current inadequacy of clinical competence would ultimately affect the students' perspective on lifelong learning. Some students are of the opinion that clinical competence is of such importance, that they regard any learning attributes that have no direct or obvious clinical outcome as being totally irrelevant. This was reflected in the 1999 student feedback session with the Head of School in Curtin, with students requesting to have more clinical hours included in the current MRS program (O'Connor, 1999).

Clearly, clinical competence is very important in professional education and should remain as one of the primary objectives of MRS undergraduate education. On the other hand, universities that are attuned to the lifelong learning agenda should not only prepare graduates for the chosen discipline ahead, but should also attempt to equip them with the necessary generic skills and lifelong learning skills (Candy, Crebert and O'Leary, 1994; Bowden and Marton, 1998; Candy, 2000). Time and effort are therefore required within the undergraduate program to develop lifelong learning competencies. However, the motivation for acquiring lifelong learning skills may be lacking if students do not see the acquisition of lifelong learning competencies as relevant and a worthwhile goal to attain during their undergraduate study (Hodgkinson, 1998). The preparation of MRS graduates for lifelong learning may then prove to be a difficult, if not impossible, course objective to attain.

With the possibility of performance-based funding by Canberra and the emphasis on increasing accountability towards the stakeholders, universities and MRS Schools are under increasing pressure on several fronts. On the one hand, it is expected that graduates be prepared for future learning by equipping them with the appropriate generic and lifelong learning competencies. On the other hand, there is the need to meet the **level** of clinical competence, as defined by the stakeholders – practitioners and employers. Although clinical competence and lifelong learning are not opposing agendas, it is crucial that all stakeholders view lifelong learning as one of the important learning outcomes of undergraduate education. Otherwise, practitioners and students alike may view MRS Schools' effort in preparing students for lifelong learning as irrelevant, and this dissatisfaction may affect their perception of the quality of the course, and possibly, the CEQ results.

Hence practitioners' view of clinical competence will undoubtedly affect their perception of lifelong learning. The current study will seek to determine the relationship between lifelong learning and clinical competence as perceived by the stakeholders (research question 2a and 2b).

2.4 Focus of Current Study

The above discussion established that the universities of the eight MRS Schools have indicated, via their mission statements and goals, lifelong learning to be part of their graduate outcomes. The AIR accreditation policy and education policy, are supportive of lifelong learning. With the launching of the CPD program, the AIR is attempting to lead its members in the direction of lifelong learning by providing a formalised framework of continuous learning.

However, available literature suggests that most practitioners, in general, seem to view current clinical competence of degree graduates to be lacking. These practitioners are likely to view the development of lifelong learning attributes to be of secondary importance. It is therefore probable that MRS students may also regard lifelong learning not to be a valued learning goal and desired learning outcome. This may have a significant impact on the development of lifelong learning in the undergraduate programs.

On the other hand, practitioners who responded to the CPD survey were in support of CPD and many called for new roles for practitioners. However these views are only a random sampling of opinions expressed through electronic discussions, journal articles and the AIR newsletter and cannot be taken to represent the majority of the practitioners. There is therefore an urgent need to have more systematic and national data collection on practitioners and students' view on lifelong learning.

The above discussion has shown that both Higher Education sector and the AIR are promoting the lifelong learning agenda. This study attempts to determine whether the lifelong learning objectives remain mere rhetoric at the upper levels of hierarchies. In particular, it seeks to determine how MRS Schools are responding to the challenge of lifelong learning.

To date, there have been no national data indicating grassroots' level of support or non-support, for lifelong learning. Information is needed on the views of practitioners, Heads of MRS Departments (HOD) and students on lifelong learning. Data are also needed on the level of importance which they placed on generic

attributes and professional/clinical attributes. Very little is also known about the workplace culture in relation to lifelong learning. In addition, there are no national data on whether current MRS courses are indeed preparing graduates for lifelong learning, as purported by their universities' mission statement. In short, there is a lack of research on lifelong learning in the MRS workplace and current MRS courses.

The current study attempts to address the above issues by exploring lifelong learning in the professional sector and Higher Education. This study responds to the need to systematically collate the perceptions of practitioners, HOD and students on the importance of lifelong learning, generic and professional attributes. To this end, a national survey on lifelong learning was conducted. To determine if current MRS courses are preparing graduates for lifelong learning, data are obtained from survey of Heads of MRS Schools, focus group discussion and one-to-one interviews with MRS academics, and a national survey of MRS students. The rationale and methodology for the current study are presented in detail in Chapter 3.

Finally, the findings of this study are analysed, with the aim of determining whether there is congruence between the professional sector and the Higher Education in the pursuit of lifelong learning.

The next chapter focuses on the research methodology employed in the current study.

Chapter 3

Methodology

Chapter 3 describes the research methodology used in the current study. To put the study in context, the main aims of the study are provided at the beginning of this chapter. A brief overview of the research methodologies is provided, listing the quantitative and qualitative approaches used in this study. This is followed by a detailed description of how the research instruments were designed and the justification for their use. An analysis of the validity and reliability of the research findings follows. The chapter concludes with a summary of the sources of data used to address the research questions.

3.1 Aims of Study

The main aim of this study is to investigate lifelong learning in MRS. Specifically, there are three major foci of this research project:

- to develop the profile of a MRS practitioner as a lifelong learner and its relevance in the context of MRS;
- to establish the importance with which the profession views lifelong learning; and
- from these findings, to determine the implications on undergraduate MRS programs at Australian universities.

3.2 Overview of Research Methodology

Every research method has its associated strengths and weaknesses. Research projects that rely on a single research strategy are vulnerable, as they are more prone to errors linked to that one methodology (Patton, 1990). In order to avoid this pitfall, this study uses both quantitative and qualitative approaches and because these approaches are appropriate to the research topic.

Quantitative research methods are designed to test hypotheses and are particularly useful in establishing relationships between variables (Morse and Field, 1995). Statistical analysis is an important component of quantitative designs as the emphasis here is on objectivity in data collection with absence of researcher's bias (Yegidis and Weinbach, 1996).

Qualitative research is concerned with understanding, interpreting and describing a particular phenomenon (Morse and Field, 1995). Unlike quantitative research which uses deductive logic, qualitative approach relies on inductive logic to arrive at conclusions (Morse and Field, 1995; Yegidis and Weinbach, 1996). Data collection is conducted via interviews, participant observation and content analysis of documents. In this instance, the researcher is often the one who collects and analyses the data (Yegidis and Weinbach, 1996). As such, measures have to be taken to minimise researcher's bias.

The combination of the two approaches is especially useful in the clarification of research problems (Brannen, 1992; Yegidis and Weinbach, 1996). Moreover, projects that uses a range of research strategies allow cross-data validity checks, thereby potentially increasing the validity and credibility of the findings (Patton, 1987).

The study is divided into 5 stages as illustrated in Figure 3.1

Phase 1 of the study involved conducting a literature review on lifelong learning in general, plus focusing on the major stakeholders within the MRS profession (see Chapter 1 and Chapter 2).

Phase 2 of the study is concerned with the designing and trialing of the research tools (both quantitative and qualitative) used in this study. This is followed by Phase 3, which is the implementation of data collection (see Chapter 3).

Analysis of data occurred in Phase 4 (see Chapter 4 and 5). During phase 5, the implications of the analysed data are discussed, with the corresponding recommendations for incorporating lifelong learning into the undergraduate MRS programs (see Chapter 6).

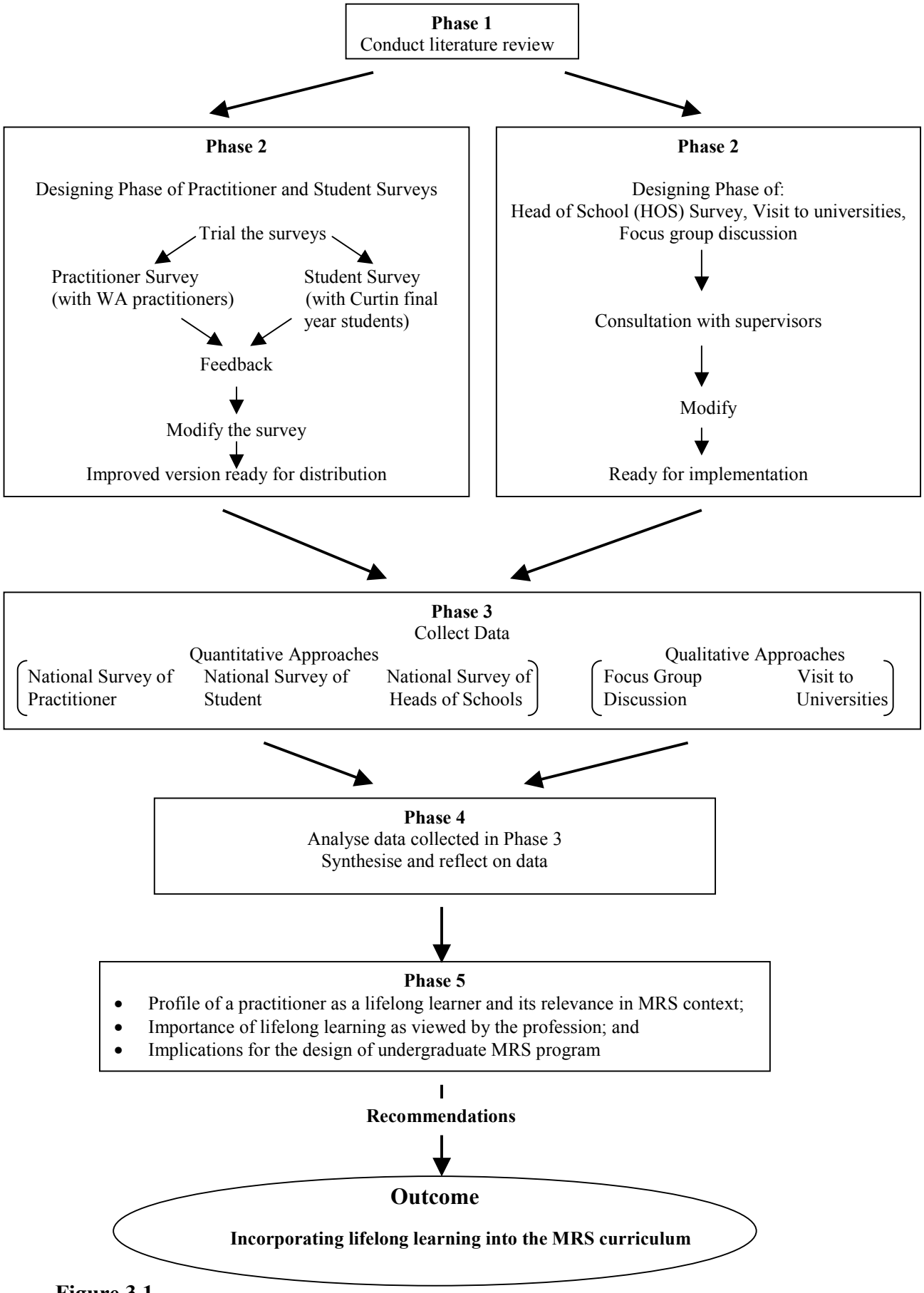


Figure 3.1
Outline of the 5 phases of the study

Quantitative Method

The second research question seeks to determine the stakeholders' views on the attributes of MRS practitioners and the relationship between lifelong learning, professional and generic attributes. The survey serves as a useful tool in describing the specific characteristics of a group of people and the relationships between variables and is therefore an ideal research instrument in this study (Jaeger, 1997).

While it is important to collect practitioners' views on their attributes, the viewpoints of other stakeholders – Heads and administrators of MRS Departments (HOD), students, academics and Heads of MRS Schools – must also be taken into account. This is essential in order to provide a comprehensive view of the current status of lifelong learning in the MRS profession. In addition, it provides evidence of the level of alignment of views amongst the various stakeholders.

The quantitative method employed in this research project therefore includes using the following instruments:

1. National survey of MRS Practitioners (including HOD) (see Appendix 3.1);
2. National survey of final year MRS students (see Appendix 3.2); and
3. National survey of Heads of MRS Schools (see Appendix 3.3).

These provide the researcher with multiple sets of data. Using multiple data sets is one of the effective methods of strengthening the research methodology and allows for data triangulation (Patton, 1990).

The selection criteria for employing MRS graduates were obtained from the senior medical imaging technologists of major public and private sectors in WA (Research Question 2e). Although the information is from only one state, it is assumed that these guidelines reflect the national trend as all MRS graduates are entering into the workforce with similar degree qualification. This is also evidenced from the fact that employers nationwide often advertise for MRS graduates interstate.

Qualitative Method

The **qualitative method** used in this study consisted of the following tools:

1. focus group discussion with MRS academics; and
2. interviews with MRS academics.

In a focus group discussion, the participants were drawn from a similar background, and divided into small groups (Crowl, 1996). The researcher provided a series of questions, which the participants brainstormed amongst the group members. Each group then shared their members' perspectives with the entire audience. Thus, this form of focus group activity is an efficient means of collecting qualitative data (Patton, 1987). Within a limited allocated time span, the researcher was able to gather the necessary information from a large group of participants.

Interviewing allowed the researcher to gain a deeper understanding of the interviewees' (ie. academics) experiences and perspective (Patton, 1987). Some of the answers gained from the interviews included the academics' personal perspectives on lifelong learning, and how each individual chose to exercise his/her own educational philosophy and approaches in the midst of the lifelong learning momentum.

Finally, it is the researcher's intentions to triangulate the data obtained from the qualitative and quantitative methods, by comparing the results obtained from the national surveys with the observational data such as website information from universities, focus group discussion and the interview data. Any consistency or inconsistency in the data can then be thoroughly examined and analysed.

3.3 National Survey of MRS Practitioners

3.3.1 Objectives of Survey

The purpose of this survey (see Appendix 3.1 for the entire survey) was to collect statistical evidence on the attributes of MRS practitioners and to establish the main features of the respondents' initial MRS course.

3.3.2 Participants

Participants in the survey included MRS practitioners and Heads/Administrators of MRS Department currently practising in Australia. As defined by the AIR, MRS practitioners include medical imaging technologists (also known as radiographers), radiation therapists, nuclear medicine technologists and sonographers (Australian Institute of Radiography, 1999).

3.3.3 Design of Survey

The survey was constructed in three sections, which are described below. The complete survey runs to eight pages and can be found in Appendix 3.1.

Section A seeks to establish the participants' background.
Aside from providing the basic demographic details of the respondents, it also enabled the researcher to correlate the views of the stakeholders and their corresponding background in the final data analysis. This section provides a snapshot of the pattern of continuing education amongst practitioners.

Section B focuses on the attributes on the MRS practitioners.
The list of attributes in the survey was compiled from various sources. These included the Candy et. al. 1994 report on *Developing Lifelong Learners through Undergraduate Education*, the *Graduates Attributes Survey* (GAS) developed by Curtin, and the AIR document, *Educational and Policy Procedures* (Candy, Crebert and O'Leary, 1994; Curtin University of Technology, 1997; Australian Institute of Radiography, 1999). These sources provided the researcher with the essential lifelong learning, generic and professional attributes from the perspective of the employers and the AIR.

The attributes were classified into the 3 categories shown in Table 3.1.

Table 3.1
Categories of Attributes for MRS Practitioners *(see Appendix 3.1)*

Items No.	Attributes	
Items 1-6	**Professional**	
	Knowledge of discipline	Verbal communication skills with patients
	Ability to apply knowledge	Professional attitude to work
	Clinical skills in handling patients	Ability to share knowledge
Items 7-14	**Generic**	
	Ability to communicate with peers	Ability to show initiative
	Ability to work in a team	Ability to make decisions
	Ability to work independently	Ability to accept advice/criticism
	Ability to take the lead	Ability to use appropriate computing skills
Items 15-25	**Lifelong Learning**	
	Ability to make critical judgements	Ability to see the 'big picture'
	Ability to self evaluate	Ability to set goals
	Ability to manage time	Willingness to learn new things
	Ability to manage one's own learning	Information literate
	Ability to adapt to change	Being confident to continue learning
	Ability to find practical solution	

Respondents were required to rate each of the attributes listed according to the level of importance and the current level of attainment. The 'level of importance' refers to how important the respondents viewed the attribute in the profession. The 'level of attainment' refers to the perceived current level (ie. actual level) the attribute has in practice, as evident amongst his/her MRS colleagues. In terms of rating scale, a response of 1 indicates a very high level of importance/attainment of the attribute, while a rating of five refers to a very low level of importance/attainment.

The information gathered from this data enabled the researcher to determine the statistical means of the importance and attainment level of each attribute. This in turn was used to address the following issues:

- stakeholders' view of the listed attributes in terms of importance (Research Question 2a);
- the relationship between lifelong learning attributes and the attributes considered most important by the stakeholders (Research Question 2b);
- significant differences (if any) between the importance of these attributes and the perceived level of attainment (Research Question 2c); and
- if the above mentioned differences are significantly different between the major group of stakeholders (Research Question 2d).

The last part of Section B required each respondent to select 10 attributes from the list of 25 attributes, with 1 being the most important and 10 being the least important of the selected 10. The respondents could also choose to add their own attributes to the list.

Section C seeks to determine the main features of the MRS initial qualification the respondents have experienced. This section was again developed from recommendations by Candy et. al. (1994) on the features of undergraduate programs that promote the development of lifelong learning attributes.

For the purpose of the present research, only the following features were addressed in this section:

- flexibility of course structure in terms of choice of optional subjects;
- inclusion of generic skills development;
- were students given increasing responsibility towards their own learning?
- major teaching and assessment methods used; and
- aspects of the course that assisted students to develop the essential characteristics of a MRS practitioner.

The aim of Section C was to provide a clear picture of whether the teaching and assessment methods employed by the MRS courses are geared towards the promotion and development of lifelong learning as defined by Candy et. al. (Research Questions 3c, 3d and 3e). The data obtained would also inform the academic community as to which aspects of the MRS courses have been identified by the Practitioners as crucial in assisting them to become effective practitioners (Research Question 3f).

In designing the survey, the researcher opted for predominantly closed form questions as it provided an efficient way of data quantification and data analysis (Borg and Gall, 1989). However, provisions have also been made for open-ended comments at the end of Section B and Section C, which allowed respondents to add their own thoughts. This in turn provided the researcher with another source of qualitative data.

3.3.4 Pilot Survey

Pre-testing a survey is absolutely crucial to assist in detecting ambiguities (Borg and Gall, 1989; Jaeger, 1997). This was especially true in this survey where the meaning of the attributes and the difficulty of rating and ranking the items could pose particular problems for interpretation. The flow of the questions must also be 'tested', as the survey must be designed so as to captivate the would-be respondents' attention (Converse and Presser, 1986).

Thus in order to improve the accuracy of the survey tool, the survey was first trialed with a group of Western Australian practitioners.

The survey was distributed during the Western Australia (WA) AIR branch meeting 3rd February 1999. The twenty-three members who attended the meeting were given a brief introduction to the challenges confronting practitioners in the new millennium. This was followed by a lively discussion between members as to what are the essential characteristics of a MRS practitioner to meet these challenges. As those present included Heads of Radiology Departments and MRS practitioners from medical imaging, radiation therapy, nuclear medicine and ultrasound, it was reassuring to note that the attributes they cited were already included in the pilot survey.

At the end of the discussion, 20 copies of the pilot survey were distributed. Aside from completing the survey, members were invited to give comments on how the survey could be further improved, paying particular attention to the clarity of the instructions and attributes description.

The pilot survey was also sent to several academics, senior and junior practitioners in WA and interstate, seeking feedback on the clarity of the terminology and questions asked. With a follow-up reminder via telephone and email, a 100% return was achieved with the majority of the feedback focusing on how to improve the description of attributes in Section B.

There were numerous comments from many senior practitioners on the difficulty of having to recall accurately the details of their initial MRS course. There were fears that the recollections may not be accurate enough thereby reducing its validity (Converse and Presser, 1986). For this reason, it was decided to make Section C optional. Another advantage of having Section C optional was that it reduced the overall length of the survey. It was hoped that this would in turn encourage more practitioners to complete and return the survey. Instructions for Section C therefore encouraged participants to complete the section if they graduated after 1990. It was felt that 1990s graduates would have less difficulty in recalling the details. In addition, including the 1990s graduates would include only the degree graduates, which would therefore provide compatible data for comparison with the responses from the current MRS degree students.

3.3.5 Survey Distribution

As the survey was designed for national distribution, the best mechanism was via the AIR membership. Thus 4000 copies of the survey were sent to the Head Office in Melbourne for distribution with the June 1999 newsletter (*Spectrum*). This provided the main vehicle for the survey distribution nationally. The survey was also brought to the attention of the MRS community through the AIR email discussion list, *Airnews* (see Appendix 3.4).

Maximising the Response Rate

In order to ensure there were sufficient responses for valid statistical analysis, the researcher adopted the following strategies to increase the response rate of the survey as advocated by Hoinville and Jowell (cited in Cohen and Manion, 1980):

- considerable attention was paid to the cover letter explaining the objectives, rationale and benefits of the research project;
- paid and self-addressed envelope to the researcher was provided;
- use of incentives, as a token of appreciation, the researcher indicated that the 100^{th}, 200^{th} and 300^{th} return would each receive a $50 book voucher; and
- a follow-up reminder of the survey (see Appendix 3.5) was posted in the July 1999 issue of *Spectrum*, urging practitioners to send in the survey if they had not already done so.

Although the AIR includes sonographers and nuclear medicine technologists, these practitioners were also represented by Australian Sonographers Association (ASA) and the Australian and New Zealand Society of Nuclear Medicine (ANZSNM) respectively. Time and financial constraints however prevented the researcher from adopting the same newsletter mailing approach with the ASA and the ANZSNM as the AIR. Consequently, in order to increase the response rate and to ensure a viable return, the researcher approached the Chairperson and Secretary of ASA and a WA representative of ANZSNM for their assistance in encouraging their members to participate in the survey. Copies of the survey were given to these representatives for their distribution during branch meetings.

In addition, to reach practitioners who are non-AIR members, senior radiation therapists and medical imaging technologists were approached via phone calls or letters to seek their assistance in encouraging their colleagues to participate in the survey. These included major radiation therapy centres nationwide and major radiology centres in WA. Again time and financial constraints prevented the researcher from contacting more radiology centres nation wide.

Strategies adopted were twofold. Copies of the survey and introductory letter (see Appendix 3.6) were mailed to the abovementioned radiation therapy and radiology centres, with permission for the practitioner in-charge to photocopy as many as were needed. In addition, an electronic version of the survey (see Appendix 3.7) was posted on a website (http://www.curtin.edu.au/curtin/dept/phys-sci/medimg/survey.html). An email explaining the rationale of the research project and the survey web address was send to ASA, AIR and WA AIR discussion lists, *ASA Newsgroup* (see Appendix 3.8), *Airnews* (see Appendix 3.9) and *Airwac* (see Appendix 3.10). The website address was advertised in the ASA September 1999 edition of newsletter, *Sound Effects* (see Appendix 3.11), and the October 1999 AIR newsletter, *Spectrum* (see Appendix 3.12). Reminders for the website survey were again posted in October and November of 1999 on the ASA and AIR electronic discussion lists (see Appendices 3.13 and 3.14).

3.4 National Survey of Medical Radiation Science Students

3.4.1 Objectives of Survey

The objective of conducting the survey of MRS students was to allow comparison of students' perception of MRS attributes with those of the Practitioners (Research Question 2a). The results of this survey will inform the profession how students viewed lifelong learning attributes. This was crucial in the promotion of lifelong learning attributes in the profession, as students will be practitioners; hence how they regarded lifelong learning attributes would determine their willingness and ability to continue learning.

Another major objective of the survey was to collect data on the main features of **current** MRS courses in Australia, as opposed to the Practitioners' data. The latter would reflect either a diploma course structure or recent degree course. As a result, the Students' and the Practitioners' data would provide two snapshots of MRS courses; one depicting the present while the other the recent past. This would give an accurate picture of how MRS courses have changed through these years.

3.4.2 Participants

The target population was final year MRS students. Being in their final year, the students would have gained sufficient clinical experience to be in a position to judge the type of attributes that the students would like to see practitioners acquire, as well as the importance and the perceived level of attainment of these attributes. Likewise, as final year students, they would also be able to answer questions pertaining to their course structure.

Permission was obtained from all eight Heads of Schools (HOS) to conduct the survey amongst their students. The researcher identified two universities with no 3rd year students in their courses. One School started the MRS course in 1998 and therefore has yet to graduate their first batch of students, while the other School has just started a new imaging modality within their course. The researcher presented the

survey to the Head of School and the Senior Lecturer in each case. In both instances, they felt confident that their 2nd year students were capable of completing the survey and volunteered to be included in the research project.

3.4.3 Design of Survey

The Student Survey (see Appendix 3.2) was similar to the Practitioner Survey. The major difference was the background information, which was restricted to age, gender, and prior qualification(s) that students may have obtained before the commencement of their MRS course.

3.4.4 Pilot Survey

Twelve third year Curtin students trialed the Student Survey on the 29th April 1999. Students took 10-18 minutes to complete the survey. Upon completion of the survey, the researcher sought immediate feedback from the students to determine the clarity of the attribute terminology and instructions, plus their ability to answer the questions on practitioners' attributes. The students did not find the survey difficult to answer. However, several students found the section on attributes to be rather daunting. They suggested that it would be best to leave the attributes section to the last, to prevent respondents abandoning the survey half way.

As a result of students' suggestion, the order of the survey was re-arranged for the Student Survey. Section A remained as the background information, Section B was on course information with the last section devoted to practitioner attributes.

3.4.5 Survey Distribution

As the researcher was to visit the six universities in the Eastern States in late September, it was decided to bring the exact number of copies required for the students together with the cover letter. Permission was obtained via email from the five HOS in September 1999. One Head of School was not available during the

period of email correspondence, and was therefore only given an original copy of the Student Survey during the researcher's visit. Due to time and financial constraints, Queensland University of Technology was omitted from the travel itinerary. However, an original copy of the Student Survey and the cover letter was send to the Head of School in Queensland.

The cover letter (see Appendix 3.15) provided the administrator of the survey with the standard instructions and assurance of confidentiality. To ensure a high rate of return, the researcher requested that the survey be given to the students during a class gathering such as in a lecture or tutorial so that the surveys could be collected at the end of the session. The survey was administered between October and December of 1999.

3.5 National Survey of Medical Radiation Science Heads of Schools

3.5.1 Objectives of Survey

As part of the data triangulation, all eight HOS were also surveyed. They played the role in directing the way in which the MRS courses in Australia are being conducted. Hence seeking to understand their course objectives, educational approaches and their views on lifelong learning in relation to MRS was crucial.

3.5.2 Design of Survey

Information was requested from the HOS regarding the following aspects of their MRS undergraduate program (Research Question 3a):

1. course objectives;
2. how the course structure, teaching and assessment methods are incorporated to promote the course objectives;
3. components of undergraduate program;
4. recognition for prior learning; and

5. MRS and lifelong learning.

3.5.3 Survey Distribution

The Survey (see Appendix 3.3) was distributed during the MRS HOS meeting in Brisbane in April 1999. Mr. Tony Knights, Head of MRS at Curtin, introduced the project on behalf of the researcher. Each of the Heads of School received a folder containing a brief outline of the research project (see Appendix 3.16), a copy of the survey and a self-addressed return envelope.

3.6 Focus group discussion with MRS Academics

The 7th Australasian Association of Educators in Medical Radiation Science (AAEMRS) Conference was held in Melbourne at Monash University on 7th-8th July 1999. This conference brought together MRS academics in Australia to discuss issues pertaining to the MRS research and education. It therefore presented the researcher with an excellent opportunity to canvass the opinion of academics on lifelong learning in the context of MRS.

3.6.1 Objective of Focus Group Discussion

This focus group discussion was important as it provided an avenue for the academics to have their input into the research project (Research Question 3b). This was particularly significant, as it was found that the academics' participation in the National Survey of Practitioners was too small to be statistically significant.

3.6.2 Format of Discussion

The 1½ hour presentation was conducted in the form of a focus-group discussion, during which the participants were first given a brief historical background of lifelong learning from the international and national perspective. The participants were then divided into groups and given three issues to discuss. Each group was given approximately 10 minutes to brainstorm each of the three topics, before

sharing the results of their discussion with the rest of the participants. The topics of discussion were:

- What are the characteristics of a lifelong learner?
- Using the Candy, Crebert and O'Leary list of lifelong learning attributes, discuss the relevance of lifelong learning for MRS graduates.
- What are the features of the undergraduate program that ensure these characteristics are enhanced/developed in our students?

3.7 Visits to Universities

3.7.1 Objectives of Visits

In order to gain first hand information on how other universities conduct their undergraduate MRS programs in Australia, the researcher visited 6 universities in September/October 1999 (see Table 3.2). The visit was to facilitate exchange of ideas with academics, namely undergraduate coordinators, clinical coordinators and clinical supervisors.

Table 3.2
Schedule for University visits

Date	Universities
25/09/99	University of South Australia
28/09/99	Royal Melbourne Institute of Technology
29/09/99	Monash University
30/09/99	Charles Sturt University
31/09/99	The University of Newcastle
01/10/99	University of Sydney

Due to time and financial constraints, Queensland University of Technology was omitted from the itinerary. As these visits were to provide an overall picture of the undergraduate courses in Australia, it was deemed that this omission should not adversely affect the accuracy of the overall picture.

The researcher relied on a structured interview schedule to keep the discussions on track. It was anticipated that the discussions with the staff members would be very

useful in providing an insight to the educational philosophy and approaches of the staff interviewed. As these visits took place during the semester break, the researcher was forewarned that not all members of the staff would be available.

3.7.2 Interview Schedule

The researcher used an interview schedule to ensure that the predetermined topics were covered within the allocated time. This also ensured that the interview was not only on track but it was also conducted in a more consistent, systematic and comprehensive manner (Patton, 1987).

Candy et al. identified clearly that teaching and assessment methods used have an impact on the development and promotion of lifelong learning attributes (Candy, Crebert and O'Leary, 1994). Biggs has also emphasised the importance of aligning the subject objectives with the teaching approaches, while ensuring that the assessment tasks are indeed measuring the desired outcomes as specified in the subject's aims (Biggs, 1999a). The interview schedule was therefore structured according to these two principles.

Interviewees were asked about their subject objectives and learning outcomes. This was to determine if the specified learning objectives were in line with learning outcomes. Questions were also structured to ascertain whether the teaching approaches were helping students to achieve the outcomes and the assessments were indeed measuring the expected 'final product'.

In addition, the interview was also designed to establish whether the subject in question aimed to promote any lifelong learning, professional attributes/skills, and how these desired attributes and skills were integrated into the unit.

Two interview schedules were planned; one was geared at the conduct of the clinical subject (see Appendix 3.17), while the second interview schedule was designed for other subjects (see Appendix 3.18).

3.8 Validity and Reliability of Data

The adoption of the triangulation strategy by correlating the results of quantitative studies and that of qualitative methods increased the overall validity of the research findings (Cohen and Manion, 1980; Bryman, 1992).

3.8.1 Survey of Stakeholders

Pilot studies were conducted for both the Practitioner and Student Surveys. This helped to establish content validity (Borg and Gall, 1989). Feedback from academics, senior and junior practitioners eliminated ambiguous items, improved clarity of instructions, as well as moderating the overall difficulty of the survey, thereby increasing reliability (Salkind, 1997).

Construct validity in this project, refers to the extent the survey instrument is related to the lifelong learning concept and practitioners' attributes (Salkind, 1997). The researcher relied on the following resources to ensure that construct validity was adhered to as closely as possible.

The teaching approaches and assessment methods in the survey were structured according to Candy et. al. 1994 report, while the attributes identified were derived from the following sources:

- MRS educational policy on expected graduates' attributes;
- Curtin Graduate Attributes Survey, which focused on employers' expectation of graduates; and
- 1994 Candy et al. report on lifelong learning.

Strategies had been put into place to combat the possibility of low response rates (see Section 3.3.5). This ensured that the appropriate statistical analysis could be conducted on the returned surveys (Borg and Gall, 1989). Increasing the response rate by active encouragement also had the additional advantage of reducing volunteer bias. Having more returns increased the possibility that the responses would bear more resemblance to the non-respondents (Crowl, 1996).

3.8.2 Focus Group Discussion

According to Crowl, 1996, the ideal scenario for focus group discussion is when participants do not know one another. This removes the possibility that participants may not be totally candid in their opinion, thereby reducing its validity. As the MRS community is relatively small in Australia, most of the participants do know one another, and the ideal scenario is therefore not possible. However, there is little to indicate that the MRS academics would not be totally forthcoming in their opinion. The researcher was careful to be on the lookout for such cues.

3.8.3 Interviews with MRS Academics

The reliability of the interview schedule was crosschecked by the supervisors. One way of increasing the interview validity was to reduce the researcher's bias (Cohen and Manion, 1980). This was achieved by using a tape recorder to record the interview, thereby eliminating the possibility of the researcher unconsciously selecting or highlighting comments that were in line with her prejudice (Borg and Gall, 1989). Compared to note taking, tape recording the interview was more reliable as it allowed the researcher to review the actual interview by re-playing the tape. To avoid misrepresentation of interviewees' responses, quotations were used whenever possible to convey their answers.

During the interviews, some staff volunteered samples of their work, such as unit outlines, assessment score sheets, feedback to students and clinical workbooks. As participation in this research project is purely on a voluntary basis, the researcher was limited in her ability to secure sufficient internal documents to validate the claims of the participants. Thus the ability of the researcher to triangulate the data in this respect was limited.

3.9 Overview of Research Questions and Sources of Data

The sources of data that were used to address the research questions are shown in Table 3.3.

The results, interpretation of data analysis, discussion and implications are presented in Chapters 4, 5 and 6.

Table 3.3
Summary of sources of data that address the research questions

Research Questions	Source of Data
Professional Sector	
First Research Question: What is the profile of a MRS practitioner as a lifelong learner?	• HOS Survey • AAEMRS
Second Research Question: How does the profession view lifelong learning in the workplace?	
(a) What do the stakeholders, ie. Practitioners, Heads of MRS Departments and Students, consider are the most important attributes of a MRS practitioner?	National Surveys: • Practitioners • Students
(b) What is the relationship between lifelong learning attributes and the attributes considered most important by the Practitioners, Heads of MRS Departments and Students?	National Surveys: • Practitioners • Students
(c) Are there any significant differences between the importance of these attributes and the perceived level of attainment?	National Surveys: • Practitioners • Students
(d) Are these differences statistically significant between the Practitioners, Heads of MRS Departments and Students?	National Surveys: • Practitioners • Students
(e) What are the selection criteria MRS employers look for in graduates?	WA major employers
Higher Education Sector	
Third Research Question: Are current MRS courses producing graduates with lifelong learning attributes?	
(a) How do MRS Schools actualise their commitment to lifelong learning?	• HOS Survey • AAEMRS
(b) How do academics view lifelong learning in the MRS discipline?	• HOS Survey • AAEMRS • One-to one interviews
(c) Are students being given increasing responsibility for their own learning as they progress through the course?	National Surveys: • Practitioners • Students
(d) What are the main teaching strategies in MRS courses?	National Surveys: • Practitioners • Students
(e) What are the main assessment methods being used?	National Surveys: • Practitioners • Students
(f) What are the factors identified by students and practitioners that are crucial in enabling both students and practitioners to become MRS practitioners?	National Surveys: • Practitioners • Students

Chapter 4

Results and Interpretations: Professional Sector

This chapter addresses Research Questions 1 and 2, which focus on the Professional sector. The results in this chapter are presented in two sections. The first section seeks to establish a profile of a MRS practitioner as a lifelong learner and the relevance of lifelong learning to the profession (Research Question 1). This is

obtained from the qualitative data analysis from the HOS Survey and the focus group discussion conducted with MRS academics at the 7th AAEMRS Conference.

The second section examines the attributes of the MRS practitioner as viewed by the stakeholders. In particular, it explores the importance in which the Practitioners, HOD and Students, regard lifelong learning attributes in relation to the professional and generic attributes. The answers to this section are informed by quantitative data collected from the Practitioner and Student Surveys. In addition, the selection criteria for graduates entering the MRS workforce are analysed to determine whether lifelong learning attributes have been included.

4.1 Demographics of the Practitioner and Student Surveys

The Student Survey was distributed to 517 MRS students through the eight participating universities. A response rate of 59% (305 valid returns) was achieved (see Table 4.1).

Table 4.1
Distribution of survey respondents from the eight participating MRS Schools

MRS Schools	Percentage of Survey Received (%)
A	83.3
B	46.6
C	85.7
D	65.7
E	75.6
F	18.0
G	96.9
H	100.0
Total Response (%)	58.9

It was recommended that the survey be distributed and collected during a class gathering eg. lecture or tutorial. However as the researcher was not present during the survey distribution, universities may have adopted different approaches resulting in the variation of responses received.

4000 copies of the Practitioner Survey were distributed in the June 1999 issue of the AIR newsletter *Spectrum*, with a reminder posted in the July 1999 *Spectrum*. A total of 581 returns were received, resulting in a response rate of 14.5%. This low response rate is consistent with the previous 1997 AIR Survey Report, which received a return of 250 surveys (Australian Institute of Radiography, 1997).

The majority of the MRS Students are between 20 to 29 years of age while the majority of Practitioners are between 20 and 40 years of age (see Table 4.2 and Figure 4.1).

Table 4.2
The age distribution in Student and Practitioner Survey

Age Group	**Students** (%)	**Practitioners** (%)
19 & below	6.6	0.9
20-29	90.8	34.3
30-39	1.3	25.3
40-49	1.3	27.3
50-59	0	11.3
60+	0	0.9
	100%	100%

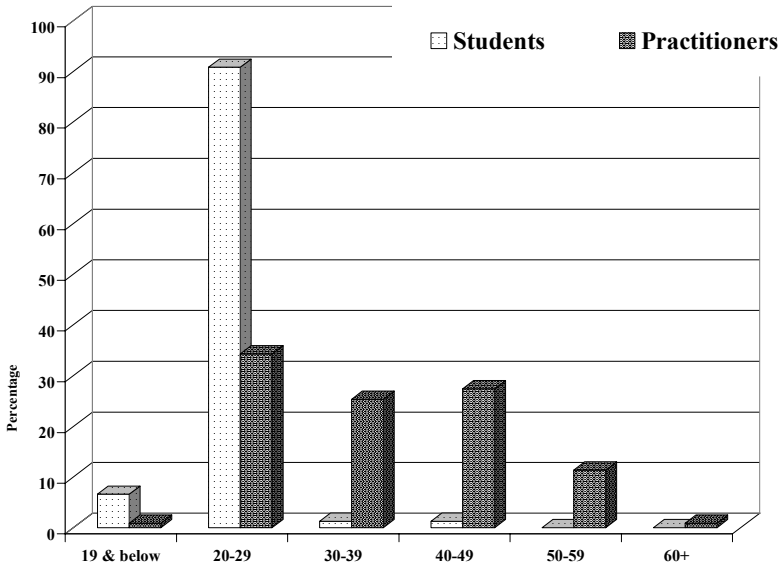


Figure 4.1
The age distribution in Student and Practitioner Survey

Figure 4.2 shows the gender distribution in the participating MRS Students and Practitioners population.

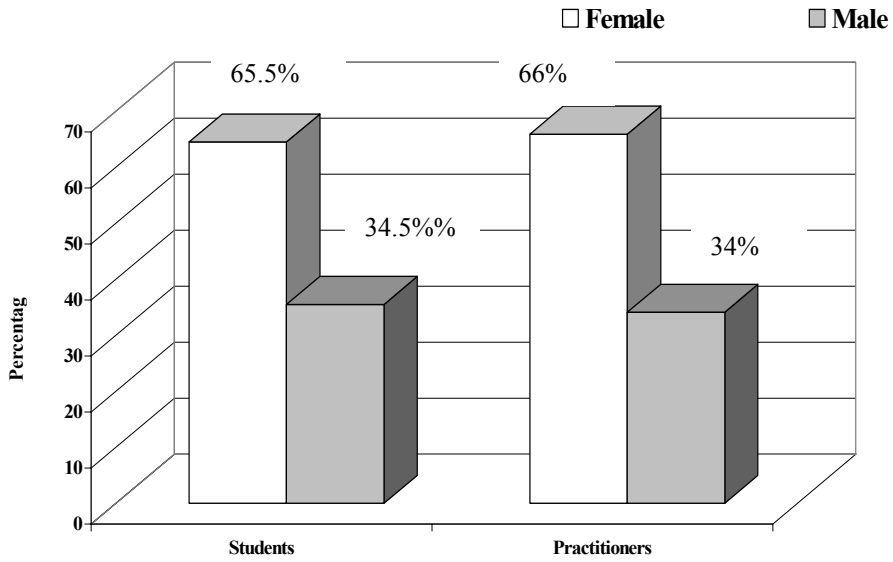


Figure 4.2
Gender distribution in the Student and Practitioner Survey.

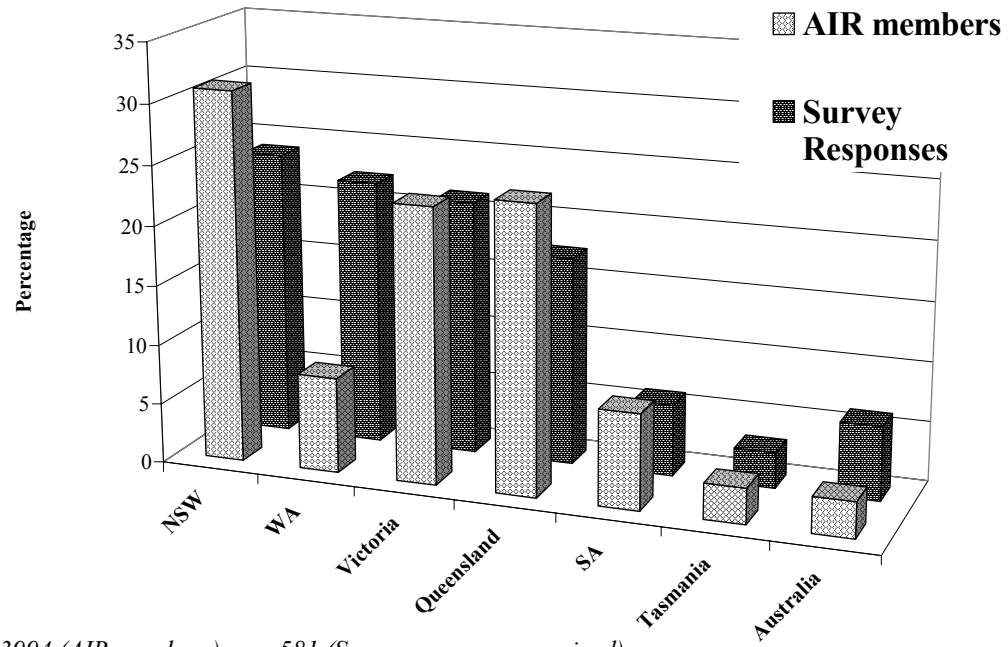
Background of Participants of Practitioner Survey

With the exception of WA, the responses from each state are compatible with the member distribution per state (see Table 4.3 and Figure 4.3).

Table 4.3
Distribution of Practitioner survey respondents received from each state matched against AIR members

States	*AIR members per state (%)	Survey responses received per state (%)
New South Wales	31	23.9
Western Australia	8	22.2
Victoria	23	21.3
Queensland	24	17.4
South Australia	8	6.0
Tasmania	3	3.0
Australia (*state not specified*)	3	6.2

*Source: *Data obtained from Nuss, 1999.*



n = 3994 (AIR members), n = 581 (Survey responses received)

Figure 4.3
Distribution of Practitioner survey respondents received from each state matched against AIR members
Source: Data of AIR membership obtained from Nuss, 1999.

There are two possible reasons for the larger WA responses. Although the AIR provided the main vehicle for survey distribution, the promotion strategies adopted by the researcher also targeted non-AIR members nationwide. In an effort to increase the response rate amongst non-AIR members, the researcher sought the assistance of HOD of the major WA clinical centres to encourage their employees to participate in the Practitioner Survey. Moreover, the fact that the researcher is known to practitioners was a contributing factor in prompting many to return the surveys (Crebbe, 1999). It is unlikely that the WA responses would skew the data, as there is no evidence to suggest that the responses from this state would be in any way different from other interstate responses.

Returns from the diploma holders and the degree holders are 37% and 31% respectively, with the certificate and associate diploma holders forming the

remainder of the returns (see Figure 4.4). The educational background of the participants corresponds with the transition of certificate to the degree pathway (see Chapter 2, Section 2.3.2). Given that Australia wide, the degree programs started only in the late 1980s and early 1990s, it is understandable that degree qualified MRS practitioners constitute only one third of the survey participants.

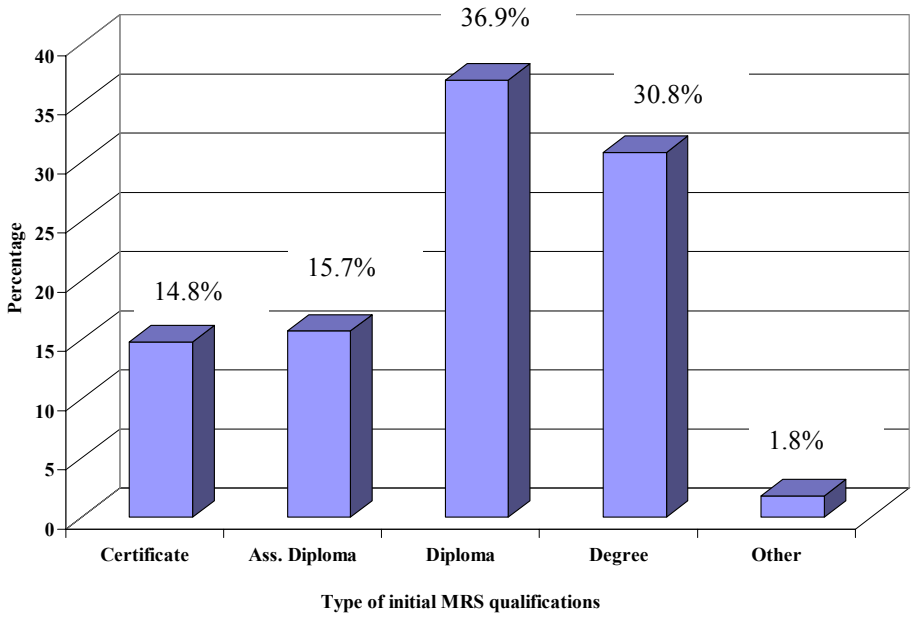


Figure 4.4
Type of initial MRS qualification amongst participants in Practitioner Survey

The majority of the participants were practitioners (80%) with the Heads and administrators forming the next largest group (14%). For the purpose of this study, the Heads and administrators, as the employers of MRS graduates, are grouped together (see Table 4.4). Since the academic community in this sample constitutes only 1.4% of the total response, it was decided that the stakeholders considered in the analysis would be the Practitioners, Heads/administrators of MRS Department (HOD) and the students from the eight MRS Schools.

Table 4.4
Current status of participants in the National Survey for Practitioners

Status	Percentage *(n = 581)*
Practitioners	80.1
Head & administrator of MRS Departments	14.2
Academics	1.4
Others *(sales representatives, scientific officer, directors, students & retirees)*	4.3
Total	100.0

4.2 Research Question 1: What is the profile of a MRS practitioner as a lifelong learner?

In Chapter 2, Section 2.1.4, the general characteristics of a lifelong learner were discussed. Research Question 1 seeks to establish a profile of a MRS practitioner as a lifelong learner and its relevance to the MRS profession.

The researcher will draw the answers to the above questions from the HOS Survey and the focus group discussion conducted during the 7th AAEMRS Conference in Melbourne.

4.2.1 Responses from Heads of Schools Survey

To canvass the opinion of the eight HOS with regard to the relevance of lifelong learning to the practitioners and the profession, they were asked the following question:

> In your opinion, what does lifelong learning mean for the Medical Imaging/MRS profession? (see Question 15: Appendix 3.3)

The common theme evident in the majority of the HOS responses is that lifelong learning is inseparable from the profession due to the rapid technological change [A8, 15] (see p. x for system of reference for direct quotes). As reflected by one HOS, practitioners with lifelong learning attributes imply that one is able to "continue learning to keep abreast with developments in the professional field" [A1, 15]. Another HOS defines a responsible practitioner as one who is aware that the

"knowledge base is growing rapidly", and would respond to these developments by striving to "continue to learn, question and criticise" [A6, 15]. To achieve this, practitioners must have the ability to access, retrieve and analyse the information and continue to engage in formal study [A1, 15; A7, 15; A5 15].

One HOS went beyond the usual description of simply responding to changes, defining a lifelong learning practitioner as one who must have the ability to "adapt, foster and promote change rather than simply respond" to changes [A2, 15]. Being proactive is how another HOS describes a lifelong learning practitioner, by playing "an active part in this development and to encourage others too" [A4, 15].

All of which should lead to a "vibrant forward thinking profession", with practitioners who are able to see the 'big picture' [A3, 15]. The latter is an essential trait of a lifelong learner, one who is able to "see themselves and the profession in the context of the health care system and the community at large" [A5, 15].

4.2.2 MRS Academics Responses in the 7th AAEMRS Conference

During the focus group discussion, the thirty participants were asked to discuss the relevance of lifelong learning for MRS practitioners. They indicated that a Department employing practitioners with lifelong learning attributes would be able to reap the benefits of having employees capable of readily acquiring new skills for the benefits of the patients. These practitioners see themselves as part of the multidisciplinary health team and are more likely to be responsive to changes in the workplace and health care system. Thus having practitioners with lifelong learning attributes will result in a profession that is well placed to meet the challenges in the new millennium. The participants' responses are tabulated against Candy et al. list of lifelong learning attributes (see Table 4.5)

Table 4.5
Profile of MRS Practitioner as a lifelong learner and its relevance to the MRS profession from the MRS academics perspective: Responses from the Focus Group

Characteristics of lifelong learner as defined by Candy et al (1994):	Profile of MRS Practitioner as a lifelong learner and its relevance to the Profession:
Inquiring mind	• Practitioner motivated to seek the information that will assist him/her to provide a better service to patient.

Helicopter vision	• An awareness of his/her role in relation to other health care profession;
	• Adopt an interdisciplinary approach and be able to interact well within the multidisciplinary health team;
	• Seeing themselves as part of the community by:
	  • Having a good working relationship with patients and vice versa;
	  • Be able to show empathy to the fullest extent.

Information literacy	• Know where and how to obtain information (from internet, professional electronic discussion list such as the AIRNEWS, professional journals etc.); • Able to critique and evaluate the acquired information.
Sense of personal agency	• Be capable of self-assessment (ie. be able to evaluate his/her own performance in order to identify areas of weakness and work towards improvement.
Range of learning skills	• Have the appropriate learning skills including reflection, critical analysis and critical evaluation of outcomes that would ultimately lead to improved practitioners' services towards patients; • Be able to adapt to changes in technology by being able to learn new and innovative MRS techniques readily.

Some participants cautioned that lifelong learning could easily be misunderstood by some practitioners as a process that centres on individual change, while MRS is based on a team approach. While lifelong learning stresses the need to acquire learning competencies for independent learning, Candy's latest addition of interpersonal skills as an essential attribute of a lifelong learner, also emphasises the importance of learning and working in a collaborative manner (Candy, 2000).

4.3 Research Question 2: How does the profession view lifelong learning in the workplace?

To determine how the profession views lifelong learning, this research question is further sub-divided into mini-questions. With the exception of Research Question 2e, which explores the selection criteria of MRS graduates who are entering the workforce for the first time, the answers to these mini-questions will be derived from the Practitioner and Student Surveys.

4.4 Research Question 2a: What do the stakeholders, ie. Practitioners, Heads of MRS Departments and Students, consider are the most important attributes of a MRS practitioner?

In the survey, participants were asked to rate each attribute on a scale of 1 (Very Important) to 5 (Very Unimportant). Participants were also asked to rate the level of attainment for each attribute on the scale of 1 (Very High) to 5 (Very Low). All responses were then weighted using a statistical weighting procedure (see Appendices 4.1 to 4.3). This method of estimating measures of importance is a robust and rigorous statistical approach that accounts for proportional differences. This provided the information about how stakeholders view the importance and the attainment level for each attribute. Table 4.6 is a compilation of the importance of attributes as ranked by Practitioners, HOD and students, without the total-weighted score of importance).

Table 4.6

Importance of attributes as prioritised by Practitioners, HOD and Students

The ranking of the attributes is obtained from the total-weighted score of importance obtained via the statistical weighting procedure. See appendices 4.1 to 4.3 for the total-weighted scored.

Practitioners *(n = 462)*		**HOD** *(n = 78)*		**Students** *(n= 305)*	
Ability to apply knowledge	P	Verbal communication skills with patients	P	Clinical skills in handling patients	P
Verbal communication skills with patients	P	Clinical skills in handling patients	P	Verbal communication skills with patients	P
Clinical skills in handling patients	P	Professional attitude to work	P	Ability to apply knowledge	P
Knowledge of discipline	P	Ability to apply knowledge	P	Ability to work in a team	G
Ability to work in a team	G	Knowledge of discipline	P	Willingness to learn new things	L
Professional attitude to work	P	Ability to work in a team	G	Ability to find practical solutions	L
Ability to work independently	G	Ability to work independently	G	Ability to make decisions	G
Willingness to learn new things	L	Ability to share knowledge	P	Ability to work independently	G
Ability to communicate with peers	G	Ability to show initiative	G	Professional attitude to work	P
Ability to share knowledge	P	Ability to make decisions	G	Ability to communicate with peers	G
Ability to make decisions	G	Willingness to learn new things	L	Ability to show initiative	G
Ability to manage time	L	Ability to communicate with peers	G	Knowledge of discipline	P
Ability to show initiative	G	Ability to find practical solutions	L	Ability to accept advice/criticism	G
Ability to find practical solutions	L	Ability to adapt to change	L	Ability to adapt to change	L
Ability to adapt to change	L	Ability to self evaluate	L	Being confident to continue learning	L
Ability to accept advice/criticism	G	Ability to manage time	L	Ability to manage time	L
Ability to self evaluate	L	Being confident to continue learning	L	Ability to make critical judgments	L
Ability to make critical judgments	L	Ability to make critical judgments	L	Ability to share knowledge	P
Being confident to continue learning	L	Ability to accept advice/criticism	G	Ability to see the “big picture”	L
Ability to see the “big picture”	L	Information literate	L	Ability to self evaluate	L
Ability to manage one’s own learning	L	Ability to see the “big picture”	L	Information literate	L
Information literate	L	Ability to manage one’s own learning	L	Ability to manage one’s own learning	L
Ability to set goals	L	Ability to set goals	L	Ability to set goals	L
Ability to use appropriate computing skills	G	Ability to take the lead	G	Ability to take the lead	G
Ability to take the lead	G	Ability to use appropriate computing skills	G	Ability to use appropriate computing skills	G

Note: P = Professional skills, G = Generic skills, L = Lifelong learning skills

The figures quoted here for n (Practitioners, HOD and Students) reflect the number of valid responses to this section.

4.4.1 Importance of Attributes

Before examining in detail the ranking of the attributes, it is essential to first determine if the stakeholders regard any of the listed attributes in the survey as unimportant attributes for practitioners to attain. The answer can be obtained by examining the frequency distribution of the level of importance of those attributes that were rated as least important (lowest priority) and those attributes that were rated as most important (highest priority).

The frequency distribution of the level of importance for attributes, which have been given lowest priority and highest priority, is shown in Figure 4.5 and Figure 4.6 as can be seen from there, the number of respondents that voted for the unimportant and very unimportant vary from a low 3.7% to 0.2% for the lowest prioritised attributes, and 1% to 0.2% for the highest prioritised attributes. This indicates that Practitioners, HOD and Students viewed all attributes, professional, generic and lifelong learning, as important attributes for MRS practitioners, since the majority of the stakeholders scored each attribute as very important or important, with very few scoring the attributes as unimportant or very unimportant.

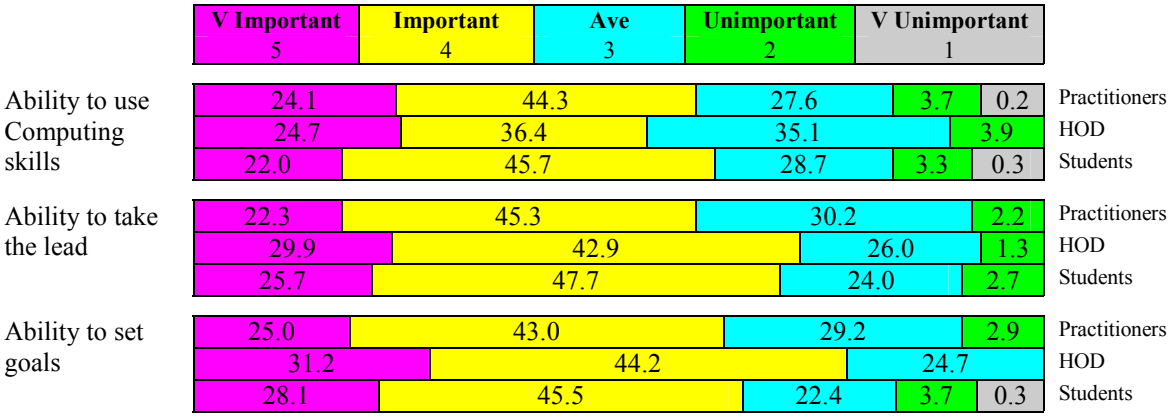


Figure 4.5
Frequency distribution of the level of importance as voted by the stakeholders for the lowest priority attributes
Even for attributes that are lowly prioritised, very few stakeholders voted the attributes as unimportant or very unimportant.

Note: Size of boxes indicating percentages are only rough representations.
V Important = Very Important; Ave = Average; V Unimportant = Very Unimportant

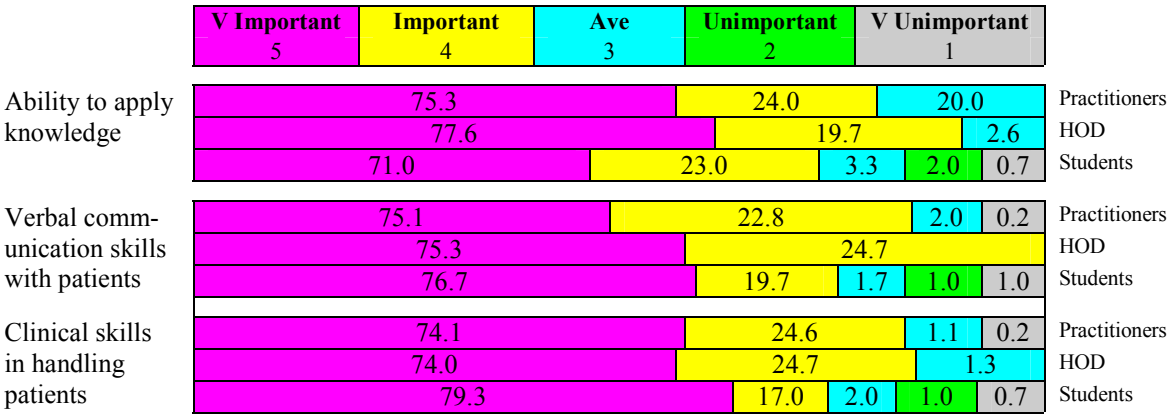


Figure 4.6
Frequency distribution of the level of importance as voted by the stakeholders for attributes that have been given the highest priority
In comparison with the figure above, even fewer stakeholders rate the attributes as unimportant or very unimportant.

Note: Size of boxes indicating percentages are only rough representations.
V Important = Very Important; Ave = Average; V Unimportant = Very Unimportant

This frequency trend thus indicates that there are no attributes that are considered to be unimportant by the majority of stakeholders. They are in agreement that all attributes listed in the survey are important attributes for MRS practitioners.

4.4.2 Prioritisation of Attributes

The attributes as prioritised by Practitioners, HOD and Students are reported in Table 4.6. All three groups have identified professional attributes as the top priority. This is followed by a cluster of generic skills interspersed occasionally by some lifelong learning and professional traits. The majority of lifelong learning attributes are located at the bottom of the list.

For the purpose of this study, the researcher will only focus on the first ten attributes, which have been given higher priority by the three stakeholders than the rest (see Table 4.7).

Table 4.7
Table showing the 10 attributes that have been given top priority by the 3 stakeholders

Practitioner	HOD	Students
Professional Attributes		
Ability to apply knowledge	Ability to apply knowledge	Ability to apply knowledge
Verbal communication with patients	Verbal communication with patients	Verbal communication with patients
Clinical skills in handling patients	Clinical skills in handling patients	Clinical skills in handling patients
Professional attitude to work	Professional attitude to work	Professional attitude to work
Knowledge of discipline	Knowledge of discipline	
Ability to share knowledge	Ability to share knowledge	
Generic Attributes		
Ability to work in a team	Ability to work in a team	Ability to work in a team
Ability to work independently	Ability to work independently	Ability to work independently
Ability to communicate with peers		Ability to communicate with peers
	Ability to make decisions	Ability to make decisions
	Ability to show initiative	
Lifelong Learning Attributes		
Willingness to learn new things		Willingness to learn new things
		Ability to find practical solutions

Note: Attributes presented here should be viewed in clusters, rather than one attribute being more important than the other within each other.

4.4.2.1 Professional attributes

All stakeholders regard professional attributes as higher priority than both generic and lifelong learning attributes. This is evident in that the first four, five and three attributes cited by Practitioners, HOD and Students respectively are all professional attributes (see Table 4.6).

The common attributes cited within this cluster by the three stakeholders are:

- ability to apply knowledge;
- verbal communication skills with patients;
- clinical skills in handling patients; and
- professional attitude to work.

All respondents regarded professional attributes as top priority. This is to be expected as professional/clinical competence is an essential component of any health care profession (Chapman, 1999). MRS is a practically oriented profession, with the 'hands-on' approach. These attributes are important as they determine the

practitioners' performance and their clinical competence level. Being able to apply the acquired knowledge in clinical settings is essential. Good patient care involves not only good clinical skills but also requires practitioners to use effective verbal and non-verbal communication. Together these attributes help determine the difference between a successful or a poorly performed procedure, and a 'good' and 'bad' MRS practitioner. Professional attitude to work is an important attribute that defines the work ethic of a practitioner. It is therefore understandable that all stakeholders have given this attribute priority above others.

Both Practitioners and HOD have also listed two additional professional attributes:

- knowledge of discipline; and
- ability to share knowledge.

Recognising that the ability to share knowledge is important indicates that both Practitioners and HOD view the ability to learn from one another as an essential part of professional development.

4.4.2.2 Generic attributes

There are two common generic attributes prioritised by the stakeholders:

- ability to work in a team; and
- ability to work independently.

MRS tasks require practitioners to work in both individual and teamwork capacity. The inclusion of these two attributes here by all stakeholders reflected this appreciation.

The following generic skills are not listed in the top ten by all stakeholders, but are still prioritised ahead of the other generic and lifelong learning attributes (see Table 4.7):

- ability to make decisions;
- ability to communicate with peers; and
- ability to show initiative.

One reason for placing the above generic skills ahead of other generic and lifelong learning attributes is that these skills directly impact on practitioners' clinical performance. Decision-making is part of practitioners' daily routine, as performing procedures requires one to make decisions. The ability to communicate with peers is an essential part of any teamwork while showing initiative is an essential characteristic of any employee in today's workforce.

4.4.2.3 Lifelong Learning Attributes

MRS is rapidly changing in terms of technological innovations and this in turn has an impact on how practitioners work. Willingness to learn new things is thus listed by all stakeholders as the highest priority of the lifelong learning attributes. Although it (willingness to learn new things) assumes a lower priority than the core professional and generic skills, putting this attribute in the forefront reflects the importance which stakeholders attach to the practitioners' desire and keenness to learn. From the Students' perspective, willingness to learn new things may also include the realisation that there is often more than one approach to a particular task. Students must therefore be willing to learn and adapt to other approaches instead of adhering to one single method.

Of particular interest is that HOD did not list any lifelong learning attributes in this cluster, although willingness to learn new things follows immediately after this first grouping of ten (see Table 4.6).

Only one lifelong learning attribute appeared in the first cluster of higher prioritised attributes. All three stakeholders have given the majority of lifelong learning attributes low priority. As a result of this, it could be concluded that although lifelong learning attributes were considered by all as important attributes for MRS practitioners, both professional and generic attributes take precedence. This is an important finding. It indicates that there is a possibility that lifelong learning could be pushed to the periphery of the curriculum, as described in the 1994 Candy et al. report. While in the MRS workplace, developing and promoting lifelong learning may not be at the top of the workplace agenda.

4.5 Research Question 2b: What is the relationship between lifelong learning attributes and the attributes considered most important by the Practitioners, Heads of MRS Departments and Students?

Research Question 2a seeks to identify which of the attributes the stakeholders considered important and to analyse the manner in which these attributes were ranked. Research Question 2b aims to establish specifically the relationship between the lifelong learning attributes and the attributes identified as important by the stakeholders.

4.5.1 Lifelong Learning Attributes in Relation to Other Attributes

As shown in Table 4.6, all stakeholders have identified professional and generic attributes as taking priority over lifelong learning attributes. Practitioners, HOD and Students alike, regarded attributes that have an immediate and direct influence upon their professional/clinical competence as being their major concern, as opposed to attributes that are perceived by them to be more future-oriented as in one's ability to continue learning.

As established in Section 4.3.1, there were no attributes that were identified as unimportant by stakeholders. It must therefore be emphasised that although lifelong learning attributes assume a lower priority than the rest of the attributes, they are still being recognised as being important and essential attributes for MRS practitioners.

Since the survey did not require participants to indicate the reasons for their rating of attributes, the researcher can only postulate the reasons for their order of priority. Ability to manage time, and one's own learning and being information literate, may be viewed by some as being more related to research and formal learning. Some practitioners believe that learning is a natural process and does not require much nurturing. Hence, it is likely that this group of Practitioners would not regard the ability to make critical judgments and to see the 'big picture' and confidence to

continue learning as of utmost importance for MRS practitioners. This is one possible reason why lifelong learning attributes are perceived as of lower priority.

One of the least prioritised generic attributes is the ability to take the lead (see Table 4.6). When seen in combination with lowly prioritised lifelong learning attribute of ability to set goals, it signifies that leadership is not viewed as a very important attribute for MRS practitioners. This is in line with the nature of practitioners' duties, when they work essentially under the direction of radiologists, or in the case of radiation therapy, as part of the treatment team.

4.5.2 Prioritisation of Lifelong Learning Attributes

To gain a better understanding of how lifelong learning is currently being regarded in the profession, it is necessary to examine how these attributes are being perceived by the stakeholders.

4.5.2.1 Lifelong Learning Attributes that are perceived to have Higher Priority

Again, attributes that are related directly to clinical competence are more highly regarded. These include:

- ability to find practical solutions;
- ability to adapt to change;
- ability to manage time; and
- ability to self-evaluate.

Being able to implement practical solutions is essential in dealing with the different scenarios that are faced by the practitioners in their duties. Students often find it difficult to improvise when confronted with unfamiliar and difficult scenarios. This could explain why, compared to other stakeholders, Students viewed this as one of the more important attributes to be attained by a practitioner (see Table 4.6).

Ability to adapt to changes is closely linked to the willingness to learn new things. The rapid technological innovations and changes in MRS have changed the way in

which practitioners work over the years. Thus, all stakeholders are aware of the need to adapt to these changes, hence the inclusion of this attribute in the first cluster of lifelong learning attributes.

Practitioners see time management as an important skill to have in these days of diminishing resources and increasing patient throughput in health care. Good time management therefore brings one a step closer to ensuring efficiency.

The ability to self-evaluate allows the practitioner to monitor his/her approach to a specific task and thus be able to further improve upon one's own performance. Students are the only group of stakeholders who put ability to self-evaluate as a much lower priority than the Practitioners and HOD, indicating the need to teach students self-evaluation and reflection skills (see Table 4.6).

4.5.2.2 Lifelong Learning Attributes that are perceived to have Lower Priority

Attributes that have been given a lower priority include:

- being confident to continue learning;
- ability to manage one's own learning;
- information literacy;
- ability to make critical judgment;
- ability to see the 'big picture'; and
- ability to set goals.

These attributes have to do with one's ability to continue learning and are not perceived by the stakeholders as being directly related to their clinical competence. This could account for the reason these attributes assume a much lower priority.

Frequency distributions of how stakeholders assigned the level of importance to the three highest and three lowest prioritised lifelong learning attributes are represented in Figure 4.7 and Figure 4.8.

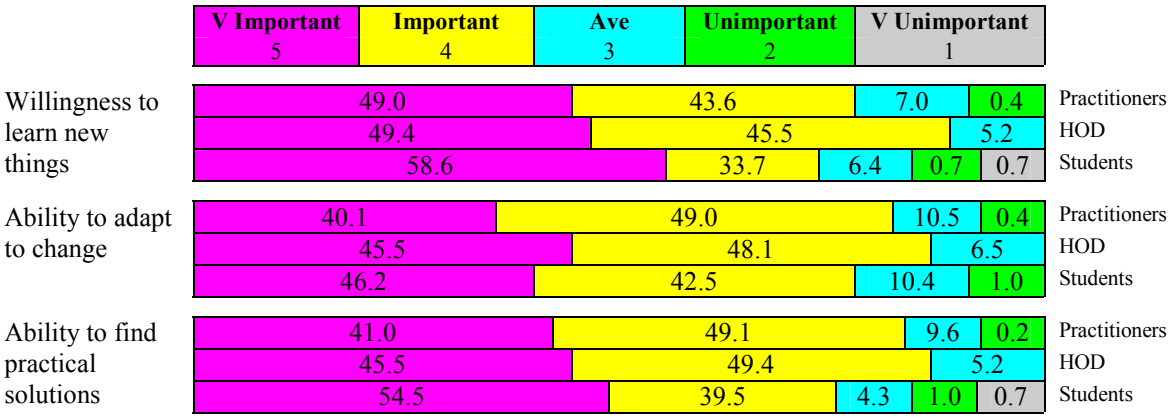


Figure 4.7
Level of importance perceived by each stakeholder for the highly prioritised lifelong learning attributes
Compared to the figure below, approximately double the number of respondents rated the attributes as very important.

Note: Size of boxes indicating percentages are only rough representations.
V Important = Very Important; Ave = Average; V Unimportant = Very Unimportant

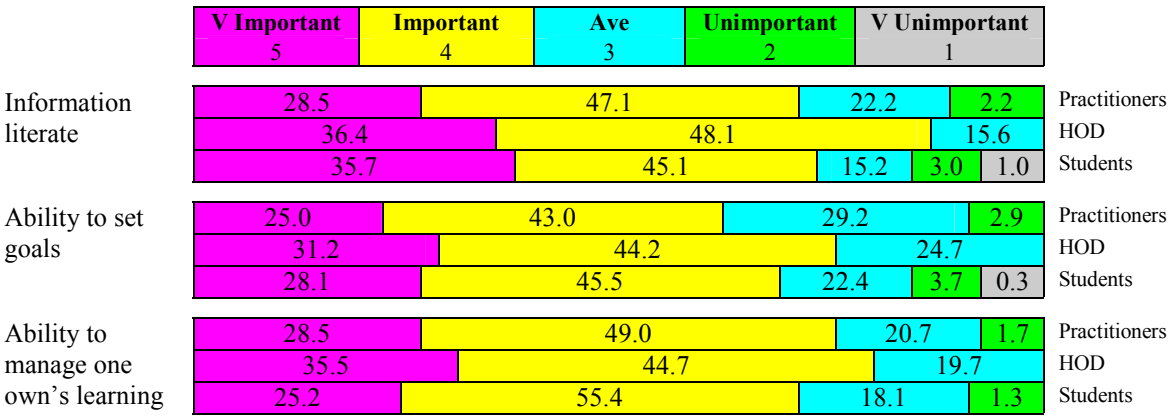


Figure 4.8
Level of importance perceived by each stakeholder for the lowly prioritised lifelong learning attributes
Compared to the figure above, approximately half the number of respondents rated the attributes as very important.

Note: Size of boxes indicating percentages are only rough representations.
V Important = Very Important; Ave = Average; V Unimportant = Very Unimportant

In both instances, about the same percentage of participants rated both categories of attributes as 'important'. The major difference in the distribution pattern lies in that with the highest priority attributes (see Figure 4.7), double the number of

respondents voted for the 'very important' category compared to the lifelong learning attributes that have been given lowest priority (see Figure 4.8).

4.6 Research Question 2c: Are there any significant differences between the importance of these attributes and the perceived level of attainment?

This Research Question seeks to determine if there is a significant difference between what the stakeholders see as important and the actual level of attainment of these attributes. The difference in mean value between the perceived importance and the actual level of attainment were tested for significance using the t-test, with the level of significance set at 0.01 level (see Table 4.8).

4.6.1 Statistical Significance between Perceived Importance and Actual Attainment Level

Results obtained from the t-test for all three stakeholders showed that for each of the attributes, there is a statistical significant difference between what the Practitioners, HOD and Students view as important and the actual level of attainment (see Table 4.8). This implies that for each of the attributes, there is a large gap between the perceived level of importance and the actual level of attainment. The three sets of stakeholders all agreed that each of the attributes, which have been regarded as important, fall below the level of expectation. These results indicate there is a need for programs to raise the current attainment level to the expected level of importance and to also manage stakeholders' expectations better so as to reduce the gap. The attributes as perceived by stakeholders, with the difference between important and attained level arranged in descending order are reported in Table 4.9.

Table 4.8

T-test of differences between important and attained attributes of MRS as viewed by Practitioners, HOD and Students

Attributes		Level	Practitioners *(n = 462)* Mean	SD	Mean Difference	t	HOD *(n = 78)* Mean	SD	Mean Difference	t	Students *(n = 305)* Mean	SD	Mean Difference	t
Knowledge of discipline	P	Impt	1.33	.57	-.78	-21.706	1.29	.51	-.82	-8.802	1.63	.82	-.62	-13.016
		Attain	2.11	.70			2.11	.67			2.25	.71		
Ability to apply knowledge	P	Impt	1.25	.45	-.83	-23.863	1.26	.50	-.93	-10.492	1.38	.71	-.69	-15.000
		Attain	2.08	.70			2.19	.72			2.07	.68		
Clinical skills in handling patients	P	Impt	1.28	.50	-.75	-20.199	1.28	.48	-.97	-9.526	1.27	.61	-.77	-16.560
		Attain	2.03	.76			2.25	.79			2.04	.75		
Verbal communication skills with Patients	P	Impt	1.27	.52	-.81	-20.976	1.25	.44	-.84	-7.942	1.30	.65	-.94	-17.971
		Attain	2.08	.78			2.09	.90			2.24	.82		
Professional attitude to work	P	Impt	1.41	.56	-.87	-20.518	1.28	.48	-1.00	-8.780	1.59	.75	-.65	-12.324
		Attain	2.28	.86			2.28	.91			2.24	.83		
Ability to share knowledge	P	Impt	1.63	.64	-.85	-18.925	1.55	.55	-1.08	-10.798	1.77	.77	-.56	-10.594
		Attain	2.48	.88			2.63	.73			2.33	.77		
Ability to communicate with peers	G	Impt	1.60	.62	-.80	-17.914	1.59	.55	-.78	-8.586	1.62	.73	-.54	-11.284
		Attain	2.40	.87			2.37	.69			2.16	.74		
Ability to work in a team	G	Impt	1.42	.58	-.71	-16.691	1.44	.58	-.53	-5.582	1.40	.67	-.63	-14.065
		Attain	2.13	.87			1.97	.82			2.03	.77		
Ability to work independently	G	Impt	1.59	.70	-.41	-9.950	1.52	.66	-.44	-5.152	1.59	.78	-.38	-9.169
		Attain	2.00	.82			1.96	.83			1.97	.76		
Ability to take the lead	G	Impt	2.12	.78	-.41	-9.821	1.99	.80	-.60	-5.771	2.04	.78	-.39	-7.999
		Attain	2.53	.83			2.59	.95			2.43	.72		
Ability to show initiative	G	Impt	1.68	.66	-.76	-17.141	1.53	.53	-.83	-8.480	1.63	.75	-.62	-12.897
		Attain	2.44	.87			2.36	.94			2.25	.77		
Ability to make decisions	G	Impt	1.62	.62	-.80	-19.022	1.55	.62	-.96	-11.186	1.54	.70	-.57	-12.896
		Attain	2.42	.81			2.51	.78			2.11	.74		
Ability to accept advice/criticism	G	Impt	1.71	.65	-.92	-20.515	1.75	.74	-.94	-8.695	1.65	.70	-.92	-15.270
		Attain	2.63	.87			2.69	.82			2.57	.92		

Table 4.8 (continued)

T-test of differences between Important and Attained attributes of MRS as viewed by Practitioners, HOD and Students

Attributes		Level	**Practitioners** *(n = 462)* Mean	SD	Mean Difference	t	**HOD** *(n = 78)* Mean	SD	Mean Difference	t	**Students** *(n = 305)* Mean	SD	Mean Difference	t
Ability to use appropriate computing skills	G	Impt	2.12	.81	-.48	-10.217	2.19	.87	-.46	-4.136	2.14	.81	-.39	-6.898
		Attain	2.60	.84			2.65	.74			2.53	.83		
Ability to make critical judgments	L	Impt	1.82	.73	-.66	-17.515	1.69	.73	-.80	-9.423	1.75	.72	-.58	-12.889
		Attain	2.48	.75			2.49	.69			2.33	.72		
Ability to self evaluate	L	Impt	1.78	.70	-.81	-18.224	1.64	.63	-1.08	-9.258	1.79	.79	-.68	-12.485
		Attain	2.59	.83			2.72	.86			2.47	.84		
Ability to manage time	L	Impt	1.67	.69	-.78	-17.032	1.69	.68	-.81	-8.660	1.75	.74	-.48	-10.154
		Attain	2.45	.86			2.50	.78			2.23	.74		
Ability to manage one's own learning	L	Impt	1.95	.75	-.84	-18.246	1.82	.74	-1.15	-9.140	1.95	.70	-.56	-10.566
		Attain	2.79	.86			2.97	.92			2.51	.79		
Ability to adapt to change	L	Impt	1.71	.67	-.86	-17.946	1.62	.61	-1.16	-9.430	1.66	.70	-.80	-13.897
		Attain	2.57	.87			2.78	.93			2.46	.85		
Ability to find practical solutions	L	Impt	1.69	.65	-.67	-16.674	1.61	.59	-.75	-9.592	1.54	.69	-.64	-14.383
		Attain	2.36	.80			2.36	.75			2.18	.75		
Ability to see the 'big picture'	L	Impt	1.89	.74	-.87	-16.753	1.84	.70	-1.19	-10.069	1.79	.73	-.68	-12.361
		Attain	2.76	.92			3.03	.91			2.47	.81		
Ability to set goals	L	Impt	2.10	.81	-.63	-14.336	1.95	.76	-.87	-8.793	2.02	.83	-.42	-9.254
		Attain	2.73	.78			2.82	.71			2.44	.81		
Willingness to learn new things	L	Impt	1.58	.64	-.83	-18.276	1.57	.60	-.85	-8.121	1.51	.71	-.81	-13.654
		Attain	2.41	.89			2.42	.89			2.32	.93		
Information literate	L	Impt	1.98	.77	-.78	-16.391	1.81	.70	-1.08	-9.029	1.89	.84	-.61	-10.364
		Attain	2.76	.89			2.89	.95			2.50	.89		
Being confident to continue learning	L	Impt	1.83	.70	-.79	-16.817	1.71	.66	-1.03	-9.825	1.73	.78	-.65	-11.227
		Attain	2.62	.91			2.74	.87			2.38	.89		

Note: The level of significance was set at .01 level. The mean difference between importance and attainment for each attribute was found to be significant ie. p<.01.
Impt = Importance of attributes; Attain = Attainment of attributes; P = Professional skills, G = Generic skills, L = Lifelong learning skills

Table 4.9

Attributes as perceived by stakeholders, with the difference between important and attainment level arranged in descending order

The difference in mean value between the perceived importance and the actual level of attainment were tested for significance using the t-test, level of significance was set at 0.01 level. The mean difference between importance and attainment for each attribute was found to be significant ie. p<.010
For detail results of the t-test, see Table 4.8.

Practitioners *(n = 462)*		**HOD** *(n = 78)*		**Students** *(n= 305)*	
Ability to accept advice/criticism	G	Ability to see the "big picture"	L	Verbal communication skills with patients	P
Professional attitude to work	P	Ability to adapt to change	L	Ability to accept advice/criticism	G
Ability to see the 'big picture'	L	Ability to manage one's own learning	L	Willingness to learn new things	L
Ability to adapt to change	L	Ability to share knowledge	P	Ability to adapt to change	L
Ability to share knowledge	P	Ability to self evaluate	L	Clinical skills in handling patients	P
Ability to manage one's own learning	L	Information literate	L	Ability to apply knowledge	P
Ability to apply knowledge	P	Being confident to continue learning	L	Ability to see the "big picture"	L
Willingness to learn new things	L	Professional attitude to work	P	Ability to self evaluate	L
Ability to self evaluate	L	Clinical skills in handling patients	P	Ability to find practical solutions	L
Verbal communication skills with patients	P	Ability to make decisions	G	Professional attitude to work	P
Ability to make decisions	G	Ability to accept advice/criticism	G	Being confident to continue learning	L
Ability to communicate with peers	G	Ability to apply knowledge	P	Knowledge of discipline	P
Being confident to continue learning	L	Ability to set goals	L	Ability to show initiative	G
Knowledge of discipline	P	Willingness to learn new things	L	Ability to work in a team	G
Information literate	L	Verbal communication skills with patients	P	Information literate	L
Ability to manage time	L	Ability to show initiative	G	Ability to make critical judgments	L
Clinical skills in handling patients	P	Knowledge of discipline	P	Ability to make decisions	G
Ability to show initiative	G	Ability to manage time	L	Ability to share knowledge	P
Ability to work in a team	G	Ability to make critical judgments	L	Ability to manage one's own learning	L
Ability to find practical solutions	L	Ability to communicate with peers	G	Ability to communicate with peers	G
Ability to make critical judgments	L	Ability to find practical solutions	L	Ability to manage time	L
Ability to set goals	L	Ability to take the lead	G	Ability to set goals	L
Ability to use appropriate computing skills	G	Ability to work in a team	G	Ability to take the lead	G
Ability to work independently	G	Ability to use appropriate computing skills	G	Ability to work independently	G
Ability to take the lead	G	Ability to work independently	G	Ability to use appropriate computing skills	G

P = Professional skills, G = Generic skills, L = Lifelong learning skills

All mean differences are statistically significantly different at the 0.01 level. Table 4.10 shows the first cluster of 10 attributes that are perceived by the stakeholders to have the largest mean difference.

Table 4.10
10 attributes that are perceived to have the largest mean difference between level of importance and actual level of attainment

Practitioner	HOD	Students
Professional Attributes		
Professional attitude to work	*Professional attitude to work*	*Professional attitude to work*
Ability to share knowledge	*Ability to share knowledge*	
Verbal communication with patients		*Verbal communication with patients*
Ability to apply knowledge		*Ability to apply knowledge*
	Clinical skills in handling patients	*Clinical skills in handling patients*
Generic Attributes		
Ability to accept advice/ criticism		*Ability to accept advice/criticism*
	Ability to make decisions	
Lifelong Learning Attributes		
Ability to see 'big picture'	*Ability to see 'big picture'*	*Ability to see 'big picture'*
Ability to adapt to change	*Ability to adapt to change*	*Ability to adapt to change*
Ability to self evaluate	*Ability to self evaluate*	*Ability to self evaluate*
Ability to manage one's own learning	*Ability to manage one own's learning*	
Willingness to learn new things		*Willingness to learn new things*
	Information literate	
	Being confident to continue learning	
		Ability to find practical solutions

Note: Attributes presented here should be viewed in cluster, rather than one attribute being more lacking than the other.

4.6.1.1 Professional Attributes

The only common attribute listed by all three stakeholders in this cluster is professional attitude to work. This implies that all respondents were in agreement that there is much room for improvement for this attribute.

Four other professional attributes cited by various stakeholders also occur within this first cluster of lacking attributes:

- ability to apply knowledge;
- verbal communication with patients;

- clinical skills in handling patients; and
- ability to share knowledge.

Within the professional category, the same attributes that have been identified as being very important were also being identified as having the largest gap difference between the level of importance and actual attainment level (see Table 4.10).

4.6.1.2 Generic Attributes

Within this cluster, the only generic skill listed by both Practitioners and Students is the ability to accept advice/criticism.

Ability to accept advice/criticism and the ability to share knowledge are essential attributes for collaborative learning and joint research ventures. These deficiencies must be addressed as practitioners work in teams and most health research projects are often multidisciplinary in nature. Failure to address this deficiency may impact upon the abilities of practitioners to work and learn in a collaborative manner. HOD however, perceived ability to make decisions as more lacking amongst practitioners.

The deficiencies in generic skills indicated by the HOD and Practitioners are also substantiated by the MRS graduates' responses on generic skills in the CEQ between 1996 and 1998 (see Table 4.11).

Table 4.11
MRS graduates responses for Generic Skills in the CEQ Survey between 1996 to 1998

University	1996	1997	1998
	Mean Score on a scale of 1 to 5		
	Response of 1: strongly disagree; 5: strongly agree		
A	3.60	3.50	3.36
B	3.26	3.20	3.21
C	3.48	3.41	3.64
D	3.40	3.44	3.35
E	3.30	3.53	3.45
F	3.72	3.77	3.52
G	3.28	3.34	3.37
National Summary	3.36	3.40	3.40

The eighth MRS School started the MRS course in 1998.
Source:(Curtin Quality Office, 2000)

Overall, MRS graduates have rated their satisfaction of generic skill acquisition a national average of 3.4 for the 3 years surveyed (see Table 4.11). On a continuum of 1 to 5, a response of 1 is 'strongly disagree' and 5 is 'strongly agree'. There are considerable debates as to the precise meaning of the response '3' (Karmel, Aungles and Andrews, 1998; Koder, 1998). However, a response of 4 or 5 is an indication of "positive agreement", thereby indicating graduates' satisfaction (Patrick, 1998, p. 32). Thus a mean score of 3.4 can be considered to be relatively low for a 5 point rating scale.

Comparing the generic skills scores of MRS graduates with nursing graduates from the same institutions, showed that the means scores for nursing graduates were only marginally higher at 3.6 (see Table 4.12).

Table 4.12
Nursing graduates responses for Generic Skills in the CEQ Survey between 1996 to 1998

University	1996	1997	1998
	Mean Score on a scale of 1 to 5		
	Response of 1: strongly disagree; 5: strongly agree		
A	3.78	3.71	3.76
B	3.38	3.41	3.50
C	3.70	3.67	3.49
D	3.60	3.60	3.62
E	3.72	3.65	3.63
F	3.46	3.65	3.45
G	3.58	3.63	3.60
National Summary	3.64	3.63	3.63

Source:(Curtin Quality Office, 2000)

4.6.1.3 Lifelong Learning Attributes

Stakeholders do not regard lifelong learning attributes as being a high priority. There is only one lifelong learning attribute appearing within the first cluster of high priority attributes. However, in general, there were between five to six attributes that appeared in this first cluster of most lacking attributes (see Table 4.10). The number of lifelong learning attributes that appear within this cluster is indicative of the low level of lifelong learning within the profession.

Three lifelong learning attributes listed by all stakeholders are:

- ability see the 'big picture';
- ability to adapt to change; and
- ability to self-evaluate.

Ability to see the 'big picture' refers to graduates being able to put all learning and workplace changes in the context of their role as MRS practitioners. This would provide practitioners with the understanding and the necessary impetus to remain sufficiently motivated to improve themselves, which in turn, would lead to a better delivery of services for patients. From the HOD's perspective, having 'helicopter vision' would also enable the practitioners to be more receptive to policy changes introduced by the HOD. Ability to adapt to change is also perceived to be lacking here. The identified gaps in these two attributes indicated that practitioners do not have a wider perspective of their role and are slow to accept changes.

The HOD also regards ability to manage one's own learning, information literacy and being confident to continue learning as the more lacking attributes. These attributes together with the ability to self-evaluate, are directly related to an individual's ability to continue learning by taking control of his/her own learning agenda. This implies that practitioners' abilities to continue learning on their own are not evident.

Willingness to learn new things, which was the only attribute in the high priority list, also appears in this cluster. Students could possibly be exercising some degree of self-evaluation when they cited the ability to accept advice and criticism and the willingness to learn new things as the attributes that were lacking. The researcher's personal experience indicates that practitioners often complain of students' unwillingness/inability to learn new techniques and see refusal to accept advice and criticism as their common weaknesses.

4.6.2 Deficiency of Lifelong Learning Attributes in MRS

Along with other attributes, lifelong learning attributes were also found to have a large gap between the important and attainment level. However with these attributes constituting at least half of the first cluster of attributes seen as lacking, lifelong learning attributes are in general, found to be more lacking than the professional and generic attributes.

4.7 Research Question 2d: Are these differences statistically significant between the Practitioners, Heads of MRS Departments and Students?

Only the professional and lifelong learning attributes (see Table 4.10) perceived by stakeholders to have the largest difference between important and attainment level will be examined here.

4.7.1 Mean Differences of Lifelong Learning Attributes

In general, HOD considered the gap between importance and attainment level, for all lifelong learning attributes, as more lacking than the Practitioners and Students. Students in general perceived a smaller difference between the importance and actual attainment level (see Figure 4.9). This smaller difference could be due to the fact that current students are immersed in a university culture that promotes lifelong learning and are therefore more comfortable with lifelong learning. They are more familiar and better prepared than practitioners for lifelong learning, and this has influenced their responses resulting in a lower mean difference.

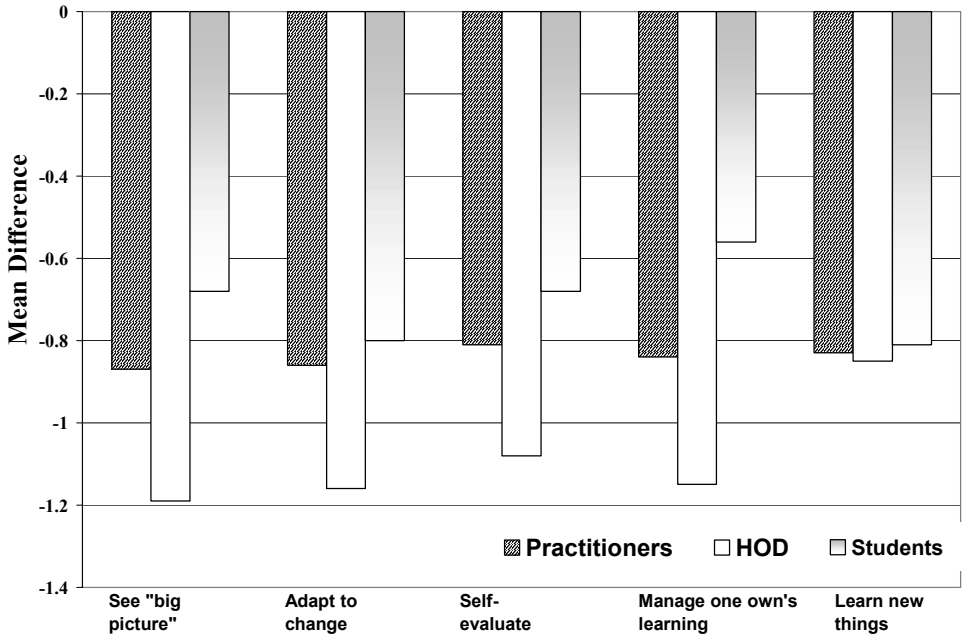


Figure 4.9
Mean differences, between levels of importance and attainment, of lifelong learning attributes, as perceived by stakeholders

4.7.2 Mean Differences of Professional Attributes

Again, it is the HOD who reports the attributes listed here as more lacking than the Practitioners and Students. Practitioners judge the differences between the importance and attainment level to be greater than the Students' (see Figure 4.10). Since the students are yet to be fully integrated into the workforce, they may not be aware of the predicament and this may account for their perception of the smaller differences. Verbal communication skills with patients were the exception, with Students seeing the difference between the importance and attainment level to be largest.

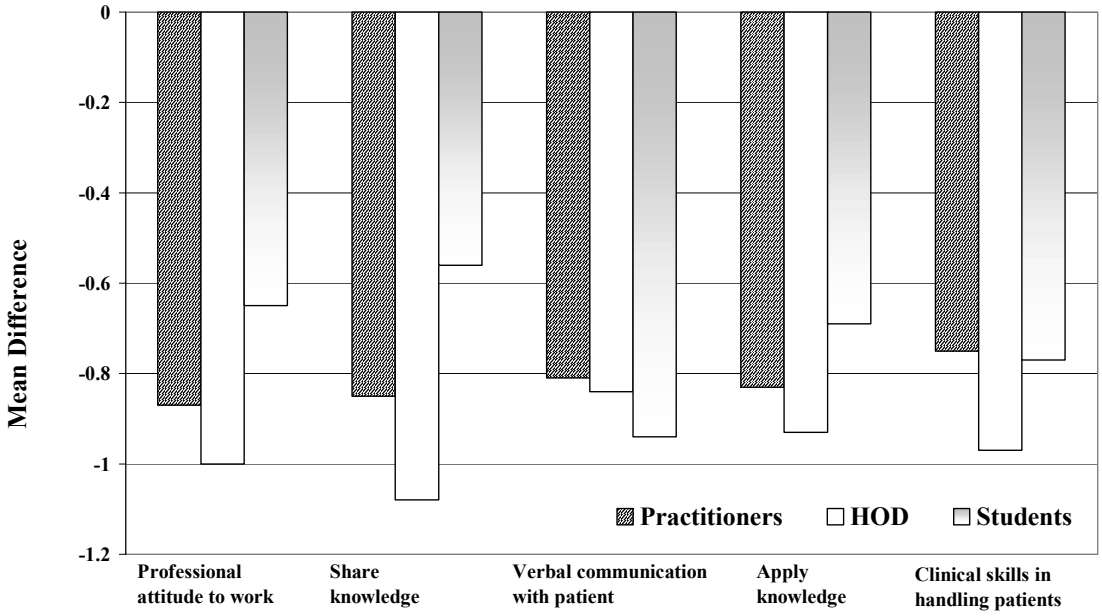


Figure 4.10
Mean differences, between levels of importance and attainment, of professional attributes, as perceived by stakeholders

4.8 Research Question 2e: What are the selection criteria MRS employers look for in graduates?

The selection criteria for MRS graduates were obtained from WA employers; namely the Health Department of WA, major public teaching hospitals, and major private radiological practices in WA. Given that employers nationwide are looking at the same entry level for MRS graduates, there is no reason to suggest that the selection criteria of employing MRS graduates in WA would be any different from other States in Australia. In fact, it is common occurrence for MRS employers to advertise interstate annually seeking new graduates to fill their vacancies. It was therefore felt that the WA data would be representative of the overall national picture.

Table 4.13 shows a compilation of the criteria obtained in 1999 from the five major employers in WA.

Table 4.13
Selection criteria for MRS graduates as listed by employers of both public and private sectors in WA

Common Essential Criteria		Classification of criteria
Bachelor of Science (MRS) or recognised equivalent acceptable to AIR	P	Knowledge of discipline
Ability to communicate effectively with patients and staff	P	Verbal communication and other form of communication skills with patients
	G	Ability to communicate with peers
Ability to operate effectively as a team member	G	Ability to work in a team
*Knowledge of quality assurance principles	P	Knowledge of discipline
Desirable Criteria		**Classification of criteria**
**Demonstrate commitment to continuing professional development	L	Lifelong learning attributes
*** Ability to think laterally	G	Ability to be innovative

* *This criterion was not included in the private sector's list.*
** *This attribute appears as an essential criterion in one major public hospital, appears twice as a desirable criterion in 2 other public teaching hospitals, and was absent in the private sector's list.*
*** *This attribute is classified as desirable and occurs only once in the private sector.*
P = professional skills, G = generic skills and L = lifelong learning skills.

There are four common criteria that are listed by the employers as essential, with a 60/40 split between professional and generic skills. The generic skills that were listed as essential include ability to communicate with staff and the ability to work as member of a team. The professional criteria specify the minimum MRS qualification for graduates to enter the workforce, plus the ability to communicate with patients.

The only lifelong learning 'attribute' which makes the list, is a 'commitment to continuing professional development'. This refers to both the desire and abilities to engage in ongoing learning; a criterion that is rather broadly defined and non-specific in this context. It is significant that only one major public hospital has listed this commitment to lifelong learning as an essential attribute, with the other public institutions classifying it only as desirable, while the private sector did not include this attribute at all in their selection criteria. One can conclude that lifelong learning does not feature high on the agenda or on the checklist of employing MRS graduates in public sector while in the private sector, lifelong learning is not even included in the selection criteria.

4.9 Summary of Findings in the Professional Sector

The profile of a MRS practitioner as a lifelong learner, as identified by the MRS academic community, is similar to that given by Candy et al. report (1994). Responses from the HOS and the teaching staff indicate lifelong learning to be an integral part of the profession, with lifelong learning attributes regarded as extremely relevant to the profession and the workplace (see Table 4.5).

The three major stakeholders, Practitioners, HOD and Students, were also supportive of the view that lifelong learning is important. This is evidenced by the fact that they rated all professional, generic and lifelong learning attributes to be important attributes for MRS practitioners to attain. However, in ranking the order of importance, all three groups of stakeholders have put attributes that are directly related to clinical competence, above attributes that were perceived to be related to learning competence. As a result, with the exception of 'willingness to learn new things', all lifelong learning attributes have been relegated to the lower end of priority scale, with professional and generic attributes being given top priority.

Results of the t-test showed that for all attributes listed in the survey; there was a statistically significant difference between the perceived level of importance and the perceived level of attainment. This implies that there is a gap between stakeholders' perceptions of the expected level of importance and the actual/current level of attainment, with the HOD perceiving the largest deficiencies. Significantly, all respondents perceived lifelong learning attributes to be more lacking than the professional and generic attributes.

In an effort to determine if workplace practice is supportive of lifelong learning, the selection criteria for graduates who are entering the MRS workplace for the first time were examined. It was found that none of the lifelong learning attributes cited in the survey have been specifically listed as essential criteria. There was, however, a broad reference to lifelong learning, via the criterion of 'commitment to continuing professional development' but this broad criterion is only listed in public sector advertisement. There was no mention of lifelong learning in the private sector's selection criteria.

Selection criteria for MRS graduates are the 'gateway' for entry into the workforce. Although stakeholders regard lifelong learning to be important attributes, this importance is not reflected in the selection criteria for MRS graduates. There is therefore non-alignment between beliefs and action in the selection criteria.

Having explored lifelong learning in the professional sector, Chapter 5 will examine lifelong learning in Higher Education.

Chapter 5

Results and Interpretations: Higher Education Sector

This chapter focuses on lifelong learning in the Higher Education sector. It seeks to determine whether the current MRS courses are preparing graduates for lifelong learning (Research Question 3). The answer to this question is obtained from both

qualitative and quantitative data via interviews and focus group discussion with MRS academics, HOS Survey and by comparing the course information obtained from Student and Practitioner Surveys.

Specifically, the study examines how MRS Schools actualise their commitment to lifelong learning and collates teaching staff views on lifelong learning. It also focuses on the main features of undergraduate course by investigating the degree to which students are given responsibility for their own learning and whether the teaching and assessment methods used in current courses promote lifelong learning attributes. Finally, the study seeks to identify the main features of the MRS course that assist students in becoming practitioners.

5 Current Medical Radiation Science courses in Australia

5.1 Are current MRS courses producing graduates with lifelong learning attributes?

This research question is further divided into sub-questions that focus on different aspects of MRS courses. The answers to these sub-questions are obtained from the results of qualitative and quantitative analyse obtained from several sources of data collected during the study. These include:

- Heads of Schools Survey;
- National Survey on MRS Practitioners;
- National Survey on MRS Students;
- Focus group discussion with MRS academics at the 7th AAEMRS conference in Melbourne; and
- interviews with academics conducted during visits to Universities.

5.2 Research Question 3a: How do MRS Schools actualise their commitment to lifelong learning?

This research question addresses the Schools' commitment to lifelong learning, by examining:

- course objectives;
- aspects of the course structure and content that promote lifelong learning; and
- aspects of the teaching and assessment methods that promote lifelong learning.

The data are obtained from the analysis of MRS Heads of Schools survey. The surveys were distributed to the 8 Heads of Schools (HOS) in April 1999, with a 100% response rate.

It is not the purpose of this research project to identify individual university's educational approaches since they were assured of confidentiality. Rather the data are used to inform the researcher of the current approaches adopted by the eight MRS Schools to promote lifelong learning. As such, results will only be used to give an aggregate picture of the MRS courses in Australia.

5.2.1 Course Objectives

To determine the course objective, the HOS were asked the following question:

> Does your Department/School explicitly promote lifelong learning as a course objective? (see Appendix 3.3, Question 3)

All HOS answered yes, thereby aligning themselves to their university policy for lifelong learning (See Chapter 2, Section 2.1.5). What is significant here is that each HOS is stating that at the School/Departmental level, they are openly committed to promoting and pursuing lifelong learning as their course objective.

5.2.2 Course Structure and Content

Which aspects of your course structure and content promote lifelong learning in your students? (see Appendix 3.3, Question 4)

General responses by the respondents to the above question are that their course structures are directed to promoting lifelong learning skills and attributes. The following quotes reflect the typical response:

> *Student-based structure – where students are expected to go out and obtain information for themselves – rather than be spoon fed. The links that are made between clinical and theory case studies etc. also encourage this.* [A4, 4]

> *We emphasise early the need to gain learning skills to be used at Uni and beyond. We expect students to apply these in the normal course progression. They are emphasised by the use of PBL and reflective processes.* [A6, 4]

> *The course structure involves progressive development of skills and self responsibility for various aspects of learning as students progress through the course, culminating in the project report and poster in the final semester.* [A7, 4]

> *Providing framework and encouraging students to seek (want to seek) more from other sources.* [A8, 4]

Some common examples that promote lifelong learning given by HOS include:

- information literacy skills;
- critical appraisal skills;
- literature review exercise;
- research projects that involve group and individual input;
- group problem-solving sessions;
- computer-aided learning sessions; and

- problem-based learning.

Since the HOS were not required to list all of their examples, it would be inappropriate to quote any numbers here. However, PBL has been listed by four universities as one of their teaching methods. One university, in particular, is adopting a total PBL approach in their entire course structure. Here peer learning is the norm as students are divided into groups of twelve, with a facilitator guiding each group. Lectures are only conducted when requested by the students [A1, 2]. In this instance, the HOS indicated that lifelong learning constitutes 13% of the undergraduate program and is embedded throughout their entire course structure [A1, 4].

5.2.3 Teaching and Assessment Methods

Which aspects of your Department's/School's teaching and assessment practices promote lifelong learning in your students? (see Appendix 3.3, Question 5)

The examples listed by the HOS were common in all eight responses. This seems to indicate that most Schools are employing similar teaching and assessment strategies.

- Case studies reports and presentations;
- poster presentations;
- research projects; and
- IT development skills from basic to information retrieval on the internet.

As one HOS put it:

> *We stress the ability to use, apply and extend knowledge, not just be able to recall. Assessments that purely test facts retention are discouraged. Considerable group work is used to enable students to experience co-learning.* [A6, 5]

Two HOS cited reflective journals and practical-problem solving based exercises [A1, 5; A7, 5] while clinical contract and professional development portfolio has only been listed once [A3, 5]. However, interviews with teaching staff from several universities indicated that assessment activities such as reflective journals [A10i; A19i; A25i] and contract learning were commonly employed in both clinical and theoretical subjects [A12i; A17i ; A27i].

5.2.4 Features of Undergraduate Program that Promote Lifelong Learning Attributes

Another source of data triangulation is from the focus group discussion with MRS academics that took place during the 7th AAEMRS conference held in Melbourne (see Chapter 4, Section 4.2.2).

> What are the features of the undergraduate program that ensure these lifelong learning characteristics discussed are enhanced/developed in our students?

Participants identified the following features as essential in promoting lifelong learning attributes (Sim, 2000):

(i) Providing a warm, encouraging and accepting learning environment where students are allowed to explore. Giving the wrong answers should not result in a severe penalty;
(ii) creating opportunities that cater for a variety of different learning styles;
(iii) using multidisciplinary teaching methods;
(iv) having a variety of teaching approaches that include role plays and case studies;
(v) including self assessment activities which require the use of reflective journals;
(vi) using group work to promote teamwork;
(vii) promoting critical thinking and questioning skills;
(viii) equipping students with research and IT skills;
(ix) adopting assessment strategies which evaluate students' generic skills;

(x) adopting a broad topic base/approach; and

(xi) incorporating professional development activities.

Not surprisingly, some of the features such as promotion of teamwork, reflective journals and IT and research skills, were already mentioned in the HOS surveys.

5.3 Research Question 3b: How do academics view lifelong learning in the MRS discipline?

While Research Question 3a examines lifelong learning at the institution level, this question examines how academics view lifelong learning in the profession. The answer to this question is obtained from the following sources:

- HOS Survey;
- Focus group discussion at 7th AAEMRS conference in Melbourne; and
- one-to-one interviews with academics.

Responses collated from the above sources indicate that academics are in favour and supportive of the need for lifelong learning. The rapid changes in MRS technology make continuous learning a necessity. From the interviews and the HOS surveys, having an inquiring mind and the ability to self-evaluate, coupled with an innovative approach are some of the most commonly cited reasons for the need to equip graduates with lifelong learning skills [A16i; A17i; A18i; A20i; A24i; A25i; A27i; A28i]. Being an autonomous learner is considered to be an essential characteristic in today's workforce [A10i; A16i] as no individual is expected to know everything [A13i].

5.3.1 Lifelong Learning and Medical Radiation Science

Questions 16 and 17 of the HOS Survey (see Appendix 3.3) seek the HOS' opinions on the employability of graduates with lifelong learning attributes and the acceptability of critical thinking practitioners by employers.

In your opinion, what is the impact on employability for having attributes of a lifelong learner? (see Appendix 3.3, Question 16)

Four HOS indicated that lifelong learning is not a consideration for employment of graduates who are entering the workforce for the first time. They felt that lifelong learning qualities are not "essential criteria" for graduates seeking their first year of employment [A6, 16]. Employers are only interested in appointing graduates who can "simply do the job" [A8, 16]. Another felt that due to the severe shortages of MRS practitioners, lifelong learning is therefore a non-issue [A3, 16]. Moreover, as pointed out by one HOS, lifelong learning is a relatively new concept in the profession and is only a crucial factor during promotion consideration [A1, 16]. These responses are also substantiated by the selection criteria of new graduates described in Chapter 4, Section 4.8. WA employers did not list any of the lifelong learning attributes as essential selection criteria for new graduates.

One HOS felt that the acceptability of lifelong learning graduates will be very much dependant on the culture of the workplace [A3, 16]. The remainder of the HOS agreed that lifelong learning does have an impact on the employability of graduates, but only in the long term. This is because lifelong learning will only be useful when the graduate is ready to consider one's career advancement [A7, 16]. One HOS further commented that practitioners with lifelong learning attributes are the ones who will develop themselves in preparation for future promotion [A4, 16].

The majority of the HOS were therefore in agreement that currently, lifelong learning has no direct impact on the employability of graduates.

In response to question 17, on how well employers are prepared to accept critical thinking graduates, there were two central themes in the HOS responses (see Table 5.1).

Table 5.1
HOS responses to employers' acceptance of critical thinking graduates

Question *(see Appendix 3.3: Question 17 of HOS Survey)*	HOS responses (n = 8)		
	Yes	No	Gradual acceptance
Do you think employers are prepared to accept graduates who are critical thinkers (ie. people who question and suggest new ways of doing things etc.), rather than conforming to the established practice?	2	3	3

Firstly, HOS indicated that most practitioners feel threatened by the seemingly more knowledgable and more critical graduates who dare to question the norm, as the following quotes illustrate:

> *Critical thinkers are challenging and many radiographers feel uncomfortable in their presence.* [A3, 17]

> *In general no. There is a reluctance in radiography for critical thinking and analytical ability to be considered useful.* [A2, 17]

Another HOS responded by looking at the 'actual' employers of MRS practitioners; ie. radiologists who own the MRS practice.

> *Most radiologists do not encourage radiographers to think critically and prefer their staff to 'thread the well-worn path of subservience'. In other words 'No' in most cases* [A5, 17]

The above quote was also supported by another HOS who indicated that:

> *.....you must always be mindful of the influence upon 'virtuous' radiographic practice of the much more powerful radiology profession. Many radiologists will still require radiographers who are willing to work under their direction.* [A3, 16]

The second emerging theme is the expressed hope that the working culture is slowly evolving to accommodate and accept practitioners with lifelong learning attributes. One HOS commented optimistically that "eventually it would be an expectation to

question current practice" [A8, 17]. Another commented that there is a gradual shift towards continuous learning, with postgraduate education now being mandatory for promotion, thereby resulting in more senior practitioners pursuing further studies [A6, 17]. Although one is hopeful that this may signal the beginning of a new trend, one must keep in mind that lifelong learning is more than the pursuit of formal postgraduate education.

What are the reasons given by the two HOS who voted that employers are prepared to accept critical thinking graduates? One felt that generally, employers are *"happy with proactive staff members"* [A4, 17], while another HOS has this to say:

> *Yes – have already demonstrated this with current PBL program which has critical thinking as a major objective. Some practitioners obviously feel threatened by this type of graduates but it is the way to go.* [A1, 17]

5.3.2 University Culture and Workplace culture

There was consensus amongst the participants in the focus group discussion at the 7th AAEMRS Conference about the need to create a learning environment in universities that is conducive to the development of lifelong learning attributes. However, the participants were also quick to highlight a cultural conflict that currently exists between university and the MRS workplace. In fact, this was a focal point that generated much heated discussion amongst the participants.

Some of the workplace practices cited that inhibit lifelong learning include rewarding seniority with specialised training and promotion and upholding the common practice that 'knowledge is power' – all of which run contrary to the promotion of lifelong learning culture.

In addition, in most clinical practices, conforming to the standard work protocol is still the norm, while critical thinking approaches are frowned upon. While students are encouraged to be inquisitive and ask questions at university, practitioners frown upon such quest for knowledge as they feel threatened and challenged by the

students. This often leads to disappointment for many students and young practitioners as they encounter the lack of support and reward for their lifelong learning endeavours as the following quotes illustrate:

> *We have feedback from students that they have very discouraging comments from staff (ie. practitioners) such as 'Why are you doing that?' and 'Why do you want to find out that information?'. So we are battling that sometimes; it is particular discouraging if they get those responses early in their student's career.* [A24i]

> *I am instilling into the students the need to question. Status quo is not always right, gather your evidence ie. evidence based. Sending the students keen and eager and they come back all crushed! The profession itself is the 'biggest brick wall that I am running against, again and again'.* [A27i]

The participants were adamant that while it is important and appropriate for the undergraduate MRS programs in Australia to actively promote lifelong learning attributes amongst students, the MRS profession must also support such endeavours. Otherwise the Schools may run the risk of preparing graduates for a working environment that is not prepared to accept lifelong learning graduates and "…they learn very fast that it is easier to just go along" [A24i].

The consensus is that before lifelong learning can become fully entrenched in the MRS profession, both employers and practitioners must embrace and support lifelong learning. This reflection is consistent with one of Candy et al.'s major findings; that lifelong learning can only thrive when all stakeholders, such as schools, universities, profession, employers and government agency, are working together in partnership to support the lifelong learning culture (Candy, Crebert and O'Leary, 1994).

The views of the MRS academics with regard to the clash between university culture and workplace culture were strongly supported by the HOS. In fact, the adverse workplace culture to lifelong learning has been identified by many HOS as the major

obstacle in preventing the development of lifelong learning attributes. This is evident in the following quotes:

> *There also needs to be cultural change in the workplace to allow recent graduates to operate as above.* (referring to the graduate's ability to be reflective and critical) [A6, 2]

> *The average graduate probably does differ from this (the ideal graduate with lifelong learning attributes) to some degree, but this is a reflection of the profession. They are anything rather than what they learn at university.* [A5, 2]

This is again supported by another HOS who indicated that their graduates are prevented from putting their lifelong learning attributes to proper use as "the workplace and the profession do not currently encourage or reward them" [A3, 2].

Perhaps the following quotes epitomised the responses of many HOS:

> *I think the problem in promoting lifelong learning is with the profession (AIR) not the courses necessarily. We are historically constrained from lifelong learning.* [A5, 18]

5.4 Research Question 3c: Are students being given increasing responsibility for their own learning as they progress through the course?

The ability to take control of one's own learning agenda does not happen by chance. In fact Candy et al. (1994) maintain that the cultivation of lifelong learning attributes should be incorporated into all undergraduate programs. This way, students can be gently and gradually eased into learning to be autonomous learners, thereby preparing them to become self-directed learners once in the workforce.

To determine if students are being more self-directed in their learning, respondents of the Student and Practitioner Surveys were asked the following question:

> As you progressed through the course, were you required to gradually take more responsibility for your own learning? (see Appendices 3.1 and 3.13, Question 7 of Course Information)

To avoid ambiguity, a brief definition of what it means to take responsibility for one's own learning was provided. Responsibility refers to students being progressively allowed to plan their own learning objectives, schedule and learning outcome. Respondents of the Practitioner and Student Surveys were also invited to elaborate on the nature of their increased responsibility.

Based on the Practitioners' and Students' responses, the researcher is able to divide the answers to Question 7 into the following three categories (see Table 5.2):

- Taking responsibility for their own learning;
- perceived as taking responsibility for their own learning (but were not); and
- not taking responsibility for their own learning.

Table 5.2

Students taking responsibility for their own learning during their MRS course

As you progressed through the course, were you required to gradually take more responsibility for your own learning?
(see Practitioner Survey: Question 7 of Section C/ Student Survey :Question 7 of Section B)

	Students *(n = 295)*		***Practitioners** *(n = 132)*	
	Count	**Yes (%)**	**Count**	**Yes (%)**
Taking responsibility for their own learning	135	70.7	53	40.2
Perceived as taking responsibility for their own learning	71	37.2	38	28.8
	Count	**No (%)**	**Count**	**No (%)**
Not taking responsibility for their own learning	21	11.0	46	34.8

Note: The responses are not cumulative. ie. respondents' comments may reflect experiences that include elements of self-directed learning as well as reliance on lecturer.
n refers to the total number of participants who answered this question; Count refers to the total number of responses in Question 7.
**Practitioners here also include Heads/administrators of MRS Departments*

5.4.1 Taking Responsibility for their own Learning

As reported in Table 5.2, more students ie. 71% of the Students compared to 40% of the Practitioners, are now reported to be taking more responsibility for their own learning.

The yes response was substantiated by the respondents having experienced one of the following:

- The total PBL approach;
- mixture of teaching methodologies that require some degree of self-directed learning; and
- research project as part of their final year curriculum.

5.4.1.1 Total Problem-Based Learning approach

Students from a university that used a total PBL approach were unanimous that they had been given opportunities to be self-directed:

> *Our whole course was about taking responsibility for our learning. There was minimal teaching by lecturers.* [S1013, b7]

> *Also, with problem based learning, you as a student, were in control of your own learning at all times. If we had gained a good understanding of the subject matter we could decide not to have certain lectures.* [S1003, b7]

> *We worked in tutorial groups and did our own research and presented and shared our knowledge back to the group.* [S1014, b7]

Students from other universities, who had experienced PBL as part of their undergraduate course, also shared the above sentiments:

> *Problem-based learning encouraged finding out for yourself how to approach a problem by carrying out your own research.* [S6006, b7]

5.4.1.2 Mixture of Teaching Methodologies

Comments from other students indicated that they are often exposed to a mixture of teaching methods, ranging from traditional didactic lectures to PBL approaches and peer learning, thus gradually assuming more responsibility for their own learning:

> *In 2nd year, we did modules which were basically done by students, but we were guided by lecturers. In 3rd year, modules were basically done totally by students with minimal guidance, as were research projects, computer assisted learning and quality control projects.* [S5002, b7]

> *Laboratories are unsupervised in 3rd year.* [S5003 b7]

> *We are given directions towards scenarios for us to find out about; no lectures.* [S5008, b7]

5.4.1.3 Research Project

Another common feature mentioned by many students from several universities, to support their claim of some degree of self-directed learning, is the final year research project:

> *The project unit gives us the chance to work and teach ourselves.* [S8003, b7]

> *Major project involved carrying out a research project with consultations only, no lectures.* [S6006, b7]

The recent developments in Higher Education may also move students towards more self-directed learning, even though in some instances it may not be a deliberate intention of the lecturers to do so. Larger classes with higher staff-student ratios result in less personal contact (Toohey, 1999) plus the move towards information technology (IT) are circumstances which 'force' students to take more responsibility for their own learning (Wild, 1994).

5.4.2 Perceived as Taking Responsibility for their own Learning

Another 37% of Students and 29% of Practitioners also voted 'yes' (see Table 5.2). However the comments that followed did not substantiate their claims of self-directed learning and were therefore classified by the researcher as "perceived as taking responsibility for their own learning." (see Table 5.2)

The typical illustrations include:

- Students not being provided with photocopy lecture notes;
- lecture notes being available on the web;
- students are/were required to do more reading with list of suggested references;
- students are/were required to do more written assignments; and
- lectures are/were still being conducted as usual but attendance is/was not compulsory.

The following quote epitomised the perceived concept of self-directed learning:

> *Lectures become more oral then* [sic] *overhead presented, therefore required to listen and take notes. However the whole course was very very easy. I felt I was 'babyed' throughout its entirety.* [S7001, b7]

One may argue that students these days are more likely to be immersed in an educational environment that places more emphasis on self-directed learning than the Practitioners surveyed. Thus, irrespective of whether students have actually been given more responsibility, the emphasis in this direction may unconsciously cause the Students to tick 'yes' box instead of 'no'. However, most respondents did elaborate their answers with illustrations of self-directed learning, and having filtered the responses according to the groupings specified above, the researcher is confident that the percentages represented in Table 5.2 are as accurate as the survey instrument would allow.

5.4.3 Not Taking Responsibility for their own Learning

35% of Practitioners answered 'no', indicating that they are/were not required to assume more responsibility; compared to only 11% of Students (see Table 5.2). The 35% recorded by the Practitioners is more likely to reflect the nature of the Practitioners' courses, rather than due to biases such as erroneous recollection. The latter has been largely avoided by making Section C voluntary for the Practitioners, requesting that only the 1990s graduates complete the Course information (See Chapter 3, Section 3.3.4). This also explains why the Practitioners who participated in this question numbers only 132.

As one Practitioner put it:

> *My course was seriously lacking in encouraging students to problem-solve, or initiate group discussions etc. It was 'read the notes, memorise, and study for the exam.' I feel that I have missed out on opportunities to learn how to improve my 'generic skills'.* [P25, c7]

The following student's response reflects the use of computer technology simply as a mode of transmission without necessarily improving student learning:

> *By 3rd year most lectures were computer based with just reiteration in scheduled lecture times.* [S8004, c7]

5.5 Research Question 3d: What are the main teaching strategies in MRS courses?

Question 8 on Course Information seeks to identify the main teaching approaches of MRS courses experienced by respondents. The answer to this question indicates whether the teaching methods used are student-centred, as they are likely to promote lifelong learning attributes. The results of the National Survey on Students and Practitioners are tabulated against one another in Table 5.3.

5.5.1 Three Main Teaching Approaches

Between the current and previous MRS courses experienced by the Students and Practitioners respectively, the three main teaching methods – clinical placement, lecture/tutorial mode and laboratory/practical sessions – remain unchanged, although there is a switch in the first two places (see Table 5.3). It came as no surprise that clinical placement and laboratory/practical sessions are two of the main teaching approaches experienced by Students and Practitioners. MRS is a vocation with a 'hands-on' approach. Since these two methodologies embody the practical element, they therefore form the major teaching component of the MRS courses.

The traditional mode of didactic teaching is the second most often used teaching method in current MRS courses, registering a drop from 98% use in previous courses to 93% in current programs. This could be due to some Schools employing a mixture of teaching methodologies, instead of total reliance on lecturing, plus one university adopting a total PBL approach.

Table 5.3

Main teaching approaches experienced by Students and Practitioners in their MRS courses

The following are some of the common teaching methods that are used in many courses. Please tick all the methods that you experienced in your course.

(see Practitioner Survey: Question 8 of Section C/ Student Survey: Question 8 of Section B)

	Student *(n =304)*		****Practitioner*** *(n =323)*	
Teaching approaches	%	Ranking	%	Ranking
Clinical attachment	96.4	1	97.2	2
Lecture tutorial mode	92.8	2	98.5	1
Laboratory/practical session	91.8	3	91.6	3
Computer-based learning	77.3	4	43.7	7
Role play	67.1	5	60.4	4
Problem-based learning	62.8	6	38.1	8
Web access learning	62.2	7	12.4	11
Self-directed learning	61.2	8	35.3	9
Audio-visual module	56.9	9	54.5	5
Peer learning	54.9	10	46.4	6
Reflective practice	47.7	11	17.3	10
Mentoring System	6.6	12	8.4	12
Other *(poster presentation)*			0.6	13

*Note: *Practitioners here also include Head of MRS Department*

5.5.2 Other Teaching Methodologies

The trend in teaching strategies can be compiled by comparing the data obtained from the Practitioner Survey (previous course) and the Student Survey (current course) (see Table 5.4 and Figure 5.1).

Table 5.4

Comparison of teaching approaches between current MRS courses (Students) and previous courses (Practitioners)

A positive value indicates that the teaching approach has been used more often in the current courses compared to the previous (Practitioners') programs. Likewise, a negative value reflects that the teaching approach is used less often in current courses.

Teaching approaches	Percentage difference between Students and Practitioners
Web access learning	49.8
Computer-based learning	33.6
Reflective practice	30.4
Self-directed learning	25.9
Problem-based learning	24.7
Peer learning	8.5
Role play	6.6
Audio-visual module	2.4
Laboratory/practical session	0.2
Lecture tutorial mode	-5.7
Mentoring System	-1.8
Clinical attachment	-0.8

*Note: *Practitioners here also include Head of MRS Department*
n = 304 (Students), n = 323 (Practitioners)

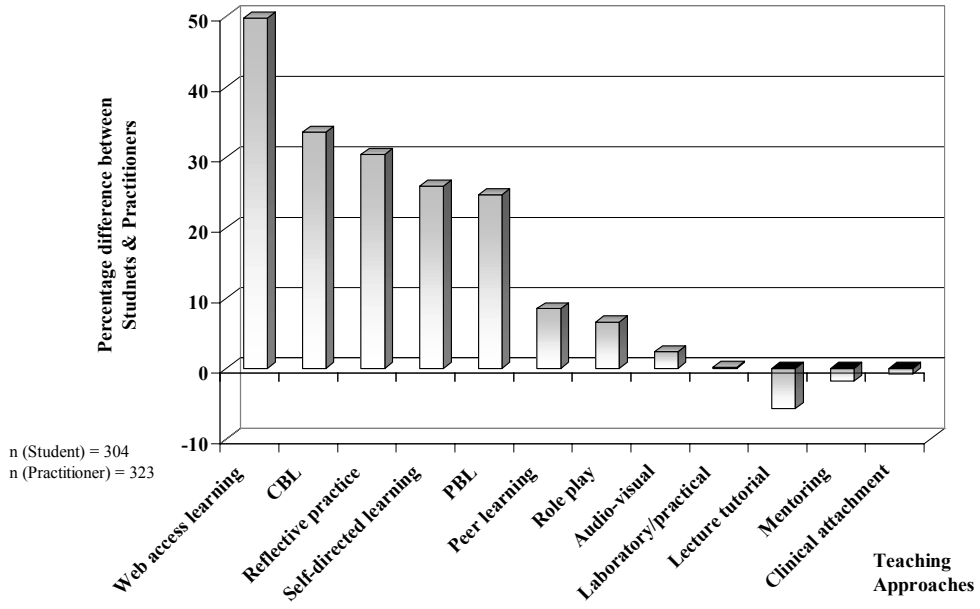


Figure 5.1

Comparison of teaching approaches between current MRS courses and previous courses

When comparing the Students' and Practitioners' statistics, not unexpectedly, there are big increases in IT based teaching methods, such as computer-based learning (CBL) and web access learning, with the latter registering a 50% increase in popularity (see Table 5.4 and Figure 5.1). In addition, in line with the educational trend towards more student-centred learning, Students are also indicating there is a big swing towards PBL and self-directed learning, together with a 30% increase in the use of reflective practice.

By the same token, one would expect peer learning, which is also a form of student-centred learning activity, to register similar large increases. However, peer learning registers only an 8.5% increase (see Table 5.4 and Figure 5.1). One possible reason for the small increase is that peer learning is a common form of informal learning activity in laboratory sessions, and this could account for the existing 46% already registered by the Practitioners in the previous MRS courses (see Table 5.4). On the other hand, the slight increase in peer learning could be due to the increased number of group and assignment projects, poster presentation and PBL approaches that is the current trend amongst MRS schools as discussed previously in Research Question 3a.

Role-play is used extensively for learning positioning techniques in laboratory sessions whereby students role-played patients and practitioners to simulate the clinical environment, thereby accounting for the 67% and 60% in current and previous courses respectively. Role-play is a student-centred form of learning, providing an ideal method of learning patient care, communication skills and team work (Sim, 1999). However, the findings did not reflect a substantial increase in this method of teaching.

With the advent of computer-based programs, one would expect the popularity of audio-visual modules to decrease instead of the slight increase in use. Mentoring system was the other method of learning that registered a drop. Possible reasons could be due to the larger class size and the current clinical environment, which puts greater emphasis on patient throughput, rendering mentoring impractical between practitioners and students. One senior Practitioner commented on the invaluable learning experience that she acquired via mentoring during his/her cadet training

days and lamented on the lack of such opportunities for current students (Adams, 1999a).

5.5.3 Trend towards Lifelong Learning

The lecture tutorial mode of teaching remained within the top three ranking. The lecture is a 'teacher-focused' strategy of information delivery that runs contrary to the 'student-focused' form of learning (Biggs, 1999a) which lifelong learning aims to promote. According to Bligh (cited in Hodgson, 1997), while didactic teaching remains an useful method of transmitting information, it does not promote critical thinking and self-directed learning.

On the other hand, the increasingly popular CBL, PBL, reflective practice, peer learning, web access and self-directed learning are teaching methodologies that require lifelong learning skills (Macdonald, Mason and Heap, 1998; Sambell and McDowell, 1998; Toohey, 1999). Both CBL and web access learning require information literacy skills and, depending on how the programs are constructed, both methods will also necessitate some degree of self-directed learning.

Thus, although the lecture remains the main method of teaching, there are evidence from the data gathered that there is an overall move towards lifelong learning. The question remains as to how much of this trend is a direct result of a conscious effort by the MRS Schools towards lifelong learning or due to the incidental consequences of an IT push by universities or a combination of both.

5.6 Research Question 3e: What are the main assessment methods being used?

This question seeks to identify the main assessment methods experienced by respondents. The purpose of this question is to establish whether the assessment methods employed are in line with the teaching approaches established in Section 5.5.

5.6.1 Three Main Assessment Methods: Written Test and Exam, Assignment Writing and Clinical Assessment

The three most commonly used assessment methods for both Students and Practitioners –written test/semester exam, clinical assessment and assignment writing – remain unchanged. The responses indicate that the traditional methods of assessment, namely test/exam and assignment writing, remain popular. Clinical assessment, which usually takes the form of hospital evaluation, constitutes the main method of assessment of student performance in clinical (see Table 5.5).

Table 5.5
Main assessment methods experienced by Students and Practitioners in their MRS courses
Please tick all the assessment methods you experienced in your course.
(see Practitioner Survey: Question 9 of Section C/ Student Survey: Question 9 of Section B)

	Student *(n =304)*		***Practitioner** *(n =326)*	
Assessment methods	%	Ranking	%	Ranking
Test &/or semester exam	99.0	1	98.5	1
Clinical assessment	99.0	2	95.1	3
Assignment writing	96.7	3	95.4	2
Oral presentation	96.1	4	85.6	5
Practical exam	85.9	5	88.7	4
Peer assessment	60.9	6	36.5	6
Open book exam	54.6	7	30.7	7
Computer based assessment	52.3	8	23.9	8
Reflective journals	40.8	9	13.5	9
Self assessment	33.9	10	12.3	10
Other *(thesis, posters, oral/viva exams)*	1.0	11	1.5	11

*Note: *Practitioners here also include Head of MRS Department*
The responses are not mutually exclusive as respondents can experience several assessment methods Simultaneously.

5.6.2 Other Assessment Methods

Computer based assessment registered the largest increase (28%), followed by reflective journals, peer assessment, open book exams and self assessment (see Figure 5.2 and Table 5.6). This increase in popularity reflects the surge in popularity of IT based and self-directed teaching methods indicated in Table 5.4.

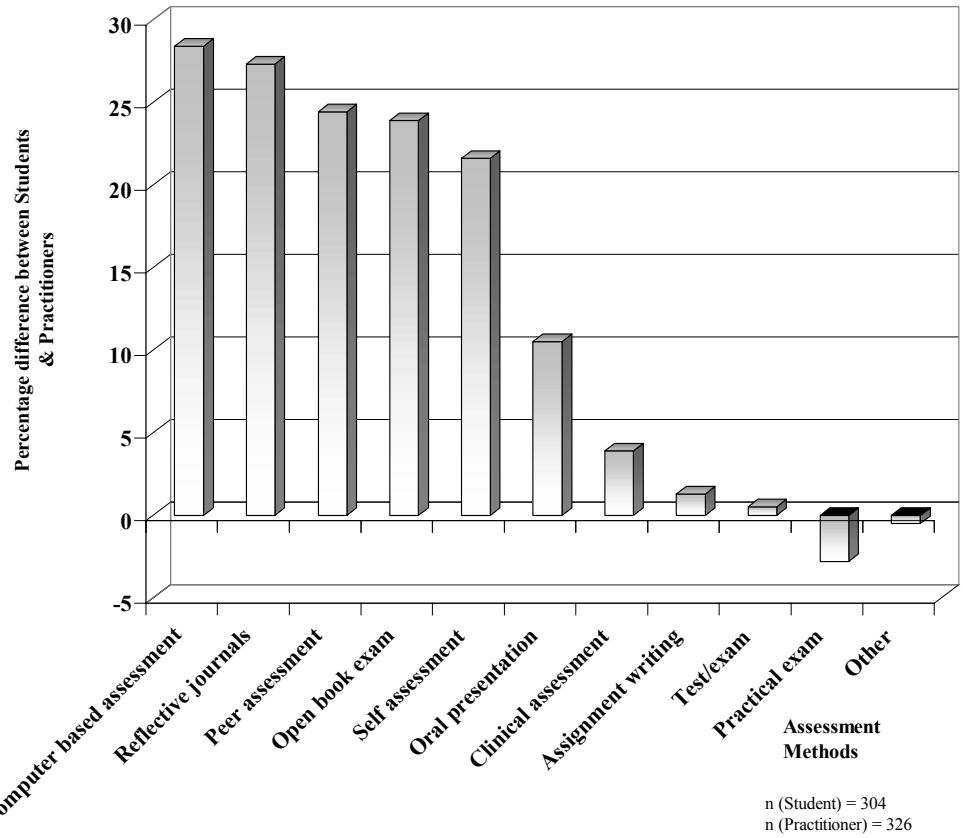


Figure 5.2
Comparison of assessment methods between current MRS courses and previous courses

Table 5.6
Comparison of assessment methods between current MRS courses and previous courses
A positive value indicates that the teaching approach has been used more often in the current courses compared to the previous (Practitioners') programs. Likewise, a negative value reflects that the teaching approach is used less often in current courses.

Assessment Methods	*Percentage difference between Students and Practitioners*
Computer-based assessment	28.4
Reflective journals	27.3
Peer assessment	24.4
Open book exam	23.9
Self assessment	21.6
Oral presentation	10.5
Clinical assessment	3.9
Assignment writing	1.3
Written test/exam	0.5
Practical exam	-2.8
Other	-0.5

*Note: *Practitioners here also include Head of MRS Department*
n = 304 (Students), n = 323 (Practitioners)

5.6.3 Non-alignment of Assessment Strategies with Teaching Approaches

Although assessment methods that are IT based and with a self-directed component (see Figure 5.2 and Table 5.6) showed an increase in use, Table 5.5 shows that the assessment methods of current courses remain ranked in the same order as in previous courses. This is significant as it indicates that although the trend is towards lifelong learning teaching approaches, MRS Schools are still relying on the same method of assessments to the same degree as in previous courses.

For example, a course that actively promotes lifelong learning would use self and peer assessment as one of the major methods of assessment (Sambell and McDowell, 1998). This is because these assessment strategies assist and develop students' ability to assess their own performance, an essential characteristic of a lifelong learner. However, both peer and self-assessment remain in the 6th and 10th ranking in both current and previous MRS courses. This further suggests that although current courses are adopting teaching methodologies that are more lifelong learning inclined, these efforts are not matched with assessment strategies that promote lifelong learning.

5.7 Research Question 3f: What are the factors identified by students and practitioners that are crucial in enabling both students and practitioners to become MRS practitioners?

Question 10 of the Student and Practitioner Surveys was an open-ended question, which invited respondents to select factors that they consider to be crucial in enabling them becoming MI/MRS practitioners. The researcher has classified the responses into seven categories as shown in Table 5.7. The criteria that determine the groupings are the number of times the factors were listed, indicating the importance, which the respondents attached to the factor(s).

5.7.1 Three Most Crucial Factors: Clinical Placement, Instructional Approach and Instructional Style

Both Students and Practitioners agree only on the first three factors. They cited clinical placement to be the most important factor in assisting their transition to practitioners (see Table 5.7).

Table 5.7
Factors identified by Students and Practitioners as crucial in enabling them to become MRS Practitioners
Please add comments about any aspect of your course that you feel has assisted you to develop the essential characteristics of a Medical Imaging/MRS practitioner.
(see Practitioner Survey: Question 10 of Section C/ Student Survey: Question 10 of Section B)

Crucial Factors	Student (n =165)		*Practitioner (n =84)	
	%	Ranking	%	Ranking
Clinical placement	88.5	1	85.7	1
Instructional approach *Laboratory sessions* *Self-directed learning*	34.5	2	22.6	2
Instructional style *Good interpersonal relationship with lecturers* *Enthusiasm of lecturers*	3.6	3	4.8	3
Assessment *Clinical assessment & practical examination*	2.4	4	1.2	6
Lifelong learning and Generic skills *Ability to work as part of the team* *Ability to learn new concepts and adapt to clinical* *Ability to work independently and take responsibility for our work*	1.8	5	-	-
Professional issues *Professional approach to work was encouraged* *Keen interest and active involvement in profession* *Importance of Professional Development Year (PDY)*	-	-	3.6	4
Others *Cadet scheme, Ability to think laterally*	-	-	4.8	3

*Note: *Practitioners here also include Head of MRS Department*
- indicates no response
The responses are not mutually exclusive
The figures quoted here for n (Practitioners and Students) reflect the number of valid responses to this section.

Listing clinical placement as the most crucial factor is to be expected. This is because MRS is a "very practical course" [S7001, b10]. **Clinical placement** therefore provides the vital link between theory acquired and the actual working environment.

> *The amount of time spent in the clinical/hospital environment is excellent – you really get to put into practice what you have been studying and learnt about. You get to deal with 'real' patients, not hypothetical situations.* [S1003, b10]

Aside from providing the vital link between theory and practice, clinical attachment also "helped to boost confidence in own abilities" [S4004, b10]. It also assists in developing and promoting other practical aspects of the practitioner as the following quote illustrates:

> *Clinical practice helped develop patient handling and communication skills and learn to interact as part of the health care team.* [S8001, b10]

How respondents view the value of the clinical component of the course is underlined by the following quotes:

> *Clinical placements are where the majority of my learning occurs.* [S1005, b10]

> *Clinical orientation reinforced how 'different' a 'patient orientated' environment is, especially for some still maturing in their early twenties.* [P56, c10]

Although most students find their initial clinical experience to be rather daunting, they often find it to be "invaluable and enjoyable", assisting them to "develop radiographic technique/imaging, patient care, technical aspects which are important components of being a diagnostic radiographer" [S1014, b10].

The importance with which respondents regard clinical work experience placement in the development of professional skills is evidenced by the number of times in which Students (89%) and Practitioners (86%) listed clinical placement to be the most important factor (see Table 5.7). This is because clinical placement exposes the students to the professional culture and workplace practice, as well as providing an

easier transition from theory to practice (Alderman and Milne, 1998). It therefore forms an integral part of the students' learning experience.

35% of Students and 23% of Practitioners nominated the **instructional approach** as the second most important factor with laboratory sessions and self-directed learning as the most commonly cited helpful aspects of the course.

Interestingly **instructional style** came in third, with having a close interpersonal relationship between lecturer and students [S4007, b10] and "enthusiasm of lecturers to encourage scientific investigations" as the key factors that assisted in their development [P544, c10].

5.7.2 Other Crucial Factors

Another factor closely associated with course structure includes clinical assessment. As admitted by one Practitioner:

> *Clinical assessment – absolutely nerve wracking* [sic]*, was good as it forced you to put into practice every part of your training, both clinical and theoretical.* [P108, c10]

Some Students also cited the attainment of generic and lifelong learning skills as being useful in their development as a practitioner. This includes the ability to work as part of a team, taking responsibility for their own learning plus the ability to apply their newly acquired knowledge to the profession. Interestingly, aside from clinical skills, the Practitioners did not list generic and lifelong learning skills as crucial.

Students, unlike the Practitioners, did not include professional issues (listed in Table 5.6) – probably because they do not see professionalism as directly impacting on their clinical competence.

5.8 Summary of Findings in the Higher Education Sector

All MRS Schools, as indicated by the HOS, promote lifelong learning as their course objective. Compared to Practitioners' responses, more students in current MRS courses are assuming increasing responsibility for their own learning as they progressed through the course. Results from the data analysis indicate that there is a general trend towards adopting teaching strategies that promote lifelong learning. However, assessment methods that promote and evaluate lifelong learning were lagging behind. This is evidenced by the fact that teaching approaches that require lifelong learning skills, such as PBL, reflective practice, peer learning, web access learning and self-directed learning, registered a large increase from previous courses. As a result of these increases, the ranking of lifelong learning teaching approaches improved. However, the ranking of assessment methods that evaluate lifelong learning remained the same, indicating that lifelong learning attributes were not assessed to the same extent. In short, there is non-alignment of teaching approaches and assessment methods.

MRS teaching staff recognised the importance of Higher Education to promote and cultivate lifelong learning. However, one of the most important findings is the concern about the conflict that currently exist between university culture and workplace culture. The MRS profession does not embrace and support lifelong learning as the workplace, in general, is not conducive for lifelong learning. This negative learning culture, if left unchecked, may prove to be the greatest obstacle to the promotion of lifelong learning amongst MRS students and practitioners. This is because the workplace culture often influences and directs the employees' learning processes (Davies and Nutley, 2000).

Clinical placement, instructional approach and instructional style were the three major factors identified, by respondents of the Practitioner and Student Surveys, that were crucial in assisting them to become Practitioners. Measures must be put in place to ensure students maximise their learning during the clinical placement. This highlights the importance of professional staff development, in ensuring that teaching staff are adopting the appropriate instructional approaches and instructional style to assist students to become effective learners.

Chapter 6

Discussion and Implications

In this chapter the findings detailed in Chapters 4 and 5 will be summarised to give an overall picture of the data obtained. These findings will then be discussed in relation to lifelong learning. Finally, based on the discussion and the data collected, the implications and recommendations for both the Profession and Higher Education will be presented.

6.1 Summary of Findings

6.1.1 Professional Sector

6.1.1.1 Profile of MRS Practitioner as a Lifelong Learner

The MRS academics' view of a practitioner as a lifelong learner are similar to Candy et al. characteristics of a lifelong learner (See Chapter 2, Section 2.1.3).

A MRS practitioner with lifelong learning attributes will be one who has:

- an inquiring mind; a practitioner who is motivated to seek more information to provide a better service to his/her patients;
- helicopter vision; an appreciation of being part of the health care team. The practitioner is able to work well as part of the multi-disciplinary team and maintains a good working relationship with his/her patients;
- information literacy skills; has the ability to access information from various sources and is able to critically evaluate the acquired information;
- sense of personal agency; the practitioner is capable of self assessment and thus is able to monitor his/her own performance; and
- range of learning skills; has a wide repertoire of learning skills such as critical thinking and reflective thinking as opposed to just rote learning.

While not referring directly to Candy's latest addition of interpersonal skills, participants of the focus group discussion highlighted the importance of group work skills since the MRS profession is based on a team approach.

All of these factors culminate in a practitioner who is able to translate the above attributes into visible benefits, and is capable of providing a continuously improving service to the patients. Practitioners with lifelong learning attributes are more proactive and are better prepared to propel the profession forward in this time of uncertainty.

6.1.1.2 Prioritisation of Attributes

The data obtained show that the three stakeholders, Practitioners, HOD and Students, regarded all attributes listed in the survey namely professional, generic and lifelong learning, as important attributes for MRS practitioners to attain (See Chapter 4, Section 4.4). By taking the weighting factor into consideration, it can be seen that the stakeholders were unanimous in the way in which they prioritised the attributes. Overall, professional attributes peaked at the high priority end, followed by generic attributes, with lifelong learning attributes remaining at the lower end of the priority scale.

Closer scrutiny of the way in which the attributes were prioritised revealed an underlying principle. In rating the attributes, the stakeholders were in effect making a distinction between types of competencies. In general, attributes that were directly related to clinical competence were more highly regarded, while attributes that were perceived to be not directly related to actual job performance such as one's ability to continue learning, have been relegated to a lower level of importance. This explains why professional attributes such as ability to apply knowledge, verbal communication skills with patients, clinical skills in handling patients and knowledge of discipline were located high on the list for all stakeholders.

Likewise, generic attributes, such as the ability to communicate with peers, working in a team and working independently, were rated more highly than the ability to use appropriate computing skills and ability to take the lead.

This same principle extends to the prioritisation of lifelong learning attributes. Within this cluster, attributes which influence one's clinical performance such as ability to find practical solutions, adapt to change, self-evaluate and manage time, were regarded to be more important. In contrast, attributes such as information literacy, ability to set goals, management of one's own learning and confidence to continue learning, have been allocated much lower priority.

6.1.1.3 Difference between Perceived Level of Importance and Current Attainment Level

Statistical analysis using t-test showed that for each of the 25 attributes listed, there was a significant difference at the 0.01 level between the perception of importance and attainment level, with the current level of attainment perceived as falling below the expected level of importance (See Chapter 4, Section 4.6). This is an important finding for the profession since it implies that there is much room for improvement for practitioners on all fronts, professional, generic and lifelong learning attributes.

Professional and lifelong learning attributes were perceived to be the most lacking. It is important to note that the same professional attributes that have been highly prioritised by all stakeholders have also been identified as having the largest difference existing between their importance and attainment level. These include

attributes such as verbal communication with patients, clinical skills in handling patients, ability to apply and share knowledge, and professional attitude to work. The lifelong learning attributes, which have been recognised as having the largest gap between importance and attainment level, were willingness to learn new things, ability to see the 'big picture', adapt to change, self-evaluate and ability to manage one's own learning. In general, HOD perceived the gap to be the widest, followed by Practitioners and Students.

6.1.1.4 Selection Criteria for Graduates

A significant finding emerged with regard to selection criteria for graduates who are entering the workforce for the first time (See Chapter 4, Section 4.8). With the exception of one WA employer, lifelong learning attributes were not included as essential selection criteria. The only reference to lifelong learning was a "demonstration of commitment to continuing professional development", and this was included as an essential criterion in only one public teaching hospital. The other public teaching hospitals listed this same criterion as desirable, while there was no mention of this commitment or any lifelong learning attributes from the private sectors' list. The implications of this finding will be discussed in Section 6.2.

6.1.2 Higher Education Sector

6.1.2.1 MRS Schools' Commitment to Lifelong Learning

Responses from all HOS showed that their Schools explicitly promote lifelong learning (See Chapter 5, Section 5.2). Findings indicated that most Schools used similar strategies to promote lifelong learning activities. Examples cited include the promotion of critical appraisal and IT literacy skills, literature review exercises, case studies, presentations, collaborative group work such as poster presentation and research projects for final year students. Some Schools employed contract learning in their theoretical subjects while others used contract learning and reflective journals in their clinical programs.

6.1.2.2 Academics' Views on Lifelong Learning in the Profession

HOS also supported the finding that lifelong learning is not an essential selection criterion for graduates entering the workforce, it is only an important consideration when practitioners seek for promotion.

There was consensus amongst all academics that it is desirable to develop and cultivate lifelong learning attributes amongst MRS students, and that universities should provide a conducive learning environment to promote these attributes.

Both HOS and academics expressed concern over the lack of support for lifelong learning in the MRS workplace (See Chapter 5, Section 5.3). MRS is a profession whereby adherence to protocol is the expected norm and practitioners therefore are expected to follow the routines rather than to challenge the status quo. As such, practitioners often feel threatened by students who are critical thinkers and question or challenge the rationale of standard practice. Some also noted that there is a prevalent subservient attitude amongst many practitioners in the profession. However, there is an expressed hope that, as more lifelong learning graduates venture into the profession, the workplace culture will slowly evolve to accept lifelong learning.

6.1.2.3 Students Assuming Increasing Responsibility for their own Learning

70% of the Students, who responded to the question of increasing responsibility, indicated that they were required to assume more responsibility for their learning, with only about 10% indicating they were not required to take on more responsibility (compared to 40% and 35% respectively of the Practitioners' responses) (See Chapter 5, Section 5.4).

There are two aspects to this increased responsibility. First, current students are assuming more responsibility for their own learning as they progress through the course. Second, they have indeed been given more responsibility for their own learning compared to the Practitioners.

From the respondents' comments, this swing towards assuming more responsibility can be attributed to three main factors:

- adopting a total PBL approach; students who experienced the total PBL approach were unanimous that they were given more responsibility for their own learning;
- mixture of teaching methodologies; the teaching methods experienced by students here included the traditional lectures, PBL, and peer learning; and
- research projects; in the form of final year research project where students were expected to work on their own with limited supervision and guidance from lecturers.

6.1.2.4 Main Teaching Approaches of Current MRS Courses

The three main teaching approaches were clinical attachment, laboratory sessions and lecture tutorial mode, with both Practitioners and Students identifying the same three factors (See Chapter 5, Section 5.5). Given that MRS is a practical-oriented vocation, it is not surprising that Schools continue to use both clinical attachment and laboratory sessions as the main teaching methods.

Although the traditional mode of didactic teaching remains the most commonly used method of teaching, comparative figures from the Students and Practitioners' data indicated an increased popularity of CBL, PBL, reflective practice, peer learning, web access and self-directed learning in current courses. This is a significant finding since it indicates that there is a swing towards adopting teaching approaches that require students to use lifelong learning skills.

6.1.2.5 Main Assessment Methods of Current MRS Courses

Assessment strategies that are IT based as well as those that incorporate some element of self-directed learning, registered an increase in popularity in current courses (See Chapter 5, Section 5.6). However, there is one distinct difference between the trend seen in assessment methods and the increased popularity of lifelong learning teaching methodology.

While teaching approaches that require lifelong learning skills have increased to assume the top ranking in current courses, the assessment methods in current courses remained in the same ranking compared to the previous MRS courses. This implies

that although more lecturers are using assessment methods that are in keeping with lifelong learning teaching approaches, Schools in general are still relying to the same degree on the assessment methods as used in previous courses. On evidence, therefore, there seems to be a mismatch between teaching approaches and assessment methods.

6.1.2.6 Crucial Factors in Enabling Students to Become MRS Practitioners

Both Students and Practitioners listed clinical placement as the most important feature of the course that assisted them in their transition to practitioners (See Chapter 5, Section 5.7). Respondents indicated that this was where the majority of learning took place as clinical placement provided the vital link between theory and clinical. It provided them with the opportunities to put into practice what they have learned in university, thereby boosting their confidence as well as increasing their motivation to learn. Being able to experience the clinical environment allowed the students to learn to interact with patients first hand and to function as part of the health care team.

Students and Practitioners both identified instructional approach and instructional style as the second and third most important features of the MRS course. This signals the crucial role these factors assume in the nurturing of future practitioners.

6.2 Discussion of Findings

6.2.1 Professional Sector

6.2.1.1 Significant Gap between Perceived Level of Importance and Current Attainment Level

Findings from the study indicated that for all the professional, generic and lifelong learning attributes listed, there was a significant gap between the perceived level of importance and perceived current level of attainment. In addition, professional and generic attributes were found to be most lacking. There are some possible reasons for these large differences. First, Practitioners may feel that it is natural to have a gap between the importance of attributes and actual attainment level, as one seldom

achieves the ideal. Second, these differences may also be reinforced by the fact that a number of the attributes may be unfamiliar to some Practitioners as this may be the first time that they were presented with the opportunity to rate the attributes. This is particularly true for lifelong learning attributes. Finally, the discrepancies indicated here are indeed reflecting the Practitioners' dissatisfaction with the current level of attainment. Given that professional attributes have been identified to have the largest deficiency, the question remains as to how much of this dissatisfaction is also due to the failure of current graduates meeting the practitioners' expectations of clinical competence.

The following section examines the issue of clinical competence as viewed by Practitioners.

Clinical Competence: What do Practitioners expect from MRS Degree Graduates?

Of the 128 open-ended comments by Practitioners, 62% were related to lack of clinical competence amongst recent graduates and students. The recurring theme in these comments was that MRS is a 'hands-on' profession, hence the importance of having sufficient hours to 'practise'. Many compared their cadet and diploma training where they had intensive clinical contact, to the reduced number of clinical hours in current courses. Some simply lamented on the lack of 'hands-on' while others clamoured for the return of more clinical hours.

> *In the certificate course, the majority of your training was spent watching, learning, practising and using your practical skills. Clinical time in the current courses is far too short as Radiography is a 'hands-on' practical science and students are not learning these practical skills in the time allocated.* [P473, c0]

> *The certificate courses where you had three full years of clinical application with lectures at night produced radiographers with excellent practical skills which are sadly lacking in current university based students because of lack of clinical experience.* [P370, c0]

Clinical competence is high on the agenda of the respondents as the following quotes illustrate:

> *I feel we had a big advantage over the way MRS practitioners are trained today. Too much emphasis is placed on academia and not enough importance is given to the clinical training today. More clinical practice is needed to produce competent practitioners. It still is for the most part a very 'hands on' job.* [P342, c0]

> *Practical skills in an hospital environment is essential to gain competence and skill. Today there is not enough 'hands on' time allowed to reinforce the theory studied so diligently.* [P 381, c0]

Many equated the considerable time they spent in clinical during their training as an essential prerequisite to being a good practitioner.

> *…The quality and quantity of our clinical time far outweighed any of the degree courses. As a result upon qualification, I was truly a qualified radiographer.* [P371, c0]

> *As a cadet radiographer, the amount of time spent in a working environment enabled us to be good practitioners.* [P502, c0]

This sentiment is shared by at least one current student as the following quote illustrates:

> *Radiography should not be a graduate course. More practical time as diploma produces better quality Radiographers!!!* [S4001, b10]

That a current student should be advocating a return to the diploma training suggests the failure of the current education system to impress upon this student that aside from professional and clinical competence, a university degree should also broaden educational context and foster other skills that are necessary for continuing learning.

While it is true that clinical competence defines a competent practitioner, is clinical competence the sole criterion for defining a responsible MRS practitioner? This raises the question of what practitioners expect from MRS degree graduates. Should practitioners be judging degree graduates simply by their clinical competence alone?

Penington (1993, cited in Chapman, 1999, p. 131) maintained that "Higher education is about excellence, not about [clinical] competence". However, excellence and clinical competence are inter-related. In a practical discipline like MRS, one cannot have excellence without clinical competence; although some practitioners may choose to argue that clinical competence alone is the sole criterion for excellence.

While clinical competence is extremely important and is part of society's expectations of any health practitioners, there are dangers in making clinical competence the sole objective of any MRS course.

First, focusing on clinical competence alone would restrict graduates and practitioners to maintaining proficiency only in the current job. It follows then that, although they may perform their current functions very well, the knowledge and skills of most practitioners would remain stagnant. Such a shortsighted objective is detrimental to the profession as rapid changes in MRS technology often render 'current' job competence and knowledge obsolete within a few years.

As one Practitioner noted, change is a constant feature in MRS profession.

> *In my 35 years of Radiography, change has been a constant in my professional life; equipment, attitudes, workplace safety etc. I have all changed for the better and radiographers who don't continue to change and grow, will, and should, be left behind.* [P143, b0]

Aside from clinical competence, one of the main objectives of a university professional degree should be to help students to develop the necessary learning competencies and lifelong learning attributes to enable them to cope with these changes. As suggested by Bowden and Marton, university education is about

"learning for an unknown future" (Bowden and Marton, 1998, p. 115). This, in turn, would ensure that future job functions are more achievable in practitioners who are better equipped to continue learning on their own (Houle, 1980).

The importance of helping graduates to develop the capacity to continue learning was acknowledged by one HOD:

> *....the degree radiographers are extremely good value. Sure they may not have had as much clinical exposure as the radiographers of days gone by, but they are very knowledgeable and quick to learn whatever area they are allocated to....they're excellent value and I would never change back to the old diploma, associate diploma or certificate courses.*
>
> (Petroni, 1999)

Second, another outcome of university education is that the graduate should also acquire a wider perspective, with an inquiring and creative approach (Candy, Crebert and O'Leary, 1994; Beetham, 1998). Focusing only on clinical competence inevitably diminishes the importance of other worthy objectives the course aims to achieve (Barnett, 1994). Students may start regarding any subjects that are unrelated to workplace performance as irrelevant (Chapman, 1999). This, in turn, will defeat the push in Higher Education on preparing students for future continuous learning and their role in forging new knowledge frontiers.

In fact, one of the reasons for upgrading the MRS qualification from a diploma to a degree level was the desire to increase the knowledge base of graduates and practitioners in order that they can be helped to expand their role further in the foreseeable future (Ryan, 1998; Durrington, 1999). Practitioners are the custodians of MRS expertise; they are therefore well placed to fully make use of their acquired knowledge and clinical skills to broaden their professional knowledge and clinical practice. Anything less than that would be deemed a failure to maintain and advance the profession and service to patients. There are increasing discussions on practitioners assuming new roles such as limited film reporting and venipuncture (Smith, 1995; Field-Boden, 1996; Field-Boden, 1997; Durrington, 1999; Hall,

Kleemann and Egan, 1999). The following quote illustrates the aspirations of some practitioners:

> *....we must be prepared to move forward into the 21st century and finally leave behind the 19th century restrictions which were placed on the early radiographers by the medical profession.*
>
> (Jeffery, 1999)

Thus, MRS undergraduate education must not be reduced to simply one of producing clinically competent MRS practitioners. As Chapman says, "Education should expand possibilities, not contract them" (Chapman, 1999, p. 133).

Therefore there needs to be a balance between ensuring there is sufficient time in MRS courses to develop the basic clinical skills as well as enabling graduates to develop the essential lifelong learning attributes that are so crucial in the survival, progression and expansion of the profession. Lifelong learning equips practitioners with the abilities to forge new knowledge frontiers, which in turn result in better outcomes for patients. Thus, the issue of clinical competence alone must not be allowed to drive the curriculum in Higher Education (Chapman, 1999).

As Adams, HOD from a paediatric hospital, puts it (Adams, 2000):

> *... our knowledge has to grow beyond what we learn from textbooks and the manufacturers. We gain a generic knowledge from these sources but we then have to learn to optimise the tools for the task and this can usually only happen by diligent practice and research in the clinical area.*

Lifelong learning is the key to unlocking that potential. This points towards the importance of promoting investigative and research skills as part of lifelong learning agenda in undergraduate courses.

The emphasis by respondents of the Practitioner Survey towards more clinical hours supports the research findings that the trainee style of learning is still very much part

of health care learning (Wilson and Pirrie, 1999). The MRS profession is therefore currently facing the widening gulf of expectations arising from the transition of cadet/diploma hospital-based training to degree university-based training. There are now two 'opposing camps'. What was previously a task-oriented (practice-based) learning environment versus a new learning culture that, although still task-oriented, is now also placing greater emphasis on critical thinking, clinical judgement, autonomy of practice and role diversification (Bechtel, Davidhizar and Bradshaw, 1999).

The employers, the AIR and MRS Schools must set up an active dialogue to discuss and address these widely different expectations of MRS workplace versus Higher Education. Failure to achieve consensus between these stakeholders will result in the continuation of the current scenario of practitioners being dissatisfied with recent graduates. It is also likely that the practitioners' view on the current inadequacy of the clinical competence level would influence student motivation and willingness to develop the skills that are required for future learning (Toohey, 1999). Practitioners have to see beyond the issue of clinical performance and share with students the need to develop these learning competencies. Thus greater collaboration between the employers, AIR and the MRS Schools to allow the re-alignment of professional expectations with the outcomes of the MRS courses and vice versa, is essential for the future and ultimate betterment of the MRS profession.

MRS Profession is not Alone!

On the issue of clinical competence, the common theme in the Practitioners' responses is that the current MRS programs failed to prepare students adequately for their clinical duties as practitioners. Such sentiments are not confined to MRS education. Medical education has also been reported as failing to prepare medical graduates adequately for medical practice (Lowry, 1992).

With regard to the perceived difference between importance and attainment level, it is significant that both HOD and Practitioners perceived this gap to be widest. This indicates that the stakeholders who are directly involved in the workplace were of a similar opinion about the existence of the perceived deficiencies.

However, it must be noted that such discrepancy is not confined solely to the MRS profession. Similar findings were also reflected in other studies (Higher Education Council, 1992a; Candy, Crebert and O'Leary, 1994; Halsall, Hustler, Carter et al., 1995; Goldfinch, Laybourn, MacLeod et al., 1998), with the most recent being funded by the Department of Education, Training and Youth Affairs (DETYA), investigating employers' satisfaction with new graduates' skills.

In the DETYA study, employers were asked to assess 25 skills and attributes across 4 skill groups: basic competencies, basic skills, academic skills and other personal qualities. Employers also identified most of the skills listed in the DETYA study as important (ACNielsen Research Services, 2000). More significantly, like the MRS findings, none of the industry surveyed scored university graduates as performing well in all or most of the skills that were being assessed. The performance ratings of new graduates who were successfully employed were judged only to be reasonable, with unsuccessful applicants faring far worse (ACNielsen Research Services, 2000). Although the sectors involved in this study were more extensive, ranging from engineering to the hospitality, manufacturing and transport industries, the findings nevertheless parallel the data obtained from the national surveys of MRS Practitioners and Students.

6.2.1.2 Non-alignment of Beliefs (Perceived Importance of Lifelong Learning) and Current Practice in the MRS Workplace

The importance and relevance of lifelong learning to the MRS profession have been endorsed by academics. This importance is again reinforced in the responses from the National Surveys of Practitioners and Students. Findings from these surveys indicated that the HOD, Practitioners and Students regarded all lifelong learning attributes as important. However, the question remains as to exactly how important this level of importance is as professed by the stakeholders? In other words, within the MRS workplace, how did HOD and Practitioners translate their recognition of the importance of lifelong learning into action?

The answer to the above question can be found in the:

- clash between workplace and university culture;
- lack of research culture in the workplace; and

- selection criteria of graduates who are entering the workforce for the first time.

Workplace and University Culture

The clash between workplace culture and university culture was a major concern expressed by the HOS and teaching staff. Feedback from students indicated that most practitioners were critical and non-supportive of students' lifelong learning endeavours. Practitioners very often felt threatened by students' inquisitiveness and critical thinking approaches. This suggests that practitioners, in general, do not encourage students to develop an inquiring mind, which is an essential hallmark of lifelong learning. This runs contrary to the findings that practitioners viewed lifelong learning as important. In reality, they were not supportive of the very basic trait of lifelong learning, which is the curiosity for learning.

Stifling an inquiring mind inhibits the development of new and better practices and deters research endeavours. This non-conducive environment to learning is supported by the following quote from a Practitioner:

> *Often in the work situation, we are not allowed to have initiative or make decisions. Some aren't given the opportunity to 'broaden their horizon' by employers, bosses etc. - depending on how much importance management sees learning new skills/knowledge in the profession of the radiographer and radiation therapist.* [P354, b0]

This non-supportive learning environment has serious implications for the development and promotion of lifelong learning in the workplace. Lifelong learning is an essential element in enabling practitioners to move forward in this era of rapidly changing technological and social changes. It is likely that students and graduates soon learn that to avoid discouraging comments and ridicule from practitioners, it is easier to adhere to the well-trodden path of routines and protocols. This does not augur well for the long-term development of the profession and ultimately impacts on practitioners' ability to continuously improve their service to the patients.

Some academics held hopes that eventually there will be gradual acceptance of lifelong learning attributes as part of workplace culture, as these attributes are now an important consideration during promotion. In addition, it is hoped that current students who are more attuned to lifelong learning, will bring these values and attitudes into the workforce [A11i; A24i]. These graduates will eventually permeate the profession and lifelong learning will be the norm. However, the profession needs to be more proactive in promoting lifelong learning amongst its members, rather than adopting a 'wait and see hopeful attitude'.

Research Culture in the Workplace

There is an increasing emphasis on the need to undertake research in all health profession (Smith, 1998). However, in a recent study investigating the feasibility of establishing a MRS research centre in WA, little research was being done by the MRS profession (Doug McGhie and Associates, 2000). There is a lack of support for research endeavours from MRS employers. The commitment to continuing learning in the workplace is directed solely at training practitioners for new emerging modalities (Doug McGhie and Associates, 2000). Performance of practitioners is judged essentially by their ability to work efficiently in clearing patient waiting lists, rather than any postgraduate studies or research projects. Research projects are viewed by employers as extravagant undertakings (Doug McGhie and Associates, 2000). WA practitioners surveyed showed little interest in pursuing postgraduate research because it would not enhance their career opportunities nor assist in their advancement within the profession (Doug McGhie and Associates, 2000). These WA findings are likely to reflect a similar picture nationwide.

While it is understandable that employers will direct their support to providing workplace training for their employees, it is inadequate to respond to changes by simply keeping pace with the latest technological development. Practitioners must also assume an active role in shaping their profession. One way of being proactive is to engage in research activities that will not only contribute to the body of knowledge, but will also inform the profession of current and future needs (Pearson and Jones, 1997; Lyons, 1999). This new information and science will in turn improve the understanding of MRS clinical practice and ultimately will lead to better

outcomes for patients. The importance of engaging in research activities is therefore crucial to the long-term development of the profession.

Moreover, it is important for employers to recognise that there are benefits for supporting research activities. This is because research outcomes, individual learning and improved clinical practice, can be successfully assimilated into workplace routines, thereby improving workplace practices (Davies and Nutley, 2000).

Selection Criteria for MRS Graduates

The importance with which employers and HOD regard lifelong learning attributes can be judged indirectly from the selection criteria for graduates who are entering the workforce for the first time. If employers and HOD value lifelong learning attributes, these would be included as essential attributes in the selection criteria for MRS practitioners.

In the public sector there is an indirect reference to lifelong learning with the inclusion of the "demonstration of commitment to continuing professional development". This was listed as an essential criterion in one public hospital, while other public hospitals classified the same criterion as desirable. There is no mention of lifelong learning in the private sector. The reference to commitment to continuing professional development is a vague criterion that could embrace any of the lifelong learning traits. Being new to the workforce, graduates would have difficulties in providing tangible evidence towards "continuing professional development".

Some employers may take the view that an explicit commitment to support employees in their lifelong learning pursuit as leading to an increase in operating costs. Cost consideration is certainly an important factor in the private sector. This may account for the reason why none of the major private sectors in WA include lifelong learning attributes in their selection criteria.

The absence of specific lifelong learning attributes sends a clear message to students and graduates alike – that employers do not regard lifelong learning sufficiently important to be included as part of essential selection criteria. Just as student learning in university is assessment-driven, the exclusion of any lifelong learning attributes as

part of job selection criteria would inevitably result in students paying little attention to the cultivation of lifelong learning attributes during their undergraduate study.

Students themselves must view the attainment of lifelong learning attributes as an important and valued outcome of their studies (Candy, Crebert and O'Leary, 1994). Failure to do so will invalidate and negate any attempts to promote lifelong learning. Thus, while universities are endeavouring to promote and cultivate lifelong learning attributes as a valued and important outcome, students are unlikely to share the same sentiments if these attributes are not regarded as essential and relevant in their future workplace; as evidenced by the workplace culture and job selection criteria.

In summary, although both HOD and Practitioners voted lifelong learning as important attributes for practitioners to attain, analysis of the findings indicated that there is non-alignment between what is considered important and their actions in terms of actual workplace culture and selection criteria.

6.2.2 Higher Education Sector

6.2.2.1 MRS Schools Adopting Lifelong Learning Teaching Approaches

Findings from the present study showed that lectures and tutorials continue to be the most commonly used teaching strategy adopted by most MRS Schools. This is not an uncommon finding as lectures continue to remain the most common method of instruction in Higher Education (Hotvedt and Scotti, 1996).

As lectures are generally content-focused, this may be indicative of MRS courses being more inclined towards a content-based curriculum. Effective development of professional and lifelong learning skills cannot take place if the focus is solely on the content (de la Harpe, Radloff and Wyber, 1999). It is the tradition of healthcare profession to focus more on the content than on developing the appropriate teaching and learning strategies to foster lifelong learning skills (McKay and Kember, 1997). The danger of focusing on a content based curriculum is that over-emphasis on content often leads students to adopt a surface approach to learning. Students rote learn instead of developing critical thinking, reflection, problem solving skills and

lifelong learning skills (Fox and Radloff, 1996). According to Biggs (1999a), the continuation of such traditional model of teaching is due solely to institution tradition.

However, despite lecturing remaining one of the main teaching methods, comparative data from the Practitioners' and Students' Surveys indicated that there is a general trend by MRS Schools towards adopting teaching methods and learning activities that encourage students to develop lifelong learning competencies. With the exception of one MRS School that has made a total conversion to PBL, other MRS Schools are adopting a mixture of traditional and lifelong learning teaching approaches.

The trend by MRS Schools towards adopting teaching approaches that assist in the development of lifelong learning competencies is evidenced by the increasing popularity of web-access learning, CBL, reflective practice, self-directed learning, PBL and peer learning. As established in Chapter 2, Section 2.1.3.3, these teaching strategies are the same learning activities that assist in the development of lifelong learning attributes. Thus there is evidence to indicate that MRS Schools in Australia are indeed moving towards adopting student-centred learning that promote lifelong learning objectives. MRS students are therefore provided with increasing opportunities to engage in appropriate learning activities that would lead directly to the acquisition of lifelong learning competencies. In addition, current students also indicated that they were assuming increasing responsibility for their own learning as they progress through the course – signalling in general that students are developing autonomy for their own learning. These findings suggest that MRS Schools are modifying their teaching approaches and learning activities in response to the changing demands of the workplace.

6.2.2.2 Assessment Methods Adopted by MRS Schools Lagging behind Lifelong Learning Teaching Approaches

Given that one of the major objectives of MRS Schools is to prepare students for lifelong learning and in view of the trend towards lifelong learning teaching approaches, it follows that the assessment methods adopted by the Schools must also

reflect this lifelong learning objective (see Chapter 2, Section 2.1.3.3 on Biggs' Model of Constructive Alignment).

Findings from this study, however, indicate that assessment methods that promote lifelong learning attributes were lagging behind lifelong learning teaching methodologies in terms of ranking. This is evidenced by the fact that in recent years, assessment strategies, such as reflective journals, self and peer assessment, which assist in the development of students learning autonomy, did not register a corresponding increase in ranking despite their increase in popularity. This is in direct contrast to the improved ranking of teaching approaches, such as self-directed/peer learning, reflective practice, CBL and web-access learning, which promote lifelong learning attributes (see Chapter 5, Table 5.3 and Table 5.5).

One possible reason for the low ranking of reflective journals, peer and self-assessment could be due to the difficulty in the implementation of these assessment strategies. For these assessment methods to be successful, an attitudinal change on the part of both students and lecturers is required (Williams, 1992). They must appreciate the benefits of these assessments and understand that the students themselves need to assume a much more active role in the evaluation process.

This implies that while Schools are increasingly using teaching approaches which promote lifelong learning attributes, these same attributes are not being assessed to the same extent. There is therefore non-alignment between teaching strategies and assessment methods as the assessment methods used are not matching the intended learning objectives/outcomes. As established in Chapter 2, Section 2.1.3.3, teaching and assessment should not be regarded as separated activities; there must be alignment of learning objectives with the teaching/learning activities and assessment methods (Biggs, 1999b). If the intended learning outcome is the cultivation of lifelong learning attributes, as evidenced by the trend towards lifelong learning teaching approaches, then these specific attributes must be assessed. However, this non-alignment of teaching and assessment is not an unusual finding. Students in general, are found to be not actively involved in the assessment process (Radloff and de la Harpe, 1999).

6.2.2.3 Important Issues to Consider during Course Design

Both Students and Practitioners were in agreement in their selection of the three most important features of the MRS course that assisted them in their transition to practitioners. These included clinical placement, instructional approach and instructional style. This section looks at the significance of these factors.

Clinical Placement: Maximising Clinical Learning

According to Martin (1997), work placement, an example of experiential learning that promotes the development of lifelong learning attributes, is gaining popularity in many university courses (see Chapter 2, Section 2.1.3.3). Clinical placement has been cited as an essential component of professional training due to the authenticity of the workplace. It offers the students an insight into professional practice, enabling them to apply the skills they acquired in university to actual work situations. This increases students' confidence and commitment, plus an awareness of a range of social skills, together with a deeper understanding of academic and professional knowledge and expertise (Brown, Bull and Pendlebury, 1997).

However, simply having work placements does not necessarily equate to better learning outcome (Martin, 1997). Studies on student learning indicate that increasing clinical hours alone is not sufficient for achieving clinical competence. This is because having acquired the skills to perform a task does not necessarily imply that students have indeed achieved the underlying understanding (Martin, 1998). Students learn not so much because of the opportunity to perform the task and practise the clinical skills, but rather because of the opportunity to engage in problem solving, as any practising practitioner would, resulting in the understanding of the key concepts (Martin, 1998). Students must therefore be encouraged and provided with opportunities to actively reflect upon their learning experiences in order to allow them to make their own connection between theory and practice (Hughes, 1998; Wilkinson, Peters, Mitchell et al., 1998).

During the one to one interviews with teaching staff, many academics voiced concern over the lack of adequate supervision for students during their clinical placement, due to lack of funding in both clinical and university sectors. This is of major concern as deep learning is only achieved by providing students with quality

supervision. This includes more than just providing the students with the opportunities to perform the tasks.

To this end, there must be support, careful planning and management to ensure that clinical placement is appropriately structured to maximise students' learning (Martin, 1997). Close collaboration is required between university and employers, with academic staff and on-site clinical supervisors working together to ensure that learning does not happen by chance (Martin, 1998). Adequate planning must be in place to ensure that there are sufficient opportunities for students to critically reflect upon their learning experiences (Hughes, 1998). This is all the more crucial given that workplace learning is often characterised by informal and incidental learning, as opposed to university learning, which is often formal and guided learning (Hughes, 1998).

Adopting Instructional Approaches to Promote Learning Competencies

Aside from laboratory sessions, which develop clinical skills, the most commonly cited instructional approaches were those teaching methodologies that promote self-directed learning. For instance, group work encourages interpersonal skills while PBL promotes problem solving skills and collaborative learning.

It simulates the type of learning that occurs in work situations and has been touted by educational experts as an example of aligned teaching and meaningful learning (Dochy, Segers and Sluijsmans, 1999; Leveson, 1999; Biggs, 1999b).

These findings therefore support current literature on the importance of adopting the appropriate instructional strategies for the desired learning. These responses, from both Students and Practitioners, point towards the link between teaching activities and effective student learning.

Adopting Instructional Style to Promote Student-centred Learning

With the emphasis moving away from the lecturer-centred to student-centred form of learning, lecturers are now assuming the role of facilitators of learning (Boyle and Trevitt, 1997). The facilitator role is crucial in ensuring that there is a conducive, non-threatening environment for effective learning (Brockbank and McGill, 1998).

Students must feel free to focus on the task of learning without fear of being reprimanded or penalised by their lecturers (Biggs, 1999a). A friendly approachable style of lecturer and their enthusiasm in encouraging students to seek knowledge have been mentioned in the survey as crucial factors that assisted students in their learning. This raises the important issue of equipping teaching staff with the appropriate facilitation skills that are necessary for this new climate of intellectual inquiry.

It came as no surprise that the survey participants voted clinical experience as the most crucial factor in effective student learning. Despite the call from practitioners to increase clinical hours, increasing clinical hours is not the solution to improve clinical competence (Martin, 1997). This is because clinical hours alone are not a measure of clinical competence (Martin, 1997). Rather more effort and attention needs to be directed at the planning and management of clinical placement in order to ensure that students maximise their learning. In addition, more innovative assessment methods are needed to determine if students have achieved the required clinical competence and lifelong learning attributes, which all stakeholders have indicated in this study as important attributes to acquire.

It is interesting to note that both Students and Practitioners alike have cited instructional approaches and instructional style as crucial factors that assisted in their learning. These two factors are fundamental to the development of a lifelong learner. Thus although not identifying lifelong learning as top priority, the stakeholders are nevertheless recognising these course features as vital in their professional development.

Hence these three issues are significant factors that Heads of School and course designers must consider during any course design and review.

6.3 Implications for Medical Radiation Science Profession

The findings of the present study have implications for the MRS profession. The findings highlighted several crucial issues such as the need to have greater

collaboration and dialogue between the major stakeholders, the seemingly competing claims between clinical competence and lifelong learning, and the exclusion of lifelong learning as essential job selection criteria for new graduates. Thus, the following sections focus on the above issues. The first section establishes the need for greater collaboration, while the second section presents a conceptual model for professional, generic and lifelong learning attributes. The third section addresses the rationale and the importance of including lifelong learning attributes in the job selection criteria for new graduates.

6.3.1 Greater Collaboration between Employers, Australian Institute of Radiography and Universities

Having identified that there are significant differences between the perceived level of importance and the current attainment level of attributes, it is essential that steps be taken to address the causes for the perceived discrepancies.

To this end, a triangular alliance between employers and HOD, AIR and the universities has to be set up to specifically determine the precise reasons for these disparities. Establishing a formalised dialogue between the stakeholders would result in building a consensus and greater cooperation in this respect between the Higher Education institutions and the professional representations. By including the employers in these discussions, a better mutual understanding of the other's expectations can be established in order that strategies can be mapped out to address the deficiencies.

It must be noted that the AIR through the PAEB, is currently responsible for accreditation of the eight MRS courses Australia wide. As in most accreditation processes, the purpose of the accreditation is to maintain the consistency of professional standards nationwide (National Board of Employment, Education and Training, 1996a). However, the formalised dialogue proposed by the researcher goes beyond that of accreditation. First, it seeks to specifically address the widespread perceived discrepancies of the attributes. Second, greater dialogue and collaboration is needed between the stakeholders to support one another in working towards establishing a common ground between the expectations of the MRS workplace and

the desired objectives and outcomes of the Higher Education. For this to occur, there must be alignment of the goals of employers, AIR (professional representations) and the Higher Education institutions (MRS Schools).

6.3.2 Conceptual Model for Professional, Generic and Lifelong Learning Attributes

As established in Chapter 4, Section 4.4, attributes that are directly related to clinical competence are regarded as more important than other attributes. As a result, Practitioners, HOD and Students have placed professional attributes as top priority, followed by generic and lifelong learning attributes.

One may well ask whether this manner of prioritisation is 'correct'. In fact, most Practitioners find it extremely difficult to rate and rank the attributes, as illustrated by the following:

> *Difficult to differentiate as a lot of these attributes are equally important.*
> [P331, b0]

> *Very difficult to prioritise (attributes) 1-26. All are important.*
> [P375, b0]

The conventional way of viewing one attribute as being more important than another implies that the professional attributes that are given higher priority would inevitably be given more attention at the 'expense' of both generic and lifelong learning attributes. Thus, instead of viewing one attribute as being more important than the other, there is no reason why the three categories of attributes cannot be viewed as inter-related and dependent upon one another. For instance, the ability to set (learning) goals coupled with the ability to manage one's own learning and self evaluate would result in practitioners acquiring new skills which are directly related to the practitioners' clinical performance and professional competence. Thus, lifelong learning attributes should be regarded as equally important as professional and generic attributes, instead of being seen as less or more important.
This view is echoed by some Practitioners:

(Lifelong learning attributes) 17-25 are very important character traits or habits to develop to accomplish items 1-16 (professional and, generic attributes) with any competence and confidence. [P381, b0]

...I believe all of the above qualities and skills (attributes 1-26) are essential in our profession. Perhaps I am too idealistic, but as a chief radiation therapist, I can observe the interplay of all these qualities and see them all of equal value. [P12, b0]

The researcher would like to propose a model depicting the inter-dependency of the three categories of attributes (see Figure 6.1). This model is similar to the model advocated by Radloff and discussed in Chapter 2 (see Section 2.1.3, Figure 2.1).

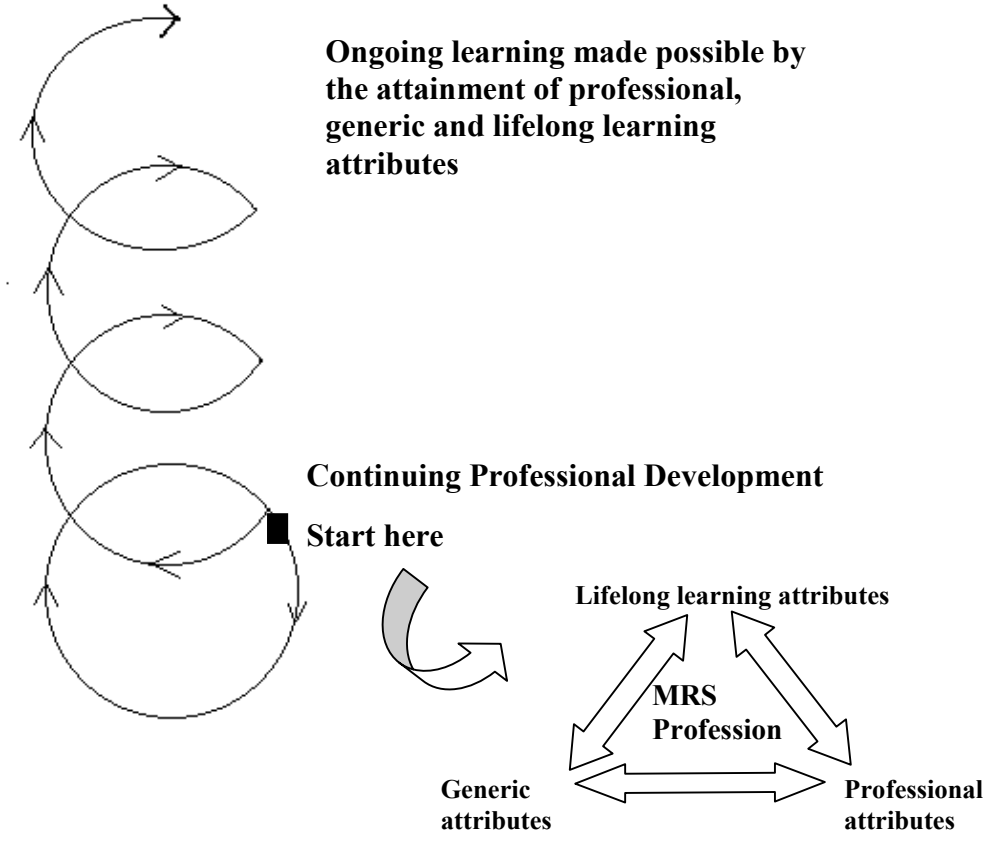


Figure 6.1
Conceptual Model showing the relationship between Professional, Generic and Lifelong Learning Attributes

Rather than being viewed as separate distinct attributes, all professional, generic and lifelong learning attributes are regarded as inter-related and dependent upon one another.
The attainment of these attributes made continuous learning possible. The process is ongoing, with the practitioner reflecting and evaluating on one's own learning and performance, resulting in professional development and better patient outcomes.

Radloff (cited in Fox and Radloff, 1996) proposed that in order for students to understand how lifelong learning skills can be successfully applied in their respective discipline, both generic and lifelong learning components must be taught within the context of the discipline. Likewise, the researcher recommends that lifelong learning, generic and professional attributes should be viewed, within the context of the MRS discipline, as inter-related and dependent upon one another. These three categories of attributes should be seen as a single entity and as an integral part of the MRS discipline (see Figure 6.1).

The conceptual model in Figure 6.1 shows the inter-relationship and interdependency of the professional, generic and lifelong learning attributes. This gives due acknowledgment to the importance of lifelong learning within the profession, without detracting from the importance of professional and generic attributes. In this model, the attributes are all regarded as equally important, instead of one attribute being more important than another. As indicated by the continuous open-ended spiral, students who are adequately equipped with the professional, generic and lifelong learning attributes are capable of continuing learning in their working life.

6.3.3 Incorporating Lifelong Learning Attributes as Essential Selection Criteria

As established in Section 6.2.1.2, the importance in which the Practitioners and HOD regard lifelong learning is not evidenced by the workplace culture and selection criteria. It is therefore essential that this non-alignment of beliefs and actions be corrected by including lifelong learning abilities as essential job selection criteria for MRS graduates who are entering the workforce for the first time.

The literature has shown that student learning is assessment driven. Students often respond to the level of assessment tasks. Even if the learning objectives specify a higher level of learning but the assessment task requires simply regurgitation of facts, then students are likely to adopt a surface approach to learning (Biggs, 1999b). By using the appropriate form of assessment, students can be encouraged to adopt a deeper approach to learning (Brown, Bull and Pendlebury, 1997).

This same driving force is just as applicable in the workplace. Selection criteria are the 'gateway' through which students enter the profession. Including lifelong learning attributes as part of the selection criteria would serve as a focal point towards which students would aim during their university training. Students and graduates alike, would then see lifelong learning as essential attributes to acquire and cultivate during their undergraduate training, thereby fulfilling the major objectives and outcomes of Higher Education.

From the workplace perspective, by specifying lifelong learning attributes as one of the major selection criteria, the importance of lifelong learning is given its rightful place, alongside with clinical competence. This has the effect of giving an added impetus to the development and inculcation of lifelong learning attributes not only amongst students, but a strong message will also be sent to the practitioners on the importance of lifelong learning. The outcome will be graduates and practitioners who are equipped with lifelong learning competencies to continue their professional development, which is currently one of the major goals of the AIR and the MRS profession.

As illustrated in Figure 6.2, the selection criteria serve as a point of intersection between the Higher Education and the MRS workplace, linking the two sectors together.

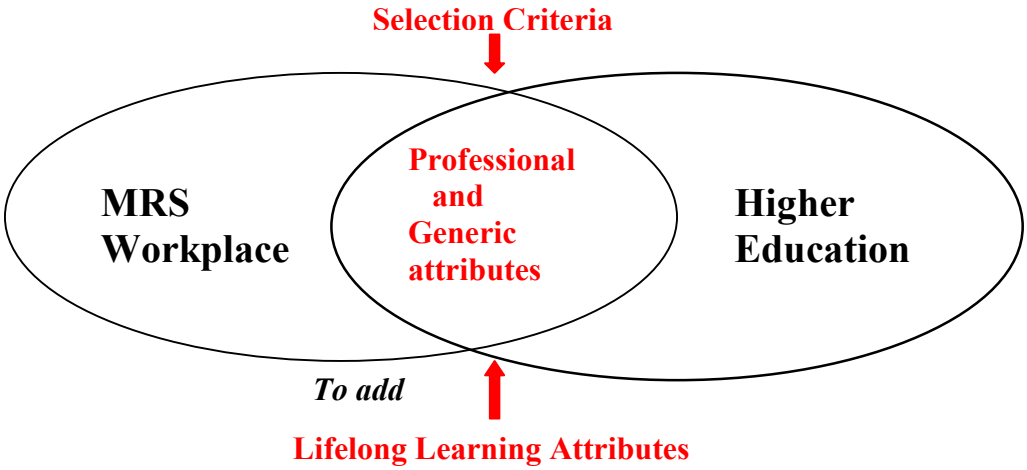


Figure 6.2
Model showing the intersection of MRS workplace with Higher Education, with the selection criteria linking the two sectors together.

The inclusion of lifelong learning attributes would result in students and the profession seeing the attainment of lifelong learning as an important and value outcome of undergraduate studies.

Currently, the essential selection criteria for MRS graduates includes only the professional and generic attributes. The researcher recommends that lifelong learning attributes be included as part of the essential selection criteria. What this model proposes is to bring the workplace and the MRS Schools into alignment, in terms of lifelong learning.

Which lifelong learning attributes should therefore be included in the selection criteria for MRS graduates? The answer to this question is examined in the following section.

Essential Selection Criteria for MRS Graduates

Based on the survey responses, the researcher has generated a list of essential selection criteria for MRS graduates who are entering the workforce for the first time. This list includes the specific lifelong learning attributes which both Practitioners and HOD have indicated as important in the national data.

Table 6.1

Essential selection criteria for MRS graduates who are entering the workplace for the first time

These attributes which include professional (P), generic (G) and lifelong learning attributes (L) have all been identified as essential for clinical competence and learning competence for ongoing continuing learning.

• Bachelor of Science (MRS) or recognised equivalent acceptable to AIR	P
• Willingness to learn new things	L
• Ability to:	
◦ communicate effectively with patient	P
◦ communicate effectively with staff	G
◦ operate effectively as team member	G
◦ accept advice/constructive criticism	G
◦ work independently	L
◦ set learning goals	L
◦ critically reflect upon one's learning experience	L
◦ manage one's own learning	L
◦ find practical solutions	L
◦ adapt to change	L
◦ access and critique the latest information/research findings	L
◦ see the big picture	L

As explained in Section 6.3.2, the attributes listed here should not be viewed as one being more important than another. Rather, all attributes should be seen as being equally important, with attributes being inter-related and dependant upon one another.

The above lifelong learning attributes have all been identified as essential for the promotion of continuous improvement and ongoing learning in the workforce. This leads to the question of how various stakeholders such as employers, students and MRS Schools, can meaningfully assess whether the specified selection criteria have been attained. The answer to this question lies in the use of learning portfolio and is addressed in the following section.

6.4 Implications for Medical Radiation Science Undergraduate Programs

The main findings of the present study showed a lack of linkage between the MRS workplace and Higher Education in terms of lifelong learning. There is also non-alignment of teaching strategies and assessment methods in relation to lifelong learning. In addition, lifelong learning attributes are not being assessed.

In line with the above findings, there are several implications for the MRS undergraduate programs and the following sections focus on these implications. The first section examines how the learning portfolio can be used effectively as the link between the MRS workplace and universities. This is followed by analysing the implications of these findings in terms of Biggs' model of constructive alignment. Finally, the importance of providing teaching staff with the appropriate development support for lifelong learning is discussed.

6.4.1 Learning Portfolio: The Link between the MRS Workplace and Higher Education

The rapid changes in MRS profession require practitioners to continue learning. Graduates who are able to demonstrate successfully their clinical competence and abilities to be independent self-directed learners would have a leading edge over others who are unable to do so (Engel, 1996).

Portfolio acts as a link between MRS workplace and Higher Education by serving as a focal point between the two sectors. From the Higher Education perspective, the portfolio is the culmination of evidence of students' learning during their undergraduate education (See Chapter 2, Section 2.1.4.3). While for the MRS employers, it is an authentic means of evaluating whether the applicants have fulfilled the job selection criteria of professional, generic and lifelong learning competencies (Gibbs, 1999).

This is because the successful completion of the portfolio requires the students to demonstrate the same competence that is required in their future workplace (Biggs, 1999b, p. 220):

- sufficient understanding of the professional knowledge that is relevant to professional practice;
- cognitive and metacognitive skills such as learning strategies, self evaluation and management skills;
- teamwork and social skills; and
- motivation and quest for (new) professional knowledge.

For the graduates, the portfolio is the forum to showcase their abilities, experiences and training and professional development during their undergraduate education. Using portfolios to provide the necessary evidence that the required learning has indeed occurred is therefore highly relevant and applicable to the long-term professional development of the graduate (Fitzsimons and Pacquanio, 1994; Fogarty, 1996).

From the employers' perspective, portfolios are particularly useful for assessing graduates who are entering the workforce for the first time. Applicants are often vying for positions with peers from similar background. Since portfolios are personalised documents and no two portfolios are the same, they are therefore extremely useful in setting individuals apart. It therefore serves as an ideal basis for employers to compare applicants' credentials and their learning competencies (Wiedmer, 1998).

By using the portfolio as one of the means of assessment during job interview, students would be motivated to engage in the learning processes as they would see the value of clinical, generic and lifelong learning competences as valued outcomes of their undergraduate education.

6.4.2 Constructive Alignment: Aligning Learning Objectives, Teaching/ Learning Activities and Assessments

6.4.2.1 The Need to Specify Learning Objectives

Interviews with MRS academic staff indicated that the learning objectives which are related to lifelong learning or generic skills such as critical thinking, teamwork skills and IT skills, are very rarely specified as learning objectives in the subject outline or handouts. This is illustrated by the following quotes:

> *These additional skills* [IT skills such as ability to access resources via the web] *are not written as part of the unit outline. However, I try to incorporate such learning objectives in the development of my units. These objectives are certainly part of the university's objectives. We are not very good at articulating such objectives. Our course is very heavily focused on radiography content.* [A20i]

It was also evident from the responses of interviewees that students were usually informed of such learning objectives via oral explanations and discussions.

> *Certainly these objectives* [group work skills and critical thinking] *are orally explained to them in the beginning.* [A12i]

> *These* [The ability to reflect and problem solve] *have not been formalised but I talk to the students during the discussions.* [A19i]

Even in universities that have explicit graduate outcomes, the acquisition of generic skills as part of the learning objectives are not necessarily clearly stated in each subject outline.

> *These* [generic skills] *are inherent in most of the subjects without being specific, but is embedded in the overall objectives of the course.* [A13i]

However, some academic staff interviewed did indicate that their universities are moving along the direction of making clear specification of learning objectives mandatory in the not too distant future.

From the findings of these interviews, it was found that only learning objectives that were related to subject content have been included in the subject handouts. Although, it is very often the intention of lecturers to promote generic, IT and other lifelong learning competences, these objectives were rarely incorporated formally in students' information. However, based on Biggs' model of aligned teaching, all learning objectives must be clearly specified in the subject outline so that there are no ambiguities in the learning objectives (see Chapter 2, Section 2.1.3.3). As such it is the researcher's recommendation that all learning objectives, be they content-specific, generic or lifelong learning, must be explicitly stipulated in students' handouts.

6.4.2.2 The Need to Assess Lifelong Learning Attributes

Interviews with MRS teaching staff also revealed that lifelong learning attributes were very rarely assessed. The following quotes echoed the sentiment of many:

> *It is hard to assess that the students actually have the (lifelong learning) attributes.* [A21i]

> *A lot of our assessments are focusing on making assessment more accurate and less subjective which doesn't tend to look at whether students have these lifelong learning attributes but rather tends to look at they can do a specific task.* [A27i]

One lecturer indicated that the issue of assessing to determine if students have indeed acquired the appropriate learning attitude is far too difficult a task. One can only hope that through the learning process, "they develop some attributes of responsibility and lifelong learning" [A21i].

Many of those interviewed felt that the process of incorporating learning activities that promote lifelong learning attributes is a step in the right direction and having learning activities is sufficient.

> *As to how they (lifelong learning attributes) are being assessed, it might not be specifically assessed. I do not look at the graduate's qualities as what you assess, but rather what you introduce the students to do and discuss.* [A9i]

In addition, findings from the Student Survey also indicated that in terms of lifelong learning objective, there is non-alignment of assessment methods with the teaching strategies and the lifelong learning objective. Assessment methods that reinforce and assess the development of lifelong learning attributes were lagging behind the teaching approaches that promote lifelong learning.

Based on Biggs' model of aligned teaching, it is inadequate to simply have students engaging in lifelong learning activities. The desired learning outcomes (ie. lifelong learning attributes) must also be assessed. Strategies therefore need to be taken to address this non-alignment by incorporating more of the student-led assessment methods such as self and peer assessment, reflective journal, learning contract, PBL and learning portfolio into the assessment strategies (see Chapter 2, Section 2.1.3.3).

6.4.2.3 The Need to Assess Students' Learning Process

Aside from directly assessing lifelong learning attributes as suggested above, emphasis must also be given to students' learning process. Curriculum that integrates cognition (learning strategies), metacognition (planning, monitoring and evaluating), motivation (setting learning goals), and affect (feelings towards the subjects), are likely to result in students possessing the necessary abilities to become effective lifelong learners, plus acquiring a much more positive attitude towards learning (Radloff and de la Harpe, 1999). This is because assessing cognitive, metacognitive, motivational and affective aspects of students' learning inform both the students and the lecturers of how the students are progressing with their learning (Radloff and de la Harpe, 1999). Incorporating such assessment methods which assess and monitor students' learning can assist them to acquire, develop and improve the learning

competencies that are essential characteristics of lifelong learners (Radloff and de la Harpe, 1999).

Indirect assessment of the learning process is via the observation of the lecturer, although it can also be inferred from the quality of the learning outcomes (Boles, 1999). Direct assessment of the learning process is via questionnaire, interviews, writing activities, teacher-constructed feedback techniques and having students complete a learning log (Radloff and de la Harpe, 1999). Assessments that actually assess the learning process are regarded as the more progressive approach to assessment (Ashcroft and Palacio, 1996).

Studies have demonstrated that the cognitive, metacognitive, motivational and affective aspects of learning have a direct impact on academic achievements as well as on increasing learning competence (Radloff and de la Harpe, 1999). As such, it is essential that students must be provided with the (Radloff and de la Harpe, 1999):

- necessary learning support towards the development of learning competencies;
- appropriate guidance towards the use of cognitive and metacognitive strategies; and
- a motivational and affective inclination towards learning.

Attention must now be directed at helping staff to develop the necessary teaching and assessment skills in order to assess that the students have indeed attained the lifelong learning skills (Radloff and de la Harpe, 1999). The departure from traditional teaching (teacher-centred) approaches towards student-centred forms of learning and the use of assessment methods that encourage lifelong learning attributes, highlight the need for professional staff development. The next section examines the importance of professional staff development in the lifelong learning culture.

6.4.3 Providing Staff Development to Support Lifelong Learning

The importance of professional development for teaching staff cannot be under-estimated. Australian universities will be judged by their teaching and learning methods, with the best universities investing heavily in staff development (Poole,

Harman and Deden, 1998). Good teaching practices focus on students and their learning. However, good teaching is not a 'skill' that comes naturally to teachers (Jackson, 1997). Teachers are often selected on their basis of their expertise in content, rather than for their teaching abilities (Radloff and de la Harpe, 1999). Staff development is necessary to ensure that good teaching prevails (Jackson, 1997; Spencer and Jordan, 1999).

The following comment was in response to the self-directed learning approaches a practitioner experienced during his undergraduate training.

> *Lecturers should be available and should be teaching, whether as tutors in tutorials or lectures. Planning our own objectives has advantages, but predominantly it creates laziness, misdirection and confusion. Furthermore, lectures* [sic] *tend to prefer this minimum hour structure because they are often lazy. This also transfers a certain attitude to students and to the profession.*
>
> [P220, c7]

The above quote highlights two crucial issues relevant in implementing any teaching practices that depart from the conventional mode of teaching. First, the importance of having students appreciate the relevance and value the learning outcomes of the new teaching approaches; failing which they are likely to resent and resist involving in the learning activities (Clark, 1994). Second, the importance of equipping teaching staff with new teaching skills.

Universities that have lifelong learning as part of their agenda must therefore provide opportunities for teaching staff to become familiar with the philosophy of student-centred learning (Clifford, 1999). They must be given the necessary support and assistance to help them in integrating the cognitive, metacognitive, motivational and affective aspects of learning into their teaching (Radloff and de la Harpe, 1999). Lecturers should develop strategies that are not only student-centred but are also oriented towards learning approaches that are crucial in the development of learning competence (de la Harpe, Radloff and Wyber, 1999). They should be equipped with new teaching methods that are compatible with their new roles as facilitators and

collaborators of learning. Facilitation skills include being able to change the learning environment to one that encourages students' participation in learning. Students need to be respected as learners with ideas to contribute to the team, and a democratic setting needs to be provided that allows students to take control of their learning agenda (Clifford, 1999).

Although universities set the regulations for assessment, it is often up to individual staff to design and implement the assessment strategies as they see fit (Smith, 1997). Thus, professional staff development programs have to assist staff with the implementation of new innovative assessment methods that promote lifelong learning (Dochy, Segers and Sluijsmans, 1999).

However, effective staff development should not be restricted to simply changing teaching and assessment activities. Good staff development programs should include changing teachers' views of teaching (Biggs, 1999b). The teaching staff themselves must also be able to appreciate the rationale for the new teaching strategies, before they can share their enthusiasm for learning with students (Wilkinson, Peters, Mitchell et al., 1998). For instance, being a facilitator of learning implies that lecturers have to relinquish the control and the authority that comes with the position of the knowledge expert. Staff reluctance to 'let go' is understandable and such resistance to conceptual change needs to be addressed (Clifford, 1999).

In fact, one of the greatest obstacles in the development of professional skills is changing the mindset of academics, from one of a 'teacher-centred and content-focused' to that of a 'student-centred and process-focused' model (de la Harpe, Radloff and Wyber, 1999, p. 15). Academic staff philosophy on teaching and learning has a direct bearing on their teaching and assessment approaches, which in turn influences students' learning approaches and outcomes (Smith, 1997; Kember, 1998). Thus, professional development should also provide teaching staff with the opportunities to change their underlying concepts of traditional teacher centred form of teaching, understanding the nature and the reasons for the changes, appreciating the need for change and be willing to undergo training to gain the new skills to effect that change (Kember, 1998; Biggs, 1999a; Prideaux and Lyons-Reid, 2000).

Effective teaching is a team effort, as no individual lecturer can single handedly bring about significant improvement in the professional skills of students (de la Harpe, Radloff and Wyber, 1999). As such, professional development is most successful when the change is effected throughout the entire organisation/School thereby providing a conducive environment for change (Carnell, 1998). Staff development of this nature requires additional funds which in these times of diminishing resources, may prove extremely difficult (Prideaux and Lyons-Reid, 2000). It requires time commitment from the often increasingly over-worked staff (Prideaux and Lyons-Reid, 2000). However there has to be commitment on the part of the university to invest in staff development, rewarding good teaching instead of focusing simply on research (de la Harpe, Radloff and Wyber, 1999).

6.5 Summary of Implications

As a result of the findings from the current study, there are three major implications for the MRS profession. First, there has to be greater dialogue and collaboration between the employers and HOD, AIR and the universities. This is necessary in order to address the discrepancies identified in all the attributes. Greater collaboration would also assist in aligning the expectations of these stakeholders with the outcomes of Higher Education. Second, to promote lifelong learning amongst the practitioners, a conceptual model emphasising the interdependency of professional, generic and lifelong learning attributes has been introduced. Finally, in order for students to see the relevance of developing lifelong learning attributes during their undergraduate education, it is necessary to include lifelong learning as an essential part of the job selection criteria for new graduates entering the workforce.

This study raises several major implications for MRS undergraduate programs.

- The portfolio can be used as an effective link between the MRS workplace and Higher Education. By using the portfolio as one of the means of assessment during job selection interviews, students would be motivated to engage in the appropriate learning processes as they would see the value of the clinical, generic and lifelong learning competences as valued outcomes of their undergraduate courses.

- Measures must be taken to ensure that the learning objectives, teaching/learning activities and assessment methods are aligned. To this end, it is not only essential to adopt teaching approaches which promote lifelong learning, but to also involve students in assessment activities that require them to use the same lifelong learning skills. Steps must be taken to monitor and assess the cognitive, metacognitive, motivational and affective aspects of students' learning. In addition, all learning objectives, whether they are content-focused, generic or lifelong learning, must be clearly specified in the subject handouts to students.
- Last but not least, teaching staff must be provided with professional staff development to familiarise them with the philosophy of lifelong learning. In addition, they need to be equipped with appropriate facilitation and assessment skills that are necessary to assist students in the development of lifelong learning.

6.6 Pause for Reflection

It is important for teaching staff to practise what they preach. Lecturers need to have a helicopter vision of the dynamic relationship between the workplace and universities. They also need to be aware of how educational policies impact on their current teaching practices. An appreciation of the above will assist them to work towards producing desired graduate outcomes.

Like students, teachers should continuously monitor, reflect on and evaluate their teaching approaches and assessment strategies. They should make use of all available information from students' and peers' feedback to inform themselves of students' learning processes, with the ultimate aim of improving student learning (Jackson, 1997).

Teaching staff should always maintain an open mind and be receptive to new teaching/learning activities and assessment strategies that can improve student learning (de la Harpe, Radloff and Wyber, 1999). Just as educators stress the need for

students to be information literate, teachers should keep abreast of the latest literature on student learning. For instance, understanding Biggs' constructive model of aligned teaching and that student learning is assessment driven, is only the beginning. Further insights are gained only by reflecting on how these ideas can be applied in their own teaching practices and sharing their thoughts/results with teaching colleagues (collaborative learning). Then, given the appropriate support, teachers will be able to translate this newly acquired knowledge into better learning outcomes for students.

In the final chapter, the researcher will examine the strengths and limitations of the study, plus suggestions for future research.

Chapter 7

Conclusions

The strength and significance, together with the limitations of the current study, are examined in this chapter. This is followed by the recommendations for MRS undergraduate programs and suggestions for future research. The chapter concludes with a summary of the present study.

7.1 Strength and Significance of Study

The present study is timely in view of the current adoption of lifelong learning in Australian universities and the Medical Radiation Science (MRS) profession. The findings of the present study provide an insight into the current status of lifelong learning in the MRS profession. This understanding of what is happening, in both the MRS workplace and Higher Education, has implications for future decision-making in terms of lifelong learning in the workplace, Australian Institute of Radiography (AIR) and MRS Schools.

The focus on quality and accountability in Higher Education requires universities to respond to the changing demands of the workplace. One of the more important contributions of this study is profiling the three main groups of stakeholders' (HOD, Practitioners and Students) views on lifelong learning in relation to professional and generic attributes. It informs MRS Schools of the attributes that are regarded as important and identifies the attributes that are lacking. This allows MRS Schools to structure their curriculum by preparing graduates to meet the expectations of the workplace.

This study has also shown the difficulty experienced by stakeholders in ranking professional, generic and lifelong learning attributes. The conceptual model introduced in this study has removed the dilemma of prioritising the attributes, bringing to focus the relationship between these attributes and continuing professional development and providing a model for promotion of lifelong learning without detracting from the importance of clinical competence.

In addition, the study documents the competing demands for clinical competence versus the need to equip students with lifelong learning competencies for future learning. In view of the push by AIR for continuing learning, the need to equip students and graduates with the ability to learn for life is becoming increasingly important. Although clinical competence and lifelong learning are not mutually exclusive, their inclusion has implications for how the employers, AIR and the MRS Schools define graduate outcomes.

Furthermore, this study highlights the lack of alignment between the perceived importance of lifelong learning and the practices that currently exist in the workplace. It has implications for the MRS workplace as a learning organisation in terms of the need to provide a conducive environment for learning and to support research that would improve MRS practices. The study also focused specifically on the need to align the workplace and universities in terms of lifelong learning. This can be achieved via a common platform by incorporating lifelong learning into the job selection criteria for graduates entering the workforce for the first time.

Current literature on student learning and Biggs' model of aligned teaching has shown the importance of aligning objectives, teaching/learning activities and assessment in relation to student learning (Biggs, 1999b). By providing a snapshot of the current teaching approaches and assessment methods adopted by MRS Schools, this study's findings have implications for how MRS teaching staff could structure their teaching activities and assessments to promote the desired professional, generic and lifelong learning competencies. To ensure the success of lifelong learning in Higher Education, the study also draws attention to the importance of professional development for teaching staff in this climate of student-centred learning.

7.2 Limitations of Study

The limitations of the study are related to both the design and methodology. These include the sample population, survey response rates, ability of participants to recollect accurately and the fact that the participants of the focus group discussion were acquainted with one another.

The AIR provided the main vehicle for survey distribution as members include radiographers, radiation therapists, nuclear medicine technologists and sonographers. However, as both nuclear medicine technologists and sonographers are also represented by their respective professional associations such as Australian and New Zealand Society of Nuclear Medicine (ANZSNM), Australian Sonographers Association (ASA) and ASUM (Australian Society for Ultrasound Medicine), it follows that a sizeable proportion of these practitioners were not surveyed, thus excluding their views on lifelong learning. In addition, by distributing the survey via AIR, practitioners who are not members of AIR were also excluded. However, due to financial and time constraints, the researcher was unable to extend the survey distribution beyond the AIR. As detailed in Chapter 3, additional strategies such as posting the survey on the web and sending surveys to major hospitals were employed to address this limitation.

One of the major limitations of the present study was the response rate for the Practitioner Survey. The number of responses received from practitioners totalled 581, which is equivalent to a response rate of only 14.5%. Although the numbers were sufficient to be statistically valid, a higher response rate would have been better and would have more accurately reflected the membership of the AIR.

Data on the main teaching approaches and assessment methods adopted by MRS Schools were collected from both the Practitioner and Student Surveys. For the Practitioner Survey, there was concern that the validity of this data may have been affected by the their ability to recollect accurately their past experiences in their MRS courses. However, Practitioners were only required to indicate the types of teaching and assessment methods they experienced in the MRS courses. They were not required to specify course details such as percentages of each of these teaching

and assessment activities experienced. As such, their responses are less likely to include inaccuracies due to memory lapse.

In the focus group discussion, given that participants are acquainted with one another, there was a possibility that they may not have been honest in their responses (Crowl, 1996). However, triangulation of data from other sources such as HOD, Practitioner and Student Surveys, plus interviews conducted with academics and HOS Survey, has shown no discrepancies with the focus group discussion data.

Despite the above limitations, this study successfully profiles the current standing of lifelong learning in the MRS profession and MRS Schools. It also presents implications linking the MRS workplace and Higher Education, which are crucial in these changing times. These implications are discussed below.

7.3 Recommendations for Medical Radiation Science Undergraduate Programs

In view of the findings of this study, the recommendations for the MRS undergraduate programs are:

1. **Adoption of Biggs' model of aligned teaching in MRS undergraduate programs**.

Findings from this study indicate that there need to be more explicit linkages between learning objectives, teaching approaches and assessment methods.
If professional, generic and lifelong learning competencies are the learning objectives, then these objectives must be clearly spelled out for the students. The teaching and learning activities should reinforce the development of these attributes, and the appropriate assessment methods should be used to determine if the specified attributes have been acquired.
Thus, based on Biggs' model of aligned teaching:

- All learning objectives must be clearly specified in the subject outline/students' handouts so that there are no ambiguities in the learning objectives;
- the specified learning outcomes (ie. lifelong learning) must also be assessed;

- direct assessment of lifelong learning attributes by using more of the student-led assessment methods such as self and peer assessment, reflective journal, learning contract, problem-based learning and learning portfolio; and
- direct and indirect assessment of students' learning processes. Indirect assessment of the learning process can be via the observation by the lecturer, while direct assessment of the learning process is via questionnaires, interviews, writing activities, teacher-constructed feedback techniques and the completion of learning logs.

2. **Implementation of the learning portfolio: to serve as a link between the MRS workplace and Higher Education**

The portfolio should be incorporated as a continuous and end of the course evaluation tool, providing evidence of students' learning and professional development during their undergraduate education. In this way, prospective employers can use the portfolio as a means of evaluating whether the graduates have fulfilled the job selection criteria, and if the graduates possess the competence that is required in their future workplace. Thus, the portfolio serves as a focal point for students to work towards during their undergraduate education, thereby effectively providing the vital link between university learning and the MRS workplace and provides evidence of achievement of objectives.

3. **The provision of professional staff development to support lifelong learning**.

Professional staff development for teaching staff is crucial to the successful implementation of lifelong learning in Higher Education. In order to encourage and motivate teaching staff to participate in professional development, teaching staff must be provided with:

- The necessary support, assistance and guidance in the development of appropriate teaching and learning activities and the corresponding assessment strategies;
- time release to enable staff to attend the development sessions;
- incentives to engage in innovative teaching and assessment practices; and
- recognition and rewards for their quality teaching.

7.4 Suggestions for Future Research

This present study has highlighted a number of lifelong learning issues, which suggest further research. Future research topics could include:

- Conducting a study of the culture of the MRS workplace in relation to lifelong learning. The aims of this study could include identifying the current work practices which inhibit or promote lifelong learning, and obstacles to research and postgraduate studies. A detailed analysis could include the strategies needed to promote lifelong learning and research activities amongst practitioners in the workplace.
- Conducting a detailed study of MRS staff teaching philosophies and the corresponding effect of these philosophies on their teaching and assessment approaches. A more detailed analysis could include examining how each of the teaching approaches/learning activities and assessment strategies impact on learning outcomes in terms of lifelong learning. The study could also include investigating how assessing students' learning process and lifelong learning attributes can be successfully applied in the MRS context.
- Replicating the current study in other settings by focusing on each MRS specialities ie. sonography, nuclear medicine and radiation therapy, in order to establish whether the different specialities produce different results.
- Undertaking a more detailed study of the attributes surveyed in this study. In particular, the study could determine whether practitioners are currently performing below expectation, the reasons for any deficiencies identified in each of the attributes and the actions required to address these deficiencies.

7.5 Summary of Study

This study aimed at investigating lifelong learning in the MRS profession. Specifically, it aimed to establish the profile of MRS practitioners as lifelong learners, the importance in which the profession views lifelong learning, and the implications for the design of undergraduate MRS programs in Australia.

This research project used both quantitative and qualitative approaches. The main methodology employed was a national survey, which was distributed to approximately 4000 practitioners nationwide. Participants of this survey also included the Heads/administrators of MRS Departments (HOD). The objectives of the survey were to seek the participants' views on the importance of professional, generic and lifelong learning attributes, and the main teaching approaches and assessment methods the participants experienced in their initial MRS courses. The survey was distributed, as an insert in the AIR (1999 June) newsletter *Spectrum*. To reach a wider MRS community, major MRS centres and radiotherapy centres in WA and interstate were contacted directly. In addition, an electronic version of the survey was available on the web. The website address was posted on the electronic discussion lists of the AIR, WA branch of AIR and ASA and was also advertised in the ASA September edition of sonographers' newsletter, *Sound Effects*, and the October issue of AIR *Spectrum*.

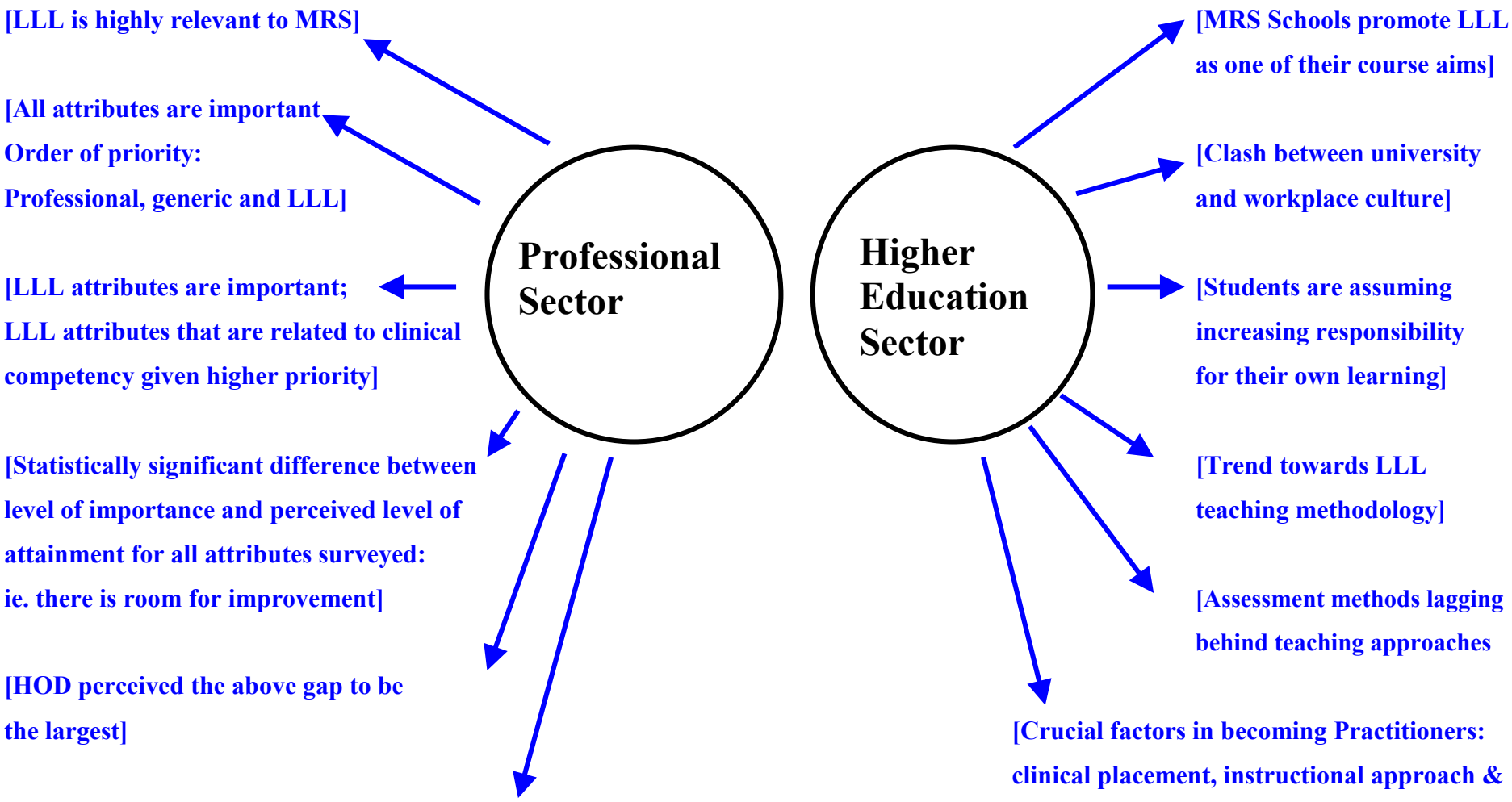
In order to provide a comparison of students' responses with the HOD and practitioners, a modified version of the national survey was sent to the eight MRS Schools at Australian universities in September/October of 1999. All final year MRS students, plus second year students from two universities, participated in this survey.

MRS academics' views were also sought in the form of focus group discussion and one to one interviews. The Heads of the eight MRS Schools also participated in a HOS Survey, seeking their views on lifelong learning, the policies and practices adopted by the Schools with regard to lifelong learning.

Selection criteria for MRS graduates who are entering the workforce for the first time were obtained from major public and private sectors in WA. This information enabled the researcher to determine if the employers have included lifelong learning characteristics in their selection criteria.

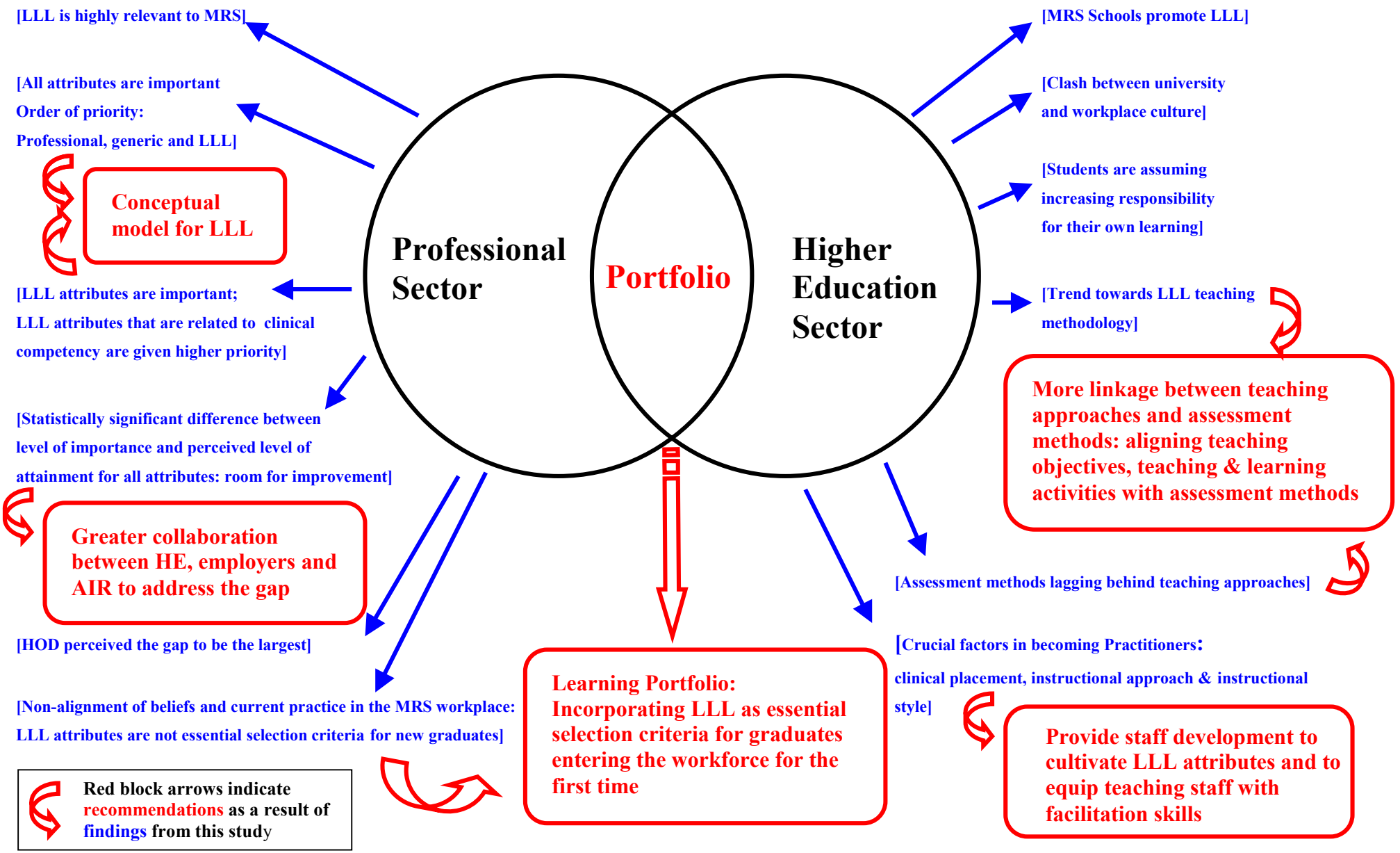
Figure 7.1 schematically shows the summary of findings while Figure 7.2 shows the summary of recommendations from this study.

Figure 7.1 Summary of Findings



LLL: Lifelong Learning

Figure 7.2 Summary of Recommendations



The academic community was overwhelmingly supportive of lifelong learning. They see lifelong learning as a key to the future of the profession. Practitioners with lifelong learning attributes are much more prepared for future learning, resulting in improved clinical applications, leading to better services and outcomes for the patients.

Practitioners, HOD and Students also affirmed the importance of lifelong learning in the profession. They have voted all professional, generic and all lifelong learning attributes listed in the survey as important attributes for MRS practitioners to attain. However, in rating the importance of attributes, the stakeholders have also made a distinction between clinical competence and learning competence. Attributes that were perceived by participants to be directly related to clinical competence were given higher priority. Learning competence, while having been recognised as important attributes, were given lower priority as they were perceived to be non-related to actual job performance and more future-oriented.

This is because MRS practitioners, like any other health professionals, are expected to maintain a high level of clinical competence. Many practitioners equated the considerable time they spent in clinical placement during their cadet and diploma courses as an essential prerequisite to being a good practitioner. This importance is also being reinforced by the way in which MRS employers judged practitioners' performance, mainly through their ability to work efficiently in reducing patient waiting lists. As a result, all three stakeholders have put professional attributes ahead of generic attributes, with lifelong learning attributes given the lowest priority. This manner of ranking has implications on the long-term development of the profession. Given that lifelong learning attributes have been relegated to the lower end of the priority scale, it follows that lifelong learning attributes are unlikely to be given the attention they deserve.

HOD, Practitioners and Students were in agreement that for every one of the 25 attributes listed in the survey, there was a large gap between the perceived level of importance and the actual level of attainment. This is a significant finding as it indicates that all professional, generic and lifelong learning attributes, which have been identified as important attributes, are currently below the level of expectation.

Professional and lifelong learning attributes were found to be the most lacking, as these attributes were identified to have the largest gap. The same professional attributes that have been identified as of utmost importance have also been identified as most lacking. This perceived lack of competence identified by all participants is partly responsible for the call for more hours in clinical placement in current MRS programs. In the case of lifelong learning, the identified deficiencies cast doubts on the ability of practitioners to respond and keep pace with changes and their ability to be self-directed learners.

Statistical analysis showed that HOD perceived the largest deficiencies, with Students registering the least difference. One possible reason could be due to the fact that students are yet to be fully integrated into the workforce and may therefore not be fully aware of the workplace situation. The only exception was verbal communication skills with patients, with Students identifying the largest deficiency.

Findings from this study indicated a lack of alignment between beliefs (perceived importance of lifelong learning) and actions (workplace practices) in the MRS workplace. Although lifelong learning has been listed as important attribute for practitioners to attain, the job selection criteria for new MRS graduates rarely include any of these attributes. The only reference to lifelong learning is the demonstration of "commitment to continuing professional development". This is a non-specific criterion, which could include any of the lifelong learning attributes.

There is also a lack of support and reward from the MRS employers for practitioners to pursue postgraduate studies and research. Practitioners indicated that there is little incentive for them to engage in postgraduate studies or research since their performance is judged primarily by their efficiency in performing daily procedures. Employers view research projects as extravagant ventures. The commitment to continuous learning in the MRS workplace is focused directly at equipping practitioners to keep pace with new modalities and performing their daily duties. However, for the profession to develop further, practitioners also need to be more proactive by getting more involved in research that could increase the body of professional knowledge, thereby improving clinical practice and informing the profession of current and future needs.

In addition, there is a lack of support by practitioners themselves for lifelong learning. MRS is a profession where adherence to the protocol is the norm and practitioners feel threatened by students' inquisitiveness and critical thinking approaches. Thus, students soon learned that to avoid discouraging remarks, it is easier to abandon the deeper approach to learning and instead adhere to the specified protocol. As such, MRS Schools run the risk of preparing graduates for a workplace that is not prepared to accept lifelong learning. Although it is important that universities should take the lead by preparing graduates for lifelong learning, in order for it to be fully entrenched in the profession, it is essential that both employers and practitioners must also embrace and support lifelong learning.

All eight HOS indicated that their Schools are committed to promoting lifelong learning as part of their course objectives. There is a trend by MRS Schools towards adopting teaching approaches that promote lifelong learning. This is evidenced by an increased popularity of computer-based learning, problem-based learning, reflective practice, peer learning, web access and self-directed learning in current courses. In line with this finding, Students also reported that they are assuming increasing responsibility for their own learning as they progressed through the course.

Assessments that promote lifelong learning competencies, such as self and peer assessment, reflective and critical thinking, are increasingly being used in current courses, reflecting the assessment trend of using more student-led assessments. However, compared to the previous courses, the ranking of these assessment methods that promote lifelong learning competencies remained unchanged. Despite the increased in adoption of teaching approaches that promote lifelong learning attributes, Schools are relying to the same extent on the assessment methods used in previous courses. This implies that assessment methods adopted by MRS Schools are lagging behind the lifelong learning teaching approaches.

Clinical placement, instructional approaches and instructional styles have been listed as essential features of the MRS courses that assisted students in their development of clinical and learning competence. The inclusion of these factors highlighted the importance of these factors during student training. HOS should therefore pay particular attention to these issues during course design and review.

This study demonstrated the lack of a common focal point between the MRS workplace and the universities. The MRS profession is currently facing the widening gulf of expectations arising from the transition of cadet/diploma training to university based training. There are two contrasting learning cultures: one that was previously a task oriented learning environment versus a new learning culture that although still task oriented, is now also placing greater emphasis towards the acquisition of learning competencies with the aims of preparing graduates for future learning and role expansion. Currently, the major link between the workplace and the MRS Schools is that the latter provides the necessary basic qualification for entry into the profession. Aside from this broad role, there is a lack of clear definition of what the profession ie. practitioners expect from degree graduates.

This study has important implications for MRS workplace and profession.

1. There should be greater dialogue and collaboration between MRS employers, AIR and universities to:

- address the gap between the perceived level of importance and actual attainment level of attributes; and
- support one another in working towards establishing a common ground between the expectations of the MRS workplace and the desired objectives and graduate outcomes.

Failing which the practitioners will continue to be dissatisfied, in particular, with the level of clinical competence of new graduates; teaching staff will feel exasperated over their inability to push the lifelong learning agenda and students will be caught in the midst of opposing cultures and differing expectations.

2. Incorporating lifelong learning attributes as essential selection criteria for graduates entering the workforce for the first time, the link between MRS workplace and Higher Education (see Figure 7.2).

Only then will students see the attainment of lifelong learning attributes as essential and desirable goals to work towards during their undergraduate training. Likewise, this would also draw practitioners' attention to the importance the employers and management place on lifelong learning.

3. There should be promotion of lifelong learning amongst practitioners with the use of a conceptual model where professional, generic and lifelong learning attributes are interlinked and regarded with equal importance (see Figure 6.1).

4. The MRS profession needs to work towards creating a workplace culture that values and supports lifelong learning.

Universities assume an important role in the promotion of lifelong learning. In line with other professional education, the aim of MRS courses has evolved beyond that of simply producing clinically competent graduates. This study indicated that MRS Schools are assuming a leading role in the profession by incorporating lifelong learning as one of their course objectives and the Schools are increasingly using student-centred learning approaches that promote lifelong learning. In doing so, the Schools aim to assist graduates in their professional growth and the long-term development of the MRS profession as a whole. However, findings from this study have also shown several important implications for the design of undergraduate MRS programs in Australia:

1. The importance of teaching in an aligned way: aligning learning objectives, teaching cum learning activities and assessment.

Interviews with teaching staff showed that although it is the intentions of lecturers to promote lifelong learning and generic attributes, these objectives are often not explicitly specified as learning objectives in students' handouts. In addition, lifelong learning attributes were rarely assessed. This is due mainly to the difficulty of assessing these attributes. Moreover, many lecturers were hopeful that the process of engaging students in such learning activities would surely inculcate some of these attributes. Students' learning is assessment driven. This, together with Biggs' model of aligned teaching, point towards the importance of assessing lifelong learning attributes. There is therefore the need to:

- specify explicitly all learning objectives in students' handouts; and
- assess the specified learning outcomes (ie. lifelong learning) by adopting more assessment methods that promote lifelong learning, as well as directly and indirectly assessing students' learning processes.

2. Using the learning portfolio during and at the end of the course evaluation to provide evidence of students' learning.

By using the portfolio as one of the means of assessment, students would be motivated to engage in evaluation and reflection on their own learning. By incorporating the acquisition of clinical, generic and lifelong learning attributes as their learning objectives, they would see the value of these attributes as valued outcomes of their undergraduate education. The portfolio acts as a link between university learning and the workplace for the students.

3. Providing professional staff development to cultivate lifelong learning attributes amongst teaching staff and to equip them with the appropriate teaching and assessment approaches.

There must be opportunities for the staff to reflect upon their own teaching approaches and be challenged to accept innovative teaching and assessment practices. They should be assisted to attain the appropriate teaching, learning and assessment skills that are compatible with their new roles as facilitators and collaborators of learning. Last but not least, for quality teaching and learning to take place, strategies must also be put in place to support and reward good teaching.

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Appendices

National Survey on:

Medical Imaging/Radiation Science Graduates in terms of Lifelong Learning

The purpose of this survey is to determine the **role and significance of lifelong learning** in the Medical Imaging (MI)/Radiation Science (MRS) profession*.

A lifelong learner is:

- one who has an inquiring mind
- able to see the 'big picture'
- one with a wide range of learning skills
- information literate
- confident about learning

(Candy et al., 1994, *Developing Lifelong Learners through Undergraduate Education*, Commissioned Report No. 28, NBEET, AGPS, Canberra)

Mr. Alan Malbon, President of the Australian Institute of Radiography (AIR), in his foreword on the introduction of Continuing Professional Development (CPD), indicated that the Council of AIR "supports unreservedly the process of lifelong learning" [February Spectrum, 1999, Vol 6 (1):4].

This survey is being sent to all AIR members, as well as MI/MRS practitioners working in hospitals, private practice and other institutions.

The information you provide will:

- assist in establishing the profile of MI/MRS Practitioners
- indicate the importance of the identified attributes
- ascertain the interest within the profession with respect to ongoing development and education.

  This is timely in view of the introduction of CPD, as it will provide you with information regarding the trend of continuing education.
- provide a snapshot of recent MI/MRS courses

This information will indicate how the profession, as a whole, can assist graduates to meet the challenges of the next millennium via better delivery of professional practice and high quality patient care.

In order to obtain an accurate broad range of views, it is important that you **send in your response**. Your participation is highly valued and greatly appreciated. The survey will require approximately 15 minutes of your time.

Each questionnaire will be treated in the strictest confidence. Information provided will not be made available to any individual or organisation. All data obtained will be reported only in an aggregated form, so that it will not be possible to identify individual responses. Results from this survey will be released via conferences, paper publication and through the Internet as soon as all responses have been analysed.

Please return the completed questionnaire in the reply paid envelope provided by the 30th June 1999. Thank you for your co-operation.
Jenny Sim

Note: *The terms Medical Imaging (MI) and Medical Radiation Science (MRS) are used interchangeably here. This survey uses the definition provided by the AIR. MI/MRS Practitioner refers to Medical Imaging practitioners, radiation therapists, nuclear medicine technologists and sonographers.

To encourage your participation and in appreciation of your effort, the 100th, 200th and 300th survey respondent will each receive a Dymocks book voucher valued at A$50. If you are interested, please put your name and address below and mail this slip to the address provided.
Name: _____ Address: _____

Section A: Background Information

This information is necessary for data analysis and to enable the researcher to co-relate responses and identify any significant factors and trends.

Please tick the appropriate response.

1 Gender: Female ❒ 1 Male ❒ 2

2 Age group:

19 years and below	❒ 1	30-39	❒ 3	50-59	❒ 5
20-29	❒ 2	40-49	❒ 4	60+	❒ 6

3 Please indicate your current status.

MI/MRS Practitioner	❒ 1	Academic	❒ 3	Administrator	❒ 5
Head of MI/MRS Department	❒ 2	Student	❒ 4	Other	❒ 6
		(1st/2nd/3rd year)	___	*(Please specify)*_____	

If you have ticked "student", you may ignore the rest of Section A, and please proceed to Section B.

4 Type of Medical Imaging/Radiation Science qualification *(Please refer to your initial/first MI/MRS qualification)*

Certificate	❒ 1	Diploma	❒ 3	Other	❒ 5
Assoc Diploma	❒ 2	Degree	❒ 4	*(Please specify)*_____	

5 You obtained the above qualification in year _____ at age _____.

6 Indicate where you received the qualification: State within Australia :_____

Other Country :_____

7 How many years have you been practising as a MI/MRS practitioner? _____

Trend of Continuing Education

8 Have you acquired additional qualifications(s) since you first qualified as a MI/MRS practitioner? Yes ❒ 1 No ❒ 2

If yes, please specify:

Type of qualification(s) _____ Year obtained: _____

Institution: _____

9 Are you currently pursuing further studies/courses etc.? Yes ❒ 1 No ❒ 2

If yes, please specify: Type of study/course _____

Research in MI/MRS

10 If you have done or currently doing research in MI/MRS, please briefly describe the project.

_____

_____

_____

This project is: completed ❒ 1

in-progress ❒ 2

11 Are you intending to start research in the near future? Yes ❒ 1 No ❒ 2

12 You are currently working in: State within Australia ❒ 1 *(Please specify)*:_____
Other Country ❒ 2 *(Please specify)*:_____

13 Indicate the work environment in which you are currently employed.
(You may choose more than one answer.)

Public hospital ❒ 1 Private hospital ❒ 3 Regional hospital ❒ 5
Private clinic/practice ❒ 2 Educational Institution ❒ 4 Other ❒ 6
*(Please specify)*_____

If you have ticked only "educational institution", you may ignore the rest of Section A, and please proceed to Section B.

14 Are you currently?

Employed Full time as MI/MRS Practitioner ❒ 1 Retired ❒ 4
Employed Part time as MI/MRS Practitioner ❒ 2 Other ❒ 5
Full time study ❒ 3 *(Please specify)* _____

15 Indicate the **main** modality that you are currently performing. *(Select only one)*

General Radiography ❒ 01 Radiotherapy Treatment Planning ❒ 07 General U/S ❒ 13
Emergency Radiography ❒ 02 Radiotherapy Treatment Delivery ❒ 08 Vascular U/S ❒ 14
Mammography ❒ 03 Brachytherapy ❒ 09 Obstetric U/S ❒ 15
Angiography ❒ 04 General Nuclear Medicine ❒ 10 Management ❒ 16
Computed Tomography ❒ 05 Radiopharmaceutical Laboratory ❒ 11 Other ❒ 17
Magnetic Resonance Imaging ❒ 06 PET ❒ 12 *(Please specify)*_____

16 If you are also actively involved in other duties, please tick these functions.
(You may choose more than one answer.)

General Radiography ❒ 01 Radiotherapy Treatment Planning ❒ 07 General U/S ❒ 13
Emergency Radiography ❒ 02 Radiotherapy Treatment Delivery ❒ 08 Vascular U/S ❒ 14
Mammography ❒ 03 Brachytherapy ❒ 09 Obstetric U/S ❒ 15
Angiography ❒ 04 General Nuclear Medicine ❒ 10 Management ❒ 16
Computed Tomography ❒ 05 Radiopharmaceutical Laboratory ❒ 11 Other ❒ 17
Magnetic Resonance Imaging ❒ 06 PET ❒ 12 *(Please specify)*_____

17 Indicate the approximate number of employees in your MI/MRS department.
(This includes MI/MRS practitioners, nurses, radiologists, physicists, radiochemists, nuclear medicine physicians, receptionists and orderlies etc.)

Fewer than 5 ❒ 1 11-20 ❒ 3 Above 50 ❒ 5
5-10 ❒ 2 21-50 ❒ 4 Other ❒ 6
(Please specify) _____

Section B: Attributes of MI/MRS Practitioners and their importance

Instructions

Please **circle** the number which best describes your answer. The meanings of the number codes are:

	1	2	3	4	5
Importance of attributes	**Very Important (VI)**	**Important (I)**	**Average (A)**	**Unimportant (U)**	**Very Unimportant (VU)**
Level of current attainment	**Very High (VH)**	**High (H)**	**Average (A)**	**Low (L)**	**Very Low (VL)**

"Importance of attributes" refers to **your perception** of how important these attributes should be **in the profession**.

"Level of current attainment" refers to **your perception** of the current level these attributes are in practice, **as evident amongst the practitioners i.e. your colleagues**.

For instance, you may view verbal communication skills with patients as of utmost importance, but feel that the Practitioners in general, would score an average rating.

		Importance of Attributes	Level of Current Attainment
		VI I A U VU	VH H A L VL
4	Verbal communication skills with patients	1 2 3 (4) 5	1 2 (3) 4 5

How to change your answer

If you want to change your answer, cross it out and circle a new number.

4	Verbal communication skills with patients	1 2 3 (4) 5	1 2 ~~(3)~~ 4 (5)

		Importance of Attributes (In Principle)					**Level of Current Attainment (In Practice)**				
		VI	**I**	**A**	**U**	**VU**	**VH**	**H**	**A**	**L**	**VL**
1	Knowledge of discipline	1	2	3	4	5	1	2	3	4	5
2	Ability to apply knowledge	1	2	3	4	5	1	2	3	4	5
3	Clinical skills in handling patients	1	2	3	4	5	1	2	3	4	5
4	Verbal communication skills with patients	1	2	3	4	5	1	2	3	4	5
5	Professional attitude to work	1	2	3	4	5	1	2	3	4	5
6	Ability to share knowledge	1	2	3	4	5	1	2	3	4	5
7	Ability to communicate with peers	1	2	3	4	5	1	2	3	4	5
8	Ability to work in a team	1	2	3	4	5	1	2	3	4	5
9	Ability to work independently	1	2	3	4	5	1	2	3	4	5
10	Ability to take the lead	1	2	3	4	5	1	2	3	4	5
11	Ability to show initiative	1	2	3	4	5	1	2	3	4	5
12	Ability to make decisions	1	2	3	4	5	1	2	3	4	5
13	Ability to accept advice/criticism	1	2	3	4	5	1	2	3	4	5
14	Ability to use appropriate computing skills	1	2	3	4	5	1	2	3	4	5
15	Ability to make critical judgments	1	2	3	4	5	1	2	3	4	5
16	Ability to self evaluate	1	2	3	4	5	1	2	3	4	5

		Importance of Attributes (In Principle)					Level of Current Attainment (In Practice)				
		VI	I	A	U	VU	VH	H	A	L	VL
17	Ability to manage time	1	2	3	4	5	1	2	3	4	5
18	Ability to manage one's own learning	1	2	3	4	5	1	2	3	4	5
19	Ability to adapt to change	1	2	3	4	5	1	2	3	4	5
20	Ability to find practical solutions	1	2	3	4	5	1	2	3	4	5
21	Ability to see the "big-picture" *(Ability to have a wide perspective)*	1	2	3	4	5	1	2	3	4	5
22	Ability to set goals	1	2	3	4	5	1	2	3	4	5
23	Willingness to learn new things	1	2	3	4	5	1	2	3	4	5
24	Information literate *(know where, how to access & evaluate information)*	1	2	3	4	5	1	2	3	4	5
25	Being confident to continue learning *(Believing in own ability to continue learning)*	1	2	3	4	5	1	2	3	4	5
26	Other characteristics *(Please specify)*	1	2	3	4	5	1	2	3	4	5
	_____	1	2	3	4	5	1	2	3	4	5
	_____	1	2	3	4	5	1	2	3	4	5
	_____	1	2	3	4	5	1	2	3	4	5

Instructions for Ranking

Of the 25+ items listed above, please rank only the **10 most important attributes in order of importance** i.e. 1 as most important, 10 as the least important

For instance, you may view 8 (Ability to work in team) as the most important attribute, while 17 (Ability to manage time) as the least important of the 10. Hence, in the table below, write "8" under Column 1, and "17" under Column 10. Place the other eight attributes in the table in corresponding order of importance.

	1: most important……10: least important									
Your Ranking	1	2	3	4	5	6	7	8	9	10
Item no. as above										

Please add any further comments.

_____

_____

_____

_____

_____

_____

Section C: Information on Recent Courses in Australia/Overseas

If you obtained your initial MI/MRS qualification before 1990, completion of Section C is optional.
However, it would be greatly appreciated if you could add comments about any aspect of your initial course that you feel has assisted you to develop the essential characteristics of a MI/MRS practitioner. Then return your completed questionnaire in the reply paid envelope.

_____

_____

_____

_____

If you obtained your initial MI/MRS qualification in 1990 or thereafter, or if you are a student, please continue with the rest of the questionnaire.

Instructions
Please respond according to **your own experience** with the Radiography/MI/MRS course (certificate/diploma/degree) you undertook or are currently undertaking. Please note that this section refers to your **initial** qualification, and **not** to your postgraduate course(s).

About your Initial Course of Study

1 Indicate your mode of study. *(You may select more than one answer.)*

Full time ❒ 1 Part time ❒ 2 On Campus ❒ 3 Off Campus ❒ 4

2 Was your course fully prescribed? (i.e. there was no choice in the selection of subjects) Yes ❒ 1 No ❒ 2

If yes, please proceed to Question 5.

3 If no, please give examples of the optional subject(s) that you have undertaken.

_____

4 Please indicate the approximate hours per week of optional subjects in the total course. _____

5 In your course, were you required to undertake subjects which were aimed at improving the generic skills? *(See Section B: Nos. 7-14)* Yes ❒ 1 No ❒ 2

If no, please proceed to Question 7.

6 If yes, please tick the skill(s) that was/were included as a compulsory part of your studies.

6.1	Study skills	❒ 1	6.4	Library skills	❒ 4
6.2	Communication skills	❒ 2	6.5	Computer literacy	❒ 5
6.3	Self-organisation, time management skills	❒ 3	6.6	Others	❒ 6

7 As you progressed through the course, were you required to gradually take more responsibility for your own learning? Yes ❒ 1 No ❒ 2
(This means that there is/was minimal teaching by lecturers. Instead, in consultation with your lecturers, you are/were allowed to plan your own learning objectives, learning schedule and outcome.)

Please elaborate on your answer.

_____

_____

_____

Teaching Approaches

8 The following are some of the common teaching methods that are used in many courses. Please tick all the methods that you experienced in your course.

8.1	Lecture-tutorial mode	❒ 01	8.7	Laboratory/practical session	❒ 07
8.2	Clinical attachment	❒ 02	8.8	Role play	❒ 08
8.3	Peer learning	❒ 03	8.9	Problem-based learning	❒ 09
8.4	Audio-visual module	❒ 04	8.10	Computer-based learning	❒ 10
8.5	Self-directed learning *(Students decide on their own learning objectives and outcome)*	❒ 05	8.11	Web access learning *(Accessing learning materials and assessment from the web*	❒ 11
8.6	Reflective practice *(Students reflect upon their learning experience. The reflective journal may form part of their assessment)*	❒ 06	8.12	Mentoring System *(Please elaborate)*_____ Other *(Please specify)* _____	❒ 12 ❒ 13

Of the items you have ticked above, please now list the 3 main teaching approaches. *(Please use code numbers*❒ xx*)* _____

Assessment Methods

9 Please tick all the assessment methods you experienced in your course.

9.1	Assignment writing	❒ 01	9.6	Test &/or semester exam	❒ 06
9.2	Oral presentation	❒ 02	9.7	Practical exam	❒ 07
9.3	Peer assessment	❒ 03	9.8	Clinical assessment	❒ 08
9.4	Open book exam	❒ 04	9.9	Computer-based assessment	❒ 09
9.5	Reflective journals *(Your reflections form part of the assessment. This does **not** refer to a logbook of student's records of clinical cases*	❒ 05	9.10	Self assessment *(Student has input into assessment)*	❒ 10
			9.11	Other *(Please specify)* _____	❒ 11

Of the items you have ticked above, please now list the 3 main assessment methods. *(Please use code numbers*❒ xx*)* _____

10. Please add comments about any aspect of your course that you feel has assisted you to develop the essential characteristics of a MI/MRS practitioner.

_____

_____

_____

Thank you for participating in this survey.

Please return this questionnaire in the reply paid envelope provided

BEFORE 30th June 1999

If you have any questions concerning this survey, please feel free to contact the researcher, Jenny Sim.

Jenny Sim, Lecturer
Department of Medical Imaging
School of Physical Sciences
Curtin University of Technology
GPO Box U 1987
Perth WA 6845

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Email: j.sim@curtin.edu.au

Medical Imaging/Radiation Science Graduates in terms of Lifelong Learning

The purpose of this survey is to determine the **role and significance of lifelong learning*** in the Medical Imaging (MI)/Radiation Science (MRS) profession.

As a final year student in the program, the information you give will:

- provide a snapshot of MI/MRS courses
- assist in establishing the profile of Practitioners
- indicate the importance of the identified attributes
- enable the researcher to ascertain if there are any differences between the attributes identified by students and Practitioners

Your input is highly valued and greatly appreciated. The survey will require approximately 15 minutes of your time. Your responses will be treated in the strictest confidence.

Please return the completed questionnaire to the staff who distributed this survey.

Thank you for your co-operation.

Jenny Sim
Lecturer
Department of Medical Imaging
Curtin University of Technology
Email: j.sim@curtin.edu.au

*A lifelong learner is:

- one who has an inquiring mind
- able to see the 'big picture'
- one with a wide range of learning skills
- information literate
- confident about learning

(Candy et al., 1994, *Developing Lifelong Learners through Undergraduate Education*, Commissioned Report No. 28, NBEET, AGPS, Canberra)

Section A: Background Information

Please tick the appropriate response.

1 Gender: Female ❒ 1 Male ❒ 2

2 Age group:

19 years and below	❒ 1	30-39	❒ 3	50-59	❒ 5
20-29	❒ 2	40-49	❒ 4	60+	❒ 6

Other Academic/Professional Qualification

3 Do you have any other academic/professional qualification prior to the commencement of the current MRS course? Yes ❒ 1 No ❒ 2

If yes, please specify:

Type of qualification(s) _____ Year obtained: _____

Institution: _____

Section B: Information about your courses

1 Indicate your mode of study. *(You may select more than one answer.)*

Full time ❒ 1 Part time ❒ 2 On Campus ❒ 3 Off Campus ❒ 4

2 Is your course fully prescribed? (i.e. there is no choice in the selection of subjects) Yes ❒ 1 No ❒ 2

If yes, please proceed to Question 5.

3 If no, please give examples of the optional subject(s) that you have undertaken.

_____

4 Please indicate the approximate hours per week of optional subjects in the total course. _____

5 In your course, are you required to undertake subjects which aim at improving the generic skills? *(See Section C: Nos. 7-14)* Yes ❒ 1 No ❒ 2

If no, please proceed to Question 7.

6 If yes, please tick the skill(s) that is/are included as a compulsory part of your studies.

6.1	Study skills	❒ 1	6.4	Library skills	❒ 4
6.2	Communication skills	❒ 2	6.5	Computer literacy	❒ 5
6.3	Self-organisation, time management skills	❒ 3	6.6	Others	❒ 6

7 As you progressed through the course, are you required to gradually take more responsibility for your own learning? Yes ❒ 1 No ❒ 2

(This means that there is/was minimal teaching by lecturers. Instead, in consultation with your lecturers, you are/were allowed to plan your own learning objectives, learning schedule and outcome.)

Please elaborate on your answer.

_____

_____

_____

_____

_____

Teaching Approaches

8 The following are some of the common teaching methods that are used in many courses. Please tick all the methods that you experienced in your course.

8.1	Lecture-tutorial mode	❒ 01	8.7	Laboratory/practical session	❒ 07
8.2	Clinical attachment	❒ 02	8.8	Role play	❒ 08
8.3	Peer learning	❒ 03	8.9	Problem-based learning	❒ 09
8.4	Audio-visual module	❒ 04	8.10	Computer-based learning	❒ 10
8.5	Self-directed learning *(Students decide on their own learning objectives and outcome)*	❒ 05	8.11	Web access learning *(Accessing learning materials and assessment from the web*	❒ 11
8.6	Reflective practice *(Students reflect upon their learning experience. The reflective journal may form part of their assessment)*	❒ 06	8.12	Mentoring System *(Please elaborate)*_____	❒ 12
				Other *(Please specify)* _____	❒ 13

Of the items you have ticked above, please now list the 3 main teaching approaches. *(Please use code numbers*❒ xx*)* _____

Assessment Methods

9 Please tick all the assessment methods you experienced in your course.

9.1	Assignment writing	❒ 01	9.6	Test &/or semester exam	❒ 06
9.2	Oral presentation	❒ 02	9.7	Practical exam	❒ 07
9.3	Peer assessment	❒ 03	9.8	Clinical assessment	❒ 08
9.4	Open book exam	❒ 04	9.9	Computer-based assessment	❒ 09
9.5	Reflective journals *(Your reflections form part of the assessment. This does **not** refer to a logbook of student's records of clinical cases*	❒ 05	9.10	Self assessment *(Student has input into assessment)*	❒ 10
			9.11	Other *(Please specify)* _____	❒ 11

Of the items you have ticked above, please now list the 3 main assessment methods. *(Please use code numbers* ❒ xx*)* _____

10 Please add comments about any aspects of your course that you feel have assisted you to develop the essential characteristics of a MI/MRS practitioner.

_____

_____

_____

_____

_____

Section C: Attributes of MI/MRS Practitioners and their importance

Instructions

Please **circle** the number which best describes your answer. The meanings of the number codes are:

	1	2	3	4	5
Importance of attributes	**Very Important (VI)**	**Important (I)**	**Average (A)**	**Unimportant (U)**	**Very Unimportant (VU)**
Level of current attainment	**Very High (VH)**	**High (H)**	**Average (A)**	**Low (L)**	**Very Low (VL)**

"**Importance of attributes**" refers to your perception of **how important these attributes should be in the profession**.

"**Level of current attainment**" refers to your perception of **the extent to which practitioners have these attributes**.

For instance, you may view verbal communication skills with patients as of utmost importance, but feel that the Practitioners in general, would score an average rating.

		Importance of Attributes	Level of Current Attainment
		VI I A U VU	VH H A L VL
4	Verbal communication skills with patients	1 2 3 (4) 5	1 2 (3) 4 5

How to change your answer

If you want to change your answer, cross it out and circle a new number.

4	Verbal communication skills with patients	1 2 3 (4) 5	1 2 (3) 4 (5)

		Importance of Attributes (In Principle)					**Level of Current Attainment (In Practice)**				
		VI	**I**	**A**	**U**	**VU**	**VH**	**H**	**A**	**L**	**VL**
1	Knowledge of discipline	1	2	3	4	5	1	2	3	4	5
2	Ability to apply knowledge	1	2	3	4	5	1	2	3	4	5
3	Clinical skills in handling patients	1	2	3	4	5	1	2	3	4	5
4	Verbal communication skills with patients	1	2	3	4	5	1	2	3	4	5
5	Professional attitude to work	1	2	3	4	5	1	2	3	4	5
6	Ability to share knowledge	1	2	3	4	5	1	2	3	4	5
7	Ability to communicate with peers	1	2	3	4	5	1	2	3	4	5
8	Ability to work in a team	1	2	3	4	5	1	2	3	4	5
9	Ability to work independently	1	2	3	4	5	1	2	3	4	5
10	Ability to take the lead	1	2	3	4	5	1	2	3	4	5
11	Ability to show initiative	1	2	3	4	5	1	2	3	4	5
12	Ability to make decisions	1	2	3	4	5	1	2	3	4	5
13	Ability to accept advice/criticism	1	2	3	4	5	1	2	3	4	5
14	Ability to use appropriate computing skills	1	2	3	4	5	1	2	3	4	5
15	Ability to make critical judgments	1	2	3	4	5	1	2	3	4	5
16	Ability to self evaluate	1	2	3	4	5	1	2	3	4	5

		Importance of Attributes **(In Principle)**					**Level of Current Attainment (In Practice)**				
		VI	**I**	**A**	**U**	**VU**	**VH**	**H**	**A**	**L**	**VL**
17	Ability to manage time	1	2	3	4	5	1	2	3	4	5
18	Ability to manage one's own learning	1	2	3	4	5	1	2	3	4	5
19	Ability to adapt to change	1	2	3	4	5	1	2	3	4	5
20	Ability to find practical solutions	1	2	3	4	5	1	2	3	4	5
21	Ability to see the "big-picture" *(Ability to have a wide perspective)*	1	2	3	4	5	1	2	3	4	5
22	Ability to set goals	1	2	3	4	5	1	2	3	4	5
23	Willingness to learn new things	1	2	3	4	5	1	2	3	4	5
24	Information literate *(know where, how to access & evaluate information)*	1	2	3	4	5	1	2	3	4	5
25	Being confident to continue learning *(Believing in own ability to continue learning)*	1	2	3	4	5	1	2	3	4	5
26	Other characteristics *(Please specify)*	1	2	3	4	5	1	2	3	4	5
	_____	1	2	3	4	5	1	2	3	4	5
	_____	1	2	3	4	5	1	2	3	4	5
	_____	1	2	3	4	5	1	2	3	4	5

Instructions for Ranking

Of the 25+ items listed above, please rank only the **10 most important attributes in order of importance** i.e. 1 as most important, 10 as the least important

For instance, you may view 8 (Ability to work in team) as the most important attribute, while 17 (Ability to manage time) as the least important of the 10. Hence, in the table below, write "8" under Column 1, and "17" under Column 10. Place the other eight attributes in the table in corresponding order of importance.

	1: most important……10: least important									
Your Ranking	1	2	3	4	5	6	7	8	9	10
Item no. as above										

Please add any further comments.

_____

_____

_____

_____

_____

Thank you for participating in this survey.

Please be assured that your response will be treated in the strictest confidence. All data obtained will be reported only in an aggregated form, so that it will not be possible to identify individual responses.

PLEASE RETURN THIS QUESTIONNIARE TO THE STAFF WHO DISTRIBUTED THE SURVEY.

Survey on Medical Imaging/Radiation Science Undergraduate Courses in the context of Lifelong Learning

This survey, as part of an ongoing research project, aims at examining undergraduate courses in relation to lifelong learning.

The purpose of this survey is to get a snapshot of the Medical Imaging/Radiation Science courses that are currently taught in Australia.

As Head of a Department/School, your response will provide a picture of the current status of lifelong learning in your department. Your cooperation in completing this survey is therefore vital.

Your response will be treated in the strictest confidence. Data obtained will be available only in aggregated form.

This survey is based on [*]Candy et al. (1994) definition of a lifelong learner. A lifelong learner as defined by Candy is:

- one who has an inquiring mind
- information literate
- able to see the 'big picture'
- confident about learning
- one with a wide range of learning skills

Jenny Sim, Lecturer
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[*] Source: Candy, P., Crebert, G. and O'Leary J. (1994) *Developing Lifelong Learners through Undergraduate Education*. Commissioned Report No. 28, NBEET. AGPS, Canberra.

Instructions: ***Please complete the survey in the context of the five characteristics of lifelong learner as listed by Candy et al. (1994)***

Course Objectives

1 What is your "ideal" of a Medical Imaging/Radiation Science graduate?

_____

_____

_____

_____

2 Does this ideal graduate differ from your current graduate? Please elaborate your answer.

_____

_____

_____

_____

	Yes	No
3 Does your Department/School explicitly promote lifelong learning as a course objective?	❒	❒

If your answer is yes, please continue with Question 4.

If your answer is no, please proceed to Question 9.

Course Structure and Content/Teaching and Assessment

4 Which aspects of your **course structure** and **content** promote lifelong learning in your students? Please describe these features.

_____

_____

_____

_____

_____

_____

5 Which aspects of your **Department's/School's teaching** and **assessment practices** promote lifelong learning in your students? Please describe these features.

_____

_____

_____

_____

_____

Commitment of Department to Lifelong Learning

6 As Head of the Department/School, what strategies do you have in place to actualise the commitment of lifelong learning?

_____

_____

_____

_____

_____

7 How does your Department/School assist staff to acquire lifelong learning skills so that they in turn can assist students to become lifelong learners? Please provide details.

Financial support _____

_____

Infrastructure support _____

_____

Time off for professional development _____

_____

Others (Please specify)

_____

_____

8 Briefly describe any existing policies or practices within your University/Department that encourage/hinder the development of lifelong learning attributes in your graduates.

_____

_____

_____

_____

_____

Please proceed now to Question 12.

9 What specific course objective(s) does your Department/School promote in Medical Imaging/Radiation Science course?

_____

_____

_____

_____

_____

10 Which aspects of your **course structure** and **content** promote the objectives listed under Question 9?

_____

_____

_____

_____

11 Which aspects of your **Department's/School's teaching** and **assessment practices** promote the objectives listed under Question 9?

_____

_____

_____

_____

Components of Undergraduate Program

12 For each of the categories listed below, please indicate the approximate content percentage it currently occupies in your entire undergraduate course.

If the percentage allocation indicated by you is not your ideal of a balanced undergraduate program, please indicate the ideal percentage in the next column.

Category	**Content Percentage** (Current)	(Ideal)
Discipline-based knowledge units (eg. Medical Imaging/Radiation Science subjects, clinical subjects etc.)	……..	……..
Generic skills units (eg. communications skills, teamwork, time management skills, leadership skills etc.)	……..	……..
General knowledge units (elective units)	……..	……..
Australian studies (awareness of cross cultural, multicultural component)	……..	……..
Lifelong learning skills (eg. learning how to learn units that involve reflective practice and higher order of thinking such as analysis, synthesis, evaluation and critical thinking)	……..	……..
TOTAL	**100%**	**100%**

		Yes	No
13	Does your Department/School have any formal arrangement with other Australian Universities/overseas institutions for credit transfer?	❒	❒

		Yes	No
14	Does your Department/School give any recognition of prior learning such as students' work experience in Radiology Department?	❒	❒

If yes, please give examples.

_____

Medical Imaging/Radiation Science Profession and Lifelong Learning

15 In your opinion, what does lifelong learning mean for the Medical Imaging/Radiation Science Profession?

_____

_____

_____

_____

16 In your opinion, what is the impact on employability for having attributes of a lifelong learner?

_____

_____

_____

_____

17 Do you think employers are prepared to accept graduates who are critical thinkers (ie. people who question and suggest new ways of doing things etc.), rather than conforming to the established practice?
Please elaborate your answer.

_____

_____

_____

_____

18 Please indicate the year in which your program became a degree course. _____

19 Please add any further comments.

_____

_____

_____

_____

20 Name of institution _____

Thank you for participating in this survey

Please return the completed questionnaire in the envelope provided to Mr. Tony Knights or by post no later than 23rd April 1999.

Return-path: <owner-airnews@connect.com.au>
Date: Fri, 18 Jun 1999 08:39:58 +0800
From: Jenny Sim <j.sim@cc.curtin.edu.au>
Subject: [AIRNEWS] National Survey on MI/MRS Graduates
Sender: owner-airnews@connect.com.au
X-Sender: nsimjh@cc.curtin.edu.au
To: airnews@connect.com.au
Reply-to: AIRNEWS <airnews@connect.com.au>
Delivered-to: airnews-obscured@mali.connect.com.au
Delivered-to: airnews@mali.connect.com.au

Hello!
I would like to draw your attention to the survey that is enclosed in the June issue of Spectrum. The survey focuses on the attributes of Medical Imaging (MI)/Radiation Science (MRS) graduates in terms of lifelong learning.

This survey has been sent to all AIR members, as well as practitioners (radiographers, radiation therapists, sonographers and nuclear medicine technologists) working in hospitals, private practice and other institutions nation wide. I invite you to complete and return the survey.
(If you have already done so, many thanks.)

The information you provide will:
1 assist in establishing the profile of MI/MRS Practitioners
2 indicate the importance of the identified attributes
3 ascertain the interest within the profession with respect to ongoing development and education
4 provide a snapshot of recent MI/MRS courses

This information will indicate how the profession, as a whole can assist graduates to meet the challenges of the next millennium via better delivery of professional practice and high quality patient care.

In order to ensure statistically significant data, may I urge you and your colleagues to complete the survey (which will take approximately 15 minutes of your time) and return the completed survey in the reply paid envelope.

Any practitioner who is interested in completing the survey but is unable to get hold of a copy, please email me direct and I will be only too pleased to send you a hardcopy of the survey. Also please feel free to email me if any of you are interested to find out more about the research project.

All data obtained will be reported only in an aggregated form. Results from this survey will be released via conferences, paper publication, Internet and through this list as soon as all responses have been analysed.

Thank you
Yours Sincerely
Jenny

Jenny Sim
Lecturer
Department of Medical Imaging
School of Physical Sciences
Curtin University of Technology
GPO Box U 1987
Perth WA 6845

Tel : (08) 9266 3550
Fax : (08) 9266 2377
Email : j.sim@curtin.edu.au

PAEB

Precis, 48th Meeting of the PAEB

Via Teleconference
Thursday February 4, 1999

1. The PAEB discussed the draft Guidelines for the Accreditation of courses in Medical Radiation Science document with a view to finalising the document at the ANC meeting.
2. The PAEB discussed the introduction of CPD within the AIR, in particular, those members who currently participate in CPD programs offered by ASUM and the ASA.
3. The PDO met with the PAEB and discussed the implementation of CPD in the AIR.
4. The Radiation Therapy course offered by Trinity College, Ireland was reviewed by the PAEB. Comments were forwarded to Council.

Precis, 49th Meeting of the PAEB

Crown Towers, Melbourne
March 15-17 1999

1. The PAEB discussed the level of enrolments for Australian undergraduate courses and the implications for workforce planning.
2. The Professional development Officer of the AIR, Greg Brown, met with the PAEB to discuss the implementation of CPD within the AIR.
3. The PAEB reviewed the Educational Policies and Procedures document – 1998 (EPPD) and forwarded a list of suggested amendments to Council.
4. The PAEB considered three exemptions from PDY and will forward its recommendations to applicants shortly.
5. As part of the agreement reached with the UK College of Radiographers for the recognition of Australian qualifications, the PAEB has finalised plans for the review of all UK course documents.
6. The PAEB commenced the review of the Competency Based Assessment (CBA) process. The PAEB will consult with CBA assessors during the year with a view to completing the review by November
7. The PAEB met with the Ultrasound Advisory Panel (UAP) to discuss the implementation of the AIR CPD program.
8. The PAEB met with the Magnetic Resonance Advisory Panel (MRAP) to discuss the inclusion of the panel's education policy as part of the EPPD.
9. Material for inclusion in the PAEB's "Guidelines for the accreditation of courses in medical radiation science" was finalised. A draft of this document will be provided to the Heads of Schools meeting scheduled for April.
10. The PAEB met with Council to discuss issues such as the review of UK courses and the Resumption of Professional Practice document.

Precis, 50th Meeting of the PAEB

AIR Secretariat, Melbourne
May 8, 1999

1. The PAEB reviewed feedback from the recent Heads of Schools meeting on the draft Accreditation Guidelines. A number of changes were made to the document which will be trialled at the re accreditation of the University of Newcastle course on 18 and 19 May 1999.
2. The PAEB discussed the implementation of CPD within the AIR.
3. With reference to the Educational Policies and Procedures Document (EPPD), the Board considered the current eligibility requirements for membership of the PAEB and State PAECs given that not all Ordinary Members possess a Statement of Accreditation (or its equivalent).
4. The PAEB considered a request for exemption from PDY and will forward its recommendation to the VIC PAEC shortly.
5. The review of the CBA is continuing with a questionnaire distributed to current CBA assessors.
6. The next meeting of the PAEB will be on Thursday June 10, 1999 via teleconference.

Justin Sara
Honorary Secretary
PAEB

Reminder

NATIONAL SURVEY ON MEDICAL IMAGING/RADIATION SCIENCE GRADUATES IN TERMS OF LIFELONG LEARNING

This is a reminder to all members who have not yet completed the above mentioned survey in the June issue of *Spectrum*. It would be greatly appreciated if you could return the completed survey as soon as possible, before July 31, 1999.

Thank you for your cooperation.

Jenny Sim, Lecturer
Curtin University of Technology

10th August 1999

Mr/Ms
Address

Dear Sir/Madam

Re: National Survey on Medical Imaging/Radiation Science Graduates in terms of Lifelong Learning

Hello! Greetings from Perth. I am a lecturer from the Medical Imaging Department, Curtin University of Technology, Perth. I am currently conducting a research, investigating the attributes of Medical Imaging (MI)/Radiation Science (MRS) in terms of lifelong learning.

The purpose of this research is for the practitioners to identify the attributes of MI/MRS Practitioners*, and rank the importance of these attributes. Data will then be co-related to determine if the current courses are actively promoting and developing these attributes.

The main data collection activity involves a national survey of MI/MRS practitioners. For this to be a success, the survey has to be distributed to as wide a professional community as possible.

I am therefore seeking your help in promoting and distributing the survey to the radiation therapists in your hospital and, possibly during one of your branch and education meetings. Please find enclosed copies of the survey and replied paid envelopes. If you need additional copies, please feel free to photocopy as many as required.

The dateline indicated in the survey is targeted at the June issue of *Spectrum* (*Spectrum* is the official newsletter of Australian Institute of Radiography [AIR]). As this is a nation wide survey, it is anticipated that the survey will reach some practitioners well after the June dateline (possibly in July and August). As such please continue to encourage your colleagues, to complete and return the survey irrespective of the published dateline.

The information obtained from this survey will indicate how the profession can meet the challenges of the next millennium via better delivery of professional practice and high quality of patient care. As soon as all responses have been analysed, the results will be released via conferences, paper publication and possibly through the Internet.

The survey is also available on the web:
http://www.curtin.edu.au/curtin/dept/phys-sci/medimg/survey.html
The survey can therefore also be returned electronically by simply clicking the "submit" button at the end of the survey. It would be appreciated if you could inform your colleagues of this option.

If there is sufficient response amongst the radiation therapy community, it may be possible to determine if the attributes regarded important by your colleagues are any different from the rest of the medical imaging community.

Please do not hesitate to contact me should you have any queries, or are interested to find out more about the research project.

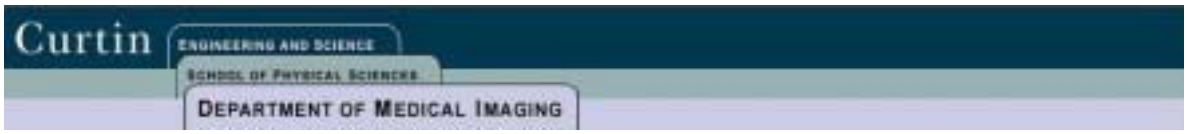
**MI/MRS Practitioners refers to radiographers, radiation therapists, sonographers and nuclear medicine technologists. Hence, all practitioners are encouraged to participate in the survey.*

Thank you once again for your help in this research project.

With much appreciation

Jenny Sim
Department of Medical Imaging

Email: j.sim@curtin.edu.au
Tel: (08) 9266 3550
Fax: (08) 9266 2377



National Survey on:

Medical Imaging/Radiation Science Graduates in terms of Lifelong Learning

The purpose of this survey is to determine the **role and significance of lifelong learning** in the Medical Imaging (MI)/Radiation Science (MRS) profession*.
A lifelong learner is:

- one who has an inquiring mind
- able to see the 'big picture'
- one with a wide range of learning skills
- information literate
- confident about learning

(Candy et al., 1994, *Developing Lifelong Learners through Undergraduate Education*, Commissioned Report No. 28, NBEET, AGPS, Canberra)

The President of the Australian Institute of Radiography (AIR), Mr Alan Malbon, in his foreword on the introduction of Continuing Professional Development (CPD), indicated that the Council of AIR "supports unreservedly the process of lifelong learning" [February Spectrum, 1999, Vol 6 (1):4].
All MI/MRS practitioners, including radiographers, sonographers, nuclear medicine technologists and radiation therapists, are being encouraged to participate in this survey.
The information you provide will:

- assist in establishing the profile of MI/MRS Practitioners
- indicate the importance of the identified attributes
- ascertain the interest within the profession with respect to ongoing development and education. This is timely in view of the introduction of CPD, as it will provide you with information regarding the trend of continuing education.
- provide a snapshot of recent MI/MRS courses

This information will indicate how the profession, as a whole, can assist graduates to meet the challenges of the next millennium via better delivery of professional practice and high quality patient care.

Your participation is highly valued and greatly appreciated. The survey will require approximately 15 minutes of your time.
Each questionnaire will be treated in the strictest confidence. Information provided will not be made available to any individual or organisation. All data obtained will be reported only in an aggregated form, so that it will not be possible to identify individual responses. Results from this survey will be released via conferences, paper publication and through the Internet as soon as all responses have been analysed.

Thank you for your co-operation.
Jenny Sim

Note: *The terms Medical Imaging (MI) and Medical Radiation Science (MRS) are used interchangeably here. This survey uses the definition provided by the AIR. MI/MRS Practitioner refers to Medical Imaging practitioners, radiation therapists, nuclear medicine technologists and sonographers.

Instructions

- The Internet Explorer browser is not able to process this type of online form. Please use the Netscape browser to complete this form. We apologise for any inconvenience.
- To complete this form, you may be required to - click on your desired response, choose a response from a pull down menu or enter the required information in the appropriate text boxes.
- Upon answering all questions, click the **submit** button at the bottom of the page to send us your responses.
- When you click on the submit button an alert will appear to warn you that the form is submitted via email and that submitting the form will reveal your email address to the recipient (Jenny Sim) and will send the form data without encryption. The form does not request any personal information such as name, address etc.

SECTION A: Background Information

This information is necessary for data analysis and to enable the researcher to co-relate responses and identify any significant factors and trends.

1. female Gender

2. 19 or under Age

3. Please indicate your current status

MI/MRS practitioner

If 'other' - please specify

If 'student' - please specify year

If you have selected 'student', you may ignore the rest of Section A, and please proceed to Section B

4. Type of Medical Imaging/Radiation Science qualification *(Please refer to your initial/first MI/MRS qualification)*

Certificate

If 'other' - please specify

5. You obtained the above qualification in year _____ at age _____

Indicate where you received the qualification:

6. State within Australia: WA

Other Country: _____

7. How many years have you been practising as a MI/MRS practitioner? _____

Trend of Continuing Education

Have you acquired additional qualifications(s) since you first qualified as a MI/MRS practitioner? ☐ yes ☐ no

If yes, please specify:

8. Type of qualification(s)

Year obtained:

Institution(s):

Are you currently pursuing further studies/courses etc.? ☐ yes ☐ no

9. *If yes, please specify:*

Type of study/course

Research in MI/MRS

If you have done or currently doing research in MI/MRS, please briefly describe the project.

10.

This project is: ☐ completed ☐ in-progress

11. Are you intending to start research in the near future? ☐ yes ☐ no

You are currently working in: *(please specify)*

12. State within Australia: WA

Other Country:

Indicate the work environment in which you are currently employed. *(You may choose more than one answer.)*

13. ☐ Public hospital ☐ Private hospital ☐ Regional hospital

☐ Private clinic/practice ☐ Educational Institution ☐ Other

If 'other' - please specify

If you have ticked only 'educational institution', you may ignore the rest of Section A, and please proceed to Section B.

Are you currently?

14. Employed Full time as MI/MRS Practitioner

If 'other' - please specify

15. Select the main modality that you are currently performing.

Radiotherapy Treatment Planning

If 'other' - please specify

If you are also actively involved in other duties, please tick these functions.*(You may choose more than one answer.)*

16.

- General Radiography ☐
- Brachytherapy ☐
- Emergency Radiography ☐
- General Nuclear Medicine ☐
- Mammography ☐
- Radiopharmaceutical Laboratory ☐
- Angiography ☐
- PET ☐
- Computed Tomography ☐
- General U/S ☐
- Magnetic Resonance Imaging ☐
- Vascular U/S ☐
- Radiotherapy Treatment Planning ☐
- Obstetric U/S ☐
- Radiotherapy Treatment Delivery ☐
- Management ☐
- Other ☐

If Other - *please specify*

17. Indicate the approximate number of employees in your MI/MRS department. *(This includes MI/MRS practitioners, nurses, radiologists, physicists, radiochemists, nuclear medicine physicians, receptionists and orderlies etc.)*

Few er than 5

If 'other' - please specify

SECTION B: Attributes of MI/MRS Practitioners and their importance

Instructions

Please select the response which best describes your answer. The meanings of the abbreviations are:

Importance of attributes

VI	I	A	U	VU
Very Important	Important	Average	Unimportant	Very Unimportant

Level of current attainment

VH	H	A	L	VL
Very High	High	Average	Low	Very Low

'Importance of attributes' refers to your perception of how important these attributes should be in the profession.

'Level of current attainment' refers to your perception of the current level these attributes are in practice, as evident amongst the practitioners i.e. your colleagues.

For instance, you may view verbal communication skills with patients as of utmost importance, but feel that the Practitioners in general, would score an average rating. For example:

	VI	I	A	U	VU	VH	H	A	L	VL
4. Verbal communication skills with patients	◉	○	○	○	○	○	○	◉	○	○

	Importance of Attributes (in principle)					Level of Current Attainment (in practice)				
	VI	I	A	U	VU	VH	H	A	L	VL
1. Knowledge of discipline	○	◉	○	○	○	○	○	○	○	○
2. Ability to apply knowledge	○	○	○	○	○	◉	○	○	○	○
3. Clinical skills in handling patients	○	○	○	○	○	○	○	○	○	○
4. Verbal communication skills with patients	○	○	○	○	○	○	○	○	○	○
5. Professional attitude to work	○	○	○	○	○	○	○	○	○	○
6. Ability to share knowledge	○	○	○	○	○	○	○	○	○	○
7. Ability to communicate with peers	○	○	○	○	○	○	○	○	○	○
8. Ability to work in a team	○	○	○	○	○	○	○	○	○	○
9. Ability to work independently	○	○	○	○	○	○	○	○	○	○
10. Ability to take the lead	○	○	○	○	○	○	○	○	○	○
11. Ability to show initiative	○	○	○	○	○	○	○	○	○	○
12. Ability to make decisions	○	○	○	○	○	○	○	○	○	○
13. Ability to accept advice/criticism	○	○	○	○	○	○	○	○	○	○
14. Ability to use appropriate computing skills	○	○	○	○	○	○	○	○	○	○

	Importance of Attributes (in principle)					Level of Current Attainment (in practice)				
	VI	I	A	U	VU	VH	H	A	L	VL
15. Ability to make critical judgments	○	○	○	○	○	○	○	○	○	○
16. Ability to self evaluate	○	○	○	○	○	○	○	○	○	○
17. Ability to manage time	○	○	○	○	○	○	○	○	○	○
18. Ability to manage one's own learning	○	○	○	○	○	○	○	○	○	○

19. Ability to adapt to change	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
20. Ability to find practical solutions	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
21. Ability to see the 'big-picture' *(Ability to have a wide perspective)*	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
22. Ability to set goals	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
23. Willingness to learn new things	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
24. Information literate *(know where, how to access & evaluate information)*	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
25. Being confident to continue learning *(Believing in own ability to continue learning)*	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
26. Other characteristics *(Please specify)*										
26.1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
26.2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
26.3	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Instructions for Ranking
Of the 25+ items listed above, please rank only the **10 most important attributes in order of importance** i.e. 1 as most important, 10 as the least important
For instance, you may view 8 (Ability to work in team) as the most important attribute, while 17 (Ability to manage time) as the least important of the 10. Hence, in the table below, write '8' under Column 1, and '17' under Column 10. Place the other eight attributes in the table in corresponding order of importance.

1: most important.....10: least important

Your Ranking	1	2	3	4	5	6	7	8	9	10
Item no. as above										

Please add any further comments.

Section C: Information on Recent Courses in Australia/Overseas

If you obtained your initial MI/MRS qualification before 1990, completion of Section C is optional. However, it would be greatly appreciated if you could add comments about any aspect of your initial course that you feel has assisted you to develop the essential characteristics of a MI/MRS practitioner. Then go to the bottom of the page to submit your responses.

If you obtained your initial MI/MRS qualification in 1990 or thereafter, or if you are a student, please continue with the rest of the questionnaire.

Instructions
Please respond according to *your own experience* with the Radiography/MI/MRS course (certificate/diploma/degree) you undertook or are currently undertaking. Please note that this section

refers to your *initial* qualification, and *not* to your postgraduate course(s).

About your Initial Course of Study

1. Indicate your mode of study. *(You may select more than one answer.)*

Full time ☐ Part time ☐ On Campus ☐ Off Campus ☐

2. Was your course fully prescribed? *(i.e. there was no choice in the selection of subjects)*

☐ yes ☐ no

If yes, please proceed to Question 5.

3. If no, please give examples of the optional subject(s) that you have undertaken.

4. Please indicate the approximate hours per week of optional subjects in the total course.

5. In your course, were you required to undertake subjects which were aimed at improving the generic skills? *(See Section B: Nos. 7-14)*

☐ yes ☐ no

If no, please proceed to Question 7

6. If yes, please tick the skill(s) that was/were included as a compulsory part of your studies

6.1 Study Skills ☐

6.2 Communication skills ☐

6.3 Self-organisation, time management skills ☐

6.4 Library skills ☐

6.5 Computer Literacy ☐

6.6 Others ☐

7. As you progressed through the course, were you required to gradually take more responsibility for your own learning? ☐ yes ☐ no

(This means that there is/was minimal teaching by lecturers. Instead, in consultation with your lecturers, you are/were allowed to plan your own learning objectives, learning schedule and outcomes.)

Please elaborate on your answer.

Teaching Approaches

8. The following are some of the common teaching methods that are used in many courses. *(Please tick all the methods that you experienced in your course.)*

8.1 Lecture-tutorial mode ☐

8.2 Clinical attachment ☐

8.3 Peer learning ☐

8.4 Audio-visual module ☐

8.5 Self-directed learning *(Students decide on their own learning objectives and outcome)* ☐

8.7 Laboratory/practical session ☐

8.8 Role play ☐

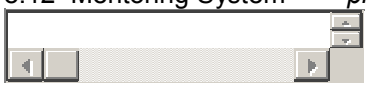
8.9 Problem-based learning ☐

8.10 Computer-based learning ☐

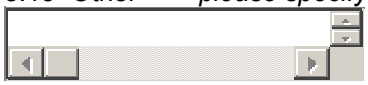
8.11 Web access learning *(Accessing learning materials and assessment from the web)* ☐

8.6 Reflective practice *(Students reflect upon their learning experience. The reflective journal may form part of their assessment)* ☐

8.12 Mentoring System ☐ *please elaborate*



8.13 Other ☐ *please specify*



Of the items you have ticked above, please now list the 3 main teaching approaches. *Please use item numbers.*

1. ☐ 2. ☐ 3. ☐

Assessment Methods

9.

Please tick all the assessment methods you experienced in your course.

9.1 Assignment writing ☐

9.2 Oral presentation ☐

9.3 Peer assessment ☐

9.4 Open book exam ☐

9.5 Reflective journals *(Your reflections form part of the assessment. This does not refer to a logbook of student's records of clinical cases)* ☐

9.6 Test &/or semester exam ☐

9.7 Practical exam ☐

9.8 Clinical assessment ☐

9.9 Computer-based assessment ☐

9.10 Self assessment *(Student has input into assessment)* ☐

9.11 Other ☐ *Please specify*

Of the items you have ticked above, please now list the 3 main assessment approaches. *Please use item numbers.*

1. ☐ 2. ☐ 3. ☐

10.

Please add comments about any aspect of your course that you feel has assisted you to develop the essential characteristics of a MI/MRS practitioner.

Click on the **submit** button below to submit your responses;

SUBMIT CLEAR

Thank you for participating in this survey.

If you have any questions concerning this survey, please feel free to contact the researcher, Jenny Sim.

Jenny Sim, Lecturer

- **Email:** j.sim@curtin.edu.au
- **Phone:** +61 (08) 9266 3550
- **Fax :** +61 (08) 9266 2377
- **Mail:**Department of Medical Imaging
  School of Physical Sciences
  Curtin University of Technology
  PO Box U1987 Perth WA Australia 6845

1 July 1999

This page is maintained by DEPARTMENT OF MEDICAL IMAGING
Last modified: Friday, 19-Mar-99 15:00:00
Please send comments to T. Harrington

EXPECT THE WORLD

Return-path: <sonography-return-192-7610372@listbot.com>
Return-path: sonography-return-@listbot.com
Date: Thu, 26 Aug 1999 16:35:15 +0800
From: Jenny Sim <j.sim@cc.curtin.edu.au>
Subject: National Survey on MI/MRS Graduates now available on Web
X-Sender: nsimjh@cc.curtin.edu.au
To: sonography@listbot.com
Delivered-to: mailing list sonography@listbot.com
Mailing-List: ListBot mailing list contact sonography-help@listbot.com
Original-recipient: rfc822;j.sim@curtin.edu.au

Australian Sonographer's Association Newsgroup - http://sonography.listbot.com/

Dear All
Hello! Greetings from Perth. My thanks to the President, Ms Jenny Cook, for allowing me to post this message through your listserver.

I am a lecturer from the Medical Imaging Department, Curtin University of Technology, Perth. I am currently conducting a National survey, investigating the attributes of Medical Imaging (MI)/Radiation Science (MRS) in terms of lifelong learning.

The purpose of this research is for the practitioners to identify the attributes of MI/MRS Practitioners (radiographers, sonographers, radiation therapists and nuclear medicine technologists), and rank the importance of these attributes. Data will then be co-related to determine if the current courses are actively promoting and developing these attributes.

This survey has been distributed to MI/MRS practitioners working in hospitals, private practice and other institutions nation wide.

The information you provide will:
1 assist in establishing the profile of sonographers
2 indicate the importance of the identified attributes
3 ascertain the interest within the profession with respect to ongoing development and education
4 provide a snapshot of recent MI/MRS courses

This information will indicate how the profession, as a whole can assist graduates to meet the challenges of the next millennium via better delivery of professional practice and high quality patient care.

In order to ensure statistically significant data, may I urge you and your colleagues to complete the survey (which will take approximately 15 minutes of your time).

You can access the survey on the following site:
http://www.curtin.edu.au/curtin/dept/phys-sci/medimg/survey.html
When you have completed the survey, simply click the "submit" button.

Alternatively, you can obtained a hard copy of the survey directly from me.

All data obtained will be reported only in an aggregated form. Results from this survey will be made available through this list, as well as via conferences, paper publication and through the Internet as soon as all responses have been analysed.

Thank you all for your help and cooperation.
Yours Sincerely
Jenny

Jenny Sim
Lecturer
Department of Medical Imaging
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Curtin University of Technology
GPO Box U 1987
Perth WA 6845

Tel : (08) 9266 3550
Fax : (08) 9266 2377
Email : j.sim@curtin.edu.au

Return-path: <owner-airnews@connect.com.au>
Date: Fri, 13 Aug 1999 13:29:43 +0800
From: Jenny Sim <j.sim@cc.curtin.edu.au>
Subject: [AIRNEWS] National Survey on MI/MRS Graduates now available on Web
Sender: owner-airnews@connect.com.au
X-Sender: nsimjh@cc.curtin.edu.au
To: airnews@connect.com.au
Reply-to: AIRNEWS <airnews@connect.com.au>
Delivered-to: airnews-obscured@mali.connect.com.au
Delivered-to: airnews@mali.connect.com.au
Original-recipient: rfc822;j.sim@curtin.edu.au

Dear All
As you are all probably aware by now, I am conducting a survey on the attributes of Medical Imaging (MI)/Radiation Science (MRS) in terms of lifelong learning.

I am glad to announce that this survey is now available on the web. You can access the survey on the following site:
http://www.curtin.edu.au/curtin/dept/phys-sci/medimg/survey.html

If you have already completed and returned the survey, thank you.
If you have not yet completed the survey, you are invited to complete the survey via the electronic means. When you have completed the survey, simply click the "submit" button.

All data obtained will be reported only in an aggregated form. Results from this survey will be released via conferences, paper publication and through the Internet as soon as all responses have been analysed.

Thank you all once again for your help and cooperation.
Yours Sincerely
Jenny

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Tel : (08) 9266 3550
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Return-path: <airwac@omen.net.au>
Date: Fri, 13 Aug 1999 17:24:17 +0800
From: AIRWAC <airwac@omen.net.au>
Subject: Fw: National Survey on MI/MRS Graduates now available on Web
To: airwac <airwac@omen.net.au>
X-MIMEOLE: Produced By Microsoft MimeOLE V5.00.2014.211
X-MSMail-priority: Normal

----- Original Message -----
From: Jenny Sim <j.sim@curtin.edu.au>
To: <airwac@omen.net.au>
Sent: Friday, August 13, 1999 1:29 PM
Subject: National Survey on MI/MRS Graduates now available on Web

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> the Internet as soon as all responses have been analysed.
>
> Thank you all once again for your help and cooperation.
> Yours Sincerely
> Jenny
>
> Jenny Sim
> Lecturer
> Department of Medical Imaging
> School of Physical Sciences
> Curtin University of Technology
> GPO Box U 1987
> Perth WA 6845
>
> Tel : (08) 9266 3550
> Fax : (08) 9266 2377
> Email : j.sim@curtin.edu.au
>

_____
This message is forwarded by the Western Australian branch of the
Australian Institute of Radiography.
"Opinions expressed on this service are not necesarily those of the WA
branch or the A.I.R."

Journal Review (con.)

theme I personally like a grab bag of different articles. A bit like checking out what Santa brought me, it's the number of presents that counts. I open up all my journals with heightened excitation, "damn it, Paediatrics again"

For this edition the first two articles caught my attention. If you are going to do a fetal echocardiography article you need excellent ultrasound images and excellent line diagrams. All these articles had both. This has not been so for past editions but the same can be said for other journals/bulletins where a ten year old barely recognisable 4 chamber view comes out of the authors cardboard library with fingerprint. We then get told that this image demonstrates the IVOT in great detail.

The written content reflects the "themed" layout where articles bring readers upto date with current techniques and usable data. As is the suffering of ultrasound worldwide, original research is not often seen.

To the credit of the Bulletin they do like to stray from the conventional themes and have in past editions run with:

- Brain August 1998, fetal and paediatric articles.
- Oncology May 1997 a great article on genetics and screening.

- Ultrasound Training and Standards August 1996, a beautiful article by Regina Fernando called "Developing Critical Thinking Skills in Student Sonographers"
- Exploring Safety Issues November 1997. "Thresholds for morphological malformations in rat embryos exposed to ultrasound". Interesting reading and fascinating pictures. Not good to be a rat at St Georges Hospital London though.

I spent 4 years in London in the early 90's. This is how I came across this journal. I've kept my membership running ever since. Why? The 4 editions of the journal are worth the $90. But I'm also spending money with ASUM-ASA memberships and a couple of textbooks each year. This subscription is worthwhile for any department. It is not quite though, a must have for a sonographer. The themed format makes them easier to use... Now where's that edition on art and craft...this time of the transducer leads.

Greg Loumeos

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NEWS

News about CT from RMIT

1. The interest generated by our CT Technology Shortcourse has lead the Department of Medical Radiations Science to develop an on-line Computed Tomography postgraduate program. The program is due for introduction in Semester 2, 2000, and will comprise of Graduate Certificate, Graduate Diploma and Masters Degree. The on-line delivery of the course will be similar to that of the highly successful postgraduate MRI program that is currently in its second semester. All students will be given the opportunity to participate in non-compulsory introductory tuition in the use of the Internet/WWW, so they can fully participate in this flexible learning program.

2. Due to the overwhelming demand for places at the CT Technology Shortcourse, this very successful program will be run again early in 2000, so stay tuned ...

Guess Who Won the Book Voucher?

National Survey on Medical Imaging/Radiation Science Graduates in terms of Lifelong Learning

I am pleased to announce that the 100th, 200th and 300th returns were sent in by the following members:

1 Mr A. Kurmis of South Australia
2 Mr A. Johnson of New South Wales
3 Ms A. Nixon of Western Australia

As such, each of them has received a $60 Dymocks book voucher.

I would like to take this opportunity to thank all who have participated in this survey.

The survey is now also available on the Web. You can access the survey on the following site:

http://www.curtin.edu.au/curtin/dept/physsci/medimg/survey.html

If you have not yet completed the hardcopy of the survey, you are invited to complete the survey via the electronic means.

Results from this survey will be released as soon as all responses have been analysed.

Thank you all once again for your help and cooperation.

Jenny Sim
Lecturer, Curtin University of Technology

Quality Control Testing Equipment

Members are invited to borrow the following equipment to enable them to perform their own quality control tests:

Digital KVp Meter

Rad Check
(simple ionisation chamber)

Digital Timer (pulses or time)

Focal Spot test tool

Filters for HVL tests
(aluminium or copper)

Densitometer

Sensitometer

Stepwedges x 2
(one with spinning top)

Diamentor
(ionisation chamber, measures area exposures units)

The equipment is to be transported at the cost of the borrower's establishment, as they are getting the benefit of its free use. Whoever uses the equipment covers the cost of forwarding it on to the next borrower.

The equipment is insured for use and transport by the AIR. "Security Post" via Australia Post is the most economical. Road transport is acceptable, e.g. TNT, Comet. If using these please stipulate road or other mode of transport required.

Contact the Diagnostic Radiography Advisory Panel:

- Rob Gaggini, SA (08) 8204 5511
- Karen Dobell, QLD, (07) 3253 1052
- Wendy Clark, NSW (02) 9515 7444
- Denise Kaye, Tas (03) 6222 8363
- Colin Jacobs, WA (08) 9346 2260
- Steve Crosling, Vic 0417 595 282

Appendix 3.13

Email posting to ASA newsgroup: Final call for Survey Participation

Return-path: <sonography-return-279-7610372@listbot.com>
Date: Fri, 29 Oct 1999 18:06:14 +0800
From: Jenny Sim <j.sim@cc.curtin.edu.au>
Subject: Final Call for Lifelong Learning Survey Submission
X-Sender: nsimjh@cc.curtin.edu.au
To: sonography@listbot.com
Reply-to: Australian Sonographer's Association Newsgroup
<sonography@listbot.com>
Delivered-to: mailing list sonography@listbot.com
Mailing-List: ListBot mailing list contact sonography-help@listbot.com
Original-recipient: rfc822;j.sim@curtin.edu.au

Australian Sonographer's Association Newsgroup - http://sonography.listbot.com/

Dear All
Apologies for cross-posting.

This is a final call for any practitioners who are interested in completing the National Survey on Lifelong Learning but have missed the opportunity to do so.

The survey is available on the web
http://www.curtin.edu.au/curtin/dept/phys-sci/medimg/survey.html

I would also like to take this opportunity to thank all sonographers who have so kindly participated in this National Survey. Last but note least, my sincere thanks to the Ms Jenny Cook and Mr Stephen Bird for their assistance in this project. As indicated, previously, results from this survey will be released as soon as all responses have been analysed.

With appreciation
Jenny Sim

Jenny Sim
Lecturer
Department of Medical Imaging
School of Physical Sciences
Curtin University of Technology
GPO Box U 1987
Perth WA 6845

Tel : (08) 9266 3550
Fax : (08) 9266 2377
Email : j.sim@curtin.edu.au

Appendix 3.14

Email posting to AIR newsgroup: Final call for Survey Participation

Return-path: <owner-airnews@connect.com.au>
Date: Tue, 02 Nov 1999 18:33:04 +0800
From: Jenny Sim <j.sim@cc.curtin.edu.au>
Subject: [AIRNEWS] Final Call for Lifelong Learning Survey Submission
Sender: owner-airnews@connect.com.au
X-Sender: nsimjh@cc.curtin.edu.au
To: airnews@connect.com.au
Reply-to: AIRNEWS <airnews@connect.com.au>
Delivered-to: airnews-obscured@mali.connect.com.au
Delivered-to: airnews@mali.connect.com.au
Delivered-to: airnews@connect.com.au
Original-recipient: rfc822;nsimjh@cc.curtin.edu.au

From: Jenny Sim <j.sim@curtin.edu.au>

Dear All
Apologies for cross-posting.

This is a final call for any practitioners who are interested in completing the National Survey on Lifelong Learning but have missed the opportunity to do so.

The survey is available on the web
http://www.curtin.edu.au/curtin/dept/phys-sci/medimg/survey.html

As indicated in the survey distributed in the June issue of Spectrum, the 100th 200th and 300th respondent would each receive a $50 book voucher. I am therefore pleased to announce that the winners are:

1 Mr A Kurmis of South Australia
2 Mr A Johnson of New South Wales
3 Ms A Nixon of Western Australia

I would also like to take this opportunity to thank all who have so kindly participated in this National Survey. Last but note least, my sincere thanks to the AIR, in particular, Mr Greg Brown of CPD, Mr Ernie Hughes and Ms Lorraine Katramados for their assistance in this project.

As indicated, previously, results from this survey will be released as soon as all responses have been analysed.

With appreciation
Jenny Sim

Jenny Sim
Lecturer
Department of Medical Imaging
School of Physical Sciences
Curtin University of Technology
GPO Box U 1987
Perth WA 6845

Tel : (08) 9266 3550
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Email : j.sim@curtin.edu.au

Medical Imaging/Radiation Science Graduates in terms of Lifelong Learning

Dear Staff

In order to ensure maximum return, it is suggested that the survey be distributed to the entire class at the end of a teaching session eg. lecture, and collected immediately thereafter.

Below is a checklist to assist you in the administration of this survey.

Thank you for administering the survey.
Please forward the responses to the address below.

Nos. Distributed: _____ Nos. Returned: _____

Background Information for Students

Purpose of Research Project

To determine the role and significance of lifelong learning* in the Medical Imaging (MI)/ Radiation Science (MRS) profession ❒

If students are unaware of the definition of a lifelong learner, please refer them to the footnote provided on the coversheet of the survey. ❒

National Survey of Practitioners

A similar survey has been sent to all AIR members, plus practitioners working in hospitals, private practice and other institutions. ❒

Students' Perspectives

As ***final year students*** in the program, the information you give will:

- provide a snapshot of MI/MRS courses ❒
- assist in establishing the profile of Practitioners ❒
- indicate the importance of the identified attributes ❒
- enable the researcher to ascertain if there are any differences between the attributes identified by students and Practitioners ❒

Confidentiality

Your participation is highly valued and greatly appreciated. ❒

The survey will require approximately 15 minutes of your time. ❒

If you have any questions concerning this survey, please feel free to contact the researcher, Jenny Sim.

Jenny Sim, Lecturer
Department of Medical Imaging
School of Physical Sciences
Curtin University of Technology
GPO Box U 1987
Perth WA 6845

Phone: (08) 9266 3550
Fax: (08) 9266 2377
Email: j.sim@curtin.edu.au

Outline of research project for distribution to the Heads of Schools

Identifying Characteristics of Medical Imaging/Radiation Science Graduates as Lifelong Learners

Researcher
Jenny Sim
Lecturer
Department of Medical Imaging
Curtin University of Technology

Aims of Project

1 Identify the current attributes of Medical Imaging/Radiation Science practitioners in relation to lifelong learning
2 Identify the gap between desirable and actual lifelong learning attributes of practitioners
3 Examine strategies that will assist undergraduates to become successful lifelong learners in the profession

Data Collection

1 Surveys of relevant Heads of Departments/Schools of the 8 universities offering Medical Imaging/Radiation Science courses
2 Interviews and focus group discussions with stakeholders such as employers, students, academics and Heads of Departments/Schools
3 National survey of Medical Imaging/Radiation Science practitioners to be distributed through the June edition of *Spectrum*
4 Follow-up visits to universities
5 Information on Australian courses through website, course calenders etc.

Contact Details
Jenny Sim
Lecturer
Department
Curtin University of Technology
GPO Box U 1987
Perth WA 6845
Phone: (08) 9266-3550
Fax: (08) 9266-2377
Email: j.sim@curtin.edu.au

Clinical Unit Coordinator/Supervisor Interview Schedule

Unit/Subject: _____ Coordinator/Supervisor: _____

Clinical Unit Objectives

1a) How do you structure your clinical units?

1b) How many clinical hours are there in total in your undergraduate course?

1c) What do you think are the most important elements in any clinical unit that determine/ensure the success of the unit?

1d) What is/are the objective(s) in the 3rd year final semester clinical unit?

Conduct of Clinical Units

2 How are the clinical units conducted?

Assessment Methods & Criteria

3 Who is responsible for the assessment of students in the clinical unit?

4 Please indicate the percentage of assessment each party is responsible for.

5 In this unit, how and what do you assess your students? Please elaborate on each of the assessment methods.

Lifelong Learning Attributes/Skills

6 Are there any lifelong learning attributes that you aim to promote in clinical units?

Professional Attributes/Skills

7 Are there any professional attributes/skills that you aim to promote in clinical units?

Integration of Attributes/Skills

7 How do you ensure these desired attributes/skills are integrated into the clinical units?

Promotion of Attributes/Skills

9 Describe how you are promoting the development of these attributes/skills you have selected.

Learning Outcomes

10 What are your expectations of a student who has obtained a pass grade in this clinical unit?

Thank you for participating in the interview

Appendix 3.18

Interview schedule for general units with MRS academics

Unit Coordinator's/Lecturer Interview Schedule

Unit/Subject: _____ Coordinator/Lecturer: _____

Unit Objectives

1 What is/are the objective(s) of this unit?

Teaching Methodology

2 How do you teach/deliver this unit?

Assessment Criteria

3 In this unit, how do you assess your students?

4 Please indicate the percentage and components of each method of assessment.

Lifelong Learning Attributes/Skills

5 Are there any lifelong learning attributes that you aim to promote in this unit?

Professional Attributes/Skills

6 Are there any professional attributes/skills that you aim to promote in this unit?

Integration of Attributes/Skills

7 How do you integrate these desired attributes/skills into your unit?

Promotion of Attributes/Skills

8 Describe how you teach/promote the development of these attributes/skills you have selected.

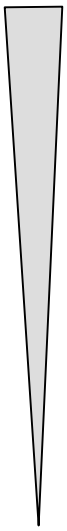
Learning Outcomes

9 What are your expectations of a student who has obtained a pass grade in this unit? (ie. what are your expectations of this student's capability?)

Thank you for participating in this interview

Attributes of MRS as prioritised by Practitioners, shown with total weighted score

Attributes of MRS Practitioners		Total weighted score of Importance	
Ability to apply knowledge	P	10412.00	(perceived as
Verbal communication skills with patients	P	10321.00	more important)
Clinical skills in handling patients	P	10288.00	
Knowledge of discipline	P	10080.00	
Ability to work in a team	G	9809.00	
Professional attitude to work	P	9774.00	
Ability to work independently	G	9132.00	
Willingness to learn new things	L	9121.00	
Ability to communicate with peers	G	9048.00	
Ability to share knowledge	P	8965.00	
Ability to make decisions	G	8937.00	
Ability to manage time	L	8776.00	
Ability to show initiative	G	8758.00	
Ability to find practical solutions	L	8700.00	
Ability to adapt to change	L	8640.00	
Ability to accept advice/criticism	G	8625.00	
Ability to self evaluate	L	8376.00	
Ability to make critical judgments	L	8240.00	
Being confident to continue learning	L	8208.00	
Ability to see the "big picture"	L	7920.00	
Ability to manage one's own learning	L	7762.00	
Information literate	L	7689.00	
Ability to set goals	L	7235.00	
Ability to use appropriate computing skills	G	7185.00	(perceived as
Ability to take the lead	G	7144.00	less important)



n for Practitioners = 462
Please note that in this statistical analysis the responses have been recoded (ie. 1 = very unimportant, 5 = very important). As such the higher weighted scores indicating more importance, and lower weighted scores indicating less importance.

Attributes of MRS as prioritised by HOD, shown with total weighted score

Attributes of MRS Practitioners		Total weighted score of Importance	
Verbal communication skills with patients	P	1754.00	(perceived as
Clinical skills in handling patients	P	1738.00	more important)
Professional attitude to work	P	1738.00	
Ability to apply knowledge	P	1733.00	
Knowledge of discipline	P	1722.00	
Ability to work in a team	G	1634.00	
Ability to work independently	G	1588.00	
Ability to share knowledge	P	1560.00	
Ability to show initiative	G	1558.00	
Ability to make decisions	G	1557.00	
Willingness to learn new things	L	1546.00	
Ability to communicate with peers	G	1533.00	
Ability to find practical solutions	L	1519.00	
Ability to adapt to change	L	1512.00	
Ability to self evaluate	L	1496.00	
Ability to manage time	L	1475.00	
Being confident to continue learning	L	1473.00	
Ability to make critical judgments	L	1472.00	
Ability to accept advice/criticism	G	1438.00	
Information literate	L	1400.00	
Ability to see the “big picture”	L	1384.00	
Ability to manage one’s own learning	L	1354.00	
Ability to set goals	L	1315.00	
Ability to take the lead	G	1287.00	(perceived as
Ability to use appropriate computing skills	G	1178.00	less important)

n for HOD = 78
Please note that in this statistical analysis the responses have been recoded (ie. 1 = very unimportant, 5 = very important). As such the higher weighted scores indicating more importance, and lower weighted scores indicating less importance.

Attributes of MRS as prioritised by Students, shown with total weighted score

Attributes of MRS Practitioners		Total weighted score of Importance	
Clinical skills in handling patients	P	6834.00	(perceived as
Verbal communication skills with patients	P	6754.00	more important)
Ability to apply knowledge	P	6545.00	
Ability to work in a team	G	6473.00	
Willingness to learn new things	L	6131.00	
Ability to find practical solutions	L	6094.00	
Ability to make decisions	G	6089.00	
Ability to work independently	G	6008.00	
Professional attitude to work	P	5994.00	
Ability to communicate with peers	G	5916.00	
Ability to show initiative	G	5904.00	
Knowledge of discipline	P	5897.00	
Ability to accept advice/criticism	G	5811.00	
Ability to adapt to change	L	5773.00	
Being confident to continue learning	L	5608.00	
Ability to manage time	L	5581.00	
Ability to make critical judgments	L	5529.00	
Ability to share knowledge	P	5499.00	
Ability to see the "big picture"	L	5459.00	
Ability to self evaluate	L	5448.00	
Information literate	L	5238.00	
Ability to mange one's own learning	L	5017.00	
Ability to set goals	L	4924.00	
Ability to take the lead	G	4893.00	(perceived as
Ability to use appropriate computing skills	G	4657.00	less important)

n for Students = 305
Please note that in this statistical analysis the responses have been recoded (ie. 1 = very unimportant, 5 = very important). As such the higher weighted scores indicating more importance, and lower weighted scores indicating less importance.