FACTORS INFLUENCING CAREER CHOICE OF BIOSCIENCE AND CHEMISTRY DOUBLE MAJOR GRADUATES FROM MALAYSIA

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DECLARATION

This thesis is my own work and no part of it has been submitted for a degree

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ABSTRACT

The thesis explores the career decisions of a case of graduates who have completed a Bioscience and Chemistry double major award. The study seeks to explore the careers these graduates have entered, and the factors influencing their choice. The study also looked into the extent of the link between the jobs and the disciplines studied. The career path taken was also explored. The findings of the study will enhance better preparation of future graduates for diversified careers.

This study used mixed methods to collect and analyse data. The first part of this study used a questionnaire to quantify those factors that influenced the career decisions. The second part of the study employed a qualitative method. Specifically, interviews of eleven graduates selected from the initial quantitative study provided a data source for developing a deeper understanding about their career decisions. The integration of results from the quantitative and qualitative methods provided in-depth answers for the five research questions.

The study shows that 30% of graduates surveyed were with discipline-related jobs, 50 % with jobs somewhat related to their curriculum and 20 % with discipline- unrelated jobs. Reasons for choosing non-discipline-related jobs were: being bored with routine laboratory jobs, having low salaries, being confined to the laboratory or lack of job opportunities. Cognitive values were considered to be more important than environmental and affective values in career choice. The factors considered to be most important were opportunity for growth, having interesting jobs, having a considerate boss, and having job responsibility. Financial rewards were ranked 14 out of 32 factors. Influences from family and lecturers were not as important. However employability skills played a role in career choice.

The study concluded that career decision-making is a complicated process. The findings of this study may contribute to the literature of career choice of science graduates in Malaysia, and have implications for the practice and future research in the innovative careers of science graduates.

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CHAPTER ONE

1.1   INTRODUCTION

This study aims to explore the career decisions of a case of Bioscience and Chemistry double discipline graduates from a Malaysian higher learning institution. This study explores the factors that influence the career choice of these graduates. The study also seeks to find out the extent to which there is a link between the disciplines studied i.e. bioscience and chemistry and the actual career pathways. Graduates from higher education do not always choose to work in the pathways that they graduated from (HESA 2003; Graduate Prospectus, 2003; Hills et al, 2003, Brown, 2005; Anderson et al., 2003; Hew et al, 2009; Ball and Chik, 2001; Leslie, 2004). Smart (1986) has suggested that the type of occupation undertaken in the early stages of a graduate's career is very much influenced by the undergraduate major studied. However, it has also been suggested that a graduate's major appears most important in preparing him or her for their first job after graduation rather than for subsequent jobs (Ball and Chik, 2001). It is acknowledged that the level of mismatch between employment and course of study or major may vary between different countries, for various disciplines, occupations and professions, and also over time, allowing for the expansions and contractions of normal economic cycles (Ball and Chik, 2001).

1.1.1   Malaysian Science Education

With the vision to become a developed country by the year 2020, the development of Science and Technology has been emphasized in Malaysia (Ninth Malaysian Plan, 2006-2010). In Malaysia where agriculture is important, bioscience studies such as

biotechnology is regarded as one of the priority areas for wealth generation and employment in the new millennium. Biotechnology prepares students with the skills and know-how on new biological processes of commercial importance in a diverse range of industries such as pharmaceutical, agricultural, industrial, forensic and healthcare sectors. Different careers are available in the biotechnology or biotechnology-related fields, from research and development to manufacturing and production, information systems, regulatory affairs and administration. Biotechnology is perceived as the key area of science in the 21st century that could keep on touching all our lives in many ways.

In Malaysia, the number of higher educational institutions has risen significantly within a short span of time. Currently (as at 2011), the Malaysian public tertiary education institutions include 20 universities, 30 polytechnics and 72 community colleges. For private tertiary education institutions, there are 28 universities, 22 university colleges, 6 branch campuses and 403 colleges. The total number of students registered in public universities is 508,254; public polytechnics and colleges is 114,417, and private higher learning institutions is 541,629 (Malaysian Higher Education Statistics, 2011). The objective of Malaysian Higher Education system is mainly to "produce professionals as demanded by the nation for human resources" (Malaysian Economic Report, 2005). It is worth noting that the number of new private university colleges and universities is still increasing. With the public and private universities and university colleges producing thousands of graduates every year, the job market seems to become saturated. It may seem that the employers are spoilt for choice. But this may not be so (Hew et al., 2009). Very often employers do have a difficult time getting the right candidates. When they do identify and employ the right

candidates, the employees may not stay on or last on the job. This illustrates that besides the right type of skills, attitudes and expectations of employees are equally important. The perceptions of a case of Bioscience and Chemistry double major graduates from a local higher learning institution in their career choice and what they look for in their careers are the focus of this study.

1.1.2 Decline in science student numbers in higher education

Choice of science careers has also been significantly affected due to the decline in entry of science students into institutions of higher learning. It has been reported that the number of students taking science subjects in schools and universities has declined in Malaysia since the mid-1980s. The ratio of students taking science was 31.69 % in the mid-1980s and by the mid-90s had dropped to 22.78%. In a policy paper, "Designing Science Education for Competitiveness" to the government in 1998, the Academy of Sciences Malaysia proposed to reverse this science: non-science student ratio to 60:40 eventually. A 1998 report by the Malaysian Science and Technology Information Centre (MASTIC) revealed that only about 30% of the students who sat the Sijil Pelajaran Malaysia (SPM) i. e. the Malaysian School Certificate Examination in 1999 took science subjects. It is not surprising that about 60% of university enrolments are in the non-sciences. This poses problems at a time when Malaysia is hoping to achieve the vision to become a developed country by the year 2020 (Ismail, 2012).

Lee (2012) commented that the drop in students taking up Science, Mathematics and pure science subjects may be due partly to the switch in the medium of instruction for Science and Mathematics from Bahasa Malaysia (BM or Malaysian national language)

to English and then back to BM again. It did not help in terms of getting trained and competent teachers and also teaching and learning materials for these two subjects especially in rural schools. The drop of students opting for science at universities may have an implication for the fewer number of science graduates. Many opt for non-science related careers. This will have a serious impact to the country which is hoping to become technologically developed by the year 2020.

Research in recent years has also shown relative declines in developed countries in the proportions of students studying science, engineering and technology at school, college and university (Ertl, 2005; Roberts, 2002).

Besides, the important issue is not just a matter of getting more students into science degrees; it is also a question of the nature and quality of the education these programs offer, and whether the curricula offer a necessary preparation for subsequent engagement with science related work and science generally.

1.1.3   Career choice and career outcomes

There are not many publications on the factors influencing and outcome of the career choice of bioscience and chemistry graduates in Malaysia, although several quantitative studies on career choice of business and accounting graduates have been reported (Teo and Poon, 1994; Moy and Lee, 2002; Hew et al., 2009). Recently, a cohort of bioscience/chemistry graduates from a Malaysian institution of higher learning disclosed that only 39% of graduates secured bioscience and chemistry-related jobs while 61% took up non-bioscience/chemistry jobs (Figure 1, unpublished

data). The non-science or somewhat-science-related jobs, however, may involve sales and marketing, working in banks to promote sales of credit cards, insurance and others. This raises many questions such as: Why are significant proportions of bioscience and chemistry graduates taking up jobs partly related or unrelated to bioscience and chemistry? What are the factors that influence their career choice? What are the reasons for these graduates to switch careers that do not follow the original career path of their choice of study? What are the reasons for their choice of different careers? It is important to investigate these questions so that Bioscience and Chemistry graduates may benefit more from their undergraduate training.
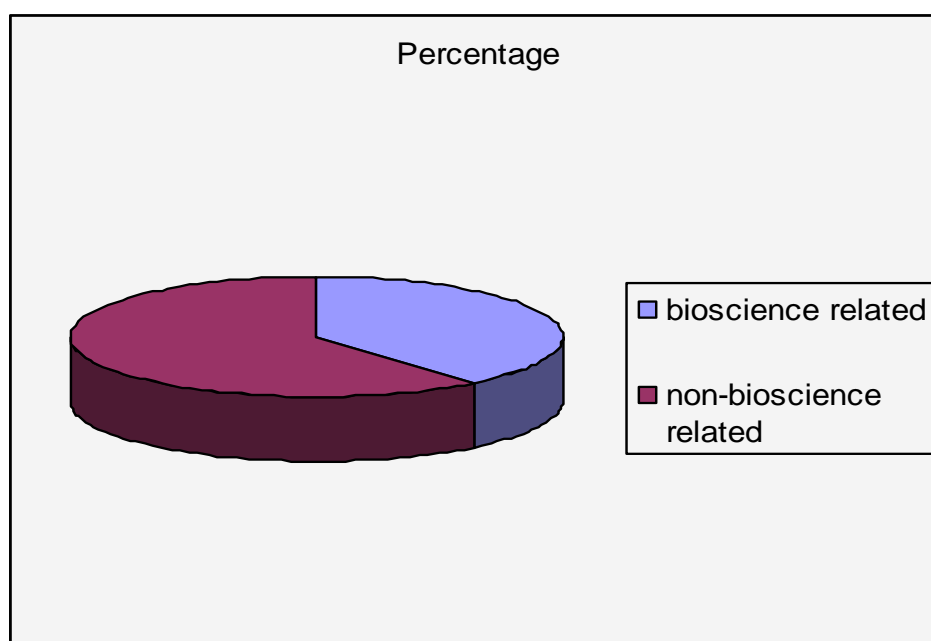
Figure 1.1: Types of jobs of bioscience/chemistry graduates from a Malaysian Higher Learning Institution (Unpublished data).

Interestingly, Quek (2008) also reported that the new work roles for chemistry graduates in Malaysia are found in careers such as banking, capital financing, commerce, computing, consultancy, fashion-designing, housing, insurance, law,

management, marketing, publishing, sales, trading and transportation. Innovative career choices for chemistry graduates were described to fall outside the conventional teaching job or doing research and laboratory work in academic institutions or industrial organizations (Chew, Lee & Quek, 1995; Lee, Quek & Chew, 2001).

International statistics in this matter also points to similar patterns. There is evidence that not all bioscience graduates from many British universities take up employment in bioscience jobs, and the first destination employment data suggest that only 50% of bioscience graduates are so employed (HESA 2003; Graduate Prospectus, 2003). A survey of graduates of BSc Honours degree in biology from a few British universities, by Quality Assurance Agency (QAA) team in the year 2000 (Hills, 2003), shows that of the 55% of graduates in employment only 12% of these were in 'scientific research, analysis and development occupations'. A possible further 34% might have been using some science base in their degree (e.g. from job categories such as 'health professionals' or 'other occupations'), but the remaining 54% were in non-science-based jobs. For those who graduated in the year 2000 from environmental science in a British university and other physical science disciplines, the proportions of graduates in different job categories are similar (Hills et al., 2003). Choosing non-subject-related careers happens with other subject areas as well but there are not few such studies made in Malaysia. This study focuses specifically on career destinations of a case of bioscience and chemistry graduates, by investigating the underlying factors of career choice.

A large number of diverse industries and businesses utilize bioscience graduates in many parts of the world. Reiss (2006) has emphasized the need to provide curricula

for three broad and equally important groups of bioscience/chemistry students : those whose main interest lies in further academic study with a view to a career in some aspect of research and development or teaching (although many will work outside science after graduating); those who wish to take a more vocational route to bioscience; and those who do not wish to become bio-scientists or chemists but for whom their bioscience/chemistry education contributes to a sense of culture and citizenship and provides some relevance to their lives (Reiss, 2006, pp. 53-54).

An overview of existing literature regarding career choice will first be discussed. Factors influencing career choices and issues regarding reasons for choosing non subject-related careers will also be discussed. This will help in the development of the argument for this study.

1.1.4   Malaysian studies of underlying factors in career choice

A few studies by Malaysian institutions on career choice and development have been conducted but most of them involved business or accounting graduates. Malaysian literature search shows that there were three similar studies done to investigate the underlying factors influencing business graduate's choice of career and their preference whether to work for multinational corporations (MNCs) or small and medium-sized enterprises (SMEs) (Teo and Poon, 1994; Moy and Lee, 2002). Moy and Lee (2002, p. 340) suggested that job attributes were the most important factors that influence the career choice among undergraduates. The job attributes which were important in choosing the undergraduates' career could be broadly categorized into three groups: the job itself, compensation or security and the company and work

environment (Moy and Lee, 2002, p.341). Moy and Lee (2002, p.343) found that Malaysian business undergraduates chose long term career prospects as the most important job attribute affecting their career choice. This was followed by pay, job security and managerial relationship.

Teo and Poon (1994) investigated the job attributes or factors which influenced the choice of employment of first year Malaysian business undergraduates. They used 10 factors such as pay, fringe benefits, working conditions, managerial quality and relationships, long-term career prospects, responsibility given, authority, involvement in decision making, marketability and job security.

Both these research studies reported that pay, fringe benefits, working conditions, long term career prospects, and marketability were significantly less favourable in SMEs than in MNCs. However, job attributes such as managerial relationships, responsibility given, authority and involvement in decision making were viewed to be favourable in SMEs because of their perception that SMEs had a 'flatter' organization structure and was less bureaucratic (Teo and Poon, 1994, pp. 21-22; Moy and Lee, 2002, p. 344).

Besides Quek's study on innovative careers for chemistry graduates, Choo et al. (2012) had reported the importance of intrinsic and extrinsic factors on career choice of Malaysian engineers from a local manufacturing factory. Since there is a lack of literature on factors underlying career choice of science graduates such as bioscience and chemistry graduates in Malaysia, an investigation and research in this phenomenon would attend to the knowledge gap in the Malaysian literature.

Besides, most studies for the business graduates were conducted with undergraduates using survey and questionnaires (Teo and Lee; Moy and Poon; Hew et al., 2009). The present study focused on the career choice decisions of bioscience and chemistry graduates and the research approach was a mixed research method.

An extensive search of the literature identified other variables which may be related to the outcome of career choice such as income or job satisfaction. In the study by Ball and Chik (2001), they classify these variables as the Job related effects. The job related effects include the following: (i) duration of employment, (2) public or private organization, (3) foreign or local employers, and (4) job fit index. All these factors have been shown to contribute to the outcome of career choice.

1.1.5 Factors and reasons for choice of subject-related or unrelated jobs

It has been suggested that the problem of graduate unemployment may arise because of a mismatch between the qualifications of the graduate and the jobs available (Lim et al., 2008, p337). This mismatch can serve as a signal of labor market disequilibrium and can convey vital market information to prospective students and the authorities (Lim et al., 2008). Anderson et al. (2003) attempt to answer the questions on why many Science graduates choose not to work in a career related to their undergraduate training. A few preliminary considerations were addressed in their study. Although there may be evidence of shortage of suitable bioscience-based jobs (especially in particular fields of study within bioscience), it appears that opportunities for economic and career advancement may have led bioscience graduates to apply for jobs which are less connected with their undergraduate course (Anderson et al., 2003). It is also

suggested by Anderson et al. (2003) that 'non-matching' may be the result of both the relatively low salaries in bioscience (salaries which appear to 'plateau' after a few years), and the attractive opportunities in other high-demand industries – particularly IT and sales and marketing. Perhaps graduates are *'choosy, possess average examination grades, seek high pay but inexperienced, not wanting to start low or they do not try hard enough'* as described by Shah (2008) regarding computer science graduates.

For some bioscience careers, an undergraduate qualification may not be enough, especially in research work. A study by Anderson et al. (2003) shows that a significant number of graduates were actually not interested in immediate career satisfaction because they actually had plans for further studies – quite possibly in fields related to their original and first preference of university course. In fact, it was shown that of those respondents who had since gone on to complete further science study, some had undertaken a second science-related bachelor degree. In this study, the graduates already had double science major qualifications.

On the contrary, graduates may commence a non-science qualification because they are bored or tired with what they were doing previously. Some may choose non-bioscience qualification because they think their science qualification is leading them nowhere or they cannot see a future in science (Anderson et al., 2003). It is claimed that many of those pursuing a non-science qualification may actually be enticed into new directions.

1.1.6   The Relationship between Higher Education and Employability

To many, good quality education leads to a good job or employability. Hesketh (2000) mentioned that 'a primary purpose of higher education is to prepare students for the world of work' (p. 246). Modern economies are evolving rapidly, leading to the demand for highly qualified personnel, because of the nature, scope and skills required by the labour markets which have become diversified and demanding. A number of research projects have explored the shortcomings of graduates through the eyes of the employers. A growing body of research suggests that industry and commerce need 'versatile and adaptable graduates (Leckey and McGuian, 1997, p. 65). Broadly speaking, the two main requirements are knowledge skills, and transferable skills (Leggert et al., 2004; de La Harpe, 2000).

However, in a rapidly changing world, graduates need to have more than the skills than mentioned above. Graduates need to be lifelong learners. The primary role of higher education is to transform students by enhancing their knowledge, skills, attitudes and abilities and at the same time empowering them as lifelong critical, reflective learners (Harvey, 2000, p. 3). This will be discussed further in Chapter 2.

1.2   Research problem

The total number of Malaysian students registered in tertiary institutions is expected to be doubled in the year 2020 (Hassan, 2006). Currently, eighty percent of public and private universities offer bioscience courses, especially biotechnology and chemistry. This illustrates the importance of the graduates' awareness of the outcome of these

bioscience courses for their future careers, and the significance of their decision-making in their career choices. The issue facing a large number of bioscience and chemistry double major graduates in Malaysia is the perceived mismatch between their course of study and their employment, that is, the training from their degree programme does not relate to their employment. The nature of their jobs can be diversified, similar to those that have been reported in countries such as United Kingdom (Brown, 2005). One common phenomenon is that a significant proportion of bioscience/chemistry graduates do not pursue careers in the subject area which they are trained in. Reasons for such phenomenon may be significant because Malaysia has a vision to be a developed country, and science and technological graduates are very much needed to bring about development and progress. Besides, the number of students enrolling for science degrees in universities has been dropping.

The Malaysian Government is aware of the need to fully utilize its labour force, especially skilled labour, to achieve sustainable economic growth, and should therefore consider a range of policy options that may improve the employment prospects of graduates. What are the reasons behind this mismatch? Is it because the bioscience and chemistry graduates choose not to work in the subject area, or few job opportunities are available or they are ill-prepared at university in the subject area (Anderson et al., 2003; Chang, 2004)? Is the current generation of bioscience and chemistry graduates looking at choices of careers in a different perspective? This study seeks to investigate the factors involved in decision making in the career choice of Malaysia bioscience and chemistry graduates. The perceptions of the graduates may also enable insights into measures that can be taken to retain more skilled science and technical graduates in the labour force. Malaysian bioscience/chemistry academics

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may face a dilemma of balancing the specific and generic transferable skills in the bioscience and chemistry course materials to meet everyone's needs, similar to that suggested by HESA (2003).

1.3   Research Aims and Objectives

The jobs of the science graduates may be diversified. Graduates may find employment in: clinical, diagnostic, pharmaceutical and forensic laboratories, healthcare industry, management, research, education, biomedical equipment and pharmaceutical sales, food manufacturing, environmental microbiology, and non-bioscience-related careers. This study aims to explore the career choice outcome of the Bioscience and Chemistry graduates from a local higher learning institution in Malaysia. It also aims to explore the reasons behind career choice and whether it relates to disciplines undertaken.

There is a lack of research into the extent to which knowledge acquired on a programme of study is used in a job specifically in bioscience and chemistry. Very often, little of the 'knowledge' acquired from a bioscience programme is applied in job settings. As in the western countries, a significant proportion of non- subject-specific job recruitment is also observed in Malaysia. Can it be as suggested by Harvey et al. (1997) that it was not so much the knowledge from the programme that was important to employers but rather whether the student had grasped the underlying principles. Through the voice and perceptions of graduates, it is hoped the factors that influence choice of careers of bioscience and chemistry graduates will become apparent.

This study allows other undergraduate to understand about career choice and the potential job markets for their relevant disciplines. Besides it enhances the understanding as to why some graduates are not keen on science jobs, the results of which may reveal reasons for current drop in science undergraduates. The study will add on to the limited literature available on Malaysian bioscience and chemistry graduates' career outcomes, career choices and career experiences.

1.4 The researcher and the steps leading to the current study

The researcher of this study has been teaching the bioscience subjects for more than ten years, and has immense interest in the study of the career choice of the bioscience and chemistry graduates. Batches of students enter yearly while others complete their studies and graduate. A question lingering in the researcher's mind is: what happens to the career outcomes of the graduates? What are the problems they face at workplaces of their own choice? It is important to find out the preferences of the graduates for the diversified types of career they have chosen and entered; the work values they harbour and the competencies they have acquired from the higher learning institution. Understanding the factors which influence career choice can provide the higher institution with better and more effective approaches to better prepare the graduates to adapt to their place of work. It is useful to consider whether there are other areas besides technical/theoretical knowledge which are also very essential for the preparation of the graduates in this globalized era.

1.5   Case study institution (Institutional Context)

The Bioscience and Chemistry double major graduates of this study were selected from the Science Faculty of a higher learning institution in Malaysia. The faculty has five departments of which one specializes in Bioscience and Chemistry. The yearly intake of Bioscience and Chemistry undergraduates varies from about 60 to 120. The course covers many applied biological and chemistry subjects. The total credit hours for both subjects are nearly equal. Besides the two major subjects taught, electives are also offered such as management, computer science, English language and psychology papers.

Bioscience and Chemistry graduates,who graduated less than four years ago, participated in a questionnaire and were interviewed. These graduates worked in different parts of Malaysia. However the majority of the graduates who were interviewed were working in Kuala Lumpur.

1.6   Key Research Question

Following the research aims and objectives, the main research question of this study is:

"What are the factors influencing the career choice of the Malaysian Bioscience and Chemistry double major graduates?" This question will be investigated using the following specific research questions:

1.   What are the career outcomes of the Bioscience/Chemistry graduates?

2.   What are the factors influencing the career choice of the Bioscience and Chemistry double major graduates?

3.   At what points do the Bioscience /Chemistry graduates make their decision in their career path?

4.   Why do the Bioscience/Chemistry graduates choose careers unrelated to their major field of study?

5.   What are the contributions of tertiary institutions to career choice of graduates?

These specific research questions were formulated in consideration of the desirable characteristics of good research questions proposed by Marshall and Rossman (2011). First, they were feasible to investigate in terms of time, effort and money. The questions were also clear and focused. Besides, they contribute to the current lack of such research in Malaysia, particularly in the field of biotechnology and chemistry. Lastly, as the research questions did not concern sensitive personal issues and the research subjects were free to leave the participation at any time, no psychological harm would be inflicted on them.

This thesis follows a standard structure, leading from the aims and design of the study, and review of the literature, to a rationale for the methodology chosen and presentation of results and discussion.

1.7 Significance of Research

Scientific and technological education plays an important role in the economic and national development of Malaysia as the government has to deploy costly and limited skilled human resources efficiently, according to the industry's needs. Applied sciences such as bioscience and chemistry, is one of the domains which has been always emphasized in Malaysia. This research views career choice among science graduates as crucial, as having spent three to four years in pursuing a major that may or may not lead to a career of choice of career. If many of the science graduates are inclined to choose a non-science career, then the public and private institutions of higher learning in Malaysia should ensure proper career counseling and course-selection for high school students, so that they can make well-informed and well-thought career decision.

This research shares similar concerns as the studies of business graduates in Malaysia where it views the certainty of career choice among bioscience/chemistry graduates as crucial as they have spent the duration of three to four years in pursuing a major that may or may not be their choice of career when they graduate.

The present study employs both quantitative and qualitative methods in contrast to the quantitative method used in most business studies on career choice. Mixed methods approach is used to bring depth to the quantitative results obtained. Besides most of the previous studies involve business undergraduates compared with the present study which involves the Bioscience and Chemistry graduates who have graduated recently. The qualitative research method allows a researcher to understand the experience and

perceptions of the graduates from their perspectives within their social environment (Cohen, 2000).

1.8   Research Design

This study employed mixed methods involving qualitative and the quantitative approach, in a sequential manner (Creswell and Plano Clark, 2007). In general, mixed methods research represents research that involves collecting, analyzing, and interpreting quantitative and qualitative data in a single study or in a series of studies that investigate the same underlying phenomenon (Leech and Onwuegbuzie, 2009, Creswell and Plano Clark, 2007, Fielding, 2010). When undertaking a mixed methods study, the researcher uses qualitative research methods for one phase or stage of a research study and quantitative research methods for the other phase or stage of the research study. Thus, a qualitative and a quantitative research study are conducted either concurrently or sequentially. One advantage of using mixed methods is that it draws together information using a range of tools so that the strength of the argument is more clearly visible and to obtain a 'synergistic view of the evidence' (Huberman and Miles, 2002, p7).

The research tool was a survey using a questionnaire for the quantitative phase of the study. A case study approach using in-depth interviews was used for the qualitative phase of this study. For the first part of the study, sampling was random which was typical of quantitative studies that seek to be representative of a larger population. The second part of the study involved a qualitative study. Sampling was purposive (Cohen et al., 2000). The participants with certain desired characteristics and criteria were

deliberately chosen for the interviews to find out more about the research questions (Punch, 1998). The research design for this study is described in detail Chapter Three.

1.9   Outline of the Thesis

The thesis consists of:

Chapter One: This chapter describes the research problem. It also provides the background, aims and significance of this study, the main research questions and a brief description of the research design and its limitations.

Chapter Two: Literature Review: is a synthesis and critical review of literature related to some career choice theories. It also discusses the outcomes of some literature findings of career choice of science graduates. The roles of work values relating to career choice were discussed. Various factors relating to career choice were also reviewed. The relationship between higher education and employability was discussed. A conceptual framework on the concepts from the literature will be proposed to frame the study.

Chapter Three: Research Design and Methodology: explicitly describes the nature and design of the methods used in this research study. Mixed method selection for this study is discussed with justifications (Creswell, 2009). The design of the research methods using the first quantitative phase followed by a qualitative phase using interviews is described. Sampling, data collection methods and data analysis are

discussed. Issues of validity and reliability, and ethical issues are also considered in this chapter.

Chapter Four and Chapter Five: Chapter Four reports and interprets the findings of the quantitative data, and Chapter Five explains the findings of the qualitative data. The reason why the quantitative data and the qualitative data are separated is due to the large volume data collected from both phases of study. Although it has to be borne in mind that the phases actually complement one another, separation of descriptions of data findings will result in a more organized and clearer presentation. The findings from the survey are described first in chapter 4 since this is a sequential mixed methods design. The open-ended questions from the questionnaire are presented as numerical data (Creswell & Plano Clarke, 2007). Data that have been generated by Likert scales in the questionnaires are analysed and answer some questions of Phase I of study. Data from the interviews are analysed using the qualitative approach (Cohen et al., 2007). Categories emerged from the sampling and coding are analysed and exemplified though discussion of quotes from the participants in Chapter 5. As this is a mixed methods study, the data from the quantitative approach and qualitative approach were integrated and discussed in Chapter 6.

Chapter Six: Analysis and discussion which involves integration of quantitative data (Chapter 4) and qualitative data (Chapter 5). Comparisons, analysis and interpretations of both sets of results aim to answer the five research questions. This chapter provides a critical discussion of the findings within the context of the literature. This chapter also relates themes established to existing literature.

Chapter Seven: Conclusions, Implications and Recommendations: Discusses the pertinent outcomes of the research study which address the research questions. It also discusses the limitations of this study, relevance and contributions to the literature, implications for the research studies and recommendations for future research.

1.10   Chapter Summary

This chapter provides the contextual background to my study: "The factors influencing career choice of Bioscience and Chemistry double major graduates". The study aims to explore the career choice decisions of the graduates. It seeks to establish the career outcomes of these graduates and to establish whether there is a relationship between the discipline studied and the careers chosen. The role of the higher learning institution will also be implicated in terms of their involvement in enhancing employability of the graduates.

LITERATURE REVIEW

2.1   Introduction

This chapter reviews the key literature related to the research questions which investigate the factors influencing career choice of Bioscience and Chemistry double major graduates and also reasons for selecting non-subject related jobs. The literature review serves both to inform the study of the research that has already been done and to assist in the construction of the research framework.

During the Eighth Malaysian Plan period, efforts were focused on laying the foundation towards building a competitive biotechnology industry. Human resource development was accorded due emphasis to create skilled workers for biotechnology-related fields. A significant milestone was achieved with the launching of the National Biotechnology Policy (NBP) in 2005, which provided a comprehensive framework to guide biotechnology development efforts in the country. Biotechnology is poised to drive the next wave of knowledge-based industries in Malaysia that will contribute to growth and wealth creation, new investment and employment opportunities as well as deliver social and environmental benefits (Ninth Malaysian Plan, 2006-2010, Chapter 6, p.157). The quality and skills of human resources are vital to the success of biotechnology. Recognizing this, various programmes were implemented to produce a pool of talent and expertise in biotechnology and biotechnology related fields. During the Ninth Malaysian Plan period, institutions of higher education produced more than 4,000 graduates with Bachelors, Masters and PhD degrees, covering a wide range of

biotechnology specializations such as molecular biology, plant biotechnology, bioprocess engineering, bioinformatics and marine biotechnology. Despite of efforts in the development of manpower, gaps however continued to persist between demand for, and supply of biotechnology skills. This was due to the fact that the creation of new employment opportunities in the sector still lagged behind (Ninth Malaysian Plan, 2006-2010). As part of efforts to move the economy up the value chain, emphasis is placed on developing the biotechnology industry. It is therefore important to understand the factors that influence the career choice of biotechnologically trained graduates. It is essential to retain these graduates with related majors in the industries. As discussed in Chapter 1, the **Key Research Question** for this study is:

What are the factors influencing career choice of Bioscience and Chemistry double major graduates?

The main research question can be investigated using the following specific research questions:

1. What are the career outcomes of the Bioscience/Chemistry graduates?

2. What are the factors influencing the career choice of the Bioscience and Chemistry double major graduates?

3. At what points do the Bioscience/ Chemistry graduates make the decision in their career path?

4. Why do the Bioscience/Chemistry graduates choose careers unrelated to their major field of study?

5. What are the contributions of tertiary institutions to career choice of graduates?

First of all, the literature review will serve to rationalize the significance of this study through critical evaluation of relevant studies. At the same time, it will establish the context of the research problem. Thus, this literature review is divided into sections which address the specific research questions (RQ). This chapter is structured in the following manner:

Section 2.2   Career choice theories (RQ2, RS3)

Section 2.3   The significance of work values in career choice (RQ2, RQ3)

Section 2.4   Factors influencing higher education outcome (RQ1, RQ2)

Section 2.5   Factors and reasons for choice of bioscience/chemistry-related or unrelated jobs. Mismatch of the labour market (RQ4)

Section 2.6   Important factors influencing career choice of graduates (RQ2, RQ3)

Section 2.7   Relationship between Higher education and employability (RQ5)

Section 2.8   Preliminary Theoretical Framework

2.2   Career choice: definitions

There are five major career theories, which are categorized as developmental, personality or typology, and behavioral theories. It will be discussed briefly as a background to understand factors involved in career choice. These theories are Ginzberg's General Theory of occupational choice, Super's Developmental Self-Concept Theory, Holland's Personality Theory of Vocational Choice, Roe's Early Determinants of Vocational Choice, and Social Cognitive Career Theory (Ireh, 2000). Ginzberg's theory proposed that the developmental leading to career choice involves the reality factor, the influence of the educational process, the emotional factor and individual values. The reality stage has three sub-stages: exploration, crystallization

and specification. In the exploration stage, the adolescent starts to narrow down choice based on personal likes, skills and abilities. An occupational choice is made in the crystallization stage. In the specification stage, individuals will equip themselves so that the career goal can be achieved.

Super's theory assumes that there are six life and career development stages, that is, crystallization stage, specification stage, implementation stage, the stabilization stage, consolidation and readiness for retirement. According to this theory, experience has influence on self-concept changes which are developed throughout the people's lives. Psychological characteristics such as needs, interest, intelligence, ability, and special aptitudes lead to career accomplishments. Social-economic factors (community, school, family, peer groups, labour markets) influence job structure (Ireh, 2000). Career theories based on psychological approaches are:

    1. Holland's theory (1992)

    2. Career anchors (Schein 1978).

Principally, these theories seek to help individuals find congruence between themselves and their work environment and subsequently to increase their career satisfaction. Table 2.1 shows the comparisons between these theories.

Table 2.1: Comparisons between Holland's Theory and Schein's Theory

Theory	About the theory	Weakness
1.Holland's theory	(1) Use six personality types as a useful guideline for helping individuals to understand their personality and vocational interests (2) Provide them with opportunities to make a rational job decision that could lead to career satisfaction (3) Theory useful for helping people to interpret their career interests and occupational choices.	(1) it ignores the process affecting individuals' career decision and choice (2) Holland (1992) also supports this view-point as he suggested in his theory's application that in order to make an effective career decision, other factors influence career choice, including age, gender, social class and educational background. (3) structural validity of Holland's personality types' model is likely to have a limited application in some cultural contexts. Study has shown that that Holland's six personality types are more relevant in a Western context.
Schein's theory	(1) Schein (1990) categorised individuals in terms of 8 different career anchors example: technical / managerial competence, security, autonomy, independence and entrepreneurial creativity, dedication, challenge and lifestyle. (2) Each career anchor represents individuals' expectations and the competencies associated with their job or career, which drive their career decisions. Individuals with the security and stability anchor tend to make career decisions based on security of employment and benefits.	Individuals' anchors might not be static but may change through different stages of their life.

Career theories based on sociological approaches are:

1.   Self-efficacy (Bandura 1977)

2.   Social learning theory (Krumboltz 1979)

3.   Social cognitive career theory (Lent, Brown & Hackett 1994).

All the theories emphasise the importance of career decision-making as a developmental process, but they focus on different applications. Bandura's (1977) self-efficacy seeks to explain the impact of social factors on how individuals develop self-efficacy and make career decisions. Krumboltz's (1979) social learning theory aims to help individuals recognise the individual and environmental factors which can either support or form a barrier to their career choices. Lent, Brown and Hackett's (1994) social cognitive career theory seeks to provide a structured career decision-making process of how individuals develop their career interest through the interaction of learning experiences, self-efficacy and outcome expectations.

Lent, Brown and Hackett's Social Cognitive Career Theory (SCCT)

This career choice model synthesizes and builds conceptual linkages between diverse career theories. SCCT focus on the inter-relationship among various personal, environmental and behavioural variables. The model contains two key personal variables that help to determine career choice: self-efficacy and outcome expectations (Figure 2.1). These personal variables develop from collective learning experiences. Self-efficacy refers to the person's belief about his ability to attain career-related achievements. The outcome expectations are personal beliefs about the consequences of performing certain behaviours. SCCT posits that people will develop lasting

interest in a career when they view themselves as competent at the required skills. Interest in turn promotes development of goals to get involved in the particular activity. These goals then lead to the selection and practice of a career (Lent, Brown and Hackett, 1994). Two contextual influences have been included in this model which impact key variables and relationships within the model. These two contextual influences are distal influences and proximal influences. Distal influences are those more distant from the decision point which may shape learning experiences, social cognition and cultural socialization. Proximal influences are near the decision point and may moderate the relationship between career interest, goals and career choice.

Outcome expectations as mentioned above are personal beliefs about the consequences of pursuing a particular career. If there is a match between work values and the perceived outcomes of choosing a particular career, interest in the job has been developed. Different individuals therefore may prioritize work values differently (Brown, 2002). Work values are beliefs about work that a person holds as standards that guide how he or she should function. The values may be the level of financial prosperity, altruism and independence that should accompany one's work. While work values are cognitive structures, they have behavioural and affective dimensions. Hence work values play a major role in setting professional goals (Brown, 2002).
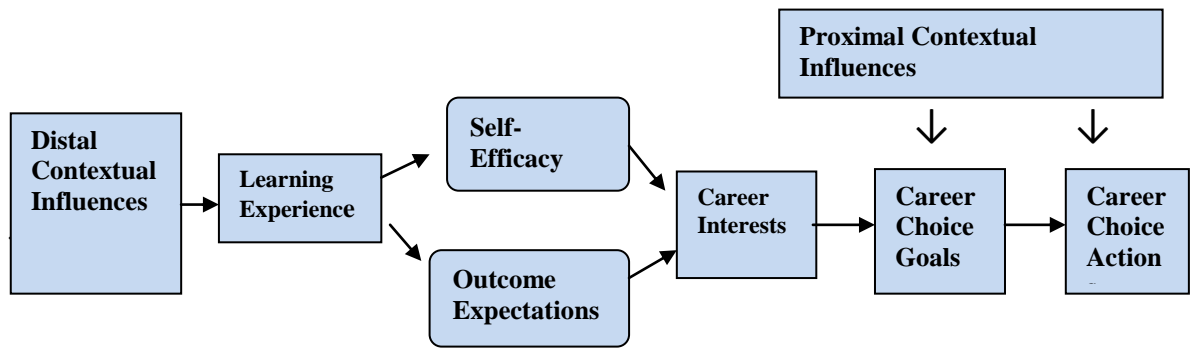
Figure 2.1: SCCT Career Choice Model (Adapted from Lent, Brown and Hackett, 1994).

2.3. The significance of work values in career choice

Work -related preferences have been the important research topic associated with various aspects of working life. It is useful to understand the importance of preferences for work as this in turn helps in explaining occupational attainment (Hakim, 2002; Dæhlen, 2005).

2.3.1 Definition of values and meaning of values

One of the most prominent and influential writers on values and value systems is Rokeach (1973) who defines a value as "an enduring belief". Values are believed to develop through the influences of culture, society and personality. Values are therefore considered to be beliefs, needs, goals and criteria for choosing behaviours and preferences (Dose, 1997). Values therefore are assumed to occupy a central place in a person's cognitive system, compared with attitudes. Values have also been closely linked to motivation (Dose 1997).

2.3.2   Values in the context of work

Values are ideals that can guide one's personal conduct, interaction with others as well as the choices made in one's career (Cassar, 2008). Work plays a key role in life, not only as the primary source of income, but also as a base for social participation, social status, consumption, health, family life, and so on. Work is therefore inextricably related to values. Additionally, Vroom (1966) found that individuals made job choices consistent with their work goals. Some of these goals were value-laden such as having opportunity to benefit society or opportunity to advance in career. This suggests that individuals make job decisions based, in part, on their work values.

Roe and Ester (1999) have provided an extensive review of the literature concerning values and work. In the literature a distinction is made between general values, or general life values and work values. As work is considered to be such a specific life domain, work values by implication have a more specific meaning than general values. The relationships between general values and work values are being viewed in different ways.

(i)   One view is that values have a particular cognitive structure that produces a structural similarity between general values and work values. This view is supported empirically by Elizur and Sagie (1999).

(ii)   Another view is that general values produce work values. Work values emerge from the projection of general values onto the domain of work (Roe and Ester, 1999, pp. 4-5). Most researchers seem to assume that work values do somehow derive from general values, but they are not very

explicit about the causal nature of this process. Many researchers have found general values to correlate with work values of a similar content (e.g. Ros, Schwartz, and Surkiss, 1999).

Researchers have therefore sought to identify a set of general types of work values. When work values are viewed as specific expressions of basic values in the work setting, then there are four higher-order basic types of individual values. These four types of work values may form two dimensions which parallel (i) the self-enhancement versus self-transcendence, and (ii) the openness to change versus conservation dimensions of basic individual values (Elizur, 1984; Ros, Schwartz, and Surkiss, 1999).

Despite a plethora of different labels, most work researchers have identified almost similar two or three types of work values: (1) intrinsic or self-actualisation values, (2) extrinsic or security or material values, (3) social or relational values (Borg, 1990). By considering the modality of their outcomes, Elizur (1984) and Elizur and Kowslowsky (2001) suggested a trichotomous classification of work values: instrumental outcomes such as work conditions and benefits; cognitive outcomes such as achievement and interest, personal growth, responsibility, independence, contribution to society; affective outcomes such as relations with associates. These categories may be interpreted as a collapsed version of Maslow's categories. This classification actually largely overlaps extrinsic, intrinsic, and social, respectively.

Recent factor analytic studies have supported a stratified approach to measuring work values whereby values have been organized within four basic dimensions: intrinsic,

extrinsic, social, and prestige (Ros, Schwartz, & Surkiss, 1999).

Some anomalies in Elizur's conclusions can be resolved by including a fourth, prestige value type. The region of values that Elizur labelled cognitive outcomes can be further divided into intrinsic and prestige regions.

```
                              ┌──────────────┐      ┌──────────────────┐
                          ↗   │   Intrinsic  │  →   │ meaningfulness.  │
                              │    values    │      │ responsibility,  │
┌──────────────┐             └──────────────┘      │   use of one's   │
│   Cognitive  │                                     │    abilities     │
│    values    │                                     └──────────────────┘
└──────────────┘             ┌──────────────┐      ┌──────────────────┐
                          ↘   │   Prestige   │  →   │   achievement.   │
                              │    values    │      │   advancement,   │
                              └──────────────┘      │ status, influence│
                                                    │     in work/     │
                                                    │   organisation   │
                                                    │   recognition,   │
                                                    │   independence   │
                                                    └──────────────────┘
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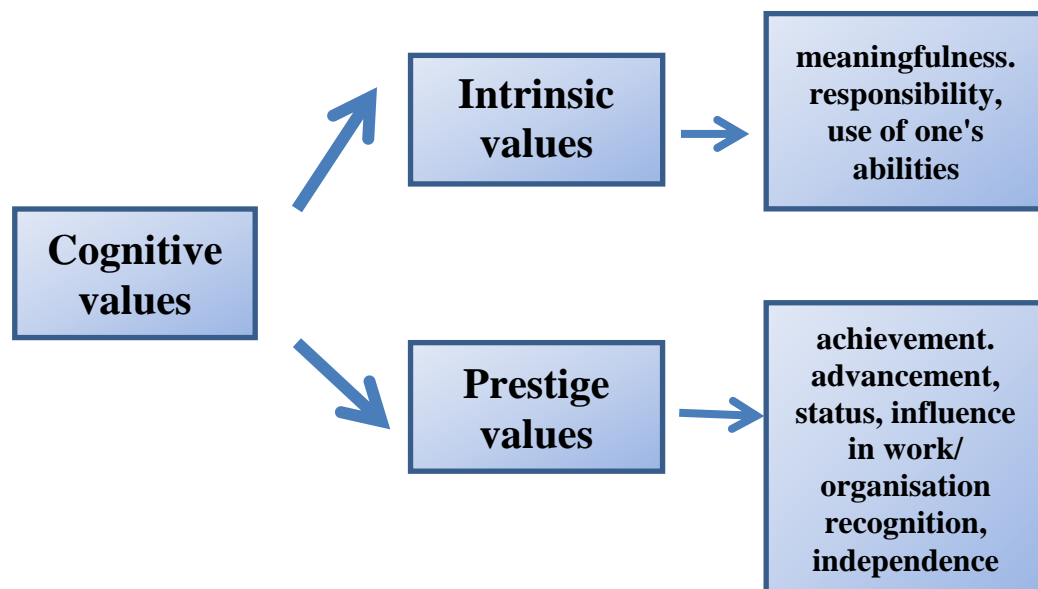
Figure 2.2: Subdivision of cognitive values

Therefore the work values in the intrinsic region (Figure 2.2) are values that contribute to a sense of personal growth and whose attainment derives directly from the nature of the work experience. The work values in the prestige region (Figure 2.2) are values which involve a comparison of self with others implying personal superiority.

2.3.3 Studies on work values of undergraduates and graduates

In the study by Cassar (2008), 24 work items were considered to be the undergraduates' preferred work values. In terms of cognitive values, 'doing work which is interesting' and offered 'opportunity for personal growth' was the highest rated work value whereas issues related to 'responsibility' and 'influence' scored lowest. In the instrumental values modality, 'job security' was rated least whereas in the affective values modality, 'being valued as a worker' was rated highest. Work values help to shape cognitions and motivations and are therefore essential in one's process of searching for employment and remaining employable.

Table 2.2: Preferred work values (Cassar, 2008)

Cognitive values	• Doing work which is interesting • Opportunity for personal growth • Achievement at work • Use of ability and knowledge in one's work • Proud to work with this particular company • Getting feedback about one's work • Having meaningful work • Advancement and promotion • Independence in one's work • Job status • Influence in one's work • Influence in one's organization • Making a contribution to society • Having responsibility at work
Instrumental values	• Physical working conditions • Benefits, vacations, sick leave, insurance, etc • Convenient hours of work • Pay and salary • Job security
Affective values	• Being valued as a worker • Having co-workers who are pleasant • Opportunity to interact with people • Recognition for doing a good job • A fair and considerate boss
Extrinsic values	• High income • Good prospects for promotion • A job that establishes contact with other people • Security against unemployment • A job where you can work independently

The Current Study

For the current study, work values influencing the career choice of the Bioscience and Chemistry double major graduates will be explored based on the categories of values described by Elizur (1984, 1991) and also the values gathered by Casaar (2008). It is the aim of this study to compare the studies on work values mentioned above with the work values of the Malaysian science graduates, which are still lacking in the literature.

2.4   Factors influencing higher education outcomes

A range of factors can influence higher education outcomes. An extensive search of the literature identified the following variables which may be related to income or job satisfaction. These variables may also be factors which influence career choice of graduates. These variables can be divided into four categories (Ball and Chik, 2001):

• Between college effects

• Within college effects

• Conditional effects

• Job related effects

Some of these variables are illustrated in Figure 2.3 (Ball and Chik, 2001).
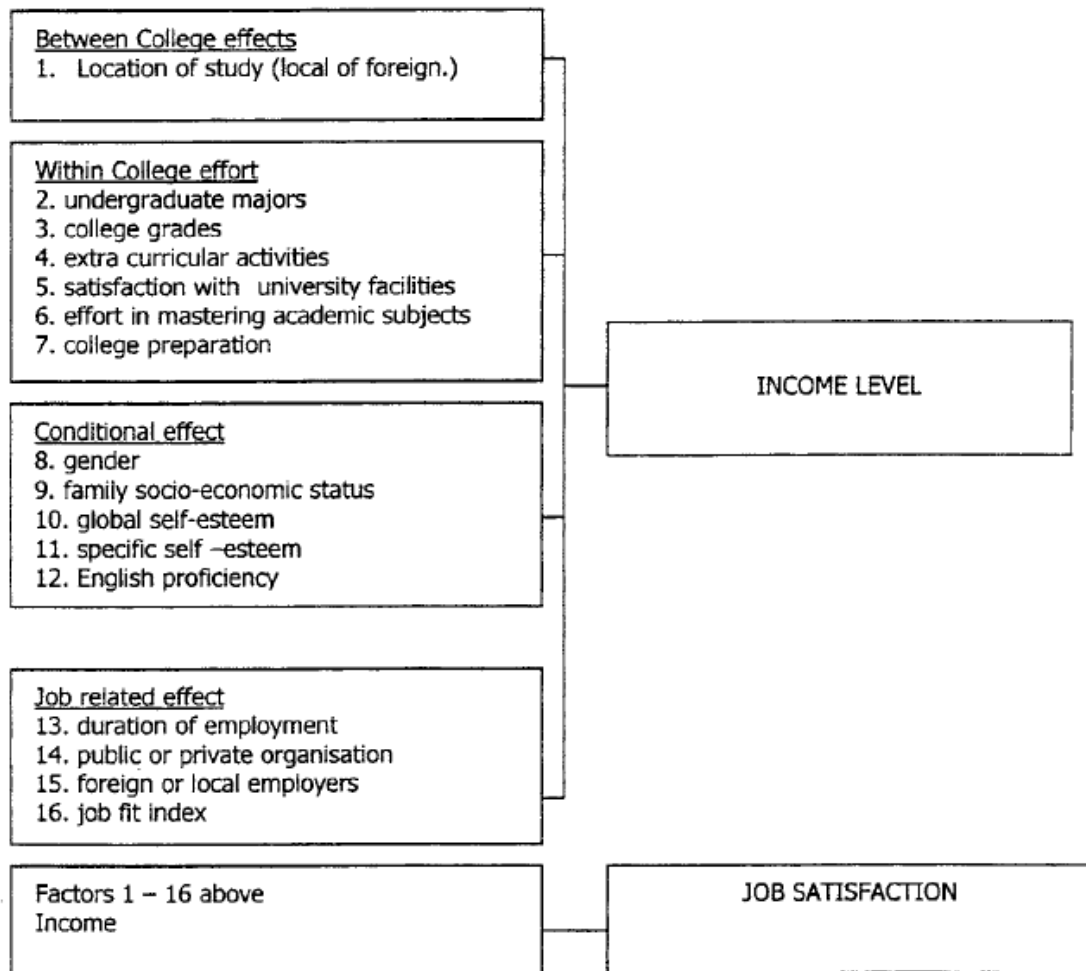
Figure 2.3: Factors influencing higher education outcomes (Ball and Chik, 2001).

A few of these variables which are important in career choice will be discussed.

2.4.1 Within college effects

2.4.1.1 Undergraduate Majors

Ball and Chik (2001) suggested that the type of degree gained is an important factor of labour market outcomes. Smith et al. (2000) consider that the labour market outcomes of UK can be either positive, meaning that the graduates will get employments or continue further studies, or negative when the graduate are unemployed or

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economically inactive. Their study also argued that graduates with professional degrees were more likely to have better labour market outcomes than graduates with lesser vocational qualifications. The latter have higher probability of being unemployed or economically inactive. A survey conducted by the National Higher Education Research Institute in 2002 on unemployment among graduates of Universiti Sains Malaysia revealed that there were significant differences in graduate labour market outcomes across degrees obtained (Kasturi, 2004). This phenomenon is supported by Lim et al. (2008) who studied the labour market outcomes of graduates of the Universiti Utara Malaysia. Lim et al. (2008) suggested that besides the type of degree, ethnicity, and number of job applications submitted were significant determinants of labor market outcomes.

2.4.1.2 College grades

Several studies have indicated the relationship between college grades and income (Pascarella and Smart, 1990). Many different explanations are given for such relationships. It can be argued that students who obtain high grades would have developed better cognitive and other skills which enable them to perform better in specific occupations and professions. With good academic results, these graduates may be more confident in their career choice. According to Pascarella and Smart (1990), employers may equate the college grades of graduates to their intelligence, diligence, effort and willingness to meet institutional demands. Good graduates, in their opinions, may be likely to be offered the better jobs. It has also been demonstrated that academic achievement may have a greater impact on job success in

professional (as opposed to non-professional) occupations and private (as opposed to public) sector (Ball and Chik, 2001).

In UK, it is commonly assumed that university graduates with the highest credentials will receive the best employment opportunities, irrespective of other characteristics such as gender or educational biography. The study by Smetherham (2006) suggested that graduates with first class Honours had a positional advantage within the labour market, when their labour outcomes are compared to those with second class lower Honours degrees. There is a significant degree of variations among the labour market outcomes of those with first class Honours. In particular, there are important gender differences among those with firsts which cannot be explained by the credential alone as presented by Smetherham (2006) in Figure 2.4 below. Reports (HEA, 2010, p. 30) agreed that salary scale may not be explained by the classes of Honours degrees.
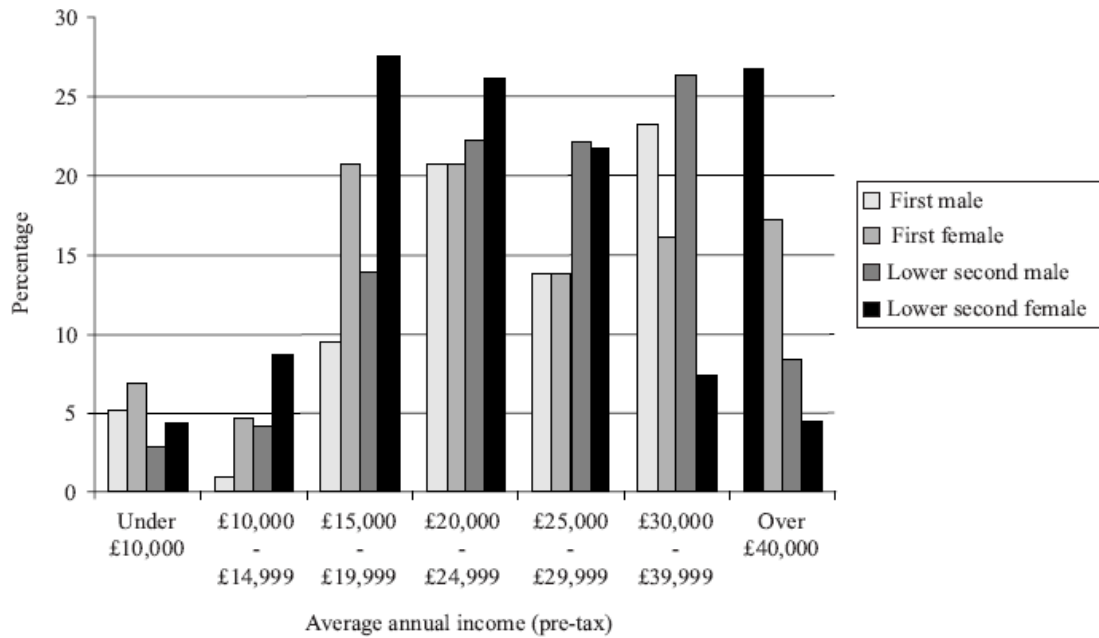
Figure 2.4: Average annual income of respondents, by gender and degree classification (Smetherham, 2006)

2.4.2 Conditional effects

2.4.2.1 Self-esteem

Many researchers have reported that the self-esteem of workers is one of the important determinants of difference in work behaviour. It has been correlated with the positive influence on the outcomes of early employment. Self-esteem therefore influences career choice of graduates in Malaysia. People with high self esteem will think, feel and behave differently from those with low self-esteem (Ball and Chik, 2001). Some Bumiputera graduates in particular in Malaysia have avoided sales jobs as reported by Salih and Young (1989). Sohail and Bradmore (2004) claim that negative perceptions of sales careers among Malaysian graduates may be fuelled by cultures, and regarded sales careers as demanding in terms of traveling and being pushy. However more

studies need to substantiate this claim. There is evidence of a link between high self-esteem and enhanced job satisfaction.

2.4.3 Job fit index

According to Ball and Chik (2001), the job fit index is a measure of workers' underemployment and in the case of highly educated individuals such as graduates, the index relates to inadequate use of skills and training. In the study by Ball and Chik (2001), the job-fix index was developed to determine whether the current occupation of the graduates commensurate with their qualifications in terms of status and pay, usefulness of the skills acquired in their academic work and the relationship between their job and the field of study. The Job fit index therefore measures the mismatch of education and work. The work of Ball and Chik (2001) as described above is comparable with that of Australian study by Anderson et al. (2003), which actually utilize various questions to work out the match between the programme studied and the types of work of graduates.

2.4.4 Duration of employment since graduation and job satisfaction

It may seem reasonable to expect that those graduates who have been working for some time would earn more than those who have just started work. In terms of job satisfaction it might also be predicted that overall job satisfaction would increase with duration of employment. It is assumed also that there is a stronger tendency of employees to accommodate their values to the job dimensions of their workplace (Ball and Chik, 2001). However, it must be argued that job satisfaction does not necessarily

increase in this way (Ball and Chik, 2001). In fact many other factors affect job satisfaction.

Locke (1976) defined job satisfaction as 'a pleasurable or positive emotional state resulting from the appraisal of one's job or job experiences'. The variety of aspects include attitude toward pay, working conditions, colleagues and boss, career prospects and the intrinsic aspects of the job itself. In the field of work satisfaction, there are three approaches:

(i)   Work attitudes which are dispositional in nature and learned through experience (stable positive or negative dispositions) or based on the genetic inheritance of an individual. Changing job in this case may not make one more satisfied with a job.

(ii)   Social information processing model: Job satisfaction and other workplace attitude are developed out of experiences and information provided by others at work. Work satisfaction of a person is influenced by the interpretation and evaluation of other people in the workplace.

(iii)   Information processing model: this is based on the accumulation of cognitive information about the workplace and one's job. This argues that a person's satisfaction is influenced directly by the characteristics of his or her job. These characteristics match with what that person wants in a job.

Job satisfaction, an internal attribution, is important because it interacts with many external factors: some within the immediate control of the individual concerned and many that are out of his/her control (Mau, Ellsworth, & Hawley, 2008). This context

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illustrates the complex nature of attribution assignment, formation, definition and interaction. There is also a problem with how job satisfaction is described and defined in the literature. This study chooses to define job satisfaction as those attributions held by an individual that are related to internal and external factors and their interactions in relationship to the global construct labelled working conditions.

The feelings of satisfaction that are associated with the job context are influenced by internal attributions, such as efficacy and autonomy and by external factors such as pay, support and environment (Loeb & Darling-Hammond, 2005).

2.5   Factors and reasons for choice of course-related or unrelated jobs

This section illustrates more regarding the preference of graduates in choosing jobs either related or not related to the programme of study (Figure 2.5). It therefore looks into ways jobs are matched and not matched to the knowledge and other skills required by the workforce.
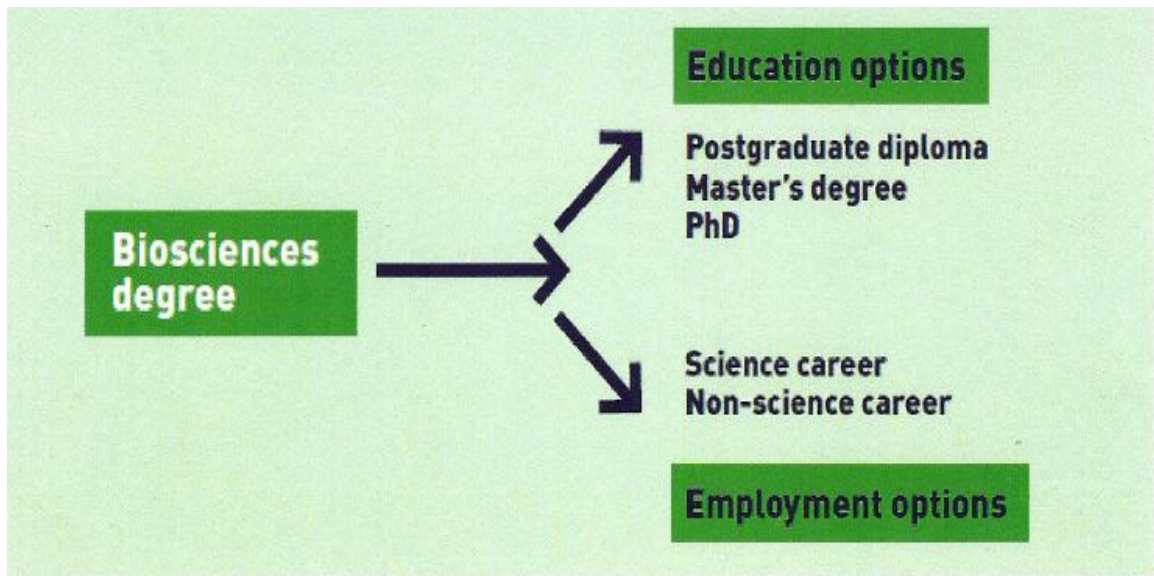
Figure 2.5: Career outcomes of science graduates

2.5.1 Mismatch and the Labour Market

A survey of graduates of BSc Honours degree in biology from a few British universities, by Quality Assurance Agency (QAA) team in the year 2000 (Hills et al., 2003) shows that of the 55% of graduates in employment, only 12% of these were in 'scientific research, analysis and development occupations'. A possible further 34% might have been using some science base in their degree (e.g. from job categories such as 'health professionals' or 'other occupations'), but the remaining 54% were in non-science-based jobs. For those that graduated in the year 2000 from environmental science and other physical science disciplines, the proportions of graduates in different job categories were similar (Hills et al., 2003). Figure 2.6 illustrates the diversity of jobs of BSc pharmacology graduates in United Kingdom with decreasing proportions of graduates entering pharmacology–related jobs.

Percentage of BSc pharmacology graduates from 4 major universities in different types of job (1996 to 98 data)

Non-discipline based=50%

Non-pharmacology non-science jobs 15%

Non-pharmacology science jobs 17%

Industrial pharmacolog laboratory 8%

Further UG study 8%

Clinical research/ medical sales/ information 12%

Teaching 4%

Management/ administration 6%

Discipline based=50%

Research degree scheme 30%

Figure 2.6: Percentage of types of jobs of BSc pharmacology graduates from British universities (Learning and Teaching Support Network, LTSN, Bioscience, 1997 and 1998 Data)

Another study (Anderson et al., 2003) argues that although there may be evidence of shortage of suitable bioscience and chemistry-based jobs (especially in particular fields of study within bioscience), opportunities for economic and social advancement may have led bioscience graduates to apply for jobs which are less connected with their undergraduate course. It is suggested by Anderson et al. (2003) that 'non-matching' may be the result of both the relatively low salaries in bioscience or chemistry (salaries which appear to 'plateau' after a few years), and the core science graduates may leave their field for another non-science field which offers higher salary compared to the former. Consider the increase in house rentals, petrol and food prices, it is logical that graduates seek higher pay.

In Malaysia, some graduates with specific qualifications (for example Arts) are already abundant in the market, whereas engineering and other science degree graduates are still in high demand. Bioscience-related employment such as biotechnology is also projected to increase quickly (Bernama. com, 2008), as the Malaysian government has a vision to become a full-fledged developed country by 2020. Nevertheless, in Malaysia graduates including science graduates with a degree no longer automatically qualify for securing their first jobs (Lim et al., 2008). With the increase in the number of public and private universities in Malaysia, the number of bioscience and chemistry graduates also increases each year. Therefore, competitions exist and graduates who possess the greatest knowledge and skills and better results in their study domain get employed first (Chang, 2004).

Another reason for the mismatch could be that some graduates have not decided firmly or definitely on a science career in the first place. The study by Anderson et al. (2003) showed that the majority of graduates (about 87%) reported that they were 'genuinely interested in science' when they first made the choice to pursue the undergraduate science degree. However, in their study, some respondents commented that their science course was 'just something to do' while they decided their future. Only 65% of respondents chose science course because they specifically desired to work in a science-based profession. Robertson (2000) surveyed the perceptions of a cohort of Year One bioscience students from a UK university, on their choice of bioscience course. The study claimed that in-school experience provided the earliest source of interest for the majority of students. The practical nature of school science, the intellectual challenge of studying science and satisfaction with the examination

results in biology and chemistry were identified by most students to be important factors of choice.

According to Anderson et al. (2003), one reason for the mismatch of work and programme of study could be due to the fact that interests and aspirations can change during and subsequent to the undergraduate degree year – and this may be reflected in the choice of employment, and the possibility that such employment is less relevant to the original programme. The study by Anderson et al. (2003) indicated that 25% of their survey sample continued to pursue a non-science qualification after graduation. Among them, about 40% have pursued their studies in business qualifications, 16% in arts, and 15% in education. It can therefore be argued that either higher education is important in shaping students' job values or else the students' job values are already determined when they first enter an educational programme. Job values or preferences here should be understood as kinds of priorities that form a certain part of work orientations (Dæhlen, 2005). Work-related values or preferences are important in explaining occupational attainment. However, values should not be interpreted as externally given, but rather as the result of socialization processes throughout important stages in a person's life. These kinds of values are thought to be deeply rooted in a person's early socialization. Job values may emerge during education as students prepare themselves for future careers and opportunities. Another possibility is that job values and work-related preferences are primarily influenced by adult experiences in and out of the labour market. Dæhlen (2005) argues that job values may change during education, indicating that education has important effects on the individual beyond the teaching of theoretical and practical skills. "While high income, job security and opportunities for advancement are considered as extrinsic rewards,

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meaningful work tasks, altruistic and social rewards are characterized as intrinsic" (Dæhlen, 2005, p.387).

Graduates may commence a non-science qualification because they are bored or tired with what they were doing previously (Anderson et al., 2003). Some may choose non-bioscience qualification because they think their science qualification is leading them nowhere or they cannot see a future in science (Anderson et al. 2003). Perhaps many of those pursuing a non-science qualification are actually enticed into new directions. One of those directions is pursuing a postgraduate study which is not science-related, for example, pursuing the Masters of Business Administration qualifications.

It has been argued that tackling mismatch by providing labour-market information and efficient job placement services should be a priority for policy-makers (Cedefop, 2009). This is claimed to be true for both vertical and horizontal mismatch. Vertical mismatch, (mismatch of level of education and job) commonly referred to as over-education, occurs when a graduate is employed in a job which requires a lower level of education. However, overskilling has negative effects on the wages earned by individuals experiencing it and on their job satisfaction. Greater care in job matching may, therefore, not only improve the welfare of overskilled employees, but also have positive effects on productivity and the growth in the economy. Graduates sometimes face horizontal skill mismatch (i.e. mismatch of field of study and job). In this case the types of education or skills are inappropriate for the job. Particular fields of study provide important specific skills for the job market (Robst, 2007a). It has been argued that graduates with specific degrees do better than those with more general degrees. This suggests that better information should be provided for potential graduates to

address and prevent mismatches of this type. A particular issue is whether genuine mismatch requires action from education providers or employers. For skill mismatch, whether horizontal or vertical, attention should be shifted away from education reform towards considering the impact of workplace and job design. This could be best achieved by giving workers greater task discretion on both social and technical control. Education mismatch can have significant labour market consequences for the mismatched individual, employers, and society. Job mismatches may cause job dissatisfaction (Di Pietro and Urwin, 2003). Education-job mismatches lead to employee turnover and have been shown to have negative effect on wages and job status (Wolbers, 2003 and Robst, 2007a). It has also been suggested that a proper match between education and employment may reduce the need for further training within the workplace.

2.6   Important factors that influence the choice of career among graduates

Literature search shows that several studies were done in Malaysia investigating the underlying factors which influenced business graduates' choice of careers, and their preferences to work in multinational corporations (MNCs) or small and medium sized enterprises (SMEs) (Teo and Poon, 1994; Moy and Lee, 2002 and Hew et al., 2009). Not many similar studies have been reported for Malaysian science graduates. However the job attributes of business graduates may be discussed first as they provide guideline for the present study with science graduates. Moy and Lee (2002) consider job attributes to be the most important factors which influence career choice among undergraduates. These attributes were categorized into three groups which include the job itself, compensation or security, and the company or work

environment (Moy and Lee, 2002). Another group of researchers, Teo and Poon (1994) found that first year business undergraduate perceived factors such as pay, fringe benefits, working conditions, managerial quality and relationships, long-term career prospects, responsibility given, authority, involvement in decision making, marketability and job security to be important in their career choice. Moy and Lee (2002) reported similar attributes for another group of Malaysian business undergraduates. Both groups of researchers agree on attributes that are more favourable for SMEs.

Hew et al. (2009)'s study on work attributes of final year undergraduates shows that the present day undergraduates place more importance to the working condition of the job and job security than to monetary gains. From the findings of Teo and Poon (1994), Moy and Lee (2002) and Hew et al. (2009), it can be concluded that different job attributes do influence an undergraduate's career choice.

2.6.1   Career choice in Entrepreneurship

Career in entrepreneurship are growing because they can offer endless opportunities. Many people are therefore attracted to entrepreneurship. Entrepreneurship development involves various activities such as producing a new product or service, which later creates an exploratory effort of individuals, groups, and communities. Several factors: the push and pull factors influence the choice of entrepreneurship. The push factors are unemployment, job dissatisfaction, failure to obtain a promotion, being dismissed from a job, economic downturn and pressures from work (Hj Othman and Ishak, 2009). The pull factors include the need for freedom, trying new things,

experience, availability of capital, skill and entrepreneurial capacity, existence of role models, economic situation, and an individual's early preparation while being employed (Mohd Salleh, 1992). Demographic, family, education, and motivation background can indirectly influence choice of entrepreneurship. Positive attitude enhances choice of entrepreneurship. A person with a satisfactory and comfortable career life may not opt for entrepreneurship, as sacrifices are involved (Hj Othman and Ishak, 2009).

2.7 The relationship between higher education and employability

Since 1980s there is growing pressure on higher education to develop the relationship between the academy and employment. The purpose of higher education seems to be contributing directly to meeting the needs of the economy (Cranmer, 2006). Increasingly, it is assumed that increased skills and educational achievement levels hold the key to economic prosperity within an increasingly competitive global economy (Purcell, Elias, & Wilton, 2004). Therefore there seems to be a chain reaction as shown in Figure 2.7:

Economy changes

Labour market requirement changes

Higher education changes and graduate employability changes
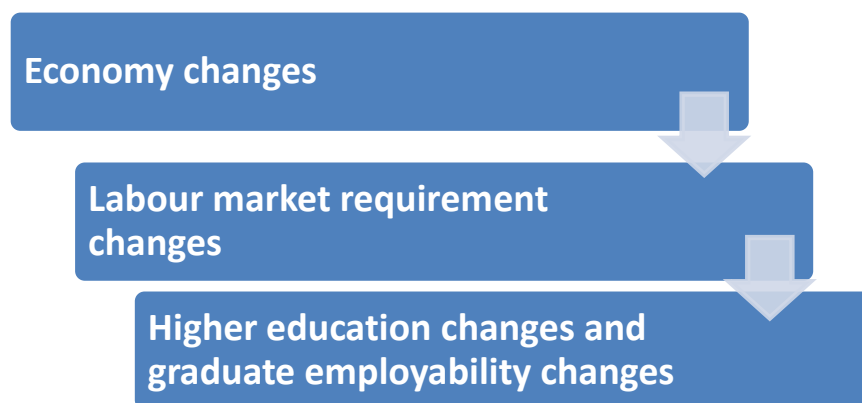
Figure **2.7**: The effects of economy changes on higher education changes

As the economy changes, so do the labour market requirements. Subsequently organizations change, and higher education also changes toward mass higher education, and finally the graduate labour market also changes accordingly. Therefore more university graduates will experience difficulties in seeking employment.

The British Government has emphasized that the key task of higher education is to enhance the employability of graduates. The National Committee of Inquiry into Higher Education, (NCIHE, 1997), has emphasised, among other things, the effectiveness of work experience.

Table 2.3 shows various definitions of employability.

Table 2.3: Definitions of employability

Definitions of employability	Sources
A mix of skills that employers expect to find in new recruits. Skill is then defined as a set of characteristics that make a person employable, including knowledge, know-how, attitudes and behaviours.	McLaughlin (1995)
Employability is about having the capability to gain initial employment, maintain employment and obtain new employment if required.	Hillage and Pollard (1998)
A set of achievements – skills, understandings and personal attributes – that makes graduates more likely to gain employment and be successful in their chosen occupations, which benefits themselves, the workforce, the community and the economy.	Yorke (2004)

2.7.1   Graduate Skills

The Dearing Report (NCIHE, 1997) presents a comprehensive list of skills and argues that higher education should realize its aspiration to be world class in both teaching and research through agreement with staff, students, government, employers and society in general. The report supports the further development of a range of what it calls 'key' skills during higher education – communication, both oral and written, numeracy, the use of communications and information technology, and 'learning how to learn', which potentially links it to thinking critically.

The skills needed:

Employers and their representatives consistently say that, to succeed at work, most people in future must develop a range of personal and intellectual attributes beyond those traditionally made explicit in programmes of study in higher education institutions.

Employers are looking for interactive and personal attributes. They are also looking for technological skills. These are elaborated below:

1. The core interactive attributes are communication, teamwork and interpersonal skills. These are necessary to communicate, formally and informally, with a wide range of people who are internal and external to the organization. It is essential to be able to relate, and feel at ease with people at all levels both in the organisation

as well as the external stakeholders. It is also necessary to maintain relationships even though circumstances change.

2. Personal attributes are attitudes and abilities including intellect, knowledge, willingness and ability to learn and continue learning, ability to find things out, willingness to take risks and show initiative, flexibility and adaptability to respond, self-motivation, self-confidence, self-management and self-promotion. These personal   attributes allow graduates to fit into the work culture, develop ideas, take initiative and responsibility and have the ability to deal with change (Harvey, 1997).

3. Technological and organisational changes over 25 years have added ICT skills, team-working, flexibility, adaptability. Furthermore, 'problem solving' has become 'creative problem-solving' and risk taking has become a key attribute. On the other hand, there is much less emphasis on knowledge and far more on willingness to continue learning.

2.7.2   Negative opinions of the Skills Agenda

Some academics are concerned about the skills agenda for various reasons:

There was concern that too much emphasis on employability will infringe academic autonomy as suggested by Bates (1999, p.116). Various researchers (Harvey, 2000; Morley, 2001) are concerned that employability agenda will downgrade education to training, will be 'anti-intellectualist', and will take away academic freedom. In fact

Harvey (2000, p.3) questioned whether higher education is responsible for training for jobs or improving their minds.

Some academics are not enthusiastic over the relationship with 'employers'. Knight and Yorke criticized that 'employers take everything and give nothing' (2004, p. 23). Smith & Comyn (2003) even blame employers for the problem of employability skills commenting that:

'Employability skills are developed throughout a person's working life and hence employers need to view the process of employability skills development as a whole of workforce issue' (2003, p. 10).

Therefore developing employability skills should be shouldered by various sectors. Yorke commented that 'some aspects of employment-related capacities can only be developed in the employment context' (Yorke, 2006, p. 3). Other authors criticize the list of generic skills for employability. For Yorke (2006) and Harvey (2000), it seems impossible to build up a list of generic skills which will satisfy all employers. This is because the lists of generic skills may be interpreted, understood and recognised differently in different context, and by different stakeholders. Beckett and Mulcahy (2006) in fact claim that: 'Lists of generic skills make no sense unless they show they are grounded in practical judgments and that the reasons practitioners can give for their judgements are articulated among their peers' (2006, p. 262). Bridgstock, (2009) has the same view that employer-driven lists of employability do not provide the full picture of what is required by graduates who are entering the labour market.

According to Knight and Yorke (2004, p. 34), employability is understood as the intrusion of 'skills' into the curriculum. However, the higher-employment interface should not be seen as an 'add-on' to academic study. Rather, employability should be considered 'a subset of, and fundamentally contingent on, transformative lifelong learning' (Harvey, 2000, p. 4). Employers could not expect university graduates to have all skills and knowledge of a good worker. It takes time and effort for graduates to 'translate' and 'transform' the knowledge and skills they learnt in universities to those they want at work. Moreover, the complexity of generic capacities is actually developed through the real engagement in workplaces.

2.7.3   Criticisms of Higher education

Universities often are criticized because they focus on the training for academic careers and for the top careers outside the academia. They are criticized to have geared their preparation for the world of work to the 'chosen few', neglecting the professional motives and prospects of those who got the opportunity of entering higher education in the process of educational expansion (Teichler, 2000).

As Orivel (1996, p. 11) puts it : "educational systems must give up on the idea of producing a mass of future employees who are extremely narrowly specialised, unable to adapt to the evolution of labour markets and technologies". Instead, the skills of employees in the contemporary world must be fluid, flexible and adaptable (Knight & Yorke, 2004; Yorke, 2006)

Clearly, in the contemporary world, the shift to employability is not downgrading higher education; rather, it increases the responsiveness of higher education to the changes of society. Since universities are not insulated from changes in the external environment, they cannot be isolated in the community they are expected to serve. In a rapidly changing world, graduates need to be lifelong learners. The primary role of higher education is to transform students by enhancing their knowledge, skills, attitudes and abilities while simultaneously empowering them as lifelong critical, reflective learners (Harvey, 2000, p. 3)

2.8   The 'New Realities': Relationship between higher education and employment

The purpose and structure of higher education is important in enhancing employability. In particular, the need for the development of critical, reflective, empowered learners raises fundamental questions about traditional forms of teaching in higher education, and the priorities of higher educational institutions and governments.

Students are empowered by developing their critical, reflective and transformative abilities (Harvey 2000). This requires an approach to teaching and learning that goes beyond requiring students to learn a body of knowledge and be able to apply it analytically. Brockband and McGill (2006) argue that facilitation of learning rather than teaching is necessary to encourage critical reflective learning.

Similarly, Harvey (2000) argues against a simplistic "magic bullet" model of employability and emphasizes that a number of other factors that could be considered relevant are personal characteristics, age, gender, external economic factors. The model is illustrated in Figure 2.8.

Figure 2.8: A model of graduate development (Adapted from Harvey, 2002).

The complex model is based on viewing employability as a process and as part of a lifelong learning journey. It is also important to note that the model incorporates the concepts of engagement, pedagogy, reflection and articulation which are processes that are ongoing.

Bridgstock (2009) suggests that desirable graduate attributes are not only generic skills but also broader career management competence. This is because the employer-driven lists of employability do not address the full picture of what is required by graduates facing the prospect of entering the labour market. Graduates will therefore require higher-order, meta-work, which are the abilities to continuously recognize and capitalize on employment and training-related opportunities and integrate these with

other aspects of an individual's life. Thus, graduates have to think critically and strategically throughout their lives with regard to employment.

There are several other models of employability:

The USEM account of employability (Knight & Yorke, 2004) is probably the most well-known and respected model in this field. USEM is an acronym for four inter-related components of employability: **U**nderstanding, **S**kills, **E**fficacy beliefs, and **M**etacognition. The authors suggest that behind the USEM model is:

> "an attempt to put thinking about employability on a more scientific basis, partly because of the need to appeal to academic staff on their own terms by referring to research evidence and theory…" (Knight & Yorke, 2004, p. 37)

Another model CareerEDGE illustrates the essential components of employability in different tiers. Students first access and develop everything on the lower tier which are essentially for reflecting on and evaluating these experiences. This will result in development of higher levels of self-efficacy, self-confidence and self-esteem – the crucial links to employability (Dacre and Sewell, 2007).

2.9   The Malaysian Studies

It can be seen that Malaysia's education objectives are similar to the Dearing Report (NCIHE 1997) objectives with particular emphasis on basic literacy skills such as speaking, listening, writing and mathematics skills. Information and Communication

Technology (ICT) too are given emphasis. Emphasis on critical thinking ensures the ability to work both independently and in teams to solve problems.

The importance of generic skills is documented in 'Quality Assurance in Public Universities of Malaysia: Code of Practice' (Quality Assurance Division, 2004). It states that the quality of university programmes is assessed by the ability of their graduates to carry out their expected roles and responsibilities in society. Competencies stated in the document include critical thinking, problem solving, creative decision making, and ability to communicate; apart from mastery of knowledge in specific fields (Nurita, Shaharudin & Ainon, 2004). A survey by Jusoh et al. (2007) indicates that employers are generally satisfied with fresh graduates' qualities such as knowledge, skills and abilities. Another group of researchers reported the importance of generic skills by exploring models of generic skills provision across disciplines in Malaysian Higher Institution (Jelas and Azman, 2008).

Problem-solving ability is now the most sought-after trait in up-and-coming executives. The changing workplace and a complex global society demand better thinking and problem solving among undergraduates and graduates. Tertiary education graduates are expected to be able to think critically, take initiatives and responsibilities, plan for goals and strategies, and solve problems (Md Yunus et al., 2006, p 86). The career prospects are limited in individuals without good problem solving skills.

In some higher learning institutions, generic skills programmes either run in parallel with existing curricula or are 'embedded' within them (Robley et al., 2003;

Mohammad et al., 2004; Leggett et al., 2004). 'Universities are unlikely en bloc to change their curricula radically further in favour of a common, generic employability agenda, unless the Funding Councils' formulae for calculating the base grant force them to do so' (Atkins, 1999, p. 277). It has been argued that some academics would not support a further diminution of the subject specific material to give way for the generic employability agenda. Besides there are significant issues such as the costs and efforts of change, the lack of expertise among existing staff in the relevant instructional design, and the delivery and assessment competencies (Atkins, 1999).

2.10   Preliminary Theoretical Framework

This study aims to explore the factors affecting career choice of the bioscience and chemistry graduates. Career choice research, especially for the science disciplines, has not been conducted widely in Malaysia. The theoretical framework for this study will be based mostly on similar previous studies outside Malaysia. Previous research has addressed general factors that affect students' career choice. Various researches have advocated the conceptual framework in molding a person's career choice. Several researchers have attempted to expand Parson's theory, by developing the so-called "trait and factor theory". Much of the current career choice research actually originates from this theory.

According to Ginzberg et al., (1951, p.197), the Trait and Factor theory is defined as follows:

> *"...Occupational choice is a compromise whereby an individual hopes to gain*
>
> *the maximum degree of satisfaction out of his working life by pursuing a*

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career in which he can make as much use as possible of his interests and capacities, in situations which will satisfy as many of his values and goals as possible."

According to Brown et al. (2002) career decision-making is based on two major theoretical perspectives of career choice and development. These are the psychological and sociological approaches. The psychological approaches base career decision on factors such as personality, interests, abilities and job satisfaction. Sociological approaches focus on demographic and environmental factors. Demographic factors encompass the following: gender, ethnicity, and socioeconomic status of the family. Environmental influences include those from family members, friends, community practices, work and economic environment. Sociological career choice approaches are theories of self-efficacy (Bandura, 1977), social learning theory advocated by Krumboltz (1979) and the Social Cognitive Career theory proposed by Lent, Brown and Heckett (1994).

Brown (2002), considers work values as the cornerstone for his values-based theory of career development. Brown's theory looks at cultural and life roles as well as work roles. In his theory, cultural and work roles act together as the primary variables influencing occupational choice, work satisfaction, and success. Brown (2002) suggests a number of propositions on the role of values in career development. He believes that individualistic culture and well-defined and prioritized work values are the most important influences in career.

Social cognitive career theory focuses on the interrelationship among various personal, environmental and behavioural variables. The variables: self-efficacy, outcome expectancies and learning experience influences career interest and ultimately career choice.

Different individuals therefore may prioritize work values differently (Brown, 2002). Work values are beliefs about work that a person holds as standards that guide how an individual should function. The values may be the level of financial prosperity, altruism and independence that should accompany one's work. While work values are cognitive structures, they have behavioural and affective dimensions. Hence, work values play a major role in setting professional goals (Brown, 2002).

Researchers have therefore sought to identify a set of general type of work values. When work values are viewed specific expressions of basic values in the work setting, then there are four higher-order basic types of individual values. These four types of work values may form two dimensions which parallel the self-enhancement versus self-transcendence, and the openness to change versus conservation dimensions of basic individual values (Elizur, 1984; Ros, Schwartz, and Surkiss, 1999).

This classification actually largely overlaps extrinsic, intrinsic, and social, respectively.' These three types of work values can be viewed as conceptually parallel to three of the higher-order basic human values:

(i)   **Intrinsic work values** directly express openness to change values-the pursuit of autonomy, interest, growth, and creativity in work.

(ii) **Extrinsic work values** express conservation values; job security and income provide workers with the requirements needed for general security and maintenance of order in their lives.

(iii) **Social or interpersonal work values** express the pursuit of self-transcendence values; work is seen as a vehicle for positive social relations and contribution to society.

Due to the changing needs and demands in the graduate labour market and economy, employability skills are considered to have important influence on career choice of graduates. Harvey (2000) emphasizes that other factors could be considered relevant such as knowledge skills, generic skills, the personal attributes, work experience and external economic factors. Yorke & Knight (2004), in their employability model (USEM model) considered the importance of four inter-related components of employability: **U**nderstanding, **S**kills, **E**fficacy beliefs, and **M**etacognition.

This study will investigate the factors influencing career choice by looking at the work values of graduates according to those work values proposed by Elizur (1984 and 1991), and Cassar (2008) who looked at values grouped under the categories: intrinsic, extrinsic, environment and others. From the literature, the values actually measure the preference of job. Anderson et al. (2003) in his study looks at perceptions of graduates about the match and mismatch of their employment with their tertiary course. The present study used some of their measures to determine the extent of matching between the employment outcome and the curriculum for the bioscience and chemistry graduates.

A preliminary theoretical framework is diagrammatically illustrated in Figure 2.9.
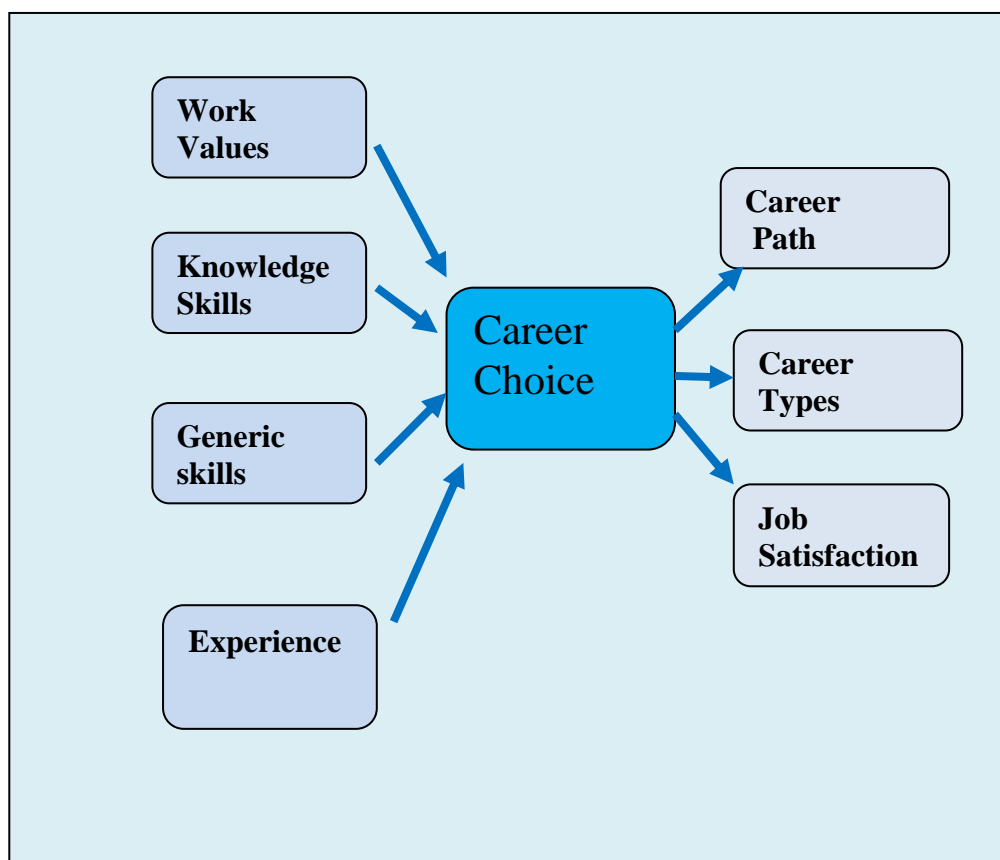
Figure 2.9: Theoretical framework for factors influencing career choice of Bioscience and Chemistry graduates.

CHAPTER THREE

METHODOLOGY

The study aims to explore the factors influencing career choice of Bioscience and Chemistry graduates. This chapter discusses the research approaches, the context of the study, the sample used, as well as the data collection and analysis methods. The chapter also discusses the role of ethics in research and how the issue of research ethics is managed in this study.

Key Research Question: Following the research aims and objectives, the main research question is:

"What are the factors influencing the career choice of the Malaysian Bioscience and Chemistry double major graduates?"

This question will be investigated using the following specific research questions:

1.   What are the career outcomes of the Bioscience/Chemistry graduates?

2.   What are the factors influencing the career choice of the Bioscience and Chemistry double major graduates?

3.   At what points do the Bioscience /Chemistry graduates make their decision in their career path?

4.   Why do the Bioscience/Chemistry graduates choose careers unrelated to their major field of study?

5.   What are the contributions of tertiary institutions to career choice of graduates?

3.1 Research paradigms

Research design is affected by issues regarding the nature of reality and the nature of knowledge. Crotty (1998) suggests that there is a relationship between the theoretical stances adopted by researchers, their research methodologies and methods. He suggests that the researcher's view of epistemology influences the theoretical perspectives which will be adopted by the researcher. The adopted theoretical perspectives will in turn influence the research methodologies, which ultimately influence the choice of research methods. Coleman and Briggs (2007) also argue that it is important to develop a research design that is consistent with the overall paradigm and related research questions.

Several research paradigms are used in social research each with a specific epistemological basis (Cohen and Manion, 2000; Gall et al., 1999; Creswell, 2009; Tashakkori and Teddle, 1998). These include positivism research paradigm, the interpretivism, postpostivism, pragmatism, and constructivism (Cohen and Manion, 2000; Gall et al., 1999; Creswell, 2009; Tashakkori and Teddle, 1998). Each has its own epistemological assumptions, beliefs and values about the nature of knowledge and reality.

Epistemology is the technical term of the theory of knowledge (Denzin and Lincoln, 2011). It looks at the question "What is the nature of the relationship between the knower or would-be knower and what can be known?" (Guba and Lincoln, 1994, p.108). The relationship between them can be known for example either by direct observation at the external world to uncover knowledge or when the inquirer and the subject of inquiry interact to create knowledge. The two main epistemological strands

are positivism and interpretivism. The main difference between positivism and interpretivism is the way they approach knowledge. In positivism, the main aim is to predict and control phenomena. It therefore aims primarily to test theories and create laws. The approach is deductive and carried out in an objective way. Interpretivism however maintains that social phenomena do not exist independently of our interpretation of them. Reality is seen as "a construct of the mind" and that "concepts of reality varies" from one person to the other" (Bassey, 1999, p.43). An objective analysis is not possible in this case because the researcher is actually involved in the research process. They make interpretations of the social constructions.

The positivist epistemology makes the assumption of a "dualism" between subject and object. The researcher believes that it is possible for them to separate the subject from the object. There are two important characteristics of positivist epistemology. Positivists believe in hypothetico-deductive testing of theories. The interpretivists however believe that theory should be grounded through the process of induction and observation. The interpretivists therefore take an insider position; being part of the research process. On the other hand the positivists are to be an outsider to the research process.

Ontology is the nature of reality. We use the terms ontology to answer the question: "What is the form and nature of reality and therefore, what is there that can be known about it?" (Guba and Lincoln, 1994, p.108). Marsh and Stocker (2002) explained that ontology can be something immutable or an undiscovered truth. It can also be something socially constructed, a human product that results in conflicting, multiple realities which can be changed over time (Marsh and Stocker, 2002). The main

approaches of ontology are objectivism and constructionism. Table 3.1 shows a comparison between the positivist and interpretive approach.

Table 3.1: Comparison of positivist and interpretive approach

	Epistemology	**Ontology**	**Methodology**
Positivist	'Dualism' Takes an outsider position	Single Reality	Deductive
Interpretive	Theory is grounded Takes an insider position	Multiply Realities	Inductive

Post-positivists, unlike the positivists, accept that the theories, hypotheses, background knowledge and values of the researcher can influence what is observed (Robson, 2002). However there is still a commitment to objectivity. Post-positivists also believe that a reality exist, but consider that it can be known imperfectly due to the researcher's limitations.

Creswell (2003) identifies four alternative positions with associated assumptions that underpin knowledge claims in social sciences. Besides postpositivism and constructivism, he also identifies advocacy/participatory research and pragmatism. Whilst the purists uphold only mono-method studies, without any mixture of research methods, situationalists agree that the selection of research methods must be situational. Pragmatists however contend with the integration of various methods in a single study (Creswell, 1994, Tashakkori and Teddlie, 1998). Pragmatism, embraces

epistemological relativism and the value of both subjective and objective points of view in the research, and ontologically embraces the positivist/postpositivist belief in a single objective truth or even multiple "truths" in the understandings of a given phenomenon (Tashakkori & Teddlie, 1998). Pragmatists accept "truth as it works at the time" (Creswell, 2003, p. 12). Instead of focusing on the incompatibility of paradigms, Johnson et al. (2007) argue that mixed methods research is located in a new world view.

This research aims to explore the perceptions of graduates regarding how they make their career choice decisions. It seeks to identify different factors influencing different individuals in career choice, within a group of graduates from the same course of study, and from the same department of a higher learning institution. The research aim lends itself to an interpretive paradigm with an in depth analysis of the phenomenon. The purpose is to advance the knowledge and meaning by describing, interpreting and reconstructing the personal realities. The exploration is essentially interpretive, in trying to elicit the in-depth answers to all the specific research questions. For instance specific research question 1 (RQ1) asks about the career outcomes of the Bioscience and Chemistry graduates. In depth answers for the outcomes such as satisfaction could be best explained by understanding and reconstructing the meanings that both the researcher and researched hold where the researcher takes the role of a facilitator. Similarly for RQ2, which investigates the factors influencing the graduates' career decision making, if family influence is considered important for one of the graduates, then through interacting with the

graduate one can explore and understand why and how the family influence plays such an important role in his/her career decision making.

Likewise to answer RQ3 and RQ4, the career path taken and the reasons for the choice of careers outside the main discipline of study respectively, interpretive exploration is expected to capture the voice of the graduates regarding their experience in choosing careers. It will also provide detailed descriptions of their personal reasons for not choosing bioscience or chemistry related jobs. According to Marshall and Rossman (2011, p. 91),

> "Because thoughts, feeling, beliefs, values and assumptions are involved, the researcher needs to understand the deeper perspectives that can be captured through face-to-face interaction…"

Rather than attempting to generalise across the population under study, this study is framed within the interpretivist approach that focuses on the need for a greater appreciation of perceived work values and career choice characteristics, seeking a deeper understanding of factors and personal circumstances that influence career choice decisions.

3.2 Case Study approach

A case study is an intensive study of a specific issue, individual or context (Trochim, 2001, p. 161). According to Yin (2009), a case study is an empirical enquiry that investigates a contemporary phenomenon within its real life context, when the boundaries between phenomenon and context are not evident, and where multiple

sources of evidence are used. A case study can be a program, an event, an activity, an institution or individuals.

A case study approach is appropriate in this case as the current study seeks to understand the factors which affect career choices of Bioscience and Chemistry graduates from a Malaysian higher learning institution. The current findings provide rich information about the issue mentioned. Intrinsic to the case study research is the fact that empirical results can be obtained from selection of specific groups or a small number of individuals (Robson, 2002). The case study is suggested to be suitable for the research questions of 'what' and 'how' and gives an in-depth contextual understanding of a particular group or individuals (Yin, 1994). Case studies are a common approach to the conduct of qualitative research (Burns, 2000) and provide a way to collect data to develop further understanding of a particular phenomenon or topic (Creswell, 2003), and in this study, career choice. The case study approach does not seek to generalise based on statistical notions of validity, but instead it aims to offer detailed understanding from which theory might be developed. It is important not to oversimplify or exaggerate results from a case study (Guba and Lincoln, 1981).

According to Yin (2009), the more the research questions seek to explain some circumstance (e.g. how or what of some phenomenon), the more the case study method is relevant. This approach seeks to provide "extensive and in-depth description of some social phenomenon" (Yin 2009, p 4). Different types of case study approach can be identified depending on the overall purpose of the study (Trochim, 2006). The first type is a "descriptive case study" which provides a detailed account of the phenomenon under study. The second type is an "interpretative case

study" which presents rich, thick descriptions. These are used to develop conceptual categories or to explain, support or challenge preconceived theoretical assumptions before the gathering of research data. The third type is "evaluative case study" which involves judgment besides description and, explanation. The current case study shares similarities with the first and second type of case study.

Many researchers (Bassey, 1999, Punch, 2005 and Gilham, 2000) recommend that case studies allow the use of mixed methods. Yin (2003) identifies that the richness of the context of a case is better explored by use of different data collection tools so that different elements are more likely to be demonstrated. Sturman (1994) also mentioned about using mixed studies for in-depth investigations of case studies:

> 'Case study is a generic term for the investigation of an individual, group or phenomenon. While the techniques used in the investigation may be varied, and may include both qualitative and quantitative approaches, the distinguishing feature of case study is the belief that human systems develop a characteristic wholeness or integrity and are not simply a loose collection of traits'.
>
> (Sturman, 1994, p. 61)

3.3   Research Methods

The purpose of this study is to explore the perceptions of recent Bioscience and Chemistry graduates regarding the factors influencing their career choice/s. This study employed methods associated with the qualitative and the quantitative approach. This

is a case study using mixed methods as mixed methods seemed most appropriate for exploring the research questions in this case (page 5).

Mixed methods research is defined as research in which the investigator collects and analyses data, integrates the findings and draws inferences using both quantitative and qualitative methods in a single study or inquiry (Tashakorri and Creswell, 2007).

Creswell & Plano Clark (2007) wrote a definition for mixed methods by blending *both* a methods and a methodological orientation along with a central assumption being made with this type of research. To them, mixed methods research is a research design with philosophical assumptions as well as methods of inquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis. Its central premise is that the use of quantitative and qualitative approaches, in combination, provides a better understanding of research problems than either approach alone (p. 5).

In an effort to gather sufficient data to most accurately answer the research questions for this case study on factors influencing career choice of Bioscience and Chemistry graduates, a mixed-methods approach was used, utilizing both quantitative and qualitative modes of research. Ivankova, Creswell and Stick (2006, p.3) stated, "When used in combination, quantitative and qualitative methods complement each other and allow for a more robust analysis, taking advantage of the strengths of each".

3.3.1   Rationale of using mixed methods

Different reasons or rationales for mixing quantitative and qualitative methods or forms of data, in a study, have been identified by researchers such as Greene et al. (1989), Cresswell (2009), Silverman (2005) and Cohen et al. (2007). According to these researchers, reasons for mixed method studies may be triangulation, complementarity, initiation or discovering paradoxes, development, or expansion, i.e. adding breath and scope to a project (Greene et al., 1989). According to Cohen et al. (2007) mixed methods help to triangulate the validity and explain more fully, the richness and complexity of human behaviour by studying it from more than one standpoint. The single method approach may provide a limited view of the complexity of human behaviour and situations where human beings interact. Exclusive reliance on one method, therefore, may bias or distort the researcher's picture of the particular aspect of reality which is being investigated.

The advantages of using mixed methods are to draw together information using a range of tools so that the strength of the argument is more clearly visible and to obtain a 'synergistic view of the evidence' (Huberman and Miles, 2002, p. 7). Bassey (1999) stresses the importance of developing a wide knowledge base to develop theory and supports the use of mixed methods. In an attempt to gain a picture of the larger group of graduates, and to triangulate, with a sense of how representative the case study sample will be, a questionnaire will be administered to the majority of alumni on predictors of their career choices. This will generate quantitative data. This will be followed by a qualitative study when interviews with a smaller number of participants will be used to elicit their responses to the research questions, exploring the issue in

greater depth. Quantitative research is often criticized for being overly simplistic, de-contextualized and reductionist in terms of its generalisations, thus failing to capture the meanings that people give to their lives and personal circumstances, therefore it will be complemented with more in-depth data.

The quantitative data generated from a larger group of graduates, helps to locate the three different groups of graduates: graduates who chose course-related jobs, those who chose jobs somewhat related to their course of study, and those who chose jobs unrelated to their area of specialisation. Descriptive statistics of distribution of the three groups of graduates provided numerical result of the outcome of the career choice (RQ1). This facilitated the sampling of the specific groups of graduates for the qualitative study. Interviewing the graduates will allow further explanations regarding the career outcomes, for example their job satisfactions and perhaps specific reasons for choice of discipline-related or non-discipline related jobs.

Similarly for RQ2, which investigates the factors of the career choice, the ranking of the factors of career choice was generated using the questionnaire with structured questions. These factors will be further explained and triangulated using semi-structured interviews. The interpretative approach enables social constructions of the graduates presenting their interpretation. Quantitative data was not adequate to explain deeper issues such as, "why were salary, interest in a job or work conditions important to a particular graduate?" The same situation also applied to RQ3, RS4 and RS5. Descriptive statistics were obtained using the quantitative data and the in-depth interviews were expected to provide more in-depth findings, regarding career choice and also contributions of higher learning institutions to their employability.

Answers to the research questions of this study were complex and a single method may not have been as effective in seeking solutions to the research questions. According to Tashakorri and Teddie (2003), these complex combinations of methods and approaches provide greater opportunities for mapping, analysis and interpretation so that holistic understandings of the research area would be gained.

Table 3.2 shows the link between the research questions and the data source for this mixed methods study.

Table 3.2: Link between data sources and research questions

Research Questions No.	Research Questions	Data sources
RS1	What are the career outcomes of the Bioscience/Chemistry graduates?	Questionnaire, interviews
RS2	What are the factors influencing the career choice of the Bioscience and Chemistry double major graduates?	Questionnaire, interviews
RS3	Is Bioscience/Chemistry their first choice for tertiary education?	Questionnaire, interviews

RS4	What are the reasons for choosing careers unrelated to their major field of study?	Questionnaire, interviews
RS5	What are the contributions of tertiary institutions to career choice of graduates such as development of generic skills?	Questionnaire, Interviews

3.4   Mixed Method design

Different researchers suggest that mixed methods can be conducted either concurrently or sequentially (Leech and Onwuegbuzie, 2009; Brannen, 2005; Creswell and Plano Clark, 2007).

As suggested by Brannen (2005), if the logic of inquiry and the nature of the research questions recommend the use of a mixed method approach, researchers need to consider the sequence of quantitative and qualitative methods. Brannen (2005) suggested that the ratio of combination can be in any order, depending on the emphasis the researcher wants to place on each method. A typology of mixed methods research designs has been suggested by Leech and Onwuegbuzie (2009). Researchers could design their own typologies. In any case, whatever framework is used, it is recommend that researchers thoughtfully create designs that effectively address their research objectives, purposes, and questions. The selection depends on the methodological relevance and also the research experience of the researcher (Rose and

Sullivan, 1996, Creswell, 1994). In this respect, the present research used a quantitative enquiry, aiming to generate representative samples from which sub-groups are selected for further intensive study using qualitative interviews. An attempt was made in the study to show how initial representation was obtained via the quantitative questionnaire. Qualitative element of the study using interviews with the graduates aims to generate more in-depth views and explanations for choice of careers which are not possible with structured questionnaires.

3.5   Research Procedure

There are several strategies for implementing quantitative and qualitative methods in one design. It is important to ensure the selected strategy matches the research problem and purpose (Creswell and Plano Clark, 2007). This research used the sequential explanatory strategy proposed by Creswell (2009). The study involved two phases. Phase I used the quantitative approach of data collection and analysis. This was followed by the collection and analysis of qualitative data in a second phase that built on the results of the initial quantitative results. The qualitative data was used to explain and enhance the quantitative results. The phases fell into clear, separate stages, an advantage of the design as suggested by Creswell (2009).

Phase One: This phase of research requires the completion of a questionnaire by the recent Bioscience and Chemistry graduates to explore the factors influencing career choice of the graduates. The statistics and interpretation of the results served as a basis for progression to the next data collection and analysis phase. The questionnaires were administered to a bigger population to explore the perceptions of the graduates about their career outcome, and factors influencing their career choice.

Phase Two: Data was collected using interviews where the Bioscience and Chemistry graduates were the respondents. The respondents' perceptions and reasons behind their career choice were investigated. Details of collection, transcriptions and analysis of interview data are presented later in this chapter.

The procedure of this study was implemented sequentially as shown in Figure 3.3, (QUAN → QUAL). The qualitative findings were used to help interpret or contextualize quantitative results.

PROCEDURE

Questionnaire

Quantitative data   collection

Statistical analysis

Quantitative data analysis

Interviews

Qualitative data collection

Codings, themes

Qualitative data analysis

Merge and Integrate data
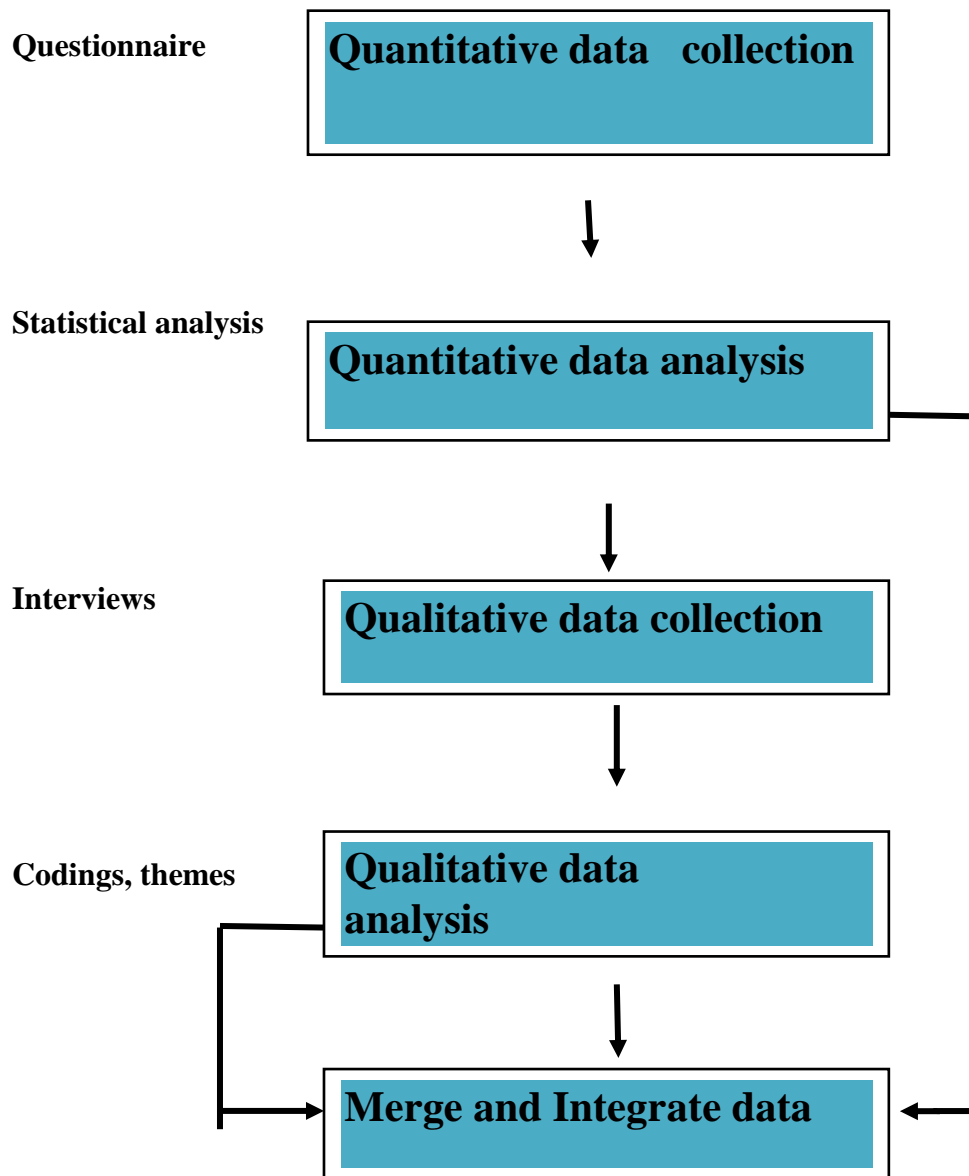
Figure 3.1: Procedures of current research

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3.6   Case Study Institution and Sampling

The higher education institution chosen for this study is the Faculty of Science from a Higher Learning Institution in Kuala Lumpur.

Sampling for quantitative study

For the first part of the study, the email addresses and contact numbers of these graduates were requested from the lecturers and undergraduates of the Bioscience and Chemistry Department of the case Institution. The Bioscience and Chemistry graduates who had graduated one to three years ago were approached to participate in the study. This could also be considered as convenience sampling which involved drawing samples that were both easily accessible and willing to participate in a study. The graduates were previously from the same institution as the researcher. However the response was slow initially. Later, some of the graduates who had responded to the questionnaire earlier, invited other graduates to take part in answering the questionnaire. In this way snowball sampling was used. Eventually, a total of 80 graduates were contacted but 50 of them completed the questionnaires. This gives a return rate of about 63%. The questionnaire (as shown in appendix A) was emailed to the graduates with explanations and invitations to participate in the survey. From the responses of the questionnaire, the extent of matching between qualification and occupations of graduates was assessed. The questionnaire also generated descriptive statistical data on factors for choice of career from a larger population.

Sampling for qualitative study

Purposive sampling was used for the qualitative phase. According to Takashakkori and Teddie (1998, p. 76), this sampling procedure involves "selection of individuals/ groups based on specific questions/ purposes of the research in lieu of random sampling and on the basis of information available about these individuals/groups". The questionnaires had identified graduates who were having jobs related to their specialisations (30%), somewhat related (50 %) or unrelated to their trained discipline (20%). This represented the outcome of their career choice. Research question 2 asks about the graduates' choice of their course of study, Research Question 3 seek to know about factors affecting their choice of jobs, and Research Question 4 seek to discover their reasons for selecting non-discipline related jobs. Therefore purposive sampling helps in the selection of the three appropriate groups of graduates for the interviews. The interviews seek to achieve thick descriptions which would answer the research questions for this study. Eleven graduates who satisfied the desired criteria or characteristics were deliberately chosen to take part in the interviews (Punch, 1998; Patton, 1990). This is a manageable size in view of the amount of time required to conduct both the quantitative and qualitative studies. The list of graduates interviewed and their particulars is provided in Table 3.4.

Table 3.3 Sampling methods

Phases	Sampling
Phase I Quantitatve phase	Snowball, convenience
Phase II Qualitative phase	Purposive

Table 3.4   List of participants for the interviews

	Code	Sex	Age	Year after graduation (Year)	Jobs
1	A1	Male	24	3	Sales executive
2	A2	Male	22	1	Research technician
3	A3	Male	24	3	Prawn farm supervisor
4	A4	Male	22	1	Software engineer
5	A5	Male	22	1	Chemicals (health) sales
6	A6	Male	24	2	Veterinary assistant
7	A7	Male	24	3	Teacher/Research student
8	A8	Female	23	1	Conveyance executive
9	A9	Male	24	2	Laboratory chemist
10	A10	Female	23	1	Medical lab technician/consultant
11	A11	Male	24	3	Promoter

3.7   Data collection

The data collection methods are discussed in the next sections.

3.7.1   Questionnaire

The questionnaire (Appendix A) was constructed with the help of informal interviews with Bioscience and Chemistry graduates and availing the relevant literature. The purpose of the questionnaire was to elicit individual views. The questions were mainly closed items. It was hoped that a short questionnaire would make the participants more willing to complete the questionnaire. In fact one of the participants thought that the questionnaire was long and requested to complete it after an examination. Data from the questionnaires were summarized using descriptive statistics to provide a picture of the participants as an overall group and using SPSS. Numerical values were applied to indicate the mean scores, standard deviations and percentage of responses from the participants. Histograms were used to illustrate findings (Field, 2005).

Besides basic demographic information (age, gender, schooling etc.), the respondents were asked to give details of their study and work. They were also asked to self-define their course of study as to whether it was concentrated on one or more major areas of study, or whether it could be defined as broad and 'generalist'; and also whether they defined their degree as less flexible around a tightly organized and understood discipline, or whether their course provided options and electives.

In addition, information on current employment was also requested pertaining to occupation; main tasks and duties; type of employer organization – and whether it

could be described as a 'science-based unit' (or organisation); and the extent to which the respondent's job could be classified as a desired career position or not.

Responses to some Likert scale items were also sought. These covered general interest in science and science careers, job satisfaction and associated benefits, generic attributes gained during the undergraduate course and their importance in the current employment, the specific usefulness and value of the 'science degree to their current employment'. Finally, respondents were asked to estimate the contribution of their undergraduate course in both obtaining their current (or most recent) employment, and the extent to which these courses were related to that employment. Respondents were asked to indicate if their current employment establishment (organisation/department/unit) could be described as 'definitely science-based', 'broadly science-based' or 'not science-related'.

This gives a self-defined measure of whether graduates perceive themselves as working in a science environment, regardless of whether the work they did was in any way related science. This measure, of course, did not cover those who might be using their science skills in an organization that could not be thought of as 'scientific'. This measure might falsely identify any totally unrelated employment in a scientific company.

The factors or work values influencing the career choice were selected after referring to the literature from both Malaysian and international studies (Elizur, 1984; Cassar, 2008; Teo and Poon ,1994; Moy and Lee 2002; Hew *et al*, 2009; Snape et al. , 2001; Ball and Chik, 2001). The Likert scale items are illustrated in Appendix A.

The draft questionnaire was tested with a group of 10 undergraduates who had agreed to assist. The piloting of questionnaire focused on relevance and the structure of the questionnaire to ensure palatability (Gall et al., 1999). It was used to check for evidence of misunderstanding or bias. This provided some interesting insights into the varying interpretation of the sentences used, the redundancy of words, scalability of response and non-response (de Vaus, 2002). After due consideration, all relevant suggestions were accommodated and the final questionnaire was then ready for administration.

Prior to the administration of the questionnaire (Appendix A), a few graduates were contacted via emails in most instances, to participate in completing the questionnaires. Through these initial contacts, the list of graduates increased. Explanations were made regarding the survey and confidentiality and anonymity were assured. If the graduates responded and agreed to complete the questionnaire, the questionnaire was then sent via the emails. Some questionnaire was administered personally. The aim of the study was explained (Johnson, 1994). Returns of the questionnaire varied. Some responded immediately, some took more than a month and were sent a reminder, while others did not return the questionnaire despite being reminded. One of the major problems in the administration of the questionnaires therefore was getting response from the graduates and getting the completed questionnaires back. While some graduates were very supportive, some did not reply: either they did not wish to participate or they were very busy at work, or some might not have checked their emails at all for a long period of time.

3.7.2   Interviews

Semi-structured interview (Appendix B) was used for the second part of this research. Interview questions were based on issues, concepts, and ideas suggested in the literature, for example, work values such as salary, working conditions and other factors influencing career choice. The interview schedule suggested themes, topics and questions that might be covered rather than any actual questions that might be used. As suggested by Minichiello et al. (1990, p.116), an interview guide:

> "… enables the researcher to start with some questions on a theme, and then he or she allows the conversation to meander according to the respondents' responses and the subsequent verbal interaction between him or herself and the informant".

The interview questions aimed to elicit the participants' perceptions about the relevance/lack of relevance and other demands of knowledge and skills during their initial year of employment. The questions were constructed with the help of literature and materials from my EdD5 assignment which involved a quantitative study of bioscience and biochemistry undergraduates regarding the knowledge and skills acquired from their institution of higher learning. A pilot study was carried out by interviewing three bioscience alumni who have graduated two to three years ago. A trial interview transcript and its coding were used as a practice. During the interview, the interview schedule was used as a guide to allow a conducive environment for a free exchange of information. The wordings and sequence of the interview guide were

not followed strictly. Appropriate probing was used when necessary to generate more in-depth information.

The interview questions were sent to the participants in advance, although some additional questions might arise during the course of the interview for the purposes of clarification. The personal particulars of the participants were recorded with their consent and confidentiality/anonymity was assured. The semi-structured interviews lasted between one to two hours, depending on the response of the participants. If certain information given during the earlier interview needed to be clarified, follow up interview/s were then arranged with the consent of the participant/s.

The audio recording of the interviews was transcribed verbatim and were sent to the respective interviewees for verification. Participants were contacted through emails and phone calls when necessary, to clarify ambiguities which might arise during interviews and data analysis. The whole data collection exercise lasted four to five months (Robson, 2002; Wragg, 2002; Silverman, 1997; Silverman, 2005; Gilbert, 2001 and de Vaus, 2002).

Qualitative interviews have weaknesses. The main weakness is the amount of time taken to plan and conduct the interviews, the transcription of the tape recordings and the data analysis (Weiss, 1994). The tape recorder can be considered to be a 'blessing' as well as a "deterrent to free speech". The respondent might have fear or unwillingness to speak freely or purposely withheld evidence which would put them in an unfavorable situation. If the interviewer failed to question the participants in a

meaningful and clear manner, the result would be gathering non-meaningful replies. The interview schedule consisted of semi-structured open-ended questions.

3.8 Quantitative Data Analysis

This section begins with a description of the procedures used to convert the raw data collected using questionnaires into important statistical data, using statistical packages for social sciences (SPSS) version 17 (Carver and Nash, 2009; Field, 2005).

3.8.1 Editing and Coding of Quantitative Data

Questionnaires which were completed and returned by the Bioscience and Chemistry graduates were checked carefully. Coding in quantitative research involves the assigning of numerical scores to the responses (Robson, 2002; Cohen, 2000). The items in the questionnaire had fixed alternative codes or answers with Likert scales and these were pre-coded. There were five scales for most questions i.e. 'strongly agree' was coded as 5, 'agree' as 4, 'somewhat agree' as 3, 'disagree' as 2 and 'strongly disagree' as 1. To ensure reliable results, careful editing was ensured so that accurate and consistent quantitative findings were achieved. The numerical scores entered into the computer were analysed using SPSS. Question 14 of the questionnaire required open ended response, and in this case, verbatim responses were assigned categories and themes.

3.8.2 Reliability of the items of the questionnaire

In statistics, Cronbach's α (alpha) is a coefficient of internal consistency. It is an estimate of the accuracy of the test scores. Generally the alpha coefficients increase as

the intercorrelations among test items increase. After the data from the questionnaires were entered into the SPSS software accordingly, alpha coefficients for the variable of each constituent were determined and this is tabulated in Table 3.5. According to George and Mallery (2006), Robson (2002) and Gliem and Gliem (2003), there is no fixed acceptable alpha value. George and Mallery (2003, p. 231) provide the following rules of thumb:

> 0.9 is excellent; ≥ 0.8 is good; ≥ 0.7 is acceptable; ≥ 0.6 is questionable; ≥ 0.5 is poor; ≤ 0.5 is unacceptable.

Therefore it can be deduced that the data collected by the measuring instrument were reliable and consistent (Table 3.5).

Table 3.5: Cronbach's alpha determined for the variables of various questions of the questionnaire

	Items	Cronbach's alpha
Generic skills	7	0.875
Factors influencing career choice	32	0.882
Reasons for choosing subject-unrelated jobs	6	0.616

Reliability of Instrument compared with other studies

The questionnaire used 32-item instrument on general work values developed by Elizur (1984), which has been tested in various cultural contexts (Borg, 1986; Elizur et.al, 1991) and was also considered appropriate for this study. The reliability (alpha= 0.8) for the scale in this study was acceptable. Compared with Elizur's studies (2001),

for the first measurement (1995), the reliability score is *alpha* = .87, for the second measurement (1998), *alpha* = .93, and for the third measurement, *alpha* = .92.

3.9   Data analysis of Interviews

According to Marshall and Rossman (2010), typical analytical procedures for interviews consist of six phases: (a) organizing the data, (b) generating categories, themes, (c) coding the data, (d) testing the emergent understandings, (e) searching for alternative explanations, and (f) writing the report. First, the interview data from this study were transcribed as accurately as possible. This was a very time-consuming process. Organising the voluminous data involved editing, cleaning up and noting down information such as the place and time of collection. According to Wengraf (2001, p. 211), during transcribing, sorting, reading, and rereading, memoing is important. This is agreed by Patton (2000) and Marshall and Rossman (2010). Memoing may be thematic and theoretical. Reflective memos, thoughts and insight are also thought to be invaluable.

Coding of data basically means "formal representation of analytical thinking (Rossman and Rossman, 2011, p.212). The main task is to generate categories and themes. Coding involved putting tags, labels, names, key words, etc. to the segments of data collected (Patton, 1990; Marshall and Rossman, 2011). According to Attride-Stirling (2001) and Weston et al. (2001) two approaches are used to develop coding framework. One approach is the use of priori codes, another approach is to use inductive codes. Other researchers may not use the same terms for these procedures. The preliminary research questions, the related literature and the relevant conceptual

frameworks were used, so that key issues and themes were identified and developed earlier to provide guidelines for data analysis (Marshall and Rossman, 2010, p.152).

Next the codes were grouped according to conceptual categories. Punch (1998) used two types of codes: descriptive codes and inferential codes. Attride-Stirling (2001) named the descriptive codes as first-level codes. Data were broken into smaller segments for the second level coding. Second-level codes or organising themes (Attride-Stirling, 2001) were used to group the broad categories created by the first level codes into a smaller number of themes (Miles & Huberman, 1994). An example of the coding of the transcribed interview data is shown in Appendix D.

Comparative approach could be used to study the connections between the patterns, themes and categories from one segment of data with another. During this process, contradictions to an emergent theme could be further analysed. After catergories and themes were developed, the next process was interpretation of the findings. "Interpretation brings meaning and coherence to the themes, patterns, and categories, developing linkage and a story line that makes sense." (Marshall and Rossman, 2011, p. 219)

3.10 Insider Research: Advantages and Disadvantages

Insider research is conducted by "complete members of organizational systems and communities" (Brannick and Coghlan, 2007, p. 59). There are several research limitations in insider research. One such limitation is the familiarity of the researcher in the research setting (Brannick and Coghlan, 2007; Mercer, 2007; Robson, 2002). Being a lecturer in biological science, I was familiar with many Bioscience and

Chemistry graduates. This included the subjects and the skills that they were taught. This familiarity was advantageous for the collection of data and analysis of results. According to Mercer (2007), there is 'a stronger rapport, and a deeper, more readily available frame of shared references by which to interpret the data collected' (p. 13). Similarly, Shah (2004) believes that "a social insider is better positioned as a researcher because of his/her knowledge of the relevant patterns of social interaction required for gaining access and making meaning" (p. 556). Obviously in the case of my research, easy access to the participants and information enhanced a smoother path for the research.

However, being familiar with the graduates interviewed had its disadvantages. According to Mercer (2007) and Brannick and Coglan (2007), this may lead to preconceived opinions and bias about the phenomenon under study. This in turn affects the collection and analysis of data especially for the interviews. According to Mercer (2007), certain "obvious or sensitive questions may not be asked, assumptions may not be challenged and consequently data may become thinner (p. 6)". Being a former lecturer of the graduates, it was possible that the graduates might show 'respect' and not challenge certain viewpoints. If the graduates were not open, the depth of information might be affected. According to Shah (2004, p. 569), "people may not share certain information with an insider for fear of being judged" (Shah, 2004, p. 569). Participants might probably be more willing to share with a 'detached outsider' than with an insider. This is in fact a disadvantage that an insider researcher should overcome. For this research, conscious efforts (that is to be reflexive) were made to avoid biases because of my familiarity and experiences in the research context, during the data collection and analysis procedures.

Other disadvantages of insider research are power imbalance and gaining trust from the participants (Mercer, 2007). Some of the graduates might have been taught by me before they graduated and started to work. The graduates might not share freely and deeply with a previous lecturer. However, since the graduates have already completed their studies, perhaps the issues mentioned above might not be so significant, since they would 'not be assessed' by me anymore.

3.11   Validity and reliability within the mixed methods design

For mixed methods research, one has to consider the standards of reliability, validity and objectivity for the quantitative method. At the same time the questions of credibility, dependability, transferability and confirmability have to be emphasized as they are the criteria for validity of qualitative research (Mertens, 2005; Creswell and Plano Clark, 2007). The following sections will discuss mainly validity of the qualitative method, as the reliability of the quantitative method has been discussed in Section 3.8.2.

3.11.1 Qualitative Method

3.11.1.1   Trustworthiness

The aim of trustworthiness in a qualitative inquiry is to support the argument that the inquiry's findings are "worth paying attention to" (Lincoln & Guba, 1985, p.290). Positivists normally claim that their data are reliable and valid mainly because of the structured questionnaires and the statistical method of analyzing their data (Creswell, 2002). The interpretivist researchers have different perceptions on how to

make their research more reliable and valid. The criteria of trustworthiness i.e. internal validity, external validity, reliability and objectivity can be replaced with credibility, transferability, dependability and confirmability respectively (Hoepfl, 1997; Lincoln and Guba, 1985). Some important strategies in replacing conventional criteria with the criterion of trustworthiness are suggested in Table 3.6.

Table 3.6   Criteria, Trustworthiness and Strategies (Adapted from Hoepfl, 1997, p. 48)

Criteria	Replaced by Criterion of Trustworthiness	Strategies
Internal validity	Credibility	Triangulation; Peer debriefing; Member checking.
External validity	Transferability	Thick description;
Reliability	Dependability	Audit trail
Objectivity	Confirmability	Audit trail

The design of this study aims to fulfill the four criteria of trustworthiness: credibility, transferability, dependability, and confirmability (Lincoln and Guba, 1985; Hoepfl, 1997; Seale, 1999; Morrow, 2005; Rodwell & Byers, 1997). Credibility aims to describe accurately the reality of the phenomenon studied and in this case the factors influencing the career choice of the science graduates. To enhance the credibility of this study, the following steps were taken: (1) sufficient time was spent with the participants during the interviews, in fact, normally a minimum of an hour, and sometimes lasted more than 2 hours. This generated a rich, in-depth data. After transcriptions, if further information were required, another interview was arranged.

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This ensured a fuller or more adequate picture for the interviews. (2) In addition, participants were given opportunities to verify the accuracy of the interview transcripts (Morrow, 2005). To further enhance credibility, the researcher can cross-validate the findings between the interviews to make the findings and conclusion more convincing and accurate (Silverman, 2005). "The most crucial technique for establishing credibility" is using "member checks" (Lincoln and Guba, 1985, p. 314).

Dependability is an assessment of the quality of the integrated processes of data collection, data analysis, and theory generation. It refers to the consistency between the data collected and the findings (Merriam, 2002, Lincoln and Guba, 1985), similar to reliability of data in a quantitative research (Seale, 1999). To achieve the dependability of this study, an audit trail was used to keep details of research activities, raw data transcriptions, and data analysis processes (Lincoln and Guba, 1985). "Auditing is an exercise in reflexivity, which involves the provision of an ethnologically self-critical account of how the research was done" (Seale, 1999, p. 468). Other strategies included: data collection over a range of time periods, audio-recordings and extensive transcriptions, some repeat interviews were conducted.

Confirmability is a measure of how well the inquiry's findings are supported by the data collected (Lincoln and Guba, 1985). It refers to the degree the findings can be corroborated by other researchers. It is an issue of objectivity, which is not possible with the interpretive studies. An important strategy for the interviewer is therefore to be reflexive. Being reflexive means that the researcher has to be reminded constantly, that her values, beliefs and personal bias, can affect the interpretation and meaning to the collected data. 'Member checking' involved meeting and contacting the

Bioscience and Chemistry graduates again after the interviews, to verify the transcriptions, and interpretations of the interview data. This could also guard against researcher bias.

3.12   Mixed methods design

"Mixed methods are used to enrich understanding of an experience or issue through confirmation of conclusions, extension of knowledge or by initiating new ways of thinking about the subject of the research" (Bazeley, 2004, p. 149). Creswell and Plano Clark (2007) defined validity in a mixed methods study as "the ability of the researcher to draw meaningful and accurate conclusions from all the data in the study" (p. 146). For any research, validity concerns the appropriateness, thoroughness and the effectiveness of the methods used.

In mixed methods design, two phases of data collection are normally involved either concurrently or sequentially. Creswell and Plano Clark (2007) highlight the issues related to sample size, introduction of potential biases and the encounter of contradictory results. Very often, the samples for the quantitative study is large compared with the much smaller sample size for the qualitative phase. In this study the participants for interviews were actually selected from the larger samples from the quantitative study in the first phase. This has been suggested to increase validity for the study. Bazeley (2002) also suggested two critical issues regarding mixed methods research. Mixed method researchers should be aware of the limitations of traditional methods as they are modified in a mixed methods environment, and the varied methods of treatment of "error" or "deviance" in their data analysis.

3.13   Ethics

This research follows the ethical principles set out by the British Educational Research Association (BERA, 2004). Research ethics requires that consent should be obtained from the participants before starting the research. The participation was on a voluntary basis. It was ensured that participants were given a full briefing on the purpose of the questionnaires and interview. The participants had the right to withdraw from the research at any time and for any reason. Assurance was given to all participants on the privacy of their participation. This would encourage the participants to speak freely. To achieve anonymity, the researcher could disguise the names of participants as well as all other personal means of identification when reporting the findings. It was ensured that the research data was protected and kept safely. The data must also remain confidential and anonymous (Cohen & Manion, 2000). Most interviews were tape-recorded. To ensure that the identity of participants was not disclosed from data such as the questionnaire and interview transcriptions, special care was taken so that codes were used for working papers.   This will ensure the authenticity and trustworthiness of the interview. Due respect must be given to the institutions concerned as well.

In summary, a case study using mixed methods was used to investigate the factors influencing the Bioscience and Chemistry double major graduates from a Malaysian higher learning institution. Data collection was by questionnaire, administered to a larger group of graduates, followed by interviews with a small number of participants. In striving for trustworthiness in the research, an open approach has been taken, with considerable detail given about the participants and the processes of coding used (member checking, audit trail). The open approach enables 'transparent' judgments to

be made about the possibility of generalisation of findings. Ethical guidelines have been strictly adhered to, both in terms of the application to the Research Ethics committee for permission to carry out the study, and also in terms of following the ethical guidelines for the participants. All data were held securely.

CHAPTER FOUR

QUANTITATIVE FINDINGS

This study seeks to investigate the factors influencing the career choice of a batch of Bioscience and Chemistry double major graduates from a higher learning institution in Malaysia. Chapter 1 of this thesis provides the introduction and background to the study whilst Chapter 2 discusses the context and relevant literature and Chapter 3 the methodological background. This chapter reports and interprets the findings of the quantitative data. It endeavours to link the findings to the research questions of this study. Chapter 5 describes and interprets the qualitative data from the interviews. The reasons why the quantitative and qualitative findings (from the interviews) are separated into two chapters are explained in Chapter 1. Both sets of data will be integrated and analysed with reference to the related literature in Chapter 6.

The questionnaire (Appendix A) was divided into four sections. The first part of the questionnaire studied the demographic variables. The second part threw light on some of the significant findings on types of employment, as to whether they were related to their degree programme and factors influencing their career choice. This chapter reports the quantitative findings and descriptive statistics.

The questionnaire was sent to eighty Bioscience and Chemistry graduates. As the graduates were working in different parts of Malaysia, there were difficulties getting their new contact numbers. A total of fifty responses were collected for the questionnaire, mainly through emails. Returns of the questionnaire varied. Some responded immediately. Some took more than a month and were sent a reminder, while others did not return the questionnaire at all despite being reminded. A total of 11 graduates were interviewed and the data collected was used to substantiate the questionnaire findings.

4.1   Data Presentation

This section begins with a description of the procedures used to convert the raw data collected from the survey using questionnaires into important statistical data, using statistical packages for social sciences (SPSS) version 17.

4.1.1   Findings

Section A : Demograhic information

50% of participants were males and 50% females. The age group of participants was between 20 to 23 years (60%) and 24 to 27 years (40%).

Section B of Questionnaire

Question 1 to Question 6

Question 1: Size of company and work choice

For Question 1, results show that about 34 % of graduates worked in big companies with more than 150 staff while 25% of graduates worked in smaller sized companies with 16-50 staff. It might have been easier to secure a job in large companies where the number of staff employed would be larger. This was followed by medium-sized companies. Graduates seemed to avoid very small companies. Interestingly, the number of graduates working in companies with an employing work force between 101-150 staff was least. This might be due to the small sample size of this study.

Besides, the graduates had probably made an estimation of the work force of their companies.

Graduates might think that the bigger companies were more stable providing them security and better prospects, especially in a foreign-invested company (Figure 4.1). These companies were probably thought to provide better salary, fringe benefits, financial stability, better updated scientific equipment as well as more promising opportunities for training. These might be reasons that some fresh graduates were not willing to seek employment in smaller companies. This illustrates Schein's anchor theory. However large companies might be more bureaucratic than smaller companies. The social relationship between superior and staff, as well as among staff may be closer and more harmonious. Staff may show greater responsibility in a close-knitted environment.
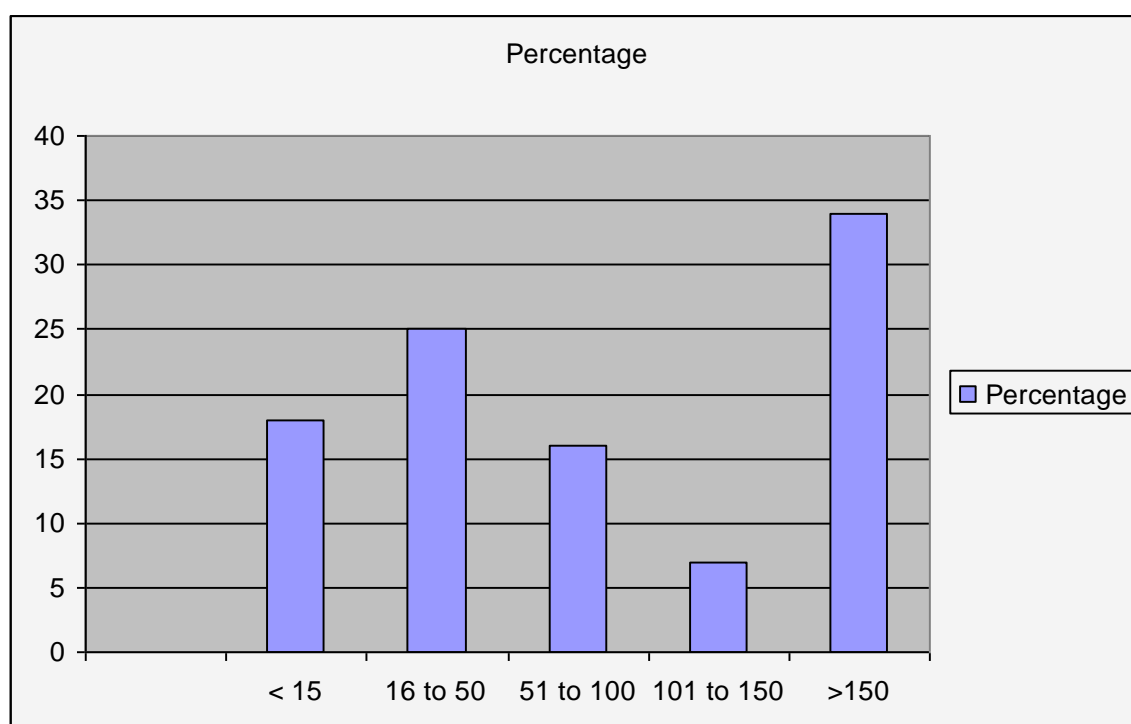
Figure 4.1: Size of companies employing Bioscience and Chemistry graduates

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Question 4: Choice of course options of graduates enrolled at tertiary education

Bioscience and Chemistry course was the first options for 68% of graduates. 32% of graduates, a fairly large proportion, said that the course was not their first option. For those whose option was not Bioscience and Chemistry, their original options are shown in Table 4.1.

Table 4.1: Course options

Course options	Number
Arts	1
Business	3
Engineering	4
Medicine	5
Dentistry	0
Pharmacy	5
Food Science	7
Law	0
Others	10

The graduates might not have considered Bioscience and Chemistry programme as their main options. However, the course options they originally preferred (Table 4.1) were mostly related to Bioscience or Chemistry, such as Food Science, Pharmacy, Medicine and Dentistry. A few of them chose business course, which was unrelated to science. Engineering course was the preferred option for some graduates. Engineering programmes require background in Mathematics and Physics. Chemistry is related to some fields of engineering.

A number of graduates originally wanted to take up Food Science courses, most probably due to the more specialized nature of this course compared with the basic bioscience and chemistry programmes. Besides, some students might not want to study two different disciplines. They might be good in either bioscience or chemistry and preferred one of the two subjects. Besides, more time and efforts would be needed to cope with two subjects. It can also be observed that 5 graduates aspired to be doctors, and another 5 graduates wanted to pursue courses in pharmacy. Both of these require good grades in biology and chemistry. The medical course is among the most competitive in Malaysia. Only students with almost perfect CGPA (Cumulative Grade Point Average) can be accepted for medicine in the local public universities. There are also limited places for pharmacy course in Malaysian public universities. Tuition fees in private and overseas universities are much higher and not affordable. Many of these Bioscience and Chemistry graduates could not afford expensive tuition fees, which cost hundreds of thousands of Malaysian Ringgit. The way the graduates made their decisions to choose their course was influenced by a number of factors which were further investigated using interviews. Some of the factors were: interest in science, parental influence, examination results and so on (Chapter 5).

It is logical to assume that the choice of career was very much related to the choice of the course of study. Question 13 of this questionnaire (discussed later in this chapter) actually shows that 'opportunity for personal growth' and 'doing work which is interesting', were the two most important factors for their career choice. Influence from family members and lecturers, was considered unimportant in the questionnaire findings. Therefore the choice of courses for tertiary education for this group of graduates most likely stemmed from their own interest.

Question 5 and 6: Perceptions of structure of course of study

The respondents were asked to self-define their course of study as to whether it was concentrated on one or more major areas of study, or whether it could be defined as 'broad' and 'generalist'. The questionnaire also asked whether they defined their degree as 'less flexible' around a tightly organized and understood discipline, or whether their course had room for options. The aim of these questions is to find out the characteristics in matching outcomes for those who split their major course of study across at least two of these major fields ('multifocus'), in this case Bioscience and Chemistry. Tightly-structured courses show some inclination to favour graduates with science-related jobs.

The results of this survey shows that 84% of graduates considered the coverage of the papers taught in preparing them for work to be broad, while 16% considered the subject coverage to be specialized. 36% of respondents considered that their degree can be defined as 'less flexible' around a tightly organized and understood discipline and 64% of respondents considered their degree to be 'flexible' with room for options and electives.

Graduates who reported their course as 'broad' or 'generalist' correlated inversely with the tendency that their 'scientific knowledge and skills' would be valued by their employer. Those who specialise or concentrate in one area are more likely to find employment where their skills are recognized compared with the 'generalist' counterparts. Tightly-structured courses tend to favour a graduate gaining a recognizably 'scientific' occupation, meaning that they are less likely to find themselves in an interim job which does not lead to a career position.

Since the majority of the graduates (84%) considered their course to be less specialized, and flexible (64%), there was a possibility that they might not be very rigid about getting bioscience and chemistry-related jobs, which need to make use of their knowledge and scientific skills. This correlates with the fact that about 58% of the case study graduates actually took up non-discipline related and somewhat discipline jobs (Question 7).

4.1.2 Relationship between the undergraduate degree and current occupation

Question 7 to Question 11: Measures of extent of matching between degree programme and employment

Questions 7 to 11 are used to measure the extent of matching between the degree programme and employment. In **Question 7** respondents were asked to indicate if their current employment establishment (organisation/department/unit) could be described as 'definitely science-based' (41 %), 'broadly science-based' (26 %) or 'not science-related' (32 %). This gave a self-defined measure of whether graduates perceived themselves working in a science environment, regardless of whether the work they did was actually related to the establishment. This measure, of course, does not account for those who might be using their science skills in organizations that could not be considered as 'scientific'. This measure would also mistakenly identify any totally unrelated employment in a science-based organization. Since the questionnaire did not ask for employment history since graduation from all participating graduates, longitudinal development of individual career progressions

could not be followed. However this was enabled through the qualitative studies using interviews, when graduates narrated their work experiences.

Question 8 investigated the course-relatedness of employment of the graduates. 30% of graduates secured employment that was definitely related to the course they studied. 20% of graduates were employed in jobs unrelated to their degree. 50% of the graduates thought that their employment was somewhat related, as shown in the pie chart in Figure 4.2.
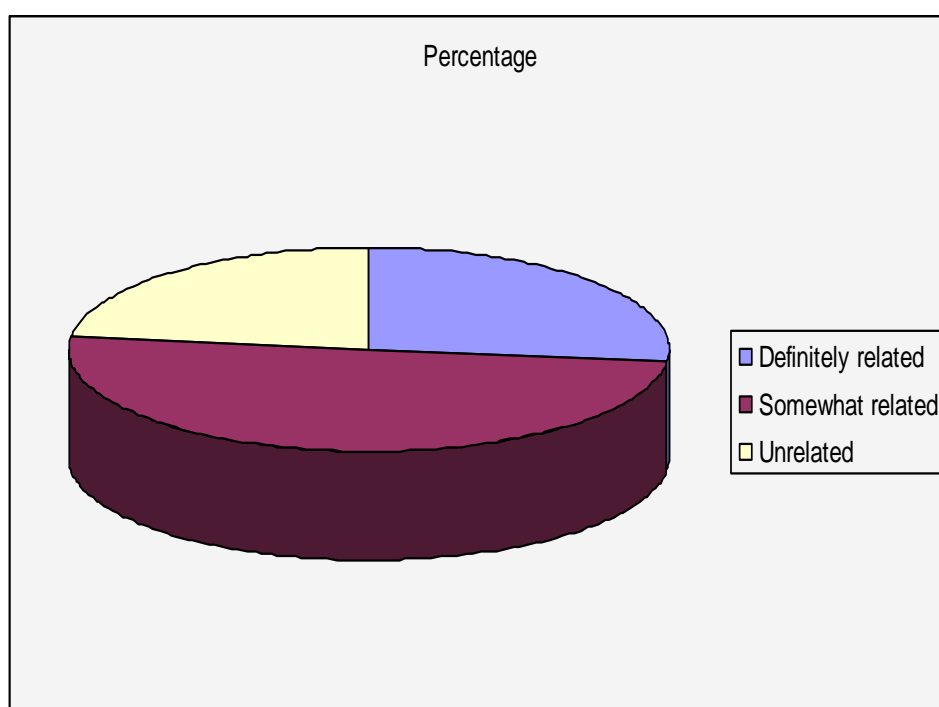
Figure 4.2 Types of employers: Related or Unrelated to Bioscience and Chemistry

It has to be pointed out here that science graduates might define course-related jobs to be those which deal strictly with laboratory testing, excluding jobs which deal with promoting or marketing of science products. 30% of the graduates work using their trained discipline, either chemistry or bioscience. Related science jobs include: chemists dealing with different products such as skin and hair products; laboratory

technicians in the hospital, quality control executives in food industry and water treatment, technical staff in the prawn farm, teaching science in schools, research assistant and so on. The somewhat related jobs include marketing and sales of health products, chemicals for research and for industries, service engineer and others. On the other hand, unrelated jobs include working in the bank as marketing executive, sales of life insurance, assistant in law film and so on. Many graduates were interested in sales and marketing and this has taken them progressively further away from their bioscience and chemistry specialisation. Therefore, not all Bioscience and Chemistry graduates want to choose employment related to their specialisation.

In response to **Question 9,** the respondents indicated the extent to which their undergraduate degree assisted them in obtaining their current positions. 48% of graduates suggested that their course of study 'contributed a great deal' to gaining their current employment, while 27% reported that the degree was 'essential in helping them' to get their current employment. 23 % of graduates reported that their course of study 'did not contribute at all' to gaining their current position. Those who indicated that their undergraduate qualification contributed a 'great deal' towards securing their present positions believed that their degree was related to their current jobs.
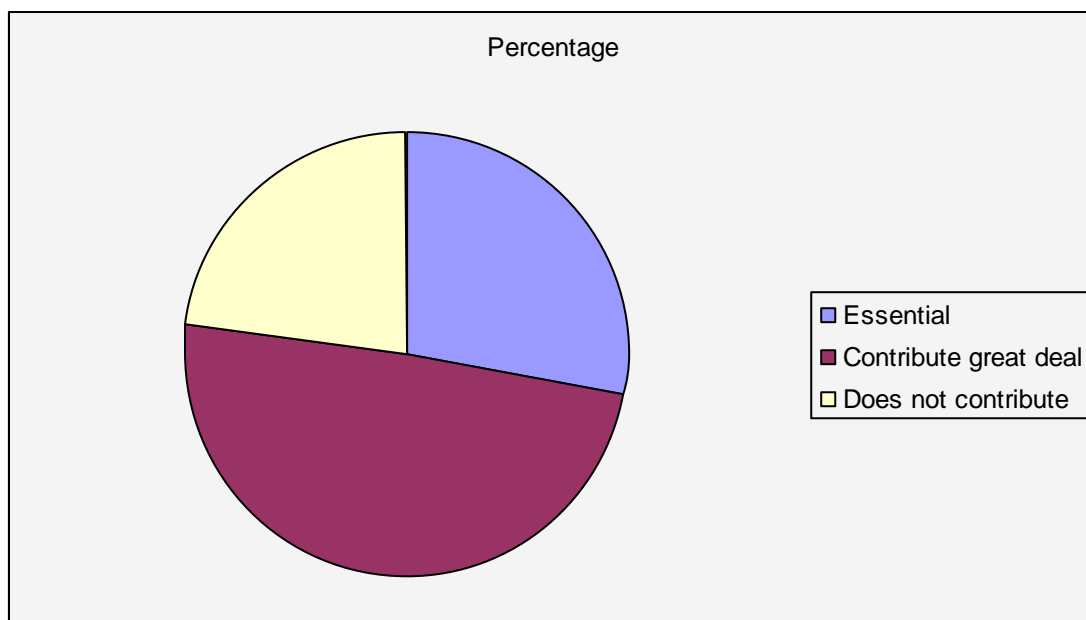
Figure 4.3: Contribution of graduate course in obtaining employment

About 80% of graduates in this study recorded that their undergraduate degree was either 'directly related' or 'somewhat related' to their current employment (Question 8 of questionnaire), while 20% reported that their current position was not related at all to their degree. However, of the 80% with science-related jobs, 30% recorded that their work was directly related to either chemistry or biology. The thing to note here is that the graduates might define 'directly related' and 'somewhat related' by considering 'directly related jobs to be jobs that involve hands-on laboratory testing. These jobs include the following: chemists, medical laboratory technicians, research assistants and quality control technicians. Jobs that were broadly related were jobs that might include sales and marketing of chemicals, health products, etc. A total of 75% of all working respondents reported that their undergraduate science degree was 'essential' or assisted 'a great deal' in gaining their current position, while around 23% reported that their programme of study did not 'contribute at all' to their gaining their jobs (Question 9 of questionnaire). This shows that the two measurements of

match/mismatch of employment to curriculum were in good agreement with each other. If disparity of this result occurred, it possibly implied that many graduates were working in 'science-based' careers which had not traditionally been recognized as 'Science' per se., for example, science graduates sometimes did not consider sales and marketing of health and chemical products as 'truly science-related', as they did not carry out laboratory-based work.

Specific usefulness and value of Bioscience and Chemistry degree to current employment was studied in **Question 10**. This question was organised on a five-point Likert scale running from 1 = strongly disagree, 2 = disagree, 3 = somewhat agree, 4 = agree to 5 = strongly agree. Mean scores were determined using SPSS. The graph comparing the mean scores of the value, use and recognition of the skills and abilities in their jobs is shown in Figure 4.4. In order to interpret the level of findings represented by the mean scores, the guideline (Table 4.2) suggested by Hj Othman and Ishak (2009) was used.

Table 4.2: Mean Score Interpretations

Mean Score	Level
1.00 -2.00	Low
2.01-3.00	Moderately Low
3.01-4.00	Moderately High
4.01-5.00	High
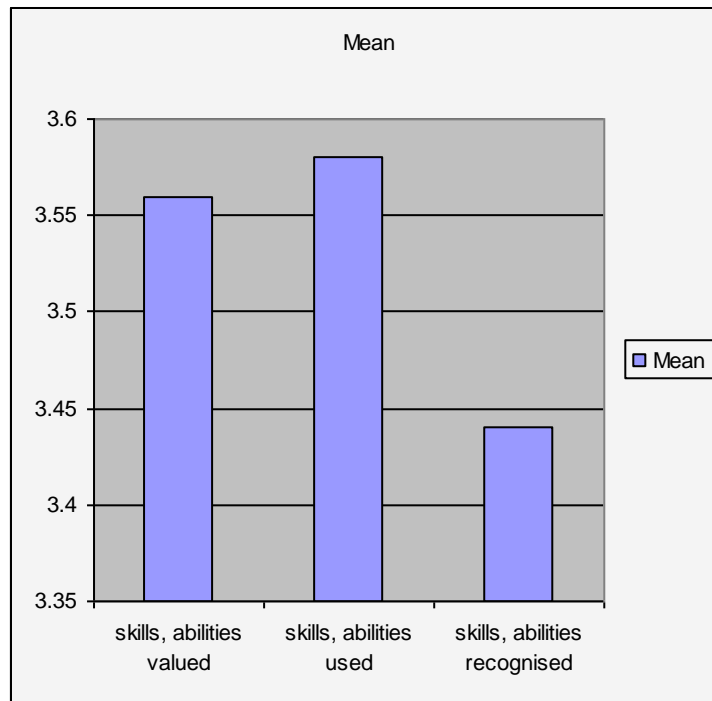
Figure 4.4: Value, usage and recognition of skills acquired

Question 10 investigated the specific usefulness and value of the degree to current employment. The mean scores of the scientific skills being valued, used and recognized were 3.56, 3.58 and 3.44 respectively (Figure 4.4), and were considered to be moderately high, according to the mean score interpretation of Hj Othman and Ishak (2009) mentioned above. This shows that graduates perceived that their degree was fairly valued and recognized and was used at work. These additional Likert questions probed the extent to which respondents felt their scientific skills and abilities were valued, used, and recognized in their position, (and by implication, also by their employer).

Table 4.3: Comparison of skills valued, used and recognized between female and male graduates

Gender	Female	Female	Male	Male
	Mean	**Standard deviation**	**Mean**	**Standard deviation**
Skills valued	3.42	1.00	3.68	1.00
Skills used	3.65	1.25	3.50	1.25
Skills recognised	3.31	0.96	3.57	0.96

Further analysis comparing the mean scores of the skills valued, used and recognized (Table 4.3) shows that the males had higher mean scores for both skills valued and skills recognized than the females. The females showed higher mean scores for skills used than the males.

It has to be stressed that the skills mentioned here refers to the scientific skills which included both the academic skills and practical skills the graduates acquired from their tertiary study. Therefore the study focused on the application of skills that the respondents believed they had developed during their undergraduate science degree and not on the full range of skills they were utilizing in their work. It can be noted, however, that more than 55 **%** of respondents indicated that their jobs gave them the chance to use the skills and abilities acquired in their undergraduate science degree, and 25% somewhat agreed.

Question 11: Outcome of employment: Satisfaction with employment

For **Question 11**, 37.5% of graduates agreed that they were satisfied with their jobs. 41.7% somewhat agreed that they were satisfied with the employment. 8.3% of graduates were strongly dissatisfied with their employment (Figure 4.5). The male graduates show a higher mean score of satisfaction with their jobs than the female (Table 4.5). This may correlate with the findings that the males perceived that their skills were more valued and recognized at work (as illustrated in Table 4.3). The reasons for their dissatisfaction were further explored during the in-depth interviews with the participants. The degree of satisfaction of graduates with their job reflects the outcome of the career choice made by the graduates. It may be assumed that the graduates had been making rational choices about educational qualifications in the quest to arrive at what they hoped would be a satisfactory career. In other words, we are assuming that respondents specifically chose a science oriented qualification because it was probably the way they wished to arrive at a specific career outcome. The reasons for satisfaction and dissatisfactions with employment would be further explained from the interviews with selected graduates. This would be further discussed in Chapter 6, by integrating both quantitative and qualitative findings.
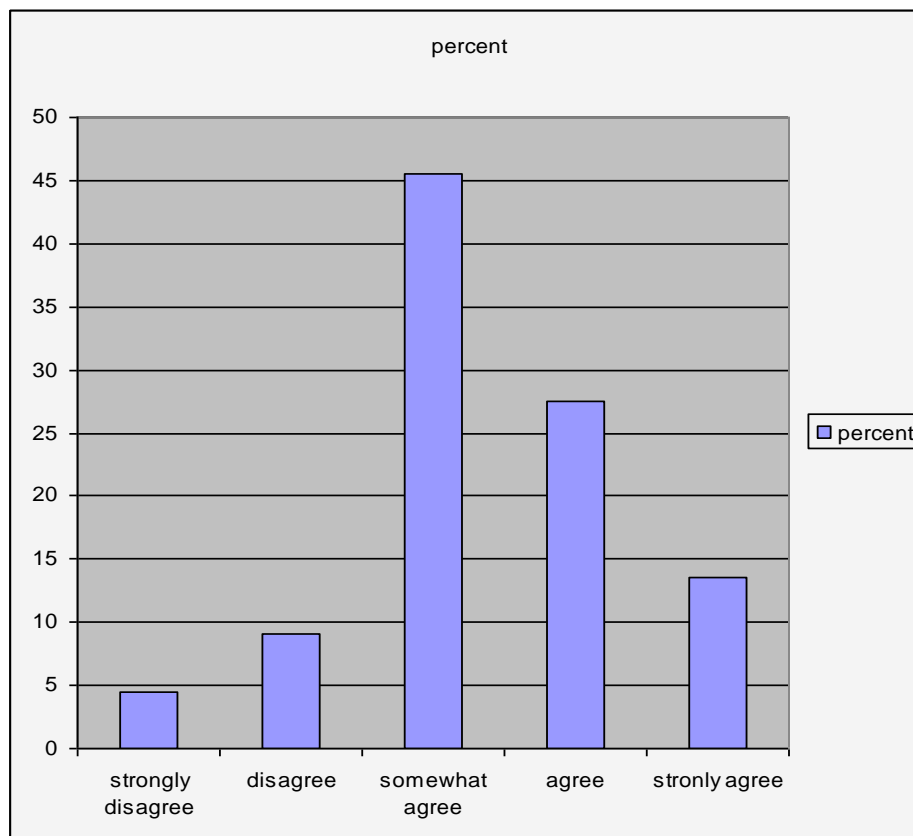
Figure 4.5: Satisfaction with employment

Table 4.4: Mean score of female and male graduates (Satisfaction with employment)

Gender	Mean	Standard deviation
Female	3.27	1.08
Male	3.47	0.84

Question 12: What are the important generic skills for employment?

This question aims to investigate the types of generic skills that the graduates perceive to be important for the employment that they have chosen. The skills perceived to be most important were 'problem solving skills' (mean score 4.51) followed by 'being

able to work independently' (4.38) and 'critical thinking' (4.26) (Refer to Figure 4.8). The mean score for communication skills (4.23) was only slightly less than that for critical thinking skill. In Malaysia, lack of communication skills has been singled out as a major reason for the high rate of unemployment (Lim et al. 2008). The last three skills were team work (4.10), leadership (4.09) and IT skill (3.68). Table 4.5 provides some explanations for the relative importance of the different generic skills for employment of the graduates.
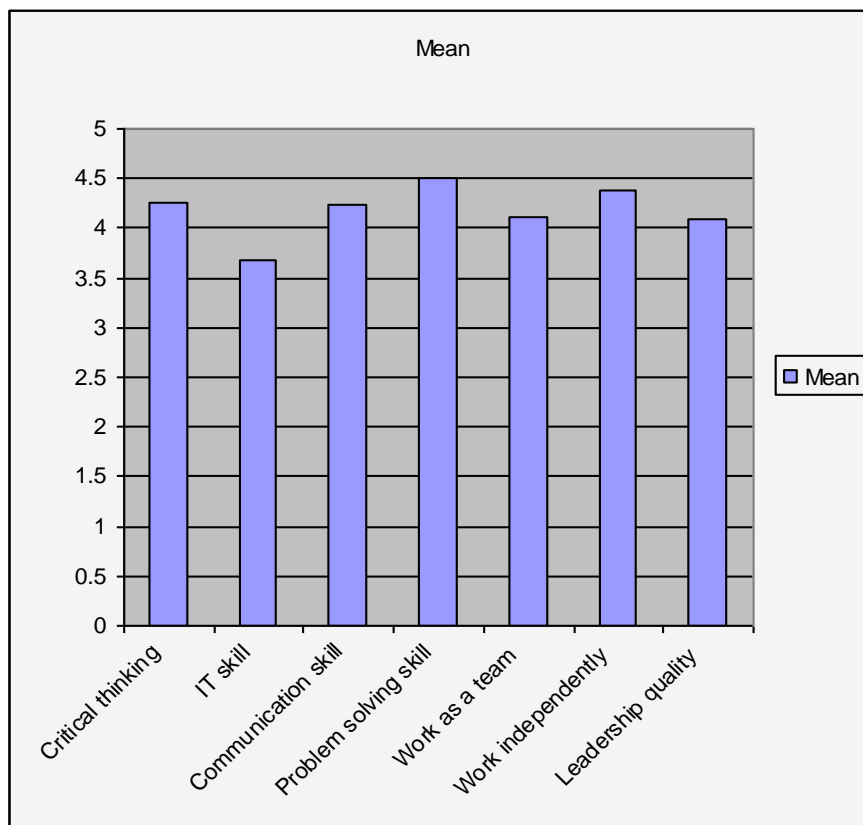
Figure 4.6: Generic skills important for employment

Table 4.5: Reasons on importance of generic skills for employment of graduates

Generic skills	Mean score	Standard deviation	Possible reasons on importance of the skills
Problem solving skills	4.51	0.95	This is considered most important as new graduates face new challenges during the probation period in the new work environment. They are learning new things and unless they cope with problems, they may not be able to perform the task assigned to them.
Being able to work independently	4.38	0.90	This is considered more important than team work, which has a lower mean score (4.23). Most companies expect staff to be work-ready, that is, new graduates must show that they can work on their own.
Critical thinking	4.26	0.87	The graduates rate critical thinking to be very important, showing that the workplace demand critical thinking that is they are expected to be able to analyse, evaluate, reason, and make informed decisions.
Communication skills	4.23	0.81	Communication skill is considered to be as important as critical thinking skill when their mean scores are compared. Good communication skills enhance learning in work place. This is especially important for new graduates. A number of graduates took up sales and marketing jobs which required good verbal communication skills.
Team work	4.10	0.94	In large companies where about 30% of graduates work (shown in Question 1), most likely a project will need the coordination of smaller groups, each focuses on parts of the whole project. Science

			students normally learn team work in the practical sessions.
Leadership	4.09	1.02	Leadership skill has a mean score almost the same as that for 'team work'. However this skill is not as important as problem solving and critical thinking skills. Since the graduates have just joined the work force, leadership skill may not be as important. But for those who are more senior at work, the chances to lead or take up managerial roles are high.
IT skill (Information technology)	3.68	0.76	IT skill is ranked the lowest compared with other generic skills most likely because of many graduates are confined to biological (medical) or chemistry laboratories.

Q13 (parts 1-32) Factors influencing career choice

This question is important as it investigates the perceptions of graduates regarding factors influencing career choice. Table 4.6 shows the mean scores which are arranged in the descending order. As illustrated in Figure 4.7, 'Opportunity for personal growth' had the highest mean score of 4.50. The next two factors with high mean scores of 4.42 and 4.40 were 'doing work which is interesting' and 'having a fair and considerate boss' respectively. This indicated that they were strong factors for career choice of the Bioscience and Chemistry graduates. This was followed by factors associating with cognitive values. These were 'having responsibility at work' (4.38), and 'skill development and recognition for a good job' (4.36). The factor 'long term career/promotion' (4.34) occupied the seventh place. The next two factors are

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'enthusiasm/ commitment' (4.30). Most of the factors thought to be very important for career choice were the cognitive factors, for example, 'opportunity for growth', 'interest', 'responsibility', and 'long term career'. However 'having a fair and considerate boss' (an affective factor) was very important for the graduates. As fresh graduates, a good superior who was considerate and encouraging, would motivate them. These superiors would impart confidence to the new graduates, who might be struggling to adapt to their new environment. 'Recognition for good job' can be considered to be an extrinsic factor. This was ranked at position 6 out of 32 factors, showing that the graduates also wished to be recognized, despite of the fact that they were new in their workplace.

Factors with mean scores of 4.0 to < 4.35

The factor 'long term career/promotion' (4.34) was ranked the seventh place. The next two factors were 'enthusiasm/ commitment' (4.30) and 'having a meaningful job' (4.28). These factors might be considered as factors of cognitive values or domain. The tenth important factor was 'self-appraisal of own personality' (4.24). One main feature regarding the ten factors mentioned above was that they could all be grouped under cognitive values, except for the third factor (i.e. mean score ranked at position 3 out of 32 factors). 'Future financial prospects' (4.18) and 'advancement and promotion' (4.12) ranked at positions 11 and 12 out of 32 factors respectively. This was followed by the factor 'received training' and the important factor 'pay and salary and high income' (4.08).

The factors discussed in this section represent the 'second series' of important factors which influenced career choice. It can be seen that fresh graduates might not consider financial rewards and salary, an extrinsic factor, to be most important in career choice. This was possibly due to competitions in the job market, which demanded work experience. Financial returns were important but securing a job might be the priority of the recent Bioscience and Chemistry graduates.

Factors with mean scores of >3.4 to <4.0

'Independence in one's work' (3.98) and 'getting feedback about one's work' (3.96) might be grouped under cognitive values. Graduates ranked 'contribution to society' (3.94), an altruistic factor, as moderately important. This shows that the graduates were not self-centered. Environmental factors included factors such as 'working conditions' (3.94) and 'convenient hour of work' (3.88). Two more factors with mean scores of 3.88 were 'benefits, vacations, sick leave, insurance' and 'opportunity to interact'. 'Influence from a particular teacher/lecturer' had a mean score of 3.86. 'Job security against unemployment' (3.76) and 'job status' (3.58) emerged as moderately important factors in career choice.

'Five-day week' (3.70) and 'geographic location' (3.44) were both factors concerned with the physical or environmental conditions. 'Being proud to work with a company which is large and stable' had a mean score of 3.48.

Factors within mean scores of >3.4 to <4.0 should be considered to be moderately important which influenced career choice. These were also cognitive factors. However, factors such as 'working conditions', 'five-day week' and 'geographic

location' could be grouped under the environmental factors. Therefore a pattern was evident for the factors influencing career choice. Cognitive factors were considered more important than extrinsic factors, which in turn was more important than the environmental factors.

Factors with mean scores of <3.0 to 3.4

For factors with mean scores from 3.0 to 3.4, their influence might not be as significant as those mentioned above. These factors with lower mean scores included the following: 'advice from friends and family members' (3.40), 'advice from lecturers' (3.32) and 'influence from a particular lecturer' (3.24). This shows that after graduating from a degree programme, the graduates became more independent and matured, and were capable of making their own decisions regarding their career choice. The factors 'related to subjects learnt before as a student' (3.12), and 'the type of company either private or public' (2.94, lowest mean score) were not significant in career choice. The graduates might not have placed a lot of emphasis on whether their jobs were related to their subjects studied. In Question 8 of the questionnaire, 20% of graduates mentioned that their jobs were not related to their degree.

The data suggests that graduates were more concerned with their interest, personal growth and career promotion prospects rather than the physical aspects like location and working hours. Overall, influences from parents, lecturers and peers were considered to be least important. Pay and salary was ranked at position 14 out of 32 factors.

The factors influencing career choice from Question 13 of the questionnaire shows a significant trend. The type of factors can be ranked as follows (in the descending order):

Cognitive factor ≥ Extrinsic Factor ≥ Environmental Factor ≥ Affective Factor

Table 4.6: Factors influencing career choice, arranged in order of high to low mean scores

	Factors influencing career choice	Mean Score	Standard Deviation
1	Opportunity for personal growth (cognitive, prospect)	4.50	0.65
2	Doing work which is interesting (cognitive)	4.42	0.70
3	A fair and considerate boss (affective)	4.40	0.78
4	Having responsibility (cognitive)	4.38	0.67
5	Skill development (cognitive)	4.36	0.60
6	Recognition for good job (cognitive)	4.36	0.63
7	Long-term career/promotion((cognitive, prospect)	4.34	069
8	Enthusiasm/ commitment (cognitive)	4.30	0.74
9	Meaningful job (cognitive)	4.28	0.70
10	Self-appraisal of own personality and knowledge (cognitive)	4.24	0.77
11	Future financial prospects (extrinsic, financial rewards)	4.18	0.80
12	Advancement and promotion (cognitive, prospect)	4.12	0.87
13	Received Training (cognitive)	4.08	0.88
14	Pay and salary, high income (Extrinsic, financial rewards)	4.08	0.70
15	Independence in organisation (cognitive)	3.98	0.89
16	Getting feedback about one's work (cognitive)	3.96	0.78
17	Contribution to society (Altruistic)	3.94	0.89
18	Working conditions (instrumental, environment)	3.94	0.91
19	Convenient hour of work (environmental)	3.88	0.87

20	Benefits, vacations, sick leave, insurance, etc (instrumental)	3.88	0.90
21	Opportunity to interact (cognitive)	3.88	0.96
22	Influence in one's organization (cognitive)	3.86	0.81
23	Job security against unemployment (cognitive)	3.76	0.82
24	Five-day week (environmental)	3.70	1.17
25	Job status (cognitive)	3.58	0.88
26	Proud to work with a company which is large and stable (cognitive)	3.48	1.04
27	Geographic location (instrumental, environmental)	3.44	1.13
28	Advice from friends and family members (Affective)	3.40	0.95
29	Advice from lecturers (affective)	3.32	0.98
30	Influence from a particular teacher/lecturer(affective)	3.24	1.06
31	Related to subjects learnt before as a student (cognitive)	3.12	0.85
32	Type of company i.e. either private or public (environmental)	2.94	1.04
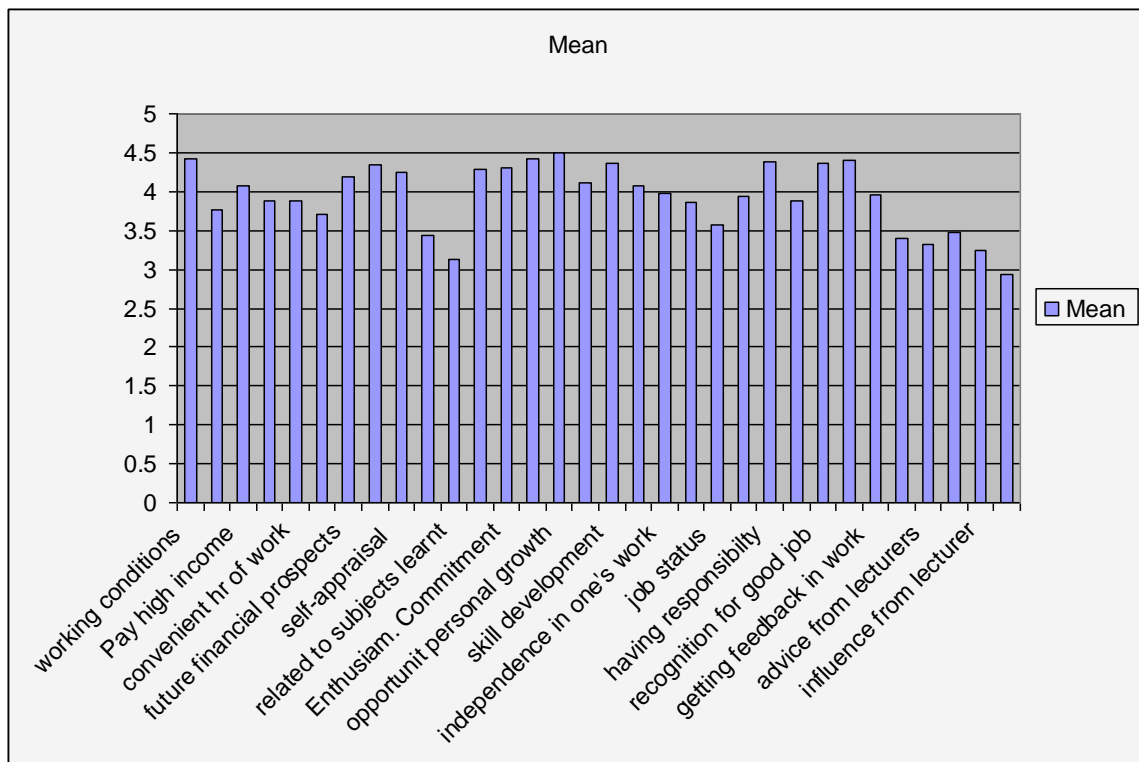
Figure 4.7: Factors affecting career choice (The sequence follows that of the questionnaire)

4.1.3 Factor analysis

Factor analysis of the 32 items is shown in Table 4.7. The items indicate work values that influence career choice of the recent graduates. Four factors were abstracted. This shows that each of the four factors plays an important role.

Table 4.7: Factor analysis   (Rotated Component Matrix]

	Component			
	I	II	III	Iv
RECOGNI	.733			
MEANING	.719			
ENTHUSM	.697			
RESPONS	.696			
INTEREST	.660			
APPRAISA	.647			
INDEPEND	.617			
INTERACT	.592			
OPPGROW	.578			
INFLUENC	.576			
PROMOTIO	.551			
SKILLDEV	.511			
LONGTERM	.496			
CONTRIBU	.387			
ADVLEC		.860		
INFLEC		.770		
GETTINFB		.644		
TRAINING		.618		
RELATED		.616		
ADVFAMIL		.592		
LARGECOM		.585		
BOSS		.366		
DAYWEEK			.818	
PAY			.781	
BENEFITS			.764	
FINANCIA			.660	
SECURITY			.552	
WORKHOUR			.497	
STATUS			.423	
WORKCON				.761
LOCATION				.696
TYPECOM				.479

Factor I in Table 4.7 shows significant loadings of cognitive or intrinsic values. Intrinsic work values directly express openness to change values. The values are

'recognition for good job', 'meaningful job' (0.672), 'enthusiasm' (0.697), 'responsibility' (0.696), 'interest' (0.660), 'self – appraisal' (0.647), 'independence' (0.617), 'interaction' (0'592), 'opportunity for growth' (0.578), 'influence at work' (0.576), 'promotion (0.551), 'skill development' (0.511) and 'long term career' (0.496).

Saturated in **Factor II** (Table 4.6) are values which can be considered as affective values; values that deal with interpersonal relationships. Values clustered under this group are: 'advice from lecturers' (0.860), 'influence from lecturers' (0.770), 'getting feedback' (0.664), 'getting training' (0.618), 'job relatedness' (0.616), 'advice from family'(0.592), and 'proud to work in large stable company' (0.585).

Factor III can be classified under extrinsic or instrumental values. The values of this group are values that involve some material return or outcome, such as pay and benefits. They are associated with security and safety needs. The values categorized under this factor are: 'five-day week' (0.818), 'pay and salary' (0.781), 'benefits from vacation, sick leave and insurance' (0.764), 'future financial prospect' (0.660), 'job security against unemployment' (0.552), 'convenient hour of work' (0.497) and 'job status' (0.423).

Factor IV is categorized under environmental values. These include values such as 'work condition' (0.761), 'geographic location' (0.696) and 'type of company i.e. either private or public' (0.479).

Question 14: What are your reasons for choosing non-subject related jobs?

Survey results for this question are illustrated in Figure 4.8. The mean scores of reasons for not getting subject-related jobs are ranked as follows: Lack of opportunity, job shortage, economical/social circumstance, low salary, interested in study and not to work yet, and poor results. The findings revealed good evidence of some shortage of suitable science-based jobs. It appeared that there was also the possibility that opportunities for economic and social advancement presented themselves in areas less connected with a respondents' undergraduate course. This is particularly the case for high salary industry. Low salary therefore also led graduates to seek non-subject-related jobs. 'Further studies' and 'having poor results' were listed as less important for this specific group of double major graduates. Explanations for the reasons to choose non-discipline- related jobs are shown in Table 4.7.

As the questions of the questionnaire were structured, there was lack of opportunity to seek more in-depth reasons behind each factor mentioned above. Interviews with eleven graduates selected from those who completed the questionnaires, were therefore conducted to seek in depth views and opinions of these graduates. Descriptive statistics using SPSS17 can be found in Appendix E.
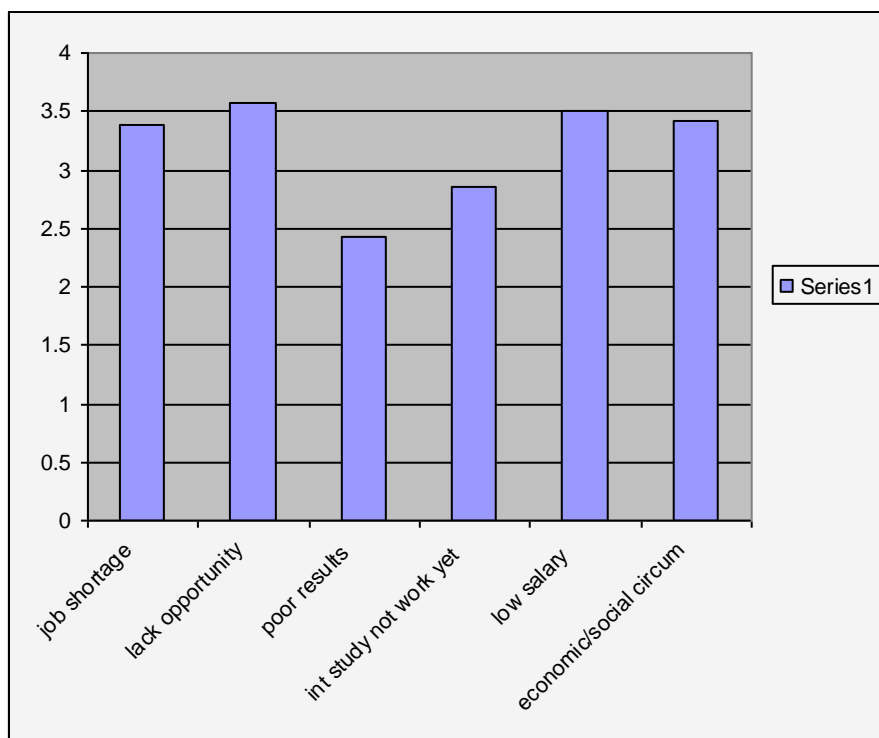
Figure 4.8: Reasons for choosing non-subject related jobs

Table 4.8: Explanations for choice of non-discipline-related jobs

Reasons for choosing non-discipline related job	Possible explanations
Lack of opportunity	Some of the graduates have recently graduated, so lack of experience may result in lack of opportunity in getting jobs, compared with the experienced graduates.
Job shortage	Reasons are due to the labour market situation. With many new colleges and new private tertiary institutions being established in Malaysia recently, competitions among increasing number of graduates result in shortage of vacancies.
Economical/social circumstance	When the economy in the country is not good, there may be lay-offs of staff. Therefore there will be less science-related jobs, and graduates may take up any non-science-related jobs.
Low salary	Pay, salary and financial rewards are essential for the new graduates to support themselves, and may be to pay off their study loans. Table 4.6 on factors influencing career choice, the mean score for financial prospects is rather high, ranked at position 11 out of 32 factors.
Interested in study not to work yet	Some graduates were interested to continue studying especially pursuing MSc or PhD. They may take up an interim job first, before embarking on studies. A few graduates wanted to pursue MBA degrees. (information from interviews).
Poor results	This has the lowest mean score. It is not the main reason leading students taking up non-discipline-related job. In fact for certain science-related jobs such as medical laboratory jobs, training is normally given, and examination results may not be an important criteria in the selection of candidates for jobs.

4.1.5 Summary:

About 80 % of the Bioscience and Chemistry graduates chose employment related to their degree programme. This is in agreement with the few measures of matching such as the extent of contribution and recognition of their skills and knowledge at work. The graduates were generally satisfied with their employment. The most important factor influencing career choice was "opportunity for personal growth'. Five factors with high mean scores were 'doing work which is interesting', 'recognition for doing a good job', 'having responsibility', 'having a fair and considerate boss', and 'skill development'. These factors were mainly factors of the cognitive values. Factor involving financial reward i.e. 'pay and salary' was ranked at position 14 out of 32 factors. The survey shows that cognitive values were more important. Factors relating to instrumental values, such as the environment factors, were of moderate importance. Factors of affective values involving influences of surrounding people were rated lowest in the findings using the questionnaire.

CHAPTER FIVE

FINDINGS FROM QUALITATIVE DATA

5.1 Introduction

In the previous chapter the findings of the quantitative data based on the questionnaire were presented, and analyzed. Findings from the qualitative data will be presented and interpreted in this chapter. The questionnaire provided an overview of information from a larger group of graduates. It has been suggested that presentation of findings and analysis together will allow more intimate association between data and interpretation (Bassey, 1999). However due to the large volume of data from the interviews and questionnaire, the findings and analysis from two data sets are presented separately, while the chapter 6 will discuss all data together for synthesis in view of the research questions.

The interviews provided rich and detailed data (Lincoln and Guba, 1985). Punch (2005) advised researchers to include details during the coding process, and to list the emerging themes and the rationale for these. The method of data analysis including the coding process was explained in Chapter 3. The findings and interpretations of the data are generated based on the interviews with the eleven respondents. The objectives of the study can then be met accordingly, and the research framework can be understood and explained.

5.2 Description of Participants

The eleven participants are listed in **Table 3.4**. Initially twelve participants were arranged to take part in the interviews but one could not take part. Their jobs include: laboratory technicians, veterinary assistants, research assistants, sales executives, sales of health products, clinical laboratory consultants, electronic technician, an assistant in a law company and others. They have worked between one to three years.

5.3   Qualitative Findings

5.3.1   Interview Data

A semi-structured interviewing approach was used to elicit the required information to confirm and supplement the findings. Initial themes emerging from the transcriptions have been identified and coded (Chapter 3). Patterns and trends drawn from the interview questions were gathered to respond to the five specific research questions. Unlike the quantitative phase, the interview data seek to triangulate and provide 'richer' answers to the research questions. To protect the identity of participants, each has been assigned an identification code.

5.4   Reasons of Job Satisfaction and Dissatisfaction

Interviews with the graduates show that job satisfaction can be brought about by three main factors: Financial, Environmental and Nature or Type of work.   This is summarized in Table 5.1, with examples for each factor. Integration of related

findings from the quantitative and qualitative studies will be discussed further in chapter 6.

As the graduates had just recently started work, they had to be self-supporting financially especially if they worked in places away from their home. Most jobs were available in the bigger cities like Kuala Lumpur where the cost of living is higher than that in smaller towns. A graduate, who worked in Kuala Lumpur, away from her home in East Malaysia, commented: "*every month I have to calculate my salary, then deduct those rental, electricity and water bills*" (A9). Therefore graduates will be unsatisfied with insufficient pay for their basic needs. Besides, some graduates need to support their parents and siblings (especially if the siblings are still studying) (A10).

The working environment affects a graduate's satisfaction at work. A few female graduates expressed concern with shift work, especially in diagnostic laboratories where there were two shifts: morning and afternoon shifts. The female graduates (A9, A10) were worried about their safety when they finished work late at night. Besides, many of the Bioscience and Chemistry graduates could only find jobs in manufacturing factories which were normally located in the suburb industrial areas, far from where they stayed. Public transportations to these places were normally infrequent and irregular. Since these graduates had just started work, they normally could not afford the purchase of a car yet. A few graduates also complained about relationships at work with their colleagues and employers. One graduate commented that if the practical skills of a new graduate were not up to the expectation of the supervisor, he/she could be bullied. Some supervisors were strict during the training sessions for the new graduates. Complaints were also encountered regarding facilities

of workplace such as laboratories (toxic chemicals in laboratories, insufficient apparatus and the reluctance in ordering chemicals) (A2, A9). A graduate interviewed was not happy with her working environment and her superior. Her comments were: "the manager was insulting…whole environment has gossips, very negative environment….not at all satisfied" (A10).

The nature or type of work affects job satisfaction. Some graduates took up jobs which required specialized science skills. They expressed their satisfaction as they felt they were being recognized and were gaining experience. Other graduates expressed that their jobs were not related to their specialisation. They might try to get science-related jobs later. Some graduates dreaded laboratory jobs as they seemed to have 'lost interest' in science experiments. One graduate (A1) actually commented that he lost interest in science laboratory sessions during his tertiary education years as there were too many practical reports to submit. Other graduates took up science laboratory jobs probably because they could not get other more suitable jobs. These graduates would most likely try to get other types of jobs as they become financially more stabilized. Table 5.1 tabulates the factors for job dissatisfaction and satisfaction, based on the interviews.

Table 5.1: Factors affecting work satisfaction and dissatisfaction

Factors	Dissatisfaction Reasons	Examples from interviews	Satisfaction Reasons	Examples from interviews
Financial	(1)Low pay not enough to make ends meet. (2)Getting pay not on time.	'initial pay low' (A9). 'pay still low, need to give to parent' (A10). Payment of salary not on time'(A10). 'for guys it's pay and prospects'(A1).	Getting good pay	'Salary high for the first job' (A5). 'Not too particular about pay but must suffice as every month I have to calculate my salary, then deduct those rental, electricity and water bills'(A8).
Environmental	(1)Working hours not convenient . (2)Working location not safe. (3) Lack of benefits. (4) Gossips (5) Boss not considerate.	'Work late, place not safe, dark and quiet'(A10). 'job not so convenient' (A9). 'Difficulty in taking leave, boss not reliable' (A10). 'Complicated environment, people problem' (A10). 'cannot get along with boss'(A3).	Good and reasonable opportunity, Happy environment	'Boss gives opportunity' (A8).
Nature	(1)Science-related (2)not science –related	'What I learnt I don't use it in my future' (A1).	'Wanting to learn new things at work, More recognized.	'To learn new things, not science again'(A8).

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	(3)R and D (Research and development)	'Dislike R and D'(A1). 'R and D needs more thinking'(A1). 'After 2,3 years, I feel bored, it's really bored, everyday lab job' (A1).		'can start something, good opportunity, exposure and experience'(A6). 'More recognized'(A9) 'Change job, study to expand knowledge' (A10). 'I work in the legal film, I also learn something new, I want experience in other field and areas instead of getting stuck to biology and chemistry'(A8).

5.5 Factors Affecting Career Choice

From the data collected through interviews with the eleven participants, the factors can be grouped under three categories: personal (work) values, labour market effects, and entrepreneur intentions. Work values help to shape cognitions and motivations and are therefore essential in one's process of searching for employment and remaining employable. As illustrated in Figure 5.1, the themes under personal (work) values are further classified under cognitive, extrinsic, affective values and environmental values. The research data identified several broad categories of career influences:

1. Personal values or influence: (i)   Cognitive values

                                     (ii)   Extrinsic values

                                     (iii)   Affective values

                                     (iv)   Environmental values

2. Labour Market

3. Entrepreneurship choice
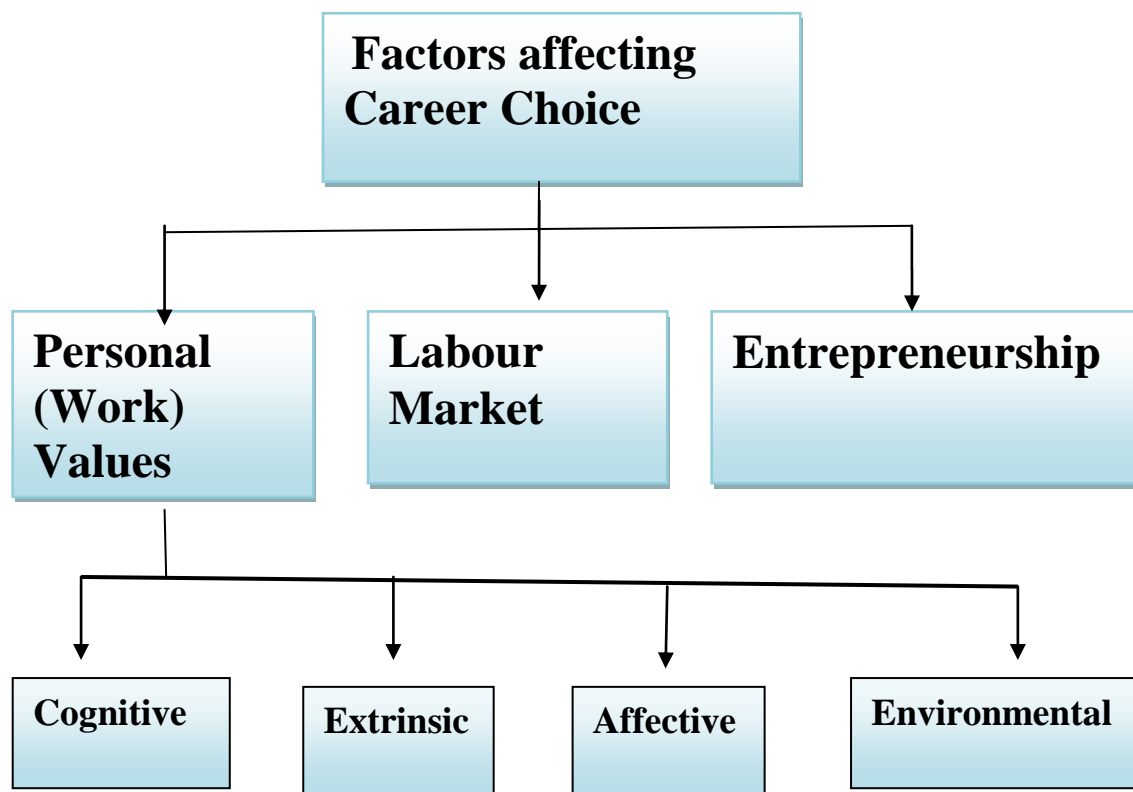
Figure 5.1: Work values which influenced career choice of Bioscience and Chemistry graduates

5.5.1 Personal values or influence

5.5.1.1 Cognitive values:

Interviews with the graduates reveal that some chose interesting, technical and challenging jobs where they could learn a lot. This was also mentioned in the quantitative questionnaire (Question 13: factors regarding interest, enthusiasm, and skill development). A3 and A7 expressed interest in science-related job, and enthusiasm in science research, and to carry out experiments. A4 chose a career with the intention to "learn things and gain experience".

When A2 was interviewed, he commented as follows:

> "I work as an analyst chemist, deal with processing department and research department. It is a technical job, I think research is deeper than study…, extremely challenging and will learn a lot." (A2)

A graduate who has moved on to pursue a postgraduate course expressed interest in her job, and has a great working environment and a good boss as follows:

> "Yes, it is good to work in the institution because it is a great working environment for a life sciences researcher! I'm working as a research assistant for a Prof. and specialized in doing molecular cancer research now. Although I just work for him for almost a year, I seriously love my job so much as my Prof. gives me an opportunity to design the project by myself, implement it and the best part is, I do have a chance to write a manuscript for my project and submit it for publishing's purpose."

Some graduates somehow chose jobs which might be difficult for them and seemed to have concerns regarding their ability to cope with the jobs. This was illustrated in the case of A2 who commented:

"They want to know how much I have learnt.   Actually I am not a good student. I am not good academically. Really, you can see some of my friends are better. I do not speak well. I am not a fast learner......" (A2)

The work values identified above were encountered in the quantitative studies as well. The qualitative phase provided explanations as to why the job was challenging and the outcome of learning was related more to experience. Regarding the cognitive value of interest and enthusiasm, the graduate explained her interest in molecular cancer research and went on to explain why the boss was considerate in giving opportunities to learn freely and allowing her a chance to publish her research findings.

5.5.1.2 Extrinsic values

Pay, salary and good prospects of jobs were factors which were also emphasized by many graduates who were interviewed (A1, A3, A5, A6, A7, A9 and A10). This is grouped under personal values (Extrinsic values) as shown in Table 5.1. Participant A6 was not very satisfied with his/her pay and planned to further his study with the hope to improve knowledge and skills, which might then enhance job opportunities and promotion aspects. Part of his comments was as follows:

"You can see my pay slip also, very low pay. But my friends say I get high salary......, after deduction for the EPF (Employment Provident Fund,

compulsory in Malaysia), still only (an amount)……. I do get other (job) offer, but decide to just stick to it (current job), not hopping anyway. Now I want to hop to (further) study, no choice. If I continue (to work), cannot get promotion." (A6)

Participant A5, who worked as a sales representative, a job not related to his course of study, stressed that the main reason he chose the job was due to the high pay that he was offered. He said: *"I work may be because of the high pay." (A5)*

His plan was to get financially stabilised first:

"For the next few years try to get stable first. My job offers very good pay, I am still under probation. See after probation, how it goes first. Probation is 6 months. It is not easy to get another sales rep job, they give six months, the target is not very high, then the pay is quite good, working environment: they don't push people. Because if it's a new product, they know it is difficult to sell. (They are) still getting people to familiarize." (A5)

These comments illustrate the importance of the pay as a factor which affected career choice. Despite of the fact that some sales job might not be related to specialization in bioscience or chemistry, the priority in career choice for the majority of the participants was financial stability. In the quantitative studies the mean score for pay was ranked as 14 out of 32 factors. However interviews in phase II revealed that pay seemed to be more important than was perceived in the quantitative study. As the participants were new graduates, financial independence and security were probably

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"realistically' very important. However, A6 actually stayed in the same job for about two years despite of the low pay and small increment. There might be two reasons for his case: firstly he wished to learn more from his job, and secondly, his family was financially stable and did not need his financial contribution.

5.5.1.3 Affective values

Factors for career choice grouped under these values include the following: "Work alone, no opportunity to mix with people, no interaction, a good boss, do not meet boss, only meet supervisor, support from family."

To the question: What about advice from people, lecturers, and friends? A8 replied:

> *"Yeah, my family suggests some good advice to me. But I still have to decide by myself, but they give me support and suggest which is good and no good, because they are older and know a lot." (A8)*

One of the participants had a very strong influence from her mother regarding her choice of course of study and also her career choice. This actually illustrates the culture in Malaysia when parents may still have a very strong influence on decisions made by their children. Due to great respect and filial piety, children normally try not to disappoint their parents. A10 demonstrated this through her comments:

> *"Yes actually my mother and my whole family wanted me to do medicine, which I was not so keen on (pursuing). I still want to do my science… I know I am an average student in science but I love Maths like nobody's*

business……So mum wanted me to study either medicine or biotechnology but

I have to look at the cash…"(A10)

5.5.1.4 Environmental values

This refers to the physical conditions at work for example the working hours, shifts, days of work per week and location of the workplace. Overall, the graduates interviewed did not place too much emphasis on physical conditions except for location of workplace (A8 and A10). A10 rejected a medical laboratory job because she did not like shift work and working during the weekends. She commented as follows:

> *"It's not so safe going out at night after office, so I drop the idea (of working as a medical laboratory technologist), and I don't like working on shift also. If it is normal working hours I would have taken it….I actually check with my friends who are actually working in the lab, they say it's quite routine and you can't do what you want to do in the weekends, that means your time is shift work, I thought it's not worth it. You are not going to live a life like that because of money, so I drop the idea."* (A10)

It can be added here that some people have their regular religious activities during the weekends and they regarded that as their priority. So shift work would not be their career choice.

5.5.2 Labour market

During the interviews, some of the graduates expressed the difficulties in getting an appropriate job. However, for their first jobs, despite of unfavourable salary, the graduates might still take up the offers. One of the graduates commented as follows:

"As regards the difficulty in getting the job, yes, it is so hard to get a research position unless you have "something' they're looking for. Frankly speaking, I'm sort of lucky to get this position because I do not have much knowledge in molecular cancer research, and limited knowledge in molecular biology techniques."

Despite of the fact that research jobs were difficult to get, the job market did not seem very bad for the science graduates of this study. Majority of the graduates were able to get discipline-related or discipline-unrelated jobs. Having training in two fields of study broadened their scope of employment. Many in fact got jobs within six months after graduation. However getting the 'perfect' job for each individual might not be that easy.

5.5.3 Entrepreneurship

During interviews, a few graduates expressed their intention of starting their own business later, reflecting interest in entrepreneurship. Some of them had both encouragement and financial support from their family to start the business. Normally, they would gain experience by working for a year or two initially. Graduates therefore

widened their career scope by choosing careers in entrepreneurship. This may also ease the current unemployment issue by expanding the job market.

The response of participant A6 illustrates this:

> *"Sooner or later, I also want to start my own business. If possible, I want to start a business dealing with food. My parents hope to sell their shop and use all their money to help us to succeed. My parents want us to do business. Their business will probably close and all their money will go to the children. But what business I don't know yet. I see that food and nutrition is quite important for health." (A6)*

As Malaysia is facing a moderately high rate of unemployment, entrepreneurship can certainly improve the situation and gives opportunities for the graduates to go into their own ventures.

5.6   Decision in career path

5.6.1 Choice of Course: Early Stage of Career Path

The early stage of the career path would be the choice of the course that the graduates wanted to pursue. Interviews reveal reasons such as interest, academic achievement, streaming during secondary school, prospects of the course and influence from parents, to be factors which influence decisions in taking Bioscience and Chemistry double discipline degree (Figure 5.2).
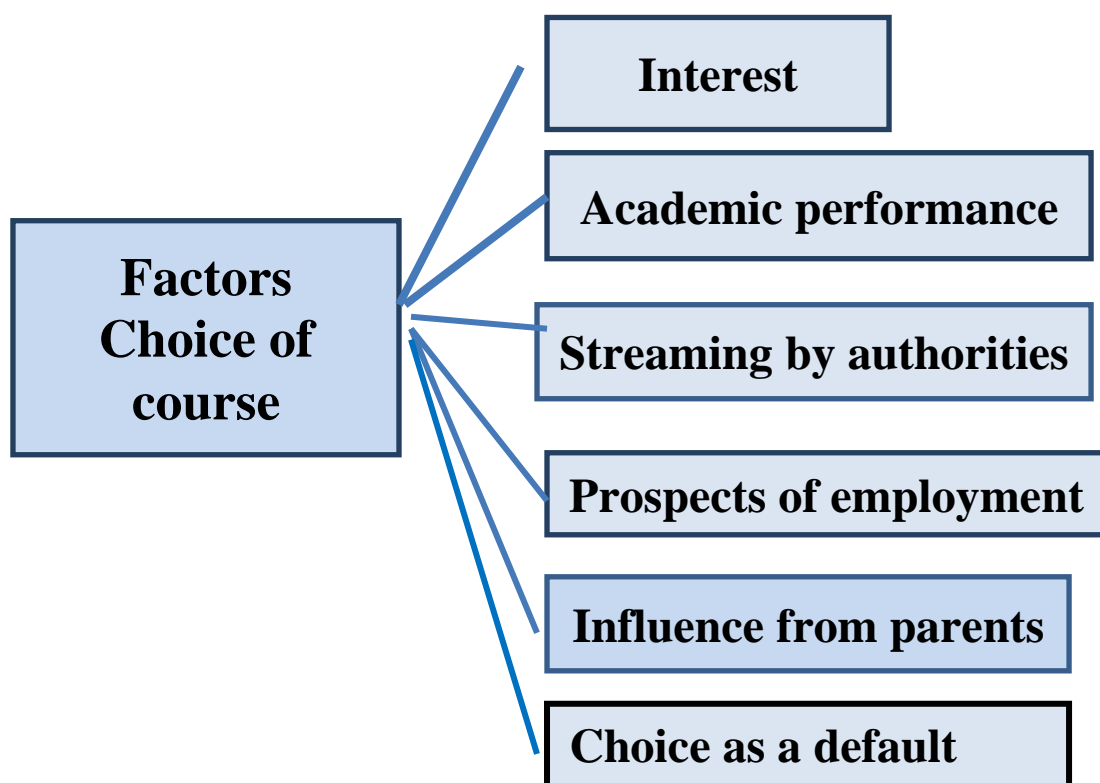
Figure 5.2: Factors for choosing course of study

Interest in chemistry and biology was the main reason for choice of the course. However some graduates initially did not have clear direction of their own except that if an application was successful, they would just pursue the course. Others actually had other preferences, but due to the demand for excellent results to gain entry or they did not pass or get credit for certain core language papers, they failed to gain entry into their desired courses.

A few examples of the comments of the graduates will support the factors stated above.

(i)   **Interest**

Interest in bioscience and chemistry was the main reason for most graduates. However there were graduates who either liked chemistry more than biology or the reverse. One respondent expressed that the choice of the course came from interest:

> *"I was interested in science subjects especially Chemistry during my secondary school education."* (A10)

(ii)   **Academic performance**

Choice of course of study depends very much on the performance of science subjects during pre-university examinations. Some of the graduates interviewed might have aspired to pursue more professional medical and pharmacy programmes, but might not have cleared the compulsory paper, the Malay language paper for the School Certificate examination. These are expressed by some participants as follows:

> *"By chance, I choose this course. If a person is not so good in Maths, engineering and IT may be out. Doctor has administrative work, If Maths is not so good choosing chemistry and biology course may be the easiest way for science." (A7)*

> *"Yes actually I want to be pharmacist or doctor, but I fail Malay paper, cannot go medicine." (A2)*

(iii)   **Streaming by authorities**

Many graduates might not have chosen bioscience and chemistry course as their   first choice. They might have been streamed in Form four (Upper secondary Year) and just follow the Science course. A comment for this is as follows:

> *"First since Form 4, I was already in Science and so I continue in Science in higher education. That time didn't think too much, just (thought) it is okay, (and) just took the course." (A9)*

(iv)   **Prospects of course**

Yet there were graduates who would follow the "crowd" as "biotechnology" was the popular and sought-after course, or a course thought to have good prospects. It   can be seen that there are a lot of doubts and uncertainties for the school leavers, who actually do not know much about their future careers. A10 commented as follows:

> *"Actually I don't have any plan, prefer R and D, later think of Chemistry and Biology. During that time everyone is talking about Biotech. It has very bright future." (A10)*

(v)   **Influence from parents**

To most graduates, advice from family members regarding course of study was important. But parents of some graduates allowed them to make their own choice. For A10, her mother's influence was very strong and her choice of course of study very much depended on her mother. This was not so for the case of A9 who commented as follows:

"My family doesn't interfere. They don't know what we are doing. My parents are not so highly educated, they do not really know what we are doing. They let you settle yourself." (A9).

(vi)   **Choice as a default**

However, there were graduates who actually disliked both arts and science streams and chose science not as an option, but as a default, as they disliked arts more than science. This is illustrated by one of the participant's comment:

"Frankly speaking, I never really liked science until pursuing the Degree. During my secondary education I "selected" science stream not as an option but as a default, as I hated art stream more than science stream. Science, in a mind of a secondary school child (at least mine), is treated as   just another subject among the other boring ones in school." (A11)

"After graduation, I did not choose Bio and Chemistry as a choice of subjects to pursue, but rather it's because I did not have other choice to choose from. From what I have explained so far you will have learned that I was not a person who liked studying." (A11)

Such students might have problems in their early education and it made choices more difficult for them. Some might be interested in science (A2, A3, A4 and A7) and that may be a 'pull' factor drawing them into bioscience and chemistry course. Yet there

were graduates who would follow the "crowd" as "biotechnology" was the popular and sought-after course (A8, A9, and A10). The following comment reveals this:

"*At that time everybody is talking about biotech course, thought it must* **have** *prospects.*" (A9)

It can be seen that there were a lot of doubts and uncertainties for the school leavers, who actually did not know much about their future careers. Sometimes career choices are made as a default.

5.7   Reasons for Choosing Non-Subject Related Jobs

The quantitative data highlighted and ranked the reasons why the case study Bioscience and Chemistry graduates did not chose jobs related to their field of study. The reasons were: lack of opportunity, job shortage, low salary and interest in study not working yet, as reasons for choosing non-subject related jobs. Interviews with the graduates explained these reasons in more depth. These are discussed below and explained with illustrations.

(i)   **Low pay and salary**

Obvious reasons that Bioscience and Chemistry graduates did not take up subject related jobs were the low salary offered. Therefore, 'non-matching' of jobs with discipline of study might be the result of the relatively low salaries. One of the attractions to sales and marketing careers, which might not be directly related to

bioscience and chemistry, was the higher pay and commissions offered by these jobs. In fact, one respondent commented as follows:

> *"Nowadays, science graduates think of money, so first thing they look for jobs in the banks, and sales…Actually the banks take in a lot of science background people, because from what I heard, we may have better understanding skill and we can easily understand and accept the new things……. Science people take up jobs (e.g.) sales, whatever heath products, hospital products, hospital instruments." (A9)*

In fact, the reason why the banks are taking in graduates with science background, as suggested by graduate *A9,* is due to the fact the banks are looking for the most competent individuals in the labour market, and they think that the science graduates can assimilate knowledge quickly as described by A9 as "understand things quickly and easily, and accept new things". Getting a highly paid job is necessary as some graduates might have financial difficulty and family commitment (A10).

(ii)　**Laboratory work is routine, isolated and boring**

This is another reason why bioscience-chemistry graduates avoided discipline-related jobs. As the graduates were just bachelor degree holders, very often they could only get routine jobs example working in the clinical laboratories or performing some basic chemical testing. Some of the comments truly expressed how they feel about the nature of their jobs:

"then, you may wonder, I have chosen a career utterly unrelated to science. Most of the answers have been given in the questionnaire. It is not the same reason that I might give 10 years ago. In order to keep my passion in science burning, I have chosen to do something else. I do not really like to be isolated in a laboratory. I need a more social lifestyle, as I think I lack communication skills after so many years of solitary 'confinement' in order to study peacefully. Nevertheless, although the knowledge learnt in school is rather futile in my current career, the critical and rational thinking skills have been utility to me. It is these, which I consider the greatest achievement I have ever earned throughout the science education." (A11)

Comments from A11 on not pursuing a science job reveals to us that sometimes the Bioscience and Chemistry graduates might not like to be isolated in the laboratory and preferred a more social lifestyle. It is reported by post graduates who work in research laboratories that they have to work long hours, under pressure and treated like 'cheap labour' (as they may be funded by research grants). Therefore it is not surprising that A11 had the same type of impression about science laboratory jobs. It is understood that in their undergraduate years, laboratory sessions might take up to six hours a day.

The reason that science-related jobs could be routine was expressed by A8 and A2:

"Because (they) always stay in the lab doing the same steps. I have training before in Klang and what I did was PCR (Polymerase Chain Reactions), DNA extraction, so every day was doing the same steps. They have already written

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the steps down in a piece of paper what you have to do. I think all the people (can) also carry out the steps." (A8)

" I find working in the laboratory after more than a year a bit boring. It was a routine job. The pay of my previous job was low but the salary of my current (second) job is not that much higher though." (A2)

(iii) Loss and change of interest during study

Although some graduates might have chosen to study bioscience and chemistry. They might lose interest probably due to the fact that the study work load was heavy or they could not cope. In fact A1 commented that he was already bored and lost interest in his final year of the undergraduate course. He actually commented: *"Our thinking in our life keeps on changing, maybe after a few years, I would like to go to other fields".* This supports the suggestion by Anderson et al. (2003) that the interests and aspirations of graduates can change during and subsequent to the undergraduate degree. This, they argue is *"reflected in the choice of employment, and also the possibility that such employment exhibits less relevance to the original training"* (Anderson et al., 2003, p.65).

(iv) Personality

To A7 and A8, the choice of a science-related or non-related job might be due to each individual's personality.

A8: "For my first job, I worked as a telemarketer at the Insurance Company.
So I have to convince the customer to buy the insurance, but I don't quite like
the work, because for me I don't like to force the customer to buy the
insurance. Then if you don't want to buy, then don't buy, but I have to
convince the customer until they buy the insurance, I don't like to do that."
(A8)

Likewise A7 disliked meeting people. He was convinced that sales and marketing jobs were not suitable for him. He preferred to be stationed in the quite corner of the research laboratory, and carried out experimental investigations. Therefore, a person's personality has been shown to be related to the choice of careers.

(v)   Not wasteful of knowledge acquired to take up programme –unrelated job.

Some graduates who did not take up science-related jobs did not think that their science knowledge acquired during their undergraduate years was wasted. They thought someday when the job market was not favourable for non-science jobs, then their expertise could be used. Therefore basic science knowledge could be used for later employment.

To a question whether it is wasteful not to take up a programme-unrelated job, the comment of A8 was as follows:

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" I don't think so, I don't think this is waste(ful), because in those 4 years, I

also learn in science, then after I graduated, I work in the legal firm, I also

can learn something new. Then those 4 years studying Biochemistry is a basic

for me. So next time if I don't want to work in the legal firm, I can shift back

(to bioscience and chemistry job)........." (A8)

A5 and A11 thought it was a bit wasteful not to use fully their training. A5 thought he would probably return to get a science job later. A11 however was convinced that the science field was not what he wanted. Therefore, graduates have different perceptions regarding their choice of careers, be it discipline-related or non-discipline-related.

(vi)   Laboratory safety and hazardous chemicals

Some graduates initially worked in chemical laboratories but they could not bear the smell of some toxic chemicals, or were allergic to some chemicals, and subsequently decided to change their jobs. In fact some female graduates were afraid that exposure to some toxic chemicals might cause infertility. A graduate in fact thought that it was not wise to work in a paint factory for more than five years, and it was essential to buy a health insurance.

Summary:

Obvious reasons that Bioscience and Chemistry graduates did not take up subject related jobs were the low salary offered and that the laboratory jobs were routine and boring (A1, A5, A6, A7, A8, A9, A10). A1 argued that the laboratory jobs normally

involved only routine quality control, quality assurance procedures and not research. His view was that some graduates liked to do the job because of personality. The graduates might opt for sales and marketing jobs which generate more income. In fact A1 commented that he was already bored and lost interest during the course of his study.

5.8   Relationship of Tertiary Education and Employability

5.8.1   Role of Higher Education in Influencing Career Choice

Interviews with the Bioscience and Chemistry graduates revealed the following themes. They were the perceptions of the graduates on ways that higher education should impart to their students, and encourage more graduates to choose either bioscience or chemistry jobs. The important employability skills which graduates perceived to be important were: knowledge skills, practical skills, industrial training, generic skills, learning to learn and reflections.

5.8.2   Practical skills

Practical skills are considered important especially for those working in related fields. Correct techniques, updating of equipment were ways students can improve and acquire some expertise to cope with work. Comments from graduates are:

- *"In my opinion, the practical skill is really important for those students who are interested in finding a job that is related to science field. So,*

during varsity life, they should pay more effort in practical class. Lecturers should show good technique in doing experiment, especially in explaining the functions of instrument, and all students should be involved in doing experiments."

- *Other suggestion: "Should organize more field trips to those factories/companies that manufacture/involve in chemistry/bioscience related field."*

Exposure to the real world like having field trips and industrial training allows undergraduates to gain more experience e.g. A8 mentioned about leaning DNA manipulation skills during industrial training.

5.8.3. Generic skills

The interviews and analysis triangulate and further explain the results of the quantitative studies.

Problem solving skill was considered the most important generic skills according to the results of the quantitative study (Chapter 4). Seven graduates interviewed (A1, A2, A3, A4 A5, A7 and A11) considered these skills to be important.

Another important skill which most graduates interviewed considered important was communication skills (A1, A2, A3, A5 and A11). Graduates in any area of work have found that being able to communicate well facilitates their learning and adjustment to their new work place.

Other skills considered by some graduates to be important were: good team work, presentations skills, marketing skills, critical thinking, and management skills. Leadership skills were hardly mentioned.

To a question whether generic skills could be taught, one comment (A4) was as follows:

> *"After going through the four years of bioscience and chemistry, you should have acquired problem-solving skills, some practical skills, practical skills should be important, some team work training. You see, for chemistry and biology, you need team work, to complete an experiment".*

An interesting remark from a graduate regarding the knowledge skills acquired from the years of higher education learning bioscience and chemistry was as follows:

> *"about skills acquired from bioscience and chemistry ;3-D(dimensional) learning from chemistry, imaginative(example in stereochemistry), Biology: memorizing and understanding, combining the two, easy to learn computer science: a 1-D(dimensional) learning."* (A4)

This illustrates an interesting result from studying the two different disciplines in one course. It also illustrates that graduates from different disciplines may acquire different generic skills and competencies.

Learning to learn: Interviews with A4, A8 and A9 illustrate that they were continually 'learning to learn'. A4 and A8 had taken up new 'roles' i.e. work roles other than their course of learning. However, they were adaptable and empowered learners in their new situations.

Table 5.2 shows the list of employability skills identified from the interviews with the graduates from this study.

Table 5.2: Desired employability skills of graduates of current study

	Code	Employability skills
1	A1	Problem solving skills, presentation skills, marketing skills
2	A2	Communication skills, problem solving skills, working with boss
3	A3	Communication, adaptation and good leadership and management skills, independence and problem solving and research skills
4	A4	Problem solving and team work learned through course eg practical, practical skills important, good command of English important for learning more from books normally written in English, after learning chemistry, acquire 3-D or more imaginative learning, biology acquire 2-D learning I e understanding and memorization, then easy to study computer science which is equivalent to 1-D learning
5	A5	Independence, problem solving skills, communications
6	A6	Communication skills, knowledge skills and some practical skills acquired useful
7	A7	Knowledge skills and practical skills, problem solving and critical thinking skills, perseverance
8	A8	Science practical skills acquired in industrial training, other skills learned through practical training
9	A9	are not doing a lot of practical more thinking better understanding skills, accept new things
10	A10	Skills learnt Study a business subject Work during term holiday Personality may suit business course
11	A11	Good communication skills, other broad based generic skills learned through science training such as problem solving skills and team work important, knowledge and subject skills not relevant as not used in work

5.8.4   Reflections

As part of education system, therefore, reflection as a process allows the student to establish connections between new and existing knowledge and experiences, to understand their own position within that relationship and to deepen the level at which they work with them at the academic, personal and professional levels. A few graduates interviewed shared their reflections on their past knowledge and experiences. They demonstrated that through reflections, they understood their past weaknesses and future directions. For example, A1 spoke of his poor performance in science during his first year of tertiary studies. It was due to his loss of interest in science. He reflected on his struggles but eventually graduated with a Bachelor degree. The reflection enabled him to realize how to choose his current career. He was aiming to further improve himself in the area that he could excel. Such reflections were also illustrated from the interviews with A8, A9 and A11.

Therefore from the interview data, the knowledge, practical and generic skills are evidently important employability skills as they are required at work places. These are summarized in Figure 5.3.
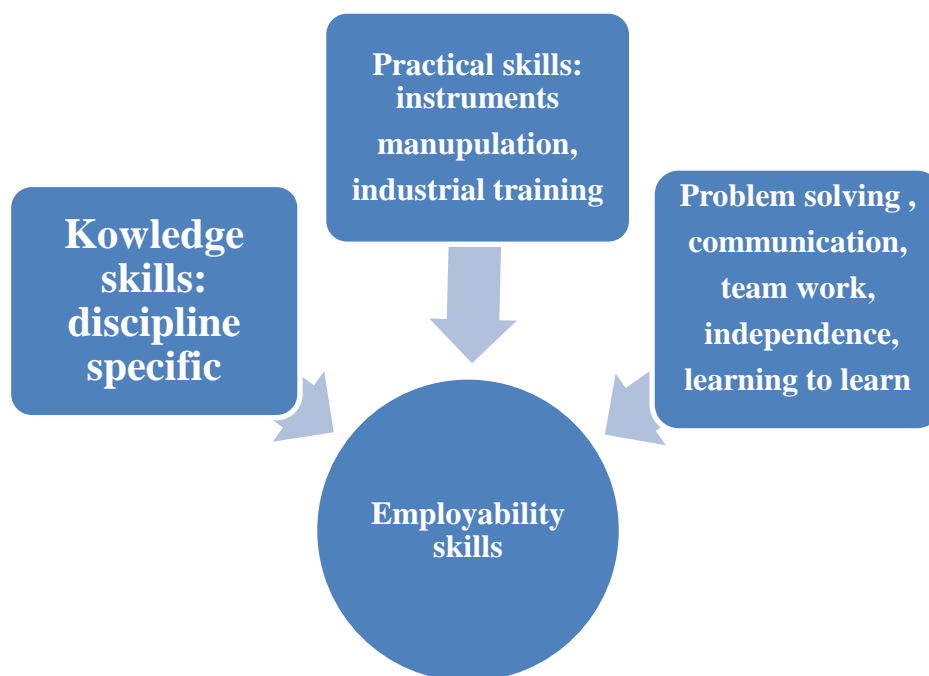
Figure 5.3: Employability skills influencing career choice of Bioscience and Chemistry graduates.

5.9   Summary

The interview data reveals that the majority of the graduates chose science related jobs. Many of them work in the laboratories such as diagnostic laboratories or as chemists in quality control laboratories. However some of them chose sales career promoting biological products, health products or chemical instruments. Factors influencing their career choice may be categorized under factors relating to personal cognitive values such as good career, promotional prospects, and having interesting jobs. Financial rewards are another important factor, although graduates may take up the first job with lower pay to gain experience first. Environmental factors such as duration of working hours and location may be of secondary importance to some of the graduates. Influences from family members are not of utmost importance. Reasons

for choosing non-degree related jobs are 1) low pay for science jobs, 2) difficulty in getting science-related -jobs, 3) laboratory jobs available are too routine and boring, 4) desire to learn new areas other than bioscience and chemistry, and, 5) intention to further their studies. Another finding of this study is the intention of some graduates in entrepreneurship.

Choice of courses also seems to be associated with the streaming during the secondary school education. Quite a number of graduates actually wanted to study more professional science courses such as pharmacy, engineering or medicine. Graduates suggested that higher learning institutions should equip them with practical skills adequate for job markets, more experience with analytical instruments, more career counseling programmes, effective industrial training and useful transferable skills such as communication skills, problem solving and critical thinking skills.

CHAPTER SIX

DISCUSSION

Integration and analysis of qualitative and quantitative data

6.1   Introduction

In this chapter, data from the questionnaire are integrated with the interview data and discussed using the categories developed in the qualitative analysis. Since this is an explanatory mixed methods study with the qualitative data given more emphasis, relevant aspects of the quantitative data are discussed within the categories that arise from the qualitative analysis. The findings from the questionnaire and interviews are also compared and linked with the literature reviewed. The discussions will be presented sequentially according to the five research questions.

There are five Research Questions (RQ) which provide the framework for this thesis. The main research question is: "What are the factors influencing the career choice of the Malaysian Bioscience and Chemistry double major graduates?" This question will be investigated using the following specific research questions:

1. What are the career outcomes of the Bioscience/Chemistry graduates?

2. What are the factors influencing the career choice of the Bioscience and Chemistry double major graduates?

3. At what points do the Bioscience /Chemistry graduates make their decision in their career path?

4. Why do the Bioscience/Chemistry graduates choose careers unrelated to their major field of study?

5. What are the contributions of tertiary institutions to career choice of graduates?

6.2   Research Question 1: What are the career outcomes of the Bioscience/Chemistry graduates?

The questionnaire (Phase I) of the study addresses the following:

    a.   Outcomes of graduate preferences in relation to course structure: whether general or specialized.

    b.   Information on the nature and extent of employment-curriculum match (or mismatch).

    c.   Measures of match and mismatch of employment to course of study.

    d.   Career satisfaction.

The main findings and themes from the both the quantitative and qualitative studies are summarized in Figure 6.1

OUTCOMES   →   FURTHER STUDY → RESEARCH

↓   ↓   ↓   →   ENTERPRENEURSHIP

WORK RELATEDNESS

(Match and Mismatch)

↓

SATISFACTION   Financial reward

                              Environment

                              Nature of work
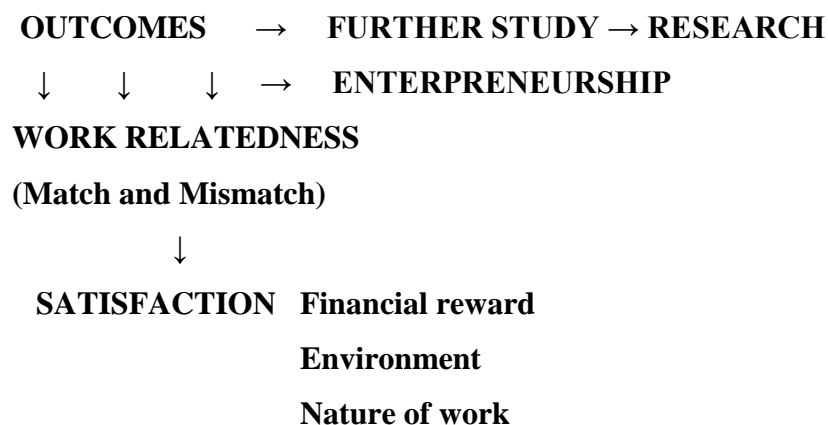
Figure 6.1: Flow chart showing outcome of career choice

This section will be discussed under the following headings:

(i) Match and mismatch of employment to the course of study

(ii) Patterns of early career outcome and career path

(iii) Satisfaction with work

6.2.1 Match and mismatch of employment to course of study

Compared with Anderson's study (2003), and Hills' study (2003) the percentage of science graduates with related jobs, broadly-related jobs and unrelated jobs are illustrated in Table 6.1.

Table 6.1: Comparisons of 'job matching' of current study with literature results.

	Current Study %	Anderson (2003) %	Hills (2003) %
Job Matching			
Related to science	30	40	12
Somewhat related	50	38	34
Unrelated	20	22	54

One-fifth of the Bioscience and Chemistry graduates participated in this study did not take up science or subject-related jobs. Despite of the fact that Anderson et al. (2003) surveyed populations with different science disciplines, the results of both our studies reveal that majority of the science graduates took up jobs directly related or somewhat related to their discipline of study. A survey of graduates with BSc honours degree in biology from a few British universities, by Quality Assurance Agency (QAA) team in the year 2000 (Hills, 2003), shows that only 12% of employed graduates were in

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'scientific research, analysis and development occupations'. 34% might have been using some science base in their degree (e.g. from job categories such as 'health professionals' or 'other occupations'), but the remaining 54% were in non-science-based jobs. There appears to be a significant difference between this study and Hills' (2003) work for graduates with non- discipline-related jobs. However, the sample size of this study was rather small compared with that of Hills' (2003) study.

Taking the few different ways of measuring curriculum-employment match as a whole, it is clear that the degree of overall matching could be regarded as quite satisfactory for the graduates of this study. Anderson et al. (2003) argued that given the variety of tasks needed in positions demanding science graduates, universities should at least provide graduates with the expertise to (i) to obtain a science job, (ii) to ensure that skills are broadly related to the potentially diverse needs of prospective employers, and (iii) to equip graduates to work in a science-based environment. From the outcome of employment of the Bioscience and Chemistry graduates, I do not agree with Anderson et al. (2003) that universities are expected to ensure graduates acquire a science job or should work in a science-based environment, rather they should enhance graduates to acquire broader skills to work in diversified types of jobs.

6.2.1.1 Comparison with literature: Innovative work roles of Bioscience and Chemistry graduates

A significant number of graduates in this study did not choose careers related to their discipline of study. Many chose sales and marketing jobs, working in the banks and working with insurance companies and law films. According to Quek (2008),

Chemistry graduates from Malaysia who place a premium upon employability must develop innovative career choices. She refers innovative careers as those which are not the norm for chemistry graduates, i.e. they fall outside the conventional teaching job or doing research and laboratory work in academic institutions or industrial organizations (Chew, Lee & Quek, 1995; Lee, Quek & Chew, 2001). Innovative careers involve new work roles. These careers claim to increase the opportunities for chemistry graduates in gaining employment, in spite of the adjustment changes in work and the changing workplace. Besides careers in banking, insurance, marketing, and law reported in this study, parallel that found by Quek (2008), which included careers such as capital financing, commerce, computing, consultancy, fashion-designing, housing, management, marketing, publishing, sales, trading and transportation. In the study by Quek (2008), the priorities of career choice of chemistry graduate employees who left their current jobs were surveyed. 40% of the chemistry graduate employees indicated that they would become salespersons, 23% of these graduates would become insurance agents, 17% would become researchers and 13% would be chemists in pharmacy stores. Conceptualizing innovative careers in terms of new work roles provides for chemistry graduates a wider range of career opportunities for seeking employment with possibilities for enjoying higher returns in salaries and also making advancement in their careers.

In my study, many Bioscience and Chemistry graduates actually took up 'non-specialisation careers' as their first jobs, with many doing sales. Therefore contrary to Quek's(2008) survey, it was found that graduates might not wait for a second job to take up non-discipline related posts. Similar to Quek's (2008) study, sales careers seemed to attract many chemists and biologists. One reason might be due to

competitions in the restricted labour market for science-related jobs, and another reason was the higher returns in salaries for doing sales, and in working in banking or financial companies. Sales jobs seemed to be a popular choice because of the attractive fringe benefits offered. In fact some top graduates academically in my study opted for sales as their first choice of jobs, instead of opting for postgraduate degrees.

According to Balbes (2006), the biggest challenge in career choice is looking beyond the more traditional roles, which represent only a fraction of the options available in this fast-growing field. Today's successful companies take a multidisciplinary approach. Analytical chemistry now relies on an increasing array of automated and computerized analytical techniques. This has to some degree reduced the number of chemists needed at the bench. But the demand for increasingly sophisticated analytical techniques, instrumentation, automation, and computerization has opened up options and opportunities for analytical chemists in other areas**.** At the same time**,** added roles have emerged for quality assurance specialists, whose role encompasses ensuring that analytical laboratories and the chemists working in them adhere to documented and approved procedures. In fact in the present study, a few graduates were hired as quality assurance personnel, and they commented that their jobs were unrelated to their science specialisation. The choice of careers really depends on how graduates visualize their career interest and career intention. We can agree with Balbes (2006) that 'leaving the chemistry department behind does not have to mean leaving chemistry behind'. Chemists have a broad range of career options to choose from, both in and out of the science laboratories (Quek, 2008). One advantage that Balbes (2006) had mentioned was that a trained chemist might still be able to go back to a

chemist-related job, when one loses his/her non-discipline related job. In fact this was suggested by one of the participants interviewed in this study (A8).

6.2.2   Patterns of career outcomes from the interviews and questionnaires

The interviews and questionnaires in general reflect the patterns of early career path and outcome but the interviews also provide a more 'narrative' view of career movements. They indicate sometimes uncertain beginnings, mixed motives and periods of change which happened as respondents tried to find a position that suited and satisfied them. Four broad groups have been identified from the quantitative and qualitative interviews. The most frequent career outcome patterns were: (i) First job followed by second job and then further study, (ii) Work and study after the undergraduate degree, then work only, (iii) Full-time study after the undergraduate degree, then move to an employment. The interviews suggested another approach to understanding early career patterns and four somewhat different sets of experiences emerged from the analysis:

Pattern I: A professional science or science-related career

This group of graduates in the survey and interviewed population went into a variety of Science-related professions. The person gained experience and gained some seniority in the organization. Some might plan to take up a postgraduate science degree. These graduates were gaining financial and job security in their early career. Some in this category were interested in entrepreneurship.

Pattern II: The undergraduate Science degree as a 'jumping off point'

This group was those who took up jobs, often broadly related or unrelated to the areas which they studied, and who found somewhat more stable employment. Although there was minimal use of science skills, the generic skills and science-related knowledge might be used example for sales jobs.

Pattern III: A conscious decision to change direction

The third pattern reflects a conscious decision to pursue a specific path. This includes graduates who complete their Science degree and then decide, either for interest or for employment-related reasons, to acquire another qualification (something other than a postgraduate degree in science). They might undertake study immediately following their initial degree, or a little later, after having some employment experience and becoming clearer about what it was they are interested in. Interviewees had pursued additional qualifications in a variety of fields including sales/marketing, information technology, physics, and teaching.

Pattern IV: The research scientist pathway

There were graduates who pursued their Masters or PhD degree and were interested to pursue a research career in either the academia or a research organization – in what might be considered the traditional research scientist career structure. A few graduates were trying to get some form of research assistantship while they pursued their postgraduate degrees. They might have intentions to fulfill their research ambitions. However, the problem is that science research positions were normally on a contract basis and not permanent. Many might wish to get a lecturer post which would be both permanent and more secure.

6.2.3 Job Satisfaction

Job satisfaction is an important career outcome. The quantitative study indicated moderate job satisfaction of the Bioscience and Chemistry graduates (Chapter 4). The statistics showed that 45.5 % of the graduates were satisfied with their career choice. 17.2 % were not satisfied, and 36.3 % were somewhat satisfied (rather neutral) with their jobs. From the interviews, reasons or factors affecting the job satisfaction of the graduates were summarized into the following themes: financial, environment and nature of work. The results are illustrated as shown in Figure 6.2.

Figure 6.2: Reasons of job satisfaction

Integrating both the quantitative and qualitative studies, it can be deduced that the graduates' reasons for job satisfaction could be due to financial reward, the nature of

their job and the environment factors (Refer to Figure 4.5 and Table 5.1). Table 5.1 tabulates the factors for dissatisfaction and satisfaction, with examples from the interviews. As the graduates had just started work, they had to survive financially especially if they were working in places away from their home. Most jobs are available in bigger places like Kuala Lumpur where the cost of living is higher. A graduate, who was working in Kuala Lumpur, away from her home in East Malaysia, commented: "*every month I have to calculate my salary, then deduct those rental, electricity and water bill*" (A9). Therefore graduates will be unsatisfied with insufficient pay for their basic needs. Besides, some graduates needed to support their parents and siblings (if they were still studying) (A10).

Working environment affects a graduate's satisfaction at work. A few female graduates expressed concern with working shifts especially in diagnostic laboratories as they were worried about safety during the late hours at night. Besides, many of the Bioscience and Chemistry graduates could only find jobs in manufacturing factories which were normally situated in the rural areas, which were far from the cities, and often had with poor and irregular public transportations. As they had just started work, they normally could not afford a car yet. A few graduates also complained about relationships at work with colleagues and employers. One graduate commented that when a new graduate was not up-to-expectation with their practical skills, they could be bullied. Some supervisors were strict during training sessions for these new graduates. Complaints were also encountered regarding facilities of workplace such as laboratories (smelly laboratories, insufficient apparatus and late orders of chemicals) (A8, A9). A graduate interviewed was not happy with her working environment and

her superior. Her comments were: "manager was insulting…whole environment has gossips, very negative environment….not at all satisfied".

Regarding the nature of work, whether a job uses their specialization, some graduates expressed that they might try to get science-related jobs later. Some graduates dreaded laboratory jobs as they seemed to have 'lost interest' in science experiments. One student actually commented that he lost interest in science laboratory sessions during university years as there were too many practical reports to submit. Other graduates took up science laboratory jobs probably because they could not get other more suitable jobs. These graduates would most likely try to get other types of jobs as they got financially more stabilized.

6.2.3.1   Comparison with literature

Pascarella and Terenzini (1991) carried out a review and synthesis of previous work, and identified a number of outcomes of university education. These included occupational status, stability of employment, career mobility and attainment and private rates of return. Job satisfaction is also an important outcome of college education. Job satisfaction is likely to influence productivity, absenteeism, turnover and hence organizational effectiveness. According to Locke's classical definition of job satisfaction (Locke, 1976), this construct consists of evaluating how the needs of an employee are fulfilled through the presence of certain conditions, or the achievement of goals in the work setting, that are aligned to the value priorities of the subject.

(1) **Income** is an important outcome variable since earnings are a proxy for the economic impact of higher education (Pascarella and Terenzini, 1991). Economic theory postulates that if the labour market were perfectly competitive, earning differential between different graduates would be a precise measure of additional productivity and hence additional contribution to economic output. As suggested by Lim et al. (2008) salary may vary according the academic performance of graduates. It may however, be argued that some graduates may initially choose low paying jobs in anticipation of being better placed to achieve a much more remunerative one later in their careers (Lim et al., 2008). Some of the graduates of this study were also prepared to get a lower pay in their first job with the aim to gain experience and to get a better-pay job later. Some graduates believed that this is unlikely to occur in the Malaysian context, particularly in view of the fact that graduates are obliged to contribute a proportion of their income to their parents. This view was illustrated in the results of this study.

Some graduates opted for postgraduate studies hoping that the salary will be higher. However, in a narrow sense, higher degree graduates are restricted in their opportunities and rewards. Certainly, academic careers may not be particularly promising, and are normally on contract basis (Freeman et al., 2001). More generally, the results suggest that an additional qualification in Science was not necessarily a passport to higher income. Large laboratories have a few more post-doctorates and graduate students, and a visiting researcher or two, but with the exception of a few large research centers associated with universities, university biology/chemistry research remains

dominated by individual investigators pursuing their own work with a small team of students and post-graduates. Opportunities for academic careers may not be very bright.

According to the perspective of Lawler & Hall (1970), an individual always establishes a process of social comparison between the inputs and outputs he or she puts into and receives from a job. For example, employees evaluate the effort and dedication they give to their jobs and therefore expect that the rewards and benefits received from the organization will match or exceed their efforts. If a positive relationship is perceived, the employee will be satisfied. However, if the relationship is perceived as negative, the employee will experience dissatisfaction.

In this study a few graduates in fact did not think this way. For example, A6 thought that the efforts that he had actually put in at work deserved a higher salary than what he was given. However he stayed on longer in his job because he still harboured hope that he could be further trained in the work place. Besides he had interest in his job despite of unsatisfactory pay.

(2) **Job environment**: Job satisfaction can be enhanced providing workers with opportunities for advancement, controlling unhealthy competition by creating a collaborative work environment, and increasing autonomy, flexibility and variety in the work (Crawford and Gressley,1993; Al-Enezi et al., 2008). In this study, some graduates were concerned about the lack of opportunity for more challenging work and work advancement. These were cited as reasons

for leaving one's field of work (Harmening et al., 1994). A few graduates expressed their problems with colleagues and also their supervisors. This agrees with other research findings. Providing equal and fair treatment of all staff irrespective of their backgrounds provides satisfaction (Harmening et al., 1994, Al-Enezi et al., 2008). It is suggested that lack of job autonomy, lack of support, lack of input in decision making, and poor career structure correlated with job satisfaction.

(3) **Nature of work:** Interviewees who were only partially using their Science-related skills and who were not satisfied with their jobs were dissatisfied for a variety of reasons, which were not always related to whether they were using their science skills or not. According to McInnis et al. (2000) and Rodrigues et al. (2007), for example, some graduates were clearly dissatisfied that they were not working in the area of their interest; others felt their work was not challenging enough; some might have enjoyed their work but were dissatisfied because they thought their superiors were incompetent managers. This indicates that job satisfaction is a complex matter, dependent not only on the nature of work but on the range of employer and employee-related factors.

The utilization of academic knowledge and recognition as a professional enhance self-esteem and is found to be major factors in overall job satisfaction of a group of medical laboratory technicians (Al-Enezi et al., 2008). The findings are consistent with several other studies (Shah et al., 2001a). The feeling that one is using one's academic training might have improved participants' perception of doing a good job and hence increased job

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satisfaction. This negative relationship might be due to the fact that competent technologists would invariably get frustrated when they could not apply their knowledge and previous experience; this they viewed as a barrier to their career progression (Shah et al., 2001a) Several such cases were reported in this study.

Jackson (2007) found in his study that science and engineering graduates tended to emphasize how much they enjoyed their work and were satisfied when their knowledge and skills were highly relevant, so that they could "make a real and valuable contribution to projects even at an early stage in their career" (Jackson, 2007: 38). Other benefits identified which bring satisfaction to graduates are job flexibility, shorter project times, variety and the opportunity to apply their skills (Jackson, 2007). Some graduates in this study felt the same way as suggested by Jackson (2007).

As mentioned in the literature, education mismatch can have significant labour market consequences for the individuals, employers, and society. Job mismatches may cause job dissatisfaction (Di Pietro and Urwin, 2003). Education-job mismatches lead to employee turnover and have been shown to have negative effect on wages and job status (Wolbers, 2003 and Robst, 2007a). This reminds us that job satisfaction is a complex matter, dependent on a range of employer, work, and employee-related factors.

6.3 **Research Question 2: What are the factors or work values influencing career choice of the Bioscience and Chemistry graduates?**

From the quantitative study, important factors are grouped into cognitive, extrinsic, altruistic, environment and personal (affective), labour market and entrepreneurship factor. The summary is tabulated (Table 6.3 and the importance of cognitive values, extrinsic, altruistic, environment, and affective values are in the sequence arranged. The numbers next to the factor indicate the ranking (small number preferred).

Table 6.2: Factors influencing career choice –values, labour market and entrepreneurship

FACTORS INFLUENCING CAREER CHOICE				
COGNITIVE	**EXTRINSIC**	**ALTRUSIVE**	**ENVIRONMENT**	**AFFECTIVE**
Personal growth[1]	financial[11]	contribute	working conditions[18]	fair boss[3]
Interesting work[2]	pay/income[14]	to society[17]	convenient hour[19]	family[28]
responsibility[4]	benefits[20]		5-day week[24]	lecturers[29]
Skill development[5]			private/public[32]	particular
Recognition[6]				lecturer[30]
Long term[7]				
Enthusiasm[8]				
Meaningful[9]				
Self appraisal[10]				
Promotion[12]				
Training[13]				
Independence[15]				
Feedback[16]				
Interaction[21]				
Influence[22]				
security[23]				
job status[25]				
large/stable[26]				
location[27]				
relatedness[31]				
LABOUR MARKET				
ENTREPRENEURSHIP: start own business, tired of working for people, financial from parents				

6.3.1 Comparison with categorisation of work values used by other researchers

The factors influencing career choice in the quantitative studies can be grouped under a few main factors in accordance with that suggested by Cassar (2009), Elizur et al. (1991); Elizur (1984), Dose (1997), Ros, Schwartz & Surkiss (1999) and Ball and Chik (2001). The factors influencing career choice might be linked to personal values and attitudes. The values were mainly cognitive values, instrumental values which

were subdivided into environmental factors and financial rewards, affective values, labour market factors and entrepreneurship factors. It has to be emphasized that different studies usually use different names or terms to describe such factors or values or attitudes which are considered to be important in influencing career choice.

In this study cognitive values seemed to be more important followed by environmental values, and affective values involving influences of people (as shown in Table 6.2). In the survey, salary and pay showed moderate mean score. However, during the interviews with graduates holding sales jobs of health products, it was disclosed that pay and salary seemed to be an important factor for career choice. Graduates working more than one or two years sometimes thought of changing jobs to get another higher pay job. But for the first jobs, graduates normally accepted the lower pay due perhaps to fear of not getting any jobs and subsequently could get working experience.

Past research on job values has distinguished between extrinsic and intrinsic rewards in working. While high income, job security and opportunities for advancement and promotion are considered as extrinsic rewards, meaningful work tasks, altruistic and social rewards are characterized as intrinsic rewards. 'Altruistic values' include helping other people and being useful to society; and 'leisure values', including flexible working hours and leisure time (Elizur, 1984). Much of recent research on gender-related job values shows that men place greater emphasis on extrinsic rewards, while women place greater emphasis on intrinsic rewards.

6.3.2   Comparisons with business undergraduates

The quantitative data suggests that graduates in this study were more concerned with their personal growth, interest and promotion prospects rather than the environmental and physical aspects like location, long work hours; and the influences from other people. Overall, influences from parents, lecturers and peers were considered least important. Pay and salary was ranked at position 14 out of 32 factors. Compared with the study by business graduates (Hew *et al*, 2009), salary was ranked third out of the 16 factors considered and working conditions ranked the most important for business graduates (Hew et al., 2009) compared with the ranking of 17 in this study for Bioscience and Chemistry graduates. In the study by Hew et al. (2009), advice from family members and lectures were not considered to be very important factors influencing their career choice, similar to that observed in this study.

Overall therefore, new graduates in this study preferred to rate higher the factors relating to work and the learning opportunities offered by the job than on issues of power (example work status) which is rated 25 out of 32 factors, and influence (rated 22 out of 32 factors). Moreover, general work conditions and prospects were rated higher than salary; being valued as a worker was more important than seeking recognition or general equity. This contrasts slightly with some of the findings in the other studies which generally argue that graduates have very high expectations of their employment prospects, demand higher-than-normal salaries and seek positions of power, influence and opportunities for fast promotion (Debono, Debono, and Caruana, 2005).

From the survey data, the perceived values of this group of Bioscience and Chemistry graduates seemed to center not only on one self but also the persons in the workplace. Issues like 'having responsibility' and 'having a fair and considerate boss' were rated much higher (in terms of mean scores) than 'job security'. Given the fact that many graduates were not finding suitable employment the first time round and that the information students heard about the labour market had changed, this might influence the choice of values they should realistically adhere to. New graduates of this study complained that most job advertisements asked for work experience. Hence, graduates might still strongly desired jobs that provided them with a sense of influence or job security. In some studies on factors influencing career choice, job security could be construed to mean labour market factor (Ahmed et al., 1997). This attribute could be regarded as the employability of job market condition. This attribute was ranked at position 23 out of 32, indicating perhaps that the market for the science graduates might still be good.

The intrinsic value was specifically defined in prior studies for accounting graduates (Felton et al., 1994; Ahmed et al., 1997) as the factor relating to one's satisfaction derived from jobs, which provide the chance to be creative, autonomous, intellectually challenging and to be working in a dynamic environment. The 'Intrinsic value' indicated by the attributes such as "contribution to society" was not considered the greatest factor as in the study by accounting graduates reported by Sugahara et al. (2009).

The factor of "Working Environment" was not rated very high as an influential factor, compared with another study by Sugahara et al. (2009). This agrees with the results of

the current study, as factors such as working conditions, convenient hour of work, and five-day week were not ranked as highly as the top fifteen factors which influence career choice. However these attributes could be crucial aspects of employers' job motivation.

The "Person's Influence" factor ranked relatively lower compared with other factors in deciding their vocational choice. Some graduates have expressed that parents might not know much about their area of training. Parental influence in this study was generally not very strong, except for a few cases. Close friends and family also did not have very strong influence. These results can be compared with that reported for business undergraduates by Moy and Lee (2002) and Teo and Poon (1994).

6.3.3 Comparisons of work values with science /other discipline students and graduates

Student interest and patterns of choice

A survey of a large sample of students in an Australian school indicated the attitudes of these students to careers. The three most important elements in choosing a career were:
• A job that will benefit the community;
• A chance to interact with many people;
• A job with plenty of variety and challenge (McInnis et al., 2000).

The current study indicated that the graduates were more concerned with the challenge from their jobs rather than altruistic values. However, interaction with people was considered more important than altruistic values. The way secondary school students perceive their work values may change after they enter universities and going through a few years of education there.

A study by Duffy and Sedlacek (2007) shows that for first year college students, the four highest work values ranked were intrinsic interest(29%), highest anticipated earnings (20%), contributions to society (15%), and prestige (12%), followed by working with people (6.7%), rapid career advancement(5.5%), independence (3.7%), and availability of job openings(3.5%). The ranking of the work values does not agree with the present study as career advancement and independence were rated higher. However the present group of graduates rated interest as very important. Undergraduates may have been more exposed than the secondary school students.

In Duffy and Sedlacek's study(2007), men were found to espouse extrinsic values, and women were more likely to espouse intrinsic values. It was suggested that men may be more prone to choose extrinsically oriented goals such as high anticipated earnings, compared with women who may go into careers related to work values of working with people and contributions to society. Another finding was that students who sought advanced degrees were more likely to choose prestige values, while those seeking a bachelor's degree were more likely to choose intrinsic values. This study did not really agree with their results.

Johnson and Elder (2002) compared change in job values of people with post-secondary education with those who have not obtained such education. They showed that those who continued their education beyond high school place greater importance on having influence at work and less importance on job security. They also claimed that college graduates place more importance on extrinsic, altruistic and social rewards than those who finished their education after high school. Therefore they are of the view that change in job values depends on education. Their study however does not adequately test whether job values are learned in school (Daehlen, 2005). From the results of the survey of this study, job security was ranked 23 (out of 32) while pay and advancement for promotion (11 out of 32) and salary was ranked 13 (out of 32). After four years of study, graduates place some emphasis on altruistic values (meaningful, enthusiasm, and responsibility). So they may comply with the view proposed by Johnson and Elder (2002).

A recent survey by Keely Global Workforce Index (KGWI) (The Star, Friday 20 April, 2012), in which nearly 170,000 people from 30 countries took part, including 4,500 Malaysians, indicated that 58% of Malaysians intend to look for new jobs, within the next year. Less than half felt they were valued by their employers. A new trend was evident among employees all age groups, who placed more importance on personal fulfillment and growth opportunities than compensation of work benefits. Many were seeking greater engagement and 'meaning' from their work. The current study shows that 'personal growth' was ranked first among the preferred work values, and 'having a meaningful job' being the ninth work value preference. This somewhat agrees with the KGWI index.

6.3.4 Other work values identified

The qualitative research of this study, using interviews, identifies the factor of entrepreneurship in career choice among graduates. The findings showed that some graduates (three graduates) had inclination and aspiration towards entrepreneurship. These findings further support the findings of previous studies because participation in entrepreneurship is vastly due to high aspirations. Findings also verify previous research by Bird (1988), Shepherd and Douglas (1997), and Krueger et al. (2000) whose studies showed that a high aspiration level can be a predictor of behaviours like involvement with entrepreneurship. Thus, with high inclination and career aspiration levels, graduates will realize the vast opportunity to be explored and choose entrepreneurship as a favorable career. In this study, one respondent was contemplating his own business, possibly in the food sector. He gained parental financial support to start the business, which is typical in the Chinese culture. Another graduate has already started his own business and was coping well.

Entrepreneurship was once seen only as a second or last choice as a career. The opportunity of choosing entrepreneurship can then expand and increase the number of graduate entrepreneurs. This situation will further hasten the growth and development of the second generation of the Business and Industrial Society as stated by the government in The Ninth Malaysian Plan (2006-2010). The study by Hj Othman and Ishak (2009) suggested that graduates with a high attitude profile towards entrepreneurship demonstrated the following attitudinal components: achievement need, internal locus of control, competitiveness, autonomy, and monetary value. Their finding shows that these factors inspired graduates towards entrepreneurship. In fact

autonomy and monetary values were pulling factors for entrepreneurship in this study. This positive attitude can be molded through the education system. A change in the education system is very much needed today to widen the scope of career choices for graduates to choose a career in entrepreneurship (Hj Othman and Ishak, 2009).

6.4   Research Question 3: At what points do the Bioscience/ Chemistry graduates make the decision in their career path?

Both the quantitative and qualitative studies show that these decisions were being made before entering higher education, after entering tertiary education, or in subsequent years after working. The discussion that follows will focus on the decision on choice of subjects and the career choice after higher education.

I Decisions of choice of course during high schools

Factors influencing choice of courses are usually academic performance, family influences, interest, lack of information of courses, financial problems, influence from the society. These were factors that are similar to studies of Robertson (2000), and Talib and Tan (2009). Considerations such as parental views of job opportunities and success in school science would appear to be more important. This may not be the case, for graduates who follow careers in their discipline areas. Common motivations for undertaking science training seemed to relate to familiarity of science ideas from high school, example in Malaysia the streaming in science and arts stream in Form 4 (Year 11). Personal interest and a range of parental and social expectations seemed significant. Familiarity due to having undertaken science subjects in high school and

enjoyment in previous school science learning was a common motivation for choosing science (Rodrigues et al., 2012). Students' intentions regarding potential careers are often formed in early high school (Quinn and Lyons, 2011). They play an important role in the perceived instrumental value of science subjects for senior high school, with students considering a science career more likely to choose science subjects, as a useful step towards their longer-term goals.

Rodrigues et al. (2012) argued that in their study with graduates working in non-discipline specific jobs, the people they interviewed did not undertake a science degree for a specific purpose, or with a specific career goal in mind. In fact, several interviewees said that they simply fell into science. In the current study some graduates interviewed also thought they studied science 'by chance'. However graduates who took up science jobs also thought this way.

II   Decisions of career after subsequent years of working

Career change, aiming for a challenging career (Quek, 2008), entrepreneurship and often intentions to further studies may take place after working for a few years. Graduate career paths evolve slowly, and some take 5 years or longer to settle into their careers. For some it involves postgraduate studies; for others the process of assimilation into the labour market involves false starts or a rethink about their early career choices (Purcell et al., 2004:15). Some of the participants of this study have worked for about three to four years. Some of them have intention to be promoted to the managerial position. As indicated by A1 who commented:

'I want to apply my chemistry background, so I can move (be promoted) to the managerial position.'(A1).

6.5   **Research question 4:** Why do the Bioscience/Chemistry graduates choose careers unrelated to their major field of study?

Reasons for not choosing science-related jobs are as follows: competition in getting science-related jobs, lack of opportunity, low pay of science jobs, jobs too routine and boring. Academic results did not contribute that significantly in this study. Integrating both the qualitative and quantitative studies group these factors under the following headings: economy, cognitive and social reasons (Figure 6.3). The economic and cognitive reasons may be classified as structural barriers while the social reasons pose as environmental barriers.
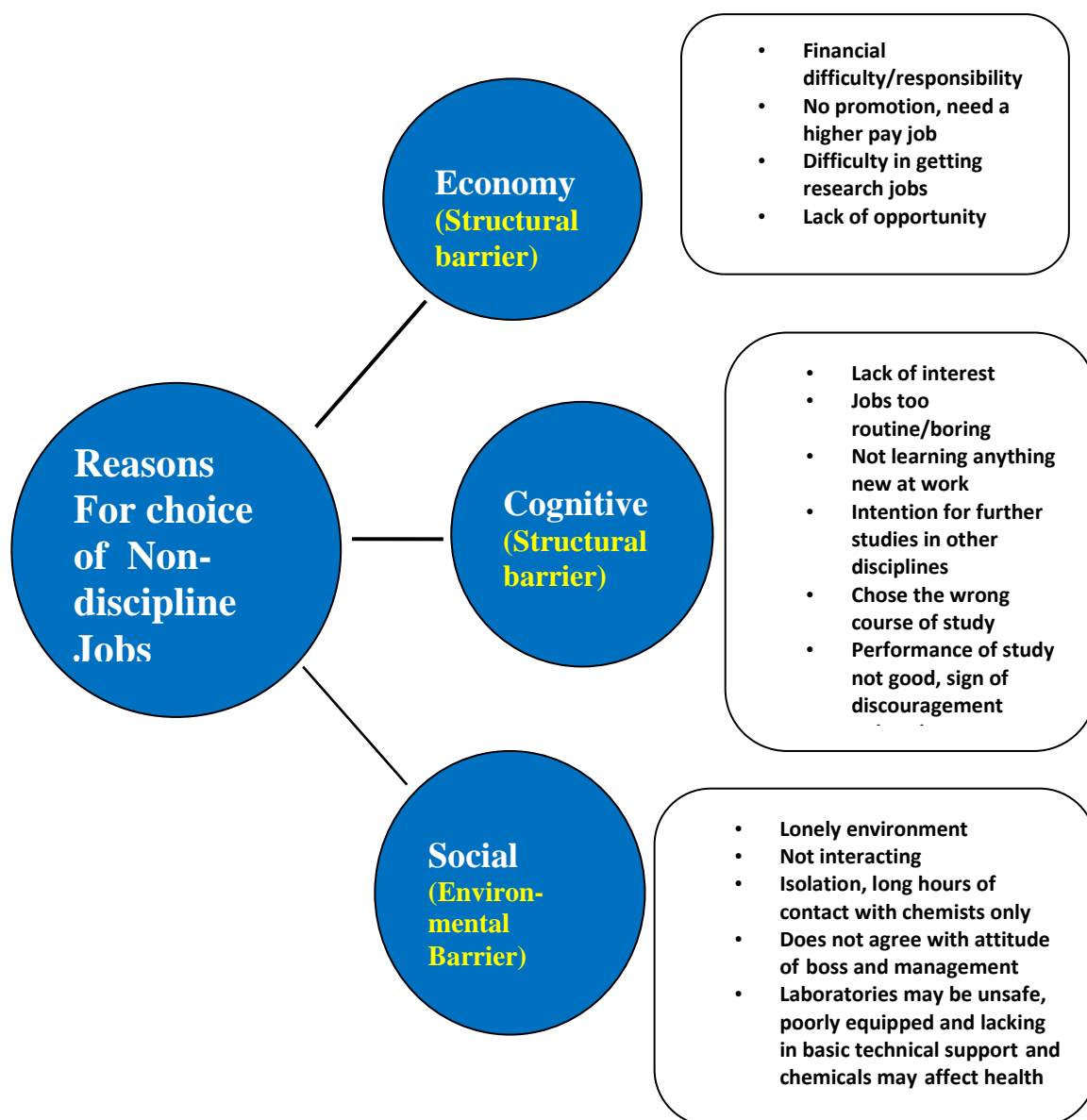
Figure 6.3: Reasons for choosing non-science jobs

Figure 4.8 (Chapter 4) shows that from the questionnaire, the reasons for choosing non-science related jobs were ranked in the descending order: lack of opportunity, job shortage, low salary, interested in study, lacking opportunity and interest in study not work yet. For the qualitative studies, various results were seen. Interviews further explored some of these reasons. There are many public universities and private universities which offer bioscience courses such as biotechnology, microbiology and

biochemistry. So the job market can be competitive despite of the fact that unemployment for other disciplines is higher than science discipline.

The following sections will discuss the reasons for choice of non-discipline related jobs. These are discussed under the following themes: Economy, Cognitive and Social factors. The discussion will be linked to previous literature.

6.5.1 Economy Factor

Most graduates in Malaysia expect that a degree will increase the lifetime earnings of a person several times compared with those with merely a high school qualification (Embong, 2007, p. 185). To obtain the qualification, they are prepared to borrow money to pay for their university education. Therefore, getting low pay jobs makes the graduates feel that they have been short changed (Embong, 2007). They do not get what they have expected. Purcell & Pitcher (1996) and Hesketh (2000) also argued that graduates may believe that they can get a better paid, more interesting and high-status job than without a university education. Many graduates may be aiming for a middle-class living. However though the graduates may be more employable by having a university degree, this may not necessarily lead them to the kinds of jobs and careers associated with what they have learned.

However, as mentioned in Chapter five, one important reason for graduates not choosing discipline-related job was the low pay. Financial reward is one of the most common extrinsic factor in the career choice literature. Employees will not be motivated if their financial rewards from work are not meeting their expectations (Kim and Cha, 2000). Financial rewards include the pay, fringe benefits,

commissions, bonuses and so on (Von Glinow, 1988). The main difficulty and obstacle faced by fresh graduates is lack of experience, and normally most employers would prefer to hire experienced workers. Therefore the salary for fresh graduates is always lower due to inexperience.

Some graduates in this study might find it difficult to find a science-related job but many got jobs within six months. In 2008, for the graduates from Australian universities seeking full-time employment, over a third (36%) of Life-Science graduates, a fifth (22%) of Chemistry graduates and a quarter (24%) of Physical Science (excluding engineering) graduates were still looking for fulltime work four months after graduating (Quinn and Lyons, 2011). Similar supply and demand issues were also evident for the UK science graduates.

While there is good evidence of some shortage of suitable science-based jobs (especially in particular fields of study within science) (Anderson et al., 2003), it appears there is also the possibility that opportunities for economic and social advancement present themselves in areas less connected with a respondents' undergraduate course. In other words, 'non-matching' is a product both of relatively low salaries in science (salaries which appear to 'plateau' after a few years) and golden opportunities in other industries – particularly high demand areas such as IT. The result of this study therefore agrees with the comments by Dipietro and Urwin (2009):

> *"As expected, earnings are found to be a strong predictor of the probability of looking for another job. More specifically, a low wage is a strong incentive for graduates to seek alternative employment".*

Several Bioscience and Chemistry graduates have worked in the same company for a few years despite of low pay because they wished to gain experience and may be waiting for the right moment to change another job. Therefore some early graduates may look beyond the amount of salary they get, and hope to get more experience, for better future prospects (Quek, 2008).

6.5.2 Cognitive Factor

It is found that some graduates got bored with laboratory work after graduation and indicated a loss of interest in science-related jobs. One graduate in the current study pointed out that she wanted to learn something new as she found that some laboratory routines became too 'boring. Similar comments such as laboratory jobs being 'monotonous' and 'doing the same thing robotically' were reported by Mclnnis et al. (2000). Therefore one should expect that interests and aspirations can change during and subsequent to the undergraduate degree. This may be reflected in the choice of employment, and the possibility that such employment exhibits less relevance to the original training. The change of interests of graduates in science reported in this study agrees with the comments by Robertson (2000). In the study by Robertson (2000), graduates may have planned to take up the science course and then a science job during high school; however changes in thinking may come along after four years of education at the higher learning institution.

A good proportion of graduates are evidently not interested in immediate career satisfaction because they have plans for further study – quite possibly in areas related to their original and first preference. In fact, of those respondents who had since gone

on to complete further science study, some 13% had undertaken a second science-related bachelor degree (Anderson et al., 2003). One graduate from this study had completed her Masters of Science in toxicology and was currently working as a research officer in a university. Four graduates are also pursuing their postgraduate studies in Science. One graduate surveyed had completed her Masters in Business Administration degree.

6.5.3 Social /Environmental Factor

Some graduates of this study shunned science laboratory jobs because of the isolation in the laboratories. This is agreed by the researchers (Report from E^a, 2000) who commented that long 'out of contact' hours meant little opportunity to socialize, except with other chemists at the work place. Besides, long hours in the laboratories make it more difficult to find time for the family (Grunert, 2011) and friends.

Dangerous chemicals are another drawback for some graduates of this study. Such experiences are also reported by women chemist researchers (Report from E^a, 2000) who have strong concerns about health and safety of working in the laboratories. Some chemists find laboratories where they work frustrating, unsafe, poorly equipped and lacking in basic technical support. This creates particular barriers for some graduates in organic chemistry where the culture and nature of the work demand long hours in the laboratories.

6.6   Research question 5: What are the contributions of higher education to the career choice   of graduates?

Despite of the fact that the graduates surveyed and interviewed worked in a range of environments, there were some common themes in relation to the competencies they needed for their jobs. For the purposes of reporting here, these can be divided into two broad areas: those relating to the use of scientific knowledge, and those relating to more general or generic science skills derived from their university experience of science learning. Besides, some of the work values listed for Q13 of the questionnaire (Table 4.6) also represent attributes or competencies which are required by the employers.

Both the quantitative and qualitative studies illustrate the importance of academic knowledge and generic skills in the careers of the graduates. With 30% of graduates getting science-based jobs, the science knowledge and practical skills acquired should be adequate, to make them ready for the workplace.

6.6.1   Science knowledge:

In response to Question 9 of the questionnaire (Chapter 4), the respondents indicated the extent to which their undergraduate degree assisted them in obtaining their current position. 48% of graduates suggested that their course of study 'contributed a great deal' to gaining their current employment, and 27% reported that their degree was 'essential in helping them' to get their current employment. 23% of graduates reported that their course of study 'does not contribute at all' to gaining their current position.

Those who indicated that their undergraduate qualification contributed a 'great deal' towards securing their present positions believed their degree was related to their current job. This measure of matching between degree programme and the job acquired usually consider both the responses 'directly related' and 'somewhat related' in relation to the extent their degree was related to the job.

Some graduates interviewed clearly utilized the scientific knowledge they acquired during their degree programme. Some commented that new techniques and training were essential in their work, implying that that world of work had much more to be learned. Some of the chemists were introduced to more sophisticated equipment than those encountered in the higher institution. In fact one graduate commented that more field trips and visits to industries should be organized, to give students more exposure to the new equipment and advanced set ups of industries. Some graduates of this study commented that more practical skills should be introduced. Indeed actual scientific work skills demanded in workplaces can be very different and sophisticated.

6.6.2 Generic skills

The skills perceived to be more important in this study were 'problem solving skills' (mean score 4.51) followed by 'being able to work independently' (4.38) and 'critical thinking' (4.26) (Refer to Figure 4.8). The other skills were team work (4.10), leadership (4.09) and IT skill (3.68). Another skill which was emphasized during the interviews was the good command of English, and good presentation skills. The interviewees did not comment extensively on the importance of generic skills to their current employment role. A few respondents indicated satisfaction with the ways their

degree program had prepared them for their workplace. Not many commented specifically to the ways that the degree program could benefit by emphasizing on the development of these generic skills. However there is little doubt about the importance of communication skills for employment, as majority of the interviewees agreed on its importance. The interviewees spoke about the need to communicate to various audiences: with colleagues outside their particular discipline and also with their superiors. In fact one graduate thought that she would learn more if she had better communication skills. Graduates interviewed also saw the problem at work without good communication skills. Many graduates were involved in sales, and some graduates expressed the importance of good presentation skills. Such skills were developed in their higher education, as project presentations were compulsory in their curriculum.

Important generic skills and social skills preferred by the employers have been discussed in many studies (Hesketh, 2000; Leckey and McGuian, 1997; Holmes, 2001; Washer, 2006). Dearing (NCIHE, 1997) emphasized four 'key' skills, namely communication skills, numeracy, the use of information technology and learning how to learn. Since the quantitative study had shown that between 50% to 70% of Bioscience and Chemistry graduates did not enter occupations directly or indirectly related to their degree, the need for incorporating general employability skills in the degree curriculum should be emphasized (Brown et al., 2005; Hassan, 2006; Singh and Singh, 2008; Abdul Rashid & Mohamad, 2008).

6.6.3 Framework of Employability Skills

Merging the work values (from **Question 13** of the questionnaire, which included some key attributes and competencies required by the employers), and the generic skills from **Question 12** of the questionnaire, as well as from the **interviews**, the framework of the key employability skills derived from this study is constructed (**Figure 6.4**). Table 6.3 shows the list of the work values (or attributes) with high mean scores (These were extracted from Table 4.6).

Table 6.3: **Job attributes and work values with high mean scores selected from Table 4.6**.

Attributes (selected from results of Table 4.6)	Mean score
Having responsibility (cognitive)	4.28
Skill development (cognitive)	4.36
Enthusiasm/ commitment (cognitive)	4.30
Received Training (cognitive)	4.08
Independence in organisation (cognitive)	3.98
Getting feedback about one's work (cognitive)	3.96
Opportunity to interact (cognitive)	3.88

interesting
independent
interaction
contributing to society
willing to learn

Problem solving skill
critical thinking skill
communcation skill
teamwork
IT
leadership
learning to learn
element of flexibility

Cognitive Skills

Affective Skills

Generic Skills
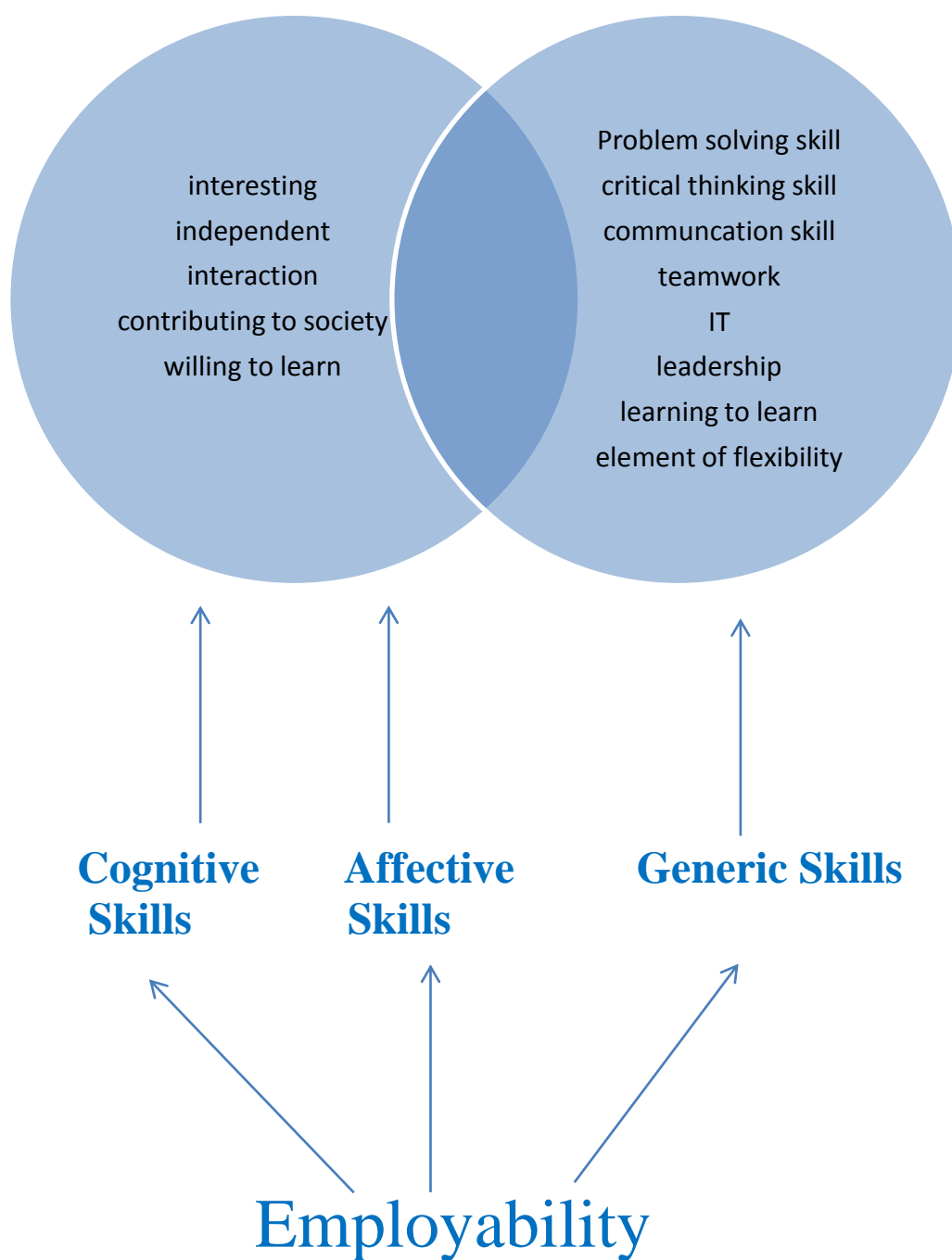
Employability

Figure 6.4: **Employability Skills Framework** for Bioscience and Chemistry Graduates. Cognitive skills, affective skills and generic skills contribute to employability.

6.6.4 Comparison with the Literature

According to McInnis et al. (2000), subject–specific knowledge and understanding is important in the jobs of almost 60 per cent of respondents in their study. Their findings indicate, however, that the respondents believed their undergraduate degree provided little assistance with regard to the development of employability skills that were important in their jobs, i.e. management skills, oral communication skills, flexibility and adaptability, the ability to work with others, and to use information technology effectively.

The present study however places more emphasis on problem solving and critical thinking skills, but agreed that communications skills and team work were important. Management skills were not mentioned much by graduates of this study, probably because it was the early career of the graduates and management skills were not essential. The author agrees with the comment by McInnis et al. (2000) that it may not be possible for an undergraduate degree to provide such a range of skills. It is agreed that the undergraduate Science degrees are limited in significant ways in providing skills and attributes required in the jobs that the respondents have undertaken. Harvey (2000), and Yorke (2006) also criticized the difficulty of acquiring the long list of skills required of graduates by the skills Agenda (NCIHE, 1997).

On the other hand, the majority of respondents in this study agreed that their undergraduate Science degree was important in obtaining their employment. An overall 41 per cent of respondents said that their undergraduate degree was essential to obtaining their current or most recent job; a further 34 per cent said it contributed a

great deal to obtaining it.

Besides, as pointed out by Cox & King (2006, p.263), the prime motivation for the majority of students is not to study a particular subject in depth, but to enhance their employment prospects'. The shift to including employability skills in the university agenda does not seem to be questionable. In fact, many universities, especially in developed countries have embedded key skills in their curricula (Fallows & Steven, 2000).

Notions of a career and a working life are becoming increasingly diverse and much more individually based and entrepreneurial. In an era where generic skills, portability of qualifications and transferable skills are key concepts underlying the vocational training system; where rapid change is occurring in the skills required in many areas of employment; and where there is greater fluidity of employment options for people with a range of skills, the notion of a set career structure based solely on the nature and type of initial training is no longer appropriate.

Personal attributes are attitudes and abilities including intellect, knowledge (in some cases) willingness and ability to learn and continue learning, ability to find things out, willingness to take risks and show initiative, flexibility and adaptability to respond, pre-empt and ultimately lead change and 'self-skills' such as self-motivation, self-confidence, self-management and self-promotion. These personal attributes are important to allow graduates to fit into the work culture, do the job, develop ideas, take initiative and responsibility and ultimately help organisations deal with change (Harvey, 1997).

According to Balbes (2006), analytical chemists, regardless of which path they take, need a strong background in chemistry, an eye for detail, good computer skills, and good laboratory and problem-solving skills.

6.6.5.1   Employability Model of This Study

This study emphasizes work values and associated competencies, academic knowledge, generic skills and work experience or industrial training. Together with reflections from some of the Bioscience and Chemistry graduates, a simple model of employability for this study is constructed as shown in Figure 6.5.
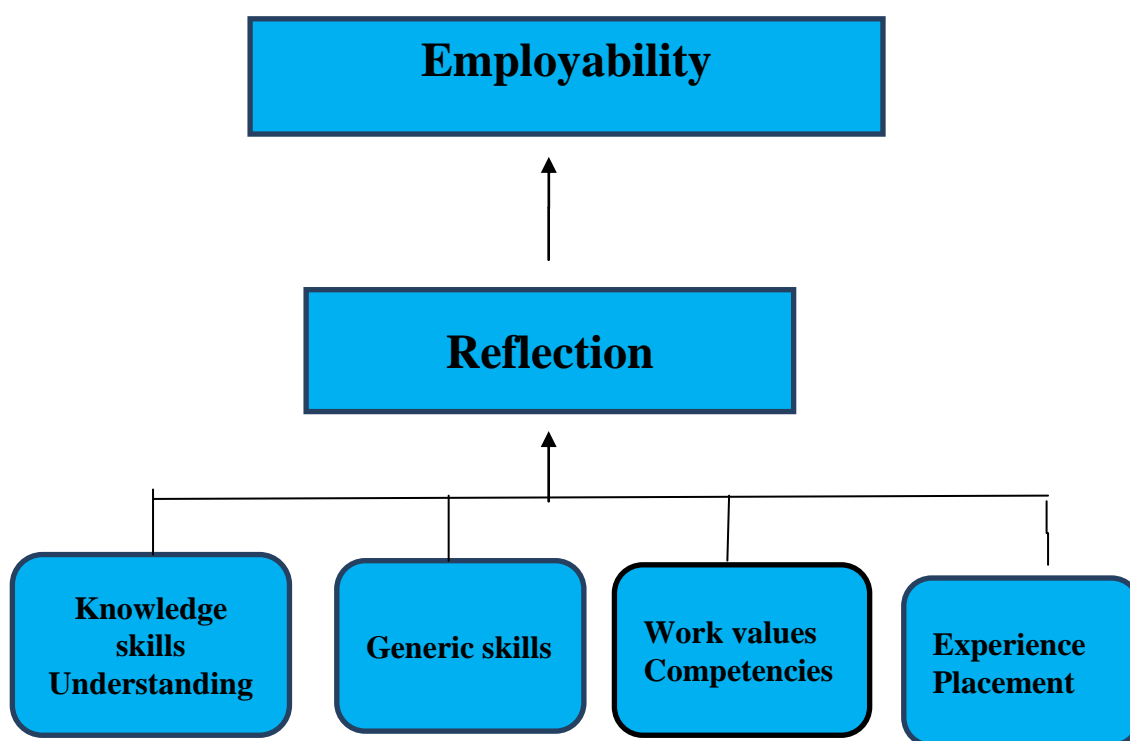
Figure 6.5: Employability Model of Current Study

The model depicted in Figure 6.5 represents a partial model compared with the USEM account of employability (Yorke and Knight, 2006).   USEM is probably the most

well-known and respected model in this field. USEM is an acronym for four inter-related components of employability: **U**nderstanding**, S**kills**, E**fficacy beliefs and **M**etacognition. According to Harvey and Knight (1996), students are empowered by developing their critical, reflective and transformative abilities. This requires an approach to teaching and learning that goes beyond requiring students to learn a body of knowledge and be able to apply it analytically. Brockband and McGill (2006) argue that facilitation of learning rather than teaching is necessary to encourage reflective learning.

The authors suggest that behind the USEM model is:

"*an attempt to put thinking about employability on a more scientific basis, partly because of the need to appeal to academic staff on their own terms by referring to research evidence and theory…*" (Knight and Yorke, 2004, p. 37). The USEM model forms part of a large body of research based, and scholarly work on employability.

Therefore, the model depicted in this study regarding employability also shows several elements suggested by the CareerEDGE model developed by Dacre and Sewell (2007). These elements include: degree subject knowledge, understanding and skills; generic skills and experience. However, these authors argue that when students have support in reflecting on and evaluating their development in these areas, it leads to enhanced self- efficacy and self-esteem and self-confidence. Similarly, some of the elements mentioned in this study are comparable with that proposed by USEM model. "Perceived self-efficacy refers to beliefs in one's capabilities to organize and execute the course of action required to manage prospective situations. Efficacy beliefs influence how people think, feel, motivate themselves and act." (Bandura, 1995, p. 2):

6.6.5.2 Reflections and Evaluations

Reflection plays a crucial role in the context of employability (Moon, 2004). Providing students with the opportunities to gain the necessary skills, knowledge, understanding and attributes is obviously important, but so too is providing opportunities for reflection on and evaluation of the learning experiences that have already taken place. Without these opportunities, a student is unlikely to give full consideration to how far they have come in developing their employability, and what they may need to do in order to develop it further (Moon, 2004). This element of reflection and evaluation is also the key to development of self-efficacy, self-confidence and self-esteem.

As part of education therefore, reflection as a process, allows the student to establish connections between new and existing knowledge and experiences, to understand their own position within that relationship and to deepen the level at which they work with them at the academic, personal and professional levels.

However, an educational application would seem to imply some form of structure to the reflective process, and to establish structure requires a greater understanding of reflection as a process within thought and the construction of knowledge. It is for this reason that models of reflection within learning may be seen as essential to the construction of reflective practices within the educational setting (Platzer et al. 1997). Bridgstock (2007) created a model of desirable graduate attributes in which she acknowledges the importance of self-management and career building skills to lifelong career management and enhanced employability. Her conceptual model

suggests that universities must begin to comprehensively and actively engage with the employability agenda, where students actively manage career building and self-management skills, through intentionally managing all aspects of their lives including learning. As the model suggests, this is achieved through reflection, evaluation and decision-making.

The knowledge skills and generic skills alone will not be sufficient for the employability skills of the current globalized economy, which is changing, competitive and demanding. Career choice has to be more diversified and adaptations to new types of jobs and new unfamiliar environments are inevitable. Therefore the current supply of work is structured around profiles or functions that— in addition to scientific–technical knowledge provided by a university degree—require developing a series of competencies and abilities that will ensure lifelong learning. In this respect, it has also been demonstrated that the speed at which graduates learn to do their jobs depends on the level and type of competencies they have acquired in their formal education.
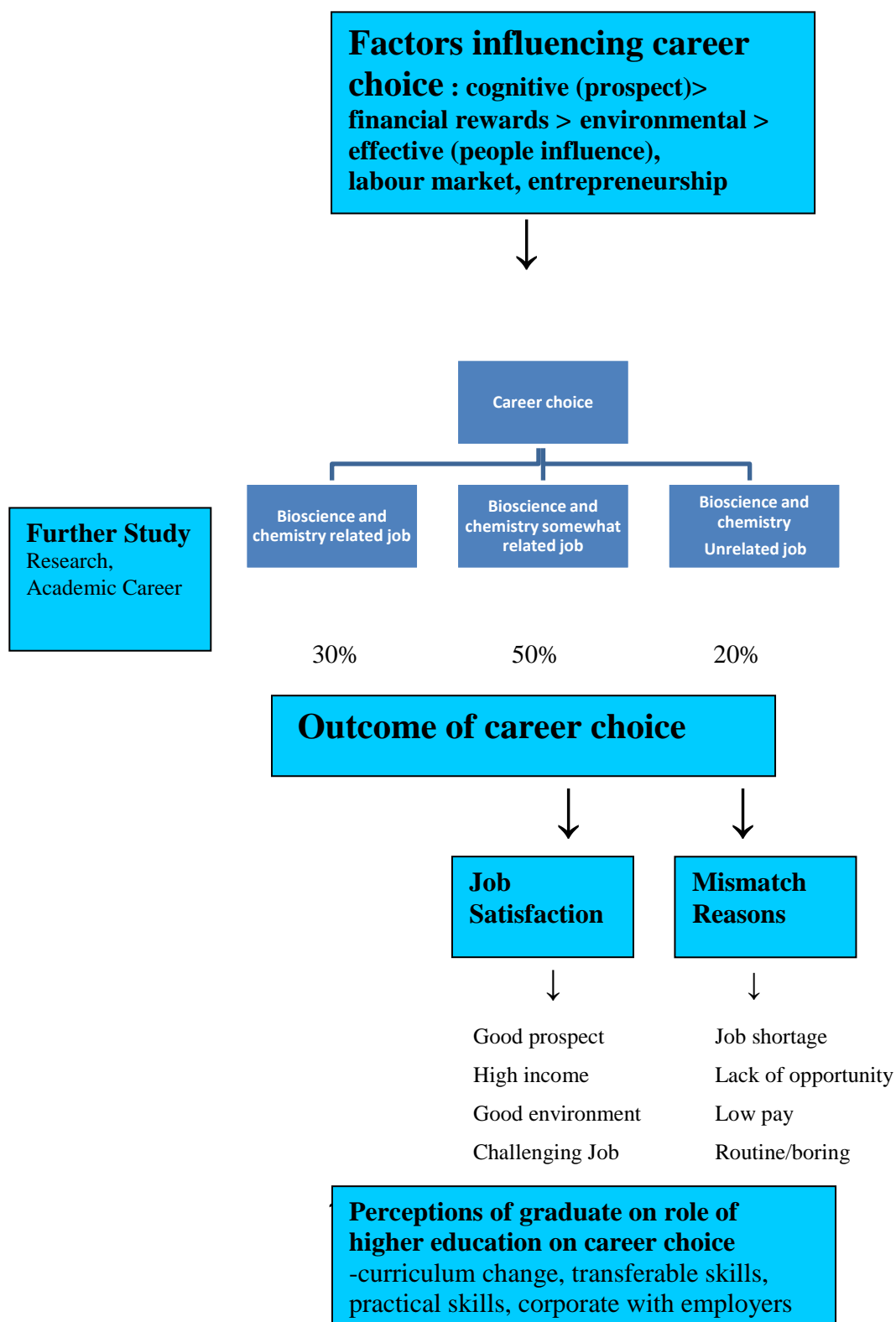
Figure 6.6: Career Choice Model of study on factors influencing career choice of Bioscience and Chemistry graduates.

6.7   Career Choice Model of study on factors influencing Career Choice of Bioscience and Chemistry graduates (Figure 6.6)

Work values are shown in this study to influence career choice. Factor analysis of the 32-item work values categorise the factors into cognitive, extrinsic (instrumental) and affective values. The case study of Bioscience and Chemistry graduates shows that their choices were influenced by the work values in the ranking as follows: Intrinsic values such as having jobs with growth prospects and which are of interest, are rated more important than financial rewards such as pay and salary.

cognitive (prospect) > financial rewards > environmental > effective (people influence)

A third of the population surveyed chose jobs related to their discipline of specialization. Half the population studied chose broadly science-related jobs. 20 % of the graduates surveyed chose jobs which were completely unrelated to their area of training. The outcome of the career choice therefore shows that subject-specific jobs might not be the priority choice of these graduates, and graduates were looking for nontraditional and innovative careers for various reasons. This career model shows that with the changing global labour market, the choice of careers for the Bioscience and Chemistry graduates was diversified. In fact they penetrated into the business commodities where greater economic growth lie. The main reasons for not choosing science jobs for this group of science graduates were as follows: job shortage, lack of opportunity, low pay, and job being routine and boring.

Good prospect and challenging jobs provided satisfaction for graduates. Besides, high income and a good working environment were also reasons for satisfaction of the graduates in their early careers. Therefore the nature of their job, good monetary return and a good superior and environment were key sources which provided satisfaction. Un-satisfaction of jobs resulted in intentions of changing jobs, planning for further studies and to become entrepreneurs.

The higher education institution has also helped the graduates to develop the core employability skills: the knowledge skills, the competencies and the generic skills which are also key factors in influencing the career choice of the graduates. Graduates perceived that industrial learning and experience enhanced integration into the work place.

Career choice is therefore complicated and influenced by the interplay of many factors: Personal work values, the environmental influence, and the knowledge and skills imparted to them by the higher learning institution.

With a broad range of careers that the Bioscience and Chemistry graduates entered, the higher education should be aware of about (1) the content of the science degree, which serves the dual purpose of catering for discipline and non- discipline graduate careers, (2) a need to break down the perception that science degrees only lead to careers related to science positions in the laboratory or the field, and (3) the image of science and science degrees in the mind of the public.

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CHAPTER SEVEN

CONCLUSION, IMPLICATION AND RECOMMENDATIONS

7.1   Introduction

The main purpose of this research is to investigate the factors that influence the career choice of the double major graduates in Bioscience and Chemistry, from a local higher learning institution. It first investigated the outcome of their career choice. Secondly it studied the factors influencing the career choice of the graduates. Thirdly the career path was investigated. Fourthly, the reasons why graduates choose careers unrelated to their major field of study were investigated, and fifthly the roles played by the higher leaning institutions to enhance the career prospects of the new graduates were studied.

This chapter consists of four sections. First, it provides a summary of major findings regarding the career choice of graduates of the double major in Bioscience and Chemistry. Second, it discusses the generalisability and limitations of this study. Thirdly it illustrates the study's theoretical and practical implications. Third, it offers recommendations for future research, for basic science graduates in their career choice, and for the higher education. This study contributes to the research in career choice of the Bioscience and Chemistry graduates, by addressing the Research Questions stated on page 16.

7.2   Summary of the Study

This study used the mixed research methods to investigate the research questions. A questionnaire was delivered to 80 graduates and 50 people responded. Eleven graduates were selected from the participants of the survey for the interviews.

The employment outcome shows that 30% of graduates surveyed were with course-related jobs, 50 % with jobs somewhat related to their curriculum and 20 % with jobs unrelated to their course of study. Various ways were used to measure curriculum-employment match. The graduates considered their programme to be broadly based and flexible. Reasons for choosing non-programme-related jobs were: being bored with routine laboratory jobs, having low salaries, being confined to the laboratory but preferring a livelier working life, and lack of job opportunities. Many graduates were involved in sales and marketing jobs.

Some graduates further their studies after working for a period, to be better equipped for other career directions. A few graduates had interest in entrepreneurship. The work values considered to be most important in influencing the graduates' career choice were opportunity for growth, having interesting jobs, having a fair and considerate boss, having job responsibility, having opportunity for skills development, being recognized and having promotion prospects. Financial rewards were ranked 14 out of 32 factors. Influences from family, lecturers were not as important. Cognitive values were considered to be more important than environmental and affective values in career choice. Generic skills perceived to be important were problem solving skills, critical thinking skills, being able to work independently and having good

communication skills. The graduates perceived that 'having jobs related to subjects learned' to be unimportant (ranked 31 out of 32 factors). The survey indicated the desire of graduates for greater involvement in industrial training and field trips, better practical skills and job seeking.

This study therefore reveals the way graduates make their career choice showing the influences of work values and employability skills. It provides future graduates an understanding of what the Bioscience and Chemistry graduates experience when making their course of study and subsequently their career choice. The emergence of more innovative careers such as those outside the bioscience and chemistry discipline, are areas of significance for the future graduates. Higher Learning Institutions should also look into the situation and incorporate ways to enhance the embedding of important skills into their curriculum so that graduates will be better prepared for the world of work.

7.3   Limitations

The findings of this study cannot be generalised, which is possibly a key limitation. The sample size of the quantitative study was considered small. This study was unable to cover the whole population of the double major graduates, as sampling was limited to fifty graduates (questionnaire) and eleven for the interviews. It was difficult to contact and get response from the graduates. Most graduates had changed their email addresses or due to their busy working life did not check their emails regularly. This study is confined to one Higher Education Institution, therefore, it cannot speak for the phenomena or situation in other tertiary institutions either locally or overseas.

This study adopted the case study approach and therefore has the following weaknesses: the case institution has its own unique characteristics and this does not allow generalizations. This problem can be solved using the suggestions of Dimmock and Donoghue (1996). They suggested that people who intend to use the information or findings from a particular case study should make sure that the information is appropriate and relevant for their own situations and characteristics. It is hoped therefore that the findings of this study may be of use for other researchers. The subjectivity of case approach also posed as a limitation. Besides it may be harder to protect the confidentiality of case studies.

Mixed methods using both quantitative and qualitative approaches were used in this study. Triangulation of data from both methods increases the reliability and validity of the study. However, "the differing quality standards — regarding truth, applicability, consistency, and neutrality — in qualitative and quantitative research are difficult to codify" as suggested by Johansson (2003, p. 11). It is commented that sometimes the qualitative data may be richer than that gained by a questionnaire, resulting in a situation where the quantitative data cannot support the qualitative data (Denzin and Lincoln, 2000).

7.4   Implications

The theoretical and practical implications of this study will be discussed.

7.4.1 Theoretical implications

Not many studies, especially using mixed methods to understand the career choice of Bioscience and Chemistry graduates in Malaysia, have been conducted. Several quantitative data on career choice are available for business undergraduates. Therefore though a small research investigation, this study may trigger interest for more extensive research to confirm the findings of this research. Western research findings are more abundant, but they may not be widely adopted in our local situations.

7.4.2 Practical implications

From the practical perspectives, the research findings can help the local institutions of higher learning to better understand the career choice of their graduates, the values they uphold and certain areas of knowledge and skills which the higher education can supply to make the graduates more "oven-baked (work-ready)" (Harvey, 1997) for their first work appointments. Educational intervention can be planned and implemented more effectively by adjusting existing policies or introducing new policies that can help the critical factors that can contribute to better prepare graduates for the diversified job markets for the bioscience and chemistry graduates. In fact the science graduates should be taught skills in sales and marketing, management, IT and the awareness of entrepreneurship intention and entrepreneur opportunity recognition (Kho, 2004). Entrepreneurship should not only be taught to business graduates, but should also be introduced to the science undergraduates. Although degree based education and training are always important to prospective employers, general and analytical skills (such as organizational skills and problem solving skills) were also

emphasized as key in the hiring process. Challenges face the educational institutions of higher learning that are redefining degree and training programmes to meet the needs of bioscience- chemistry areas. The programs need to be focused enough to meet specialized needs of the bioscience and chemistry firms, flexible enough to adapt to rapidly changing technologies, yet broad enough to capture students concentrating on a variety of disciplines (such as organization and technical writing) need to be equally emphasized.

One thing that has to be borne in mind is that inclusion of appropriate skills business management components (such as marketing) into the curriculum of the science course will also pose some challenges. There is a problem of time and space of the curriculum to allow the expected curriculum to be delivered within the crowded contents of the science syllabus. However a careful and strategic plan may overcome the demands and expectations. The higher education should have the commitment to better prepare their graduates for employment. Universities should take the initiative to upgrade outputs of their science graduates.

Close collaborations or partnerships between bioscience and chemistry firms and educational institutions may be one of the best ways to focus on developing the right mix of workforce skills for bioscience and chemistry-related employment. The industry should provide more places for industrial training of undergraduates, organize well-planned training sessions for undergraduates to exposure them to the reality of the workplace, so that they are more job-ready in a very competitive marketplace. There were incidences when students sent for industrial training were not trained or exposed but instead were doing non-related tasks, for example clerical duties.

Sometimes when graduates go for industrial training, no allowance or a very small allowance was given by the company concerned. it will be more encouraging if an appropriate allowance is given to these undergraduates who have to pay for their traveling and meal allowance each day for three months.

One of the main reasons that graduates opt for bioscience and chemistry unrelated job is that the jobs they are offered are often very routine work such as performing routine medical technologist tests or some quality control tasks. To these graduates the jobs are so routine to the point of being boring. After working for a period of time to gain experience, these graduates normally change jobs. They may take up a job in sales and marketing, which they believe will offer better salaries. Therefore industries or employers should consider the welfare of their employees, as dissatisfaction can in turn lead to low productivity and high staff turnover rate, which would not benefit the company concerned.

Malaysia's vision to become a developed nation by the year 2020 has placed science and technology as important as these are often regarded as forces behind economic development in industrialized countries (Loo et al., 1997). Students' lack of interest in science has reduced the enrolment in the sciences as compared to the art stream at higher secondary level. The proportion of enrolment is less than the expected - 60:40 percent ratio (EPU, 2006). Therefore knowledge of the factors affecting the bioscience and chemistry graduates will prove valuable information for further steps that can be taken by policy makers to in order to achieve the increase in enrolment of science undergraduates.

7.4. 3   Implications for the graduates

The findings of this research provide useful employment information for the bioscience and chemistry graduates regarding their choice of course of study, the factors influencing their career choice, their career-choice outcomes including the career paths taken. There are not many Malaysian literatures in this aspect, and the voices of the previous graduates should be valuable to them. Research using perceptions of final year undergraduates on career choice are insufficient because these graduates have not actually gone into the workplace yet and their perceptions may not be adequate.

The graduates in this study have voiced the need to improve their practical skills at higher education, to have more visits to industries and to be taught communications skills for interviews. The higher learning institution should therefore heed their suggestions. Without good practical skills pose problems to fresh graduates who are expected to know some basic skills in handling certain equipment when they start working. Higher education institution should therefore upgrade their technology and equip with more up-dated equipment and techniques. This ensures that undergraduates are exposed to up-dated science knowledge and technical skills. Besides some graduates manage to get posts as research assistants and they normally have problems because during their undergraduate course such research techniques may not have been emphasized. Similarly graduates who have decided to pursue their postgraduate course, found that they had to learn a lot of 'new' techniques themselves at work.

7.5   Recommendations

7.5.1   Recommendation for further research

First, further research might focus on the entire cohort of graduates; generating a bigger number of respondents, and also interviews should include more graduates of the last six years, instead of just recent years, with effort to analyze their career progress and how it affects career choice over time (longitudinal effects). It is important to capture the experiences and the stories of success of these graduates.

Second, further research may be done by comparing career choice of graduates from different institutions. This study is limited to one case institution, and the results may not be generalized. Research design based on more higher learning institutions will be more creditable. Further research with comparison of different science disciplines such as physics, mathematics, engineering, business studies and social science, should be conducted. The impact of gender on the influences of career choice, influences that affect different races or cultures can be investigated so that policies can be designed to accommodate for them.

Further research may also look at the perceptions of the universities, getting opinions from the academia. Employer expectations through surveys and interviews will further enhance the understanding of better career choice of graduates, and ways of making their career more satisfactory, and more relevant. Besides, such studies may provide some solutions to retain more science graduates in the technical jobs. Malaysia is a

developing country, and expertise and trained personnel in science and technology is still lacking.

The contributions of further research in this area are significant, and undergraduates can benefit from the experiences of previous graduates and can make better decisions regarding their career choice in the career-competitive world.

7.5.2   Recommendation for the graduates

The available information on graduate employment, work and utilisation can often be lopsided, biased or insufficiently scrutinised. Clearly, many suggestions that graduates should acquire general competencies, should develop better problem solving skills, critical thinking skills, should cultivate communicative skills, should work as a team, should cultivate leadership abilities, should be prepared for entrepreneurship and, last but not least, should be flexible. If we look at the wealth of suggestions made in various countries by employers, committees considering the future of higher education and education researchers analysing the connections between higher education and work, graduates are therefore expected to

— be flexible,

— be innovative and willing to contribute

— be interested in and prepared for life-long learning,

— be versatile in generic skills which cut across disciplines, example acquire

    critical thinking skills, communicative skills, team work skills,

— be willing to take on responsibilities,

— interested in entrepreneurship,

— be prepared for the internationalisation of the labour market,

— Constantly updating and developing knowledge in new technologies.

In recent years there are several obvious reasons for the increasing emphasis on general competencies, social skills and personality. Firstly, it has been assumed that specialised professional knowledge is now becoming obsolete more quickly than in the past. Secondly, a growing number of professions and of positions within entreprises and public organisations is no longer clearly 'demarcated' and are now based on knowledge coming from different disciplines. Thirdly, with the current mass access to higher education (example in Malaysia), employment problems and also the dynamic changes in the economy most likely elicit mismatches between the skills of graduates and the demands of the employment system. Therefore today's graduates must be more flexible and able to 'absorb' disappointments better and to adapt with ease to job tasks especially those which they may not have anticipated in advance.

7.5.3 Recommendation for Higher Education

Higher education may help graduates to be better and adequately prepared for the job markets by considering the following suggestions:

i) Review the curriculum of the programmes to ensure graduates are equipped with skills and knowledge required by the industry and employers. In this regard, soft skill subjects such as communication, problem-solving and language skills especially English, have been introduced. The usage of English as learning and teaching medium should also be strengthened.

ii) Double major subjects such as Bioscience and Chemistry should ensure that graduates possess broader knowledge. However, caution must be taken to prepare the curriculum that covers broad areas in a limited time of three to four years.

iii) Introduce marketing and management courses for the science graduates who are not prepared for the business world, as their training is in science and technology.

iv) Teach relevant and up-dated practical skills so that graduates can also embark on research work and be better prepared to do postgraduate studies in bioscience or chemistry. A major problem for graduates to lose interest in science-related jobs is the routine procedures associated with quality control jobs.

(iii)   Science curricula should enable undergraduates to spend time outside the higher institution in places where their specialisation can be applied. This enables students to develop an understanding of science in its societal and industrial contexts.

iii) Introduce entrepreneurship programmes to encourage graduates to be self-employed.

iv) Equip graduates with better skills in application of jobs such as writing application letters, interview skills and better communication skills.

7.6   Conclusion

The Research Questions of this study were addressed and provided data on the outcomes of the career choice of the Bioscience and Chemistry graduates. The factors influencing career choice, and reasons for their choice of non-subject related jobs were presented. The roles of higher education in enhancing the career prospects were discussed. A few contributions are worth being mentioned. First by identifying the career outcomes of graduates, and understand their perceptions on factors influencing their career choice decisions, future graduates can use them as career guides. Institutions of higher education could use them as implications to improve the curriculum and devise other steps to better prepare the graduates for the world of work. This study is especially significant in investigating the match and mismatch between employment and specializations, at a time when science graduates enrolment is declining in Malaysia.

This study used the mixed research methods to collect data to answer the research questions. As mentioned before, a richer source of data, expressed both in 'numbers' and 'words' was gathered. The quantitative study used a reliable questionnaire as the measuring instrument. The interviews unfold the inner voice of the graduates. The combination approach was unique and generated useful data to answer the research questions. This study therefore contributes to the Malaysian literature on the career choice of Bioscience and Chemistry graduates.

Questionnaire

Career Choice Survey (Questionnaire)

The purpose of this survey is to investigate the factors influencing career choice of science graduates. The survey is strictly confidential and voluntary. Participants will remain anonymous. The questionnaire is meant for a study and should not be circulated. Your participation and cooperation is very much appreciated.

Section A: Please place a tick (√) in the appropriate box.

Basic demographic information:

Age group

< 20 years	
21-23 years	
24 -27 years	
28-31Years	
> 31 years	

Gender:

Female	
Male	

Year of graduation :
Work status: Employed (   ); unemployed (   ); Further study (   )
If working, job title and main activities:

Section B: Please place a tick (√) in the appropriate box.

1. **Size of employing organization**

No of staff	
< 15	
16 to 50	
51 to 100	
101 to 150	
>150	

2. **Type of qualification**:

BSc	
MSc	
Others	

3. **Is Bioscience/Chemistry course your first option?**

Yes	
No	

4. **If not, what is your other option**? (Please tick once)

Course options	
Arts	
Business	
Engineering	
Medicine	
Dentistry	
Pharmacy	
Food Science	
Law	
Others	

5. **How do you feel about the coverage of the papers taught in preparing you for work? Would you describe as broad or specialized?**

Broad	
Specialized	

6. Can your degree be defined as 'less flexible' around a tightly organized and understood discipline or 'flexible' with room for options and electives?

Less flexible	
Flexible	

7. What is your current employment organisation (department/unit)? It can be described as …………

	Bioscience	Chemistry
Definitely bioscience/chemistry-based		
Broadly bioscience/chemistry-based		
Not bioscience/chemistry-related		

8. Is your current occupation related to your degree?

Definitely related	
Somewhat related	
Unrelated	

9. What is the extent to which your degree assisted and contributed in obtaining your current (most recent) employment.

Essential	
Contributed a great deal	
Does not contribute	

For the following questions, please place a (√) in the box which you think is most appropriate.

10. Specific usefulness and value of bioscience /chemistry degree to current employment.

	Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
	1	2	3	4	5
Scientific skills and abilities **valued**					
Scientific skills and abilities **used**					
Scientific skills and abilities **recognized**					

11. What is the extent of satisfaction with your current job?

	Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
	1	2	3	4	5
I am satisfied with my current job					

12. Do you think the following generic skills are important for your job? Please tick in the appropriate box for each skill.

	Strongly Disagree 1	Disagree 2	Somewhat Agree 3	Agree 4	Strongly Agree 5
Critical thinking skill					
IT skill					
Communication skill					
Problem solving skill					
Work as a team					
Ability to work independently					
Leadership quality					

Section C

13.   For the following factors which influence your choice of career, please place a tick in the box corresponding to the number which you think most appropriate.

   1: Unimportant;   2: Less Important   3: Somewhat important
   4: Important   5: Very important

	Un-important	Less important	Some-what important	Important	Very Important
Factors influencing career choice	1	2	3	4	5
Working conditions					
Job security against unemployment					
Pay and salary, high income					
Benefits, vacations, sick leave, insurance, etc					
Convenient work hours					
Five-day week					
Future financial prospects					
Long-term career and promotion prospects					
Self-appraisal of own personality and knowledge					
Geographic location					
Related to subjects learnt before as a student					
An interesting, meaningful job					
Enthusiasm/ commitment					
Doing work which is interesting					
Opportunity for personal growth					

Factors influencing career choice	Un-important	Less important	Some-what important	Important	Very Important
	1	2	3	4	5
Advancement and promotion					
Skill development					
Received Training					
Independence in one's work					
Influence in one's organization					
Job status					
Making a contribution to society					
Having responsibility at work					
Opportunity to interact with people					
Recognition for doing a good job					
A fair and considerate boss					
Getting feedback about one's work					
Advice from friends and family members					
Advice from lecturers					
Proud to work with a company which is large and stable					
Influence from a particular teacher/lecturer					
Type of company i.e. either private or public					

Section D

If your job does not relate to subject you have majored in, please answer the following question. (If your job is related, you are welcomed to give your opinion).

For the following factors which influence your choice of career, please place a tick in the box corresponding to the reasons which you think most appropriate.

14. What are your reasons for choosing non-subject related jobs?

	Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
Reasons	1	2	3	4	5
Shortage of suitable subject-related jobs					
Lack of opportunity					
Poor results					
Only interested to study, and not to work yet					
Low salary					
Economic and social circumstances					

Other reasons:

_____

Any other comments on how the higher education can help you in your career choice.

_____

Thank you very much for your participation.

APPENDIX B

Interview Guide

1. What was the title of the degree you obtained?
2. What is your current employment?
3. Is it broadly related or not related to Bioscience/Chemistry?
4. Is it your first or second or third job?
5. What are your job functions?
6. Why do you choose a Bioscience/Chemistry unrelated job after three years of specific training in Bioscience and Chemistry? Can you elaborate?
7. What are the factors that influence your career choice decisions?
8. How did you choose to study this programme in the first place?
9. Is this the employment which you are going to make your career in or just filling in while you find the job you want or decide the area you want to make your career in later?
10. At what points did you make the decision in your career path?
11. Think back to when you started, what did you find to be the hardest part of the job?
12. What are the career outcomes of the Bioscience/Chemistry graduates?
13. Are you satisfied with your job? Salary, working environment, etc.
14. What do you think should have been done by the higher learning institution to better guide and train you, so that you have made a better choice of your course of study, and be more appropriately prepared for your job?
15. What do you think about the role of employers?
16. Is there anything you would like to add/ Anything I haven't asked that you think might be relevant to this area?

APPENDIX C

An example of Transcriptions (A5)

Answers regarding his job as a sales representative in health products:

"A little bit relaxed, may be (use) some scientific term, sometimes you explain to doctors or you read through the journals, you (know) the terms. My colleague who studied marketing has to carry a dictionary. So they have problems. They will find it a problem. They will study before they go (to see cents). Then my case, I go there, and whenever doctors throw the question at me, at least I can try to relate it, just try, at least it is possible (and not impossible to explain)"

Q: You say previously you have tried the nutrition job, did you say it is difficult to get?

A   Quite difficult, they will consider those graduates from food industry or nutritionist, because we are chemistry and biology, we are not that specific.

Q.   Not specific? Is that what they (the employer) mentioned?

A.   They will consider them (the nutritionists) first.

Q.   They prefer you to be trained specifically?

A   So it depends on luck, then you are doing well. Not necessary depends on what you study. When you are working, you get exposed.

Q.   You study for 4 years (the science course).

A.   It is a waste.

Q.   Does it mean without experience, then can't get jobs?

A.   Definitely, most company are looking for experience.

Q   If you work for a while, do you think another job will come by?

A   For the next few years, get stable first, get financial stable first. This job offers very good pay. I am still under probation. See after probation how it goes first. Probation is 6 months. It is not easy to get another sales rep job. They give 6 months, the target is not very high, then the pay is quite good. (As for) working environment, they don't push their people, because it's a new product. They know it is difficult to sell. (They are) still getting people to familiarise (with the job).

Q   So your colleagues are pretty new(in the company)?

A.   Ya… we are still learning. I work may be because of the high pay.
(Q: Question; A: answer)

Appendix D: An example of Transcriptions and Coding

Transcriptions (participant A10)	Codes	Category
May I ask what is your first job? Ya this is formerly my first job. This is the customer care consultant in the clinical lab.	First job, clinical	Subject related mismatch
What does the job involve? Ok, what I do is only actually attend to customers, they will call (be told) the type of blood tests available, etc, maybe it's only that.	Customer, consultation	Somewhat related
So what is the background that you need? You don't need a background actually after working so long I was told by my manager, she put it as a high end job, like a nutritional job. At the end of the day it is not like that, it is more 'clerical'.	High qualification not required, Wrong impression of job, Clerical.	Over-qualify Not well informed Not happy
Related to bioscience job? It is definitely not bioscience-related. I apply for a clinical lab job, but shift work. My resume was given to another department. Work alternate Saturday. What happen is the manager call me ane with my qualification, just offered first job. But there is shift work. I cannot rely on my mother(to fetch me). After working hour, the place is quiet not very safe.	Unrelated to training Transfer department Working weekend Shift work, hours and place not safe	Working condition Family influence Inconvenient time and place Carrier choice factors (environmental, social factors)
I actually check with my friends who actually work in the lab, in other labs there are technicians, they say it's quite routine and basically you can't do what you want to do in the weekends and everything, that means your time is shift work. I thought it's not worth it. You're not going to live a life like that because of money, so I drop the idea and they offer this (consultation) job. The starting pay is RM…..	Obtain information Job routine Lack of freedom Earning not everything in life Reject job offer	

Yes it's something like that only, you don't need a qualification to do it. Pay is a bit higher than the other one (job). Then my manager told me that upon confirmation, it will be RM.., but now I'm confirmed, the salary is still low. They didn't keep promise…it's just RM…only. At this point, I think it's very insufficient because it's very hard . I want to give (money) to my mother, also I can't give so much. I want to get a car also, I cannot .Yes, I actually am looking for one that all factors…At this point the job is really routine because it doesn't (allow) your brains to think (much).	Pay is low, not enough for expenses Commitment to family Not challenging, not learning much	Financial reward low Maternal influence No Satisfaction
I have been applying for jobs, apply admin job, wasteful I think. I am capable of doing those jobs I think either a management or a postgraduate biotech master course, after all still do management besides science…..	Apply other jobs Intention to further study example business course MBA	Dissatisfaction Change of job Unrelated to science Further study

APPENDIX E: SPSS FILES

Descriptive statistics

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	30	60.0	60.0	60.0
	Male	20	40.0	40.0	100.0
	Total	50	100.0	100.0	

Qualification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bsc	49	98.0	98.0	98.0
	MSc	1	2.0	2.0	100.0
	Total	50	100.0	100.0	

Science option

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	34	68.0	68.0	68.0
	No	16	32.0	32.0	100.0
	Total	50	100.0	100.0	

Flexibility

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less flexible	18	36.0	36.0	36.0
	Flexible	32	64.0	64.0	100.0
	Total	50	100.0	100.0	

Questionnaire Question 8

Match

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Definitely related	14	28.0	30.4	30.4
	Somewhat related	23	46.0	50.0	80.4
	Unrelated	9	18.0	19.6	100.0
	Total	46	92.0	100.0	
Missing	System	4	8.0		
Total		50	100.0		

(Taking into consideration those who were not working)

Questionnaire Question 9

Use of knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Essential	12	24.0	27.3	27.3
	Contribute a great deal	21	42.0	47.7	75.0
	Does not contribute	10	20.0	22.7	97.7
	4	1	2.0	2.3	100.0
	Total	44	88.0	100.0	
Missing	System	6	12.0		
Total		50	100.0		

(Taking into consideration those not working)

Generic skills (Mean scores and standard deviations
and Cronbach's alpha)

	Mean	Std. Deviation
problem solving	4.51	.953
work independently	4.38	.898
critical thinking	4.26	.871
communication	4.23	.813
team work	4.11	.938
leadership	4.09	1.018
IT skill	3.68	.755

Reliability Statistics

Cronbach's Alpha	N of Items
.875	7

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