Generic Attributes of Australian Information Systems Graduates: an Empirical Study

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Abstract

The need to provide currency in education in terms of the qualities and skills of graduates is a continuous requirement of higher education institutions. Industry expects that graduates from courses of study at universities have the necessary skills and attributes to be able to work in the modern work environment.

The generic attribute agenda permeates all areas and sectors of education. Some of the areas of the generic attribute agenda include teaching, learning, assessment and the development of the generic attributes in students. This thesis specifically deals with a singular discipline, Information Systems, and the identification of the generic attributes applicable to this discipline. It does not attempt to enter the debate on the broader issues of how generic attributes are taught, assessed and developed in the educational sphere. The areas of teaching, learning, assessment and development of generic attributes in higher education are outside the scope of this thesis.

This thesis presents an investigation of the extent of coverage of the identified generic attributes within the unit objectives. The generic attributes required from the Information Systems (IS) industry for graduates from IS courses of study were identified and validated using an extensive three round Delphi questionnaire of academics and industry representatives. Academic participants were from several Australian universities that offer IS undergraduate courses of study. Industry representatives were from the Australian Computer Society (ACS) and the Australian Information Industry Association (AIIA) and local Australian IS industry employers that employ the graduates from the participating universities also took part in the survey. The validation process involved two surveys, one in Queensland and a second involving the other Australian states. The significant finding from this survey was that the attribute of working as part of a team in a productive and cooperative manner was rated as the most important. Other significant findings

included the high correlation between the Queensland study and the national study in terms of the relative importance of the attributes. Another important finding is that the attribute relating to discipline knowledge was rated as relatively unimportant being ranked 13th out of 29 attributes.

The extent of treatment of the attributes within a course of study was identified by means of mapping each of the unit objectives within a course of study against the generic attributes and then plotting this data on a Kiviat chart. The universities used in this study included Queensland University of Technology (QUT), Southern Cross University (SCU), Bond University and Royal Melbourne Institute of Technology(RMIT). A similar mapping was performed for the major curriculum documents IS'97 Model Curriculum and Guidelines for Undergraduate Degree Courses in Information Systems (IS'97), Information Systems-Centric Curriculum (ISCC'99) and the Australian Computer Society Core Body of Knowledge. Comparisons were then made between the curriculum documents and the courses of study in terms of the extent of treatment of the generic attributes.

Statistical analysis of the combined data from both the Queensland and Australian studies identified eight underlying factors. These included Team Communications, Information Use, Individual Competencies, IS Knowledge, Professionalism, Project Management, Professional Development and Diversity.

Team Communications** are associated with the attributes of working as part of a team, oral communications, written communications, interpersonal skills, time management and define problems. **Information Use** is associated with the attributes of: retrieval, evaluation and use of information, and sensitivity to gender customs and cultures. **Individual Competencies** are associated with the attributes of: self-motivation, ability to learn independently, reflection on strengths and weaknesses and work independently. **IS Knowledge** is associated with the attributes of: programming language ability, IS knowledge, reference discipline knowledge and technical competence. **Professionalism** is associated with the attributes of: ethics, curiosity about technology, continuous learning and intellectual development, embracing change, and professional development. **Project Management** is associated with the attributes of: analyse and evaluate solutions, understand the* *profit motive of business, knowledge of business operations and its orientation, quality of solutions and project management skills.* ***Professional Development *is associated with the attributes of: research skills and related discipline knowledge.* ***Diversity*** *is associated with the attribute of operate in a diverse environment.*

An important finding from the mapping processes were that all the documents displayed a similar coverage of the generic attributes. All the graphs showed a strong treatment of IS discipline knowledge. IS'97 showed the strongest coverage of written and oral communications as compared to the other curriculum documents or the courses of study examined.

A number of limitations were identified during the study. Some of the more important ones are:

- *This study identified a significant shortfall in the manner in which the objectives of the units of study that comprise IS courses of study at the tertiary level are written. The study found that the curriculum documents from the USA were often written with a specific number of objectives that often related to the length of the course or the number of times class was held during a week. In Australia the traditional unit has approximately 6-8 objectives. The objectives are often related to the content of the unit rather than what the student should be able to do at the end of the unit, in terms of the attributes identified by the university as being obtained by the students when they complete the course of study.*
- *The lack of direct access to the large mailing list of the industry representative body.*
- *The currency of the unit outline.*
- *The fact that many course unit outlines are written when a course of study is accredited. This means that by the time the course of study is due for re-accreditation, that a long period of time has elapsed. This time period is often five years or more. In the IS discipline this is an extremely long period for any course of study to be accredited;*
- *The emerging and constantly changing employer and IS professional desired attributes of graduates. This is a reflection of the changing nature of the IS*

environment. The fact that employers and IS professionals judge the quality of a university course based on what the graduates can actually do in the workplace;

- *There is a large difference between the percentage coverage of the model curriculum documents within the courses offered in the USA where they constitute approximately 30 percent of the total course content. In the Australian context the model curriculum coverage represents approximately 83 percent of the course content;*
- *The study used curriculum documentation and there was no validation from a student perspective of what they learnt or what generic attributes were developed in units they studied; and,*
- *The courses of study used in this research are restricted to the tertiary sector and the current educational offerings of universities in the states of Queensland, New South Wales and Victoria, in Australia. While this may represent the views of the eastern part of the country, they may not be totally representative of the offerings for the country as a whole.*

One of the most important outputs from this research has been the development of a replicable methodology for determining the extent of coverage of the generic attributes within units and courses in other disciplines. The process would be to identify the relevant curriculum documents for the discipline and the Core Body of Knowledge from the associated professional association. The generic attributes that may have a specific context within the discipline need to be validated using a similar method such as the Delphi technique. Mapping of the generic attributes would then be done and a set of similar graphs produced. This research process meets the third research objective of producing a replicable methodology for mapping the unit objectives against the generic attributes.

This study is unique in that it sought the views of both industry and academics of the required generic attribute of graduates from IS courses of study. The study then mapped the generic attributes against the unit objectives to give an indication of the extent of treatment or development during a student's course.

In an attempt to increase the response rate to the Delphi study email was used as a medium for data collection. This provided the necessary data for the identification and validation of the importance of the generic attributes in a relatively short period of time as compared to the time that a traditional Delphi study would have taken. The email medium also allowed for the easy follow up of any questions raised during the course of the questionnaires. Delphi studies may now be conducted in a relatively short time frame. This will give the researchers the ability to publish their findings more quickly than other methods of conducting studies using the Delphi method. Individually addressed email, where this was possible, enhanced the response rate and provided the researcher with added anecdotal evidence from comments made in the reply to the survey instrument.

The generic attributes need to be developed within the courses of study at the institutions examined in this study. Specifically the wording of objectives needs to reflect not only the content of the material to be covered but also the process through which the student gains that knowledge or competency.

The elicitation of the generic attributes is required as part of the unit outline and should clearly demonstrate to students what skills they will be developing within a particular unit. This information is then able to form part of the accreditation submission for institutions seeking accreditation from professional bodies such as the ACS.

From the process of gathering information for this study it became clear that the writers of the unit outlines need to have professional development in the writing of the unit objectives to address the inclusion of the generic attributes.

The identification of generic attributes needs to be continually reviewed and a follow-up study is suggested to identify any longitudinal trends that may be evolving since this study commenced in 1998. This follow-up is needed because of significant changes in society may suggest that there are new and additional attributes that are now considered to be generic skills.

The relationship between the generic attributes identified in this study and the multi-literacies (Millard Sheets Library, 2003. -http://www.otis.edu/library/infolit.htm, Accessed 12 January, 2004) that are now the focus of educators will provide the platform for a follow-up study of the generic attributes agenda.

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Supplementary Material

List of Abbreviations

Abbreviation	Full Name
ACS	Australian Computer Society
IS’97	IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems
IS’95	IS'95 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems
IRMA/DAMA	IRMA/DAMA 2000 Information Resources Management Curriculum Model: An International Curriculum Model For a 4-Year Undergraduate Program.
IFIP	International Federation of Information Processing
AIIA	Australian Information Industries Association
IS	Information Systems
ISCC’99	ISCC'99 An Information Systems-Centric Curriculum'99 Program Guidelines for Educating the Next Generation of Information Systems Specialists, in Collaboration with Industry
ICF2000	Informatics Curriculum Framework
OEIS	Organisational and End-user Information Systems
IAC	Industry Advisory Committee
DEST	Department of Education Science and Training
TAFE	Technical and Further Education
ASF	Australian Standards Framework
WWW	World Wide Web
AIS	Association for Information Systems
ACM	Association for Computing Machinery
AITP	Association for Information Technology Professionals
OSRA	Office Systems Research Association

Abbreviation	Full Name
PC	Principal Component
PAF	Principal Axis Factoring
KMO MSA	Kaiser-Meyer-Olkin Measure of Sampling Adequacy
PPR	Performance Planning and Review
SPSS	Statistical Package for the Social Sciences
APDIRSR	Asia Pacific Directory of Information Systems Researchers
SIM	Society of Information Management
CEO	Chief Executive Officer
ECDL	European Computer Driving License Standard of Competence
UCSI	Unified Classification Scheme for Informatics

Glossary

Term	Definition	Page Reference
Generic Skills	Generic attributes	2.4
Generic Attributes	Generic attributes comprise skills, competencies, attributes, capabilities and values that are transferable from the learning environment to the world of work.	2.3
Competencies	Skills transferable across disciplines, skills specific within a particular discipline, or skills that are transferable from the academic environment to the work environment (Crebert 1995)	2.4
Units	"Units of study are the basic unit of a course or program, which a student may undertake and on successful completion of the unit's requirements, gain credit towards completion of the course or program. Units of study are sometimes referred to as 'units', or 'subjects'" (Commonwealth Department of Education Science and Training 2002, DESTpac 2002)	1.2
Courses of Study	"A course is a program of study formally approved/accredited by the institution or any other relevant accreditation authority and which leads to an academic award granted by the institution or which qualifies a student to enter a course at a level higher than a bachelor's degree. It includes courses of an equivalent nature undertaken overseas" (Commonwealth Department of Education Science and Training 2002, DESTpac 2002)	1.3
Degree Programs	A course in a specific discipline.	1.3
Coverage	The number of times a generic attribute is mentioned as being developed as part of the unit objective statement.	3.20
Extent of Treatment	The amount of treatment that a specific generic attribute receives within a course or a curriculum document.	3.24
Underlying Factor	A subset of generic attributes that are identified from the data by a process of factor analysis.	4.17
Generic Attribute Objective	An objective that develops a generic attribute.	5.7
IT20	Bachelor of Information Technology Degree at QUT	5.26
IT21	Bachelor of Information Technology Degree at QUT	5.35

Statement of Original Authorship:

The work contained in this thesis has not been previously submitted for a degree or diploma at any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signed:

Date: 1 March 2004

Acknowledgements

I embarked on this study of generic skills and competencies in the mid 1980s, when as a curriculum developer for the Queensland Technical and Further Education system I was part of a small team of teachers charged with rewriting an Information Technology course that would be competency based and relevant to both employers and students alike. I would like to thank Dr James J White for his support and enthusiastic encouragement at this time.

There are many personal and professional rewards for researchers who undertake a PhD. These far outweigh the many difficult times that all researchers experience during an extended period of study. The path to the completion of this study was often a lonely and individual endeavour. I drew encouragement and assistance from many people. My principal supervisor, Associate Professor Alan Underwood, was foremost among these people. His scholarship and practical view of reality have guided me through this research. With his guidance and support I was able to present my findings at a large number of international conferences that as a part time student I otherwise would not have been able to attend.

Associate Professor Christine Bruce, my associate supervisor, gave me invaluable support and guidance throughout my studies. Her breadth of knowledge and practical experience in the process of completing a doctorate were invaluable to me along this journey. I would like to thank Professor Bruce Lo for the long hours spent in the early phases of the study. His guidance and advice helped me gain a richer understanding of the problems associated with developing curricula that meet industry needs.

I would like to thank the Australian Information Industries Association (AIIA) and the Australian Computer Society for their support for this study. Without their support the industry perspective would not have been available.

To the staff at Central Queensland University (CQU) Bundaberg campus and the staff and fellow students of the Information Systems Management Research

Concentration at Queensland University of Technology who supported me in this research project – thank you.

This research would not have been possible without the support of the many hundreds of Information Systems (IS) professionals who responded to the three rounds of the Delphi study, which formed part of this project.

I would like to thank my parents, Professor Emeritus Martin Snoke and Nan Snoke for their constant support and understanding over the years of this study.

Finally, sincere thanks to my wife, Miriam, without her support I would never have been able to complete this thesis. To my son, Martin, who has only known a father who has been studying and my daughter, Louisa, I offer this work as a token of what is achievable.

Robert Lee Snoke
March 2004

Dedication

To my wife Miriam, my son, Martin and my daughter, Louisa Snoke
In appreciation of time lost spent with you.

Chapter 1

Introduction

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Abstract

This chapter introduces the whole study. It describes the rationale and motivation for completing the study. It presents the research methodology. The outputs from the Delphi studies conducted along with the mapping of the generic attributes against the unit objectives of the courses of study from participating universities are described. Data used in this study was obtained from the course accreditation documentation from participating universities, the Australian Computer Society (ACS) Core Body of Knowledge and the major curriculum documents IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems (Davis, Gorgone, Couger, Feinstein, & Longenecker, 1997), ISCC'99 An Information Systems-Centric Curriculum'99 Program Guidelines for Educating the Next Generation of Information Systems Specialists, in Collaboration with Industry (Lidtke, Stokes, Haines, & Mulder, 1999), Informatics Curriculum Framework 2000 for Higher Education (Mulder & vanWeert, 2000) and the Organisational and End-user Information Systems Model Curriculum (O'Connor, 1996)..

Outputs from the study (to January 2004) include nine refereed conference publications, one journal article and one book chapter. Two additional manuscripts have been submitted for publication.

1 Background

This chapter introduces the whole study. It states the problem to be investigated and describes the rationale and motivation for completing the study. It presents the research methodology including the research objectives and associated hypothesis. Publications from the study, limitations of the study and an outline of this thesis including a general overview of each of the succeeding chapters are presented.

This study provides a means of identifying and gaining a richer understanding of specific courses of study in IS in terms of how well they meet the needs of the industry that employs these graduates. The study examines unit objectives of

Information Systems (IS) courses and the incidence of coverage of the generic attributes required of the graduates of tertiary courses of study with IS majors. Two aspects of the generic attributes agenda are addressed. First, the identification and validation of the relative importance of specific attributes from both an industry and academic perspective and second, the amount of coverage that each of the identified attributes receives within the tertiary courses of study.

The outputs from the Delphi studies conducted, along with the mapping of the generic attributes against the unit objectives of the courses of study, are described. Data used in this study was obtained from the following sources:

- Course accreditation documentation from participating universities;
- Australian Computer Society (ACS) Core Body of Knowledge;
- IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems (Davis et al., 1997);
- ISCC'99 An Information Systems-Centric Curriculum'99 Program Guidelines for Educating the Next Generation of Information Systems Specialists, in Collaboration with Industry (Lidtke et al., 1999);
- Informatics Curriculum Framework 2000 for Higher Education (Mulder & vanWeert, 2000); and,
- Organisational and End-user Information Systems Model Curriculum (O'Connor, 1996).

The methodology presented as part of this thesis can be replicated in other disciplines. The replicable nature of the methodology defines the importance of this study.

A tertiary program of study in the Australian context is defined as a course. The Commonwealth Department of Education Science and Training (DEST) define units of study and courses as follows:

> "Units of study are the basic unit of a course or program, which a student may undertake and on successful completion of the unit's requirements,

> gain credit towards completion of the **course** or program. Units of study are sometimes referred to as ‘units’, or ‘subjects’” (Commonwealth Department of Education Science and Training, 2002, DESTpac 2002).
>
> “A course is a program of study formally approved/accredited by the institution or any other relevant accreditation authority and which leads to an academic award granted by the institution or which qualifies a student to enter a course at a level higher than a bachelor's degree. It includes courses of an equivalent nature undertaken overseas” (Commonwealth Department of Education Science and Training, 2002, DESTpac 2002).

Courses consist of a number of units of study, which may be of one or two semester’s duration. A semester in the Australian context is usually a term of 13 weeks of lectures followed by an examination period. Units examined in this thesis in the Australian context have duration of 14 weeks. The course duration in the USA varies by institution with a common length of between 12 weeks, if the institution operates on a quarter basis, up to 18 weeks, if the institution operates on a semester basis. Five of the major curriculum documents examined in this thesis have their origin and focus in the USA. These curriculum documents are important in the Australian context, as they are the basis of the course content at Australian universities.

In the past, tertiary education institutions responded to changing industry skill requirements by a process of consultation with local industry representatives at the time of accreditation of the courses of study or the introduction of new courses of study. This process of consultation often involved the use of surveys, analysis of job advertisements in the local and national newspapers and discipline reports.

Some institutions form Industry Advisory Committees (IAC). These advisory committees often consist of representatives of industry and businesses that employ the graduates of the course and representative academics. This consultative process usually takes place in a five-year cycle when the courses of study are required to be reaccredited by the Commonwealth Department of Education Science and Training (DEST).

The length of the course must also be added to the time frame when considering the impact of a changing IS environment. This often means that a course which allows students in a full time mode of study four years to complete, when added to the five years from its inception, may result in a graduate finishing a decade after the course commenced. In today's society with its ever-changing technologies, this means that graduates may be totally unsuited to the work environment for which they originally studied.

Some of the basic skills of graduates, identified during the consultation process, may be considered out of date by the time the first graduates complete their course of study. The time frame from the identification of desired skills in the early course development process until the first graduates of the course are ready to seek employment is approximately four to six years. This lengthy period of time causes many of the graduates to be unsuited to the current industry requirements of employers due to their lack of current industry skills.

To alleviate the above problem the present system of accreditation is one of continual redesign with no required formal input from external bodies. The universities are responsible for the design of their own curriculum.

1.1 Statement of the Problem

The aim of the study was to identify the extent of treatment of the generic attributes within courses of study and the major curriculum documents. This evolved into a research study investigating the incidence of treatment of the generic attributes. It was noted that there was a wide difference in the terminology used to describe the incidence of treatment of the generic attributes. The study evolved from examining the depth of treatment of the generic attributes within courses of study to the incidence of treatment of the generic attributes due to the wide difference in interpretation of the objectives of the units of study.

In this thesis, the term tertiary sector will mean the university level of providers of post-compulsory education courses of study, as distinct from the Technical and Further Education (TAFE) sector.

In 2002 the Australian Minister for Education, Science and Training, The Hon Brendan Nelson, MP issued a number of discussion papers relating to teaching and learning in the tertiary sector. These papers were issued as discussion papers leading to some reforms in the higher education sector. In his first paper Nelson identifies the need for curriculum change to meet the needs of the student (Nelson, 2002a). In his second paper Nelson identifies one of the terms of reference driving the current set of educational changes as requiring "institutions to provide sufficient numbers of appropriately qualified graduates to meet the demands of industry" (Nelson, 2002b, p 1).

The research presented here partially addresses the question of the amount of coverage of the generic attributes within the curriculum that are valued or required by industry and academics of graduates of IS courses.

This study presents a technique for identifying the incidence of coverage of the generic attributes of IS graduates desired by industry with a course of study unit objectives. An outcome of the research is that the application of the methodology may provide industry with more suitable entry-level employees.

This research does not address the questions relating to the assessment of the generic attributes. This topic will form the basis of further research.

1.2 Hypothesis

The research hypothesis for this thesis is:

- Tertiary IS courses of study do not meet IS industry needs.

Educational courses of study, as stated in their objectives, do not meet the IS industry and academic requirements in relation to generic attributes.

1.3 Research Objectives

Based on the above research hypothesis the following specific objectives for the research have been formulated:

1. Identify the generic attributes required of the entry level IS graduate employee;
2. Analyse the offerings of the education providers; and,
3. Develop a replicable methodology for mapping the unit objectives against the identified generic attributes.

The research involved a number of studies to identify and validate the generic attributes. This was then followed by the association of the generic attributes with the objectives of the units within the courses of study.

1.4 Research Process

The research was conducted as a number of sub-studies. These included studies of the following:

1. Queensland study of the generic attributes of IS graduates;
2. Australian study of the generic attributes of the IS graduate;
3. Identification of the key words from the unit objectives of the units offered within a course of study with an Information Systems (IS) major; and,
4. Mapping of the generic attributes against the unit objectives.

In the first two phases of the study, a three round Delphi study of industry and academics was undertaken to identify and rate the importance of the generic attributes. In the third phase of the study keywords from both the textbooks used in the units and keywords from the objectives of the unit outlines were listed. These lists became the vehicle for comparison of the generic attributes against the unit objectives.

The last phase of the study involved a simple count of the number of times that a generic attribute was mentioned in the objectives of the unit outlines within a course of study. The data was represented on a Kiviat chart for each of the courses of study. A comparison line graph was used to compare the courses of study, the major IS curriculum documents and the ACS Core Body of Knowledge.

1.5 Significance of the Study

The theoretical significance of the study is the development of a replicable methodology of interest and use beyond the IS discipline. The methodology of mapping the generic attributes against the unit objectives is applicable to any discipline. Prior to the mapping process the discipline will need to identify the generic attributes as applicable to their discipline.

1.5.1 Significance to Academics

The study will enhance the ability of academics to provide programs of study that meet the needs of the professional associations and the local IS industry. The study produced a replicable methodology, which will enable education and training providers to determine the coverage of the generic attributes of graduates within a course of study. The application of the methodology by education and training providers will help them identify when and if a course of study requires redesign as distinct from re-accreditation.

1.5.2 Significance to Industry

The significance of the study to the IS industry is that new employees will possess the identified generic skills or attributes required of entry-level employees. The application of the methodology will provide industry with a list of the current generic attributes and their relative importance.

1.5.3 Significance to Student

Students completing courses of study at institutions that have adopted and applied the methodology outlined in this research will be assured that they have the current generic attributes required by employers.

1.5.4 Significance to Professional Associations

Professional associations, such as the Australian Computer Society, define attributes of professionals within their industry. The identification of the generic attributes for graduates from a specific course of study will aid the applicant in meeting the membership requirements of the ACS.

1.6 Limitations of the Study

The courses of study used in this research are restricted to the tertiary sector and the current educational offerings of universities in the states of Queensland, New South Wales and Victoria, in Australia. While this may represent the views of the eastern part of the country, they may not be totally representative of the offerings for the country as a whole.

In terms of the Australian Standards Framework (ASF) levels for higher education the university, degree courses of study equate to levels 7-8 of the framework. Data about the courses of study was taken from the most recently available information as supplied by the institutions offering undergraduate courses of study in Information Systems. A significant problem was encountered in the quality and variety of information provided by the institutions. Many changes were noted in the information provided from the World Wide Web (WWW) in terms of what was currently being taught as compared with the information supplied to the Australian Computer Society (ACS) when the courses were accredited, even though this was a very short time frame of less than two years.

Lack of access to industry email lists restricted the number of industry participants. This was caused by the fact that email questionnaires were sent only once and reminder notices could not be sent. In addition, a feature of the research methodology was that each of the emails was individually addressed. With the lack of access to the email lists, this was not possible. Further discussion of this will be done in Chapter 3 on Research Methodology.

The unit outlines were written by a diverse group of individuals, some of whom did not teach the units for which they were responsible for writing the unit outlines. This is a significant limitation because the writer may not have had a clear understanding of the focus, intent and depth of treatment of the knowledge to be developed in the unit.

The fact that many course unit outlines are written when a course of study is accredited. This means that by the time the course of study is due for re-accreditation that a long period of time has elapsed. This time period is often five years or more. In the IS discipline this is an extremely long period for any course of study to be accredited.

The emerging and constantly changing employer and IS professional desired attributes of graduates. This is a reflection of the changing nature of the IS environment. The fact that employers and IS professionals judge the quality of a university course based on what the graduates can actually do in the workplace.

The generic attributes as defined in this study are developed and enhanced during the lifelong learning process that most individuals go through. The curriculum documents contain specific statements of learning objectives for a particular period. One of the difficulties in comparing the curriculum documents to the stated learning objectives of the units of study is that we would not be comparing similar items.

The absence of detailed demographic data from the respondents as this may indicate significant differences in the data. For example, Chief Executive Officers (CEO) may have quite a different view of the essential attributes than the Human Resource (HR) person or other individuals within an organization.

The study used curriculum documentation and there was no validation from a student perspective of what they learnt or what generic attributes were developed in units they studied.

The curriculum documents used in this study originate from the United States of America (USA). In the USA the curriculum documents used in this study account for approximately 30 percent of a course of study. The curriculum documents define only the discipline specific knowledge to be acquired by the student within a broad four year course. The expectation of curriculum writers in the USA is that some of the more generalised attributes will be developed in the other 70 percent of the degree. In the Australian context, the documentation of the Australian Computer Society (ACS) and the unit outlines account for approximately 83 percent of the course.

1.7 **Use of Previously Published Research Papers**

The QUT PhD rule six (Queensland University of Technology, 2002) stipulates the following conditions for including previously published material in the thesis:

> *"Original work by the candidate arising from the research reported in the thesis and which has been published prior to the submission of the thesis may be included. Such inclusion may be either by way of elaboration or explication of the previously published work, or by verbatim inclusion of published work either in appendices or as part of the main text."*

I have chosen to include material from research papers previously published in the proceedings of conferences, journal articles, and chapters in texts. In the cases of the conference proceedings all of the conferences are international, refereed conferences, with at least two referees. Additional publications arising from the research include a journal article and a chapter in a text. A summary of the papers and the chapters that draw on them is provided in the following section.

The papers are not reproduced verbatim. Instead, they are re-worked so that the thesis maintains its structural integrity. Rather than detracting, I would argue that the use of the material from these papers, produced out of the PhD work, strengthens the thesis. This is founded on the basis that each of the papers has been examined, and found worthy, by referees associated with these prestigious conferences where paper acceptance rates are generally no higher than about 50 percent while some of the conference acceptance rates have been only 35 percent.

1.8 Publications Arising from the Research

The following is a list of publications arising from the research and the chapters that draw on them.

Snoke, R. (1996). *A Technique for Mapping Tertiary Information Systems Education and Training onto Current and Predicted Industry Needs* (Paper presented at the 7th Australasian Conference on Information Systems). Hobart: University of Tasmania. (Chapter Three)

Snoke, R., & Underwood, A. (1998a, 4 - 6 June, 1998). *Generic Attributes of IS Graduates - An Australian Study.* Paper presented at the European Conference on Information Systems, AIX, France. (Chapter Three and Chapter Four)

Snoke, R., & Underwood, A. (1998b, 30 September - 2 October 1998). *Generic Attributes of IS Graduates - A Queensland Study.* Paper presented at the Australasian Conference on Information Systems, University of New South Wales, Sydney, New South Wales. (Chapter Three and Chapter Four)

Snoke, R., & Underwood, A. (1999, 1 - 3 December 1999). *Generic Attributes of IS Graduates - an Australian IS Academic Study.* Paper presented at the 10th Australasian Conference on Information Systems, Victoria University of Wellington. (Chapter Three and Chapter Four)

Snoke, R., & Underwood, A. (2000, 2-3 June, 2000). *Generic Attributes of IS Graduates - A Comparison of Australian Industry and Academic Views.* Paper presented at the Fourth Pacific Asia Conference on Information Systems, Hong Kong University of Science and Technology. (Chapter Three and Chapter Four)

Snoke, R., & Underwood, A. (2001a, 27-29 June, 2001). *An Australian Industry View of the Generic Attributes of IS Graduates.* Paper presented at the 9th European Conference on Information Systems, Bled, Slovenia. (Chapter Three and Chapter Four)

Snoke, R., & Underwood, A. (2001b). Generic Attributes of IS Graduates - A Comparison of Australian Industry and Academic Views. *Journal of Global Information Management, Vol 9* (No 2), 33-40. (Chapter Three and Chapter Four)

Snoke, R., & Underwood, A. (2002a). Generic Attributes of IS Graduates - An Analysis of Australian Views. In F. Tan (Ed.), *Advanced Topics in Global Information Management*. London: Idea Group Publishing. (Chapter Three and Chapter Four)

Snoke, R., Underwood, A., & Bruce, C. (2002b, 7 - 10 July, 2002). *An Australian View of Generic Attributes Coverage in Undergraduate Programs of Study: An Information Systems Case Study.* Paper presented at the 2002 Annual International Conference of the Higher Education Research and Development Society of Australasia, Edith Cowan University. (Chapter Three and Chapter Five)

Snoke, R., & Underwood, A. (2002c, 9 - 11 August). *IS Curriculum Evaluation for Core Capabilities: A Methodology for Determining the Coverage.* Paper presented at the Americas Conference on Information Systems 2002, Dallas. (Chapter Three and Chapter Five)

Snoke, R., & Underwood, A. (2002d, 2-4 September). *IS Curriculum Evaluation for Core Capabilities: A Comparison of IS'97 and the Australian Computer Society Core Body of Knowledge.* Paper presented at the Pacific Asia Conference on Information Systems, Tokyo. (Chapter Three and Chapter Five)

Snoke, R. (2003, 6-9 July). *An Australian view of generic attributes coverage in undergraduate programs of study: an information systems case study of a regional and a capital city university.* Paper presented at the 2003 Annual International Conference of the Higher Education Research and Development Society of Australasia, Canterbury University. (Chapter Three and Chapter Five)

1.9 Manuscripts Submitted for Publication Arising from the Research

The following manuscripts have been submitted for publication.

Snoke, R., & Underwood, A. (2004) Generic Attributes of Faculty of Information Technology - Information Systems Graduates. Manuscript submitted for publication. (Chapter 3 and Chapter 5)

Snoke, R., & Underwood, A. (2004) An Australian View of Generic Attributes Coverage in Undergraduate Programs of Study: A QUT FIT Case Study. Manuscript submitted for publication. (Chapter Three and Chapter Five)

1.10 Structure of Thesis

Chapter Two presents a systematic review of the current literature that underpins the study in a contemporary context and is classified into relevant categories. Specific reference is made to the major curriculum documents relating to the information systems discipline. These include:

- IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems (Davis et al., 1997);
- ISCC'99 An Information Systems-Centric Curriculum'99 Program Guidelines for Educating the Next Generation of Information Systems Specialists, in Collaboration with Industry (Lidtke et al., 1999);
- Informatics Curriculum Framework 2000 for Higher Education (Mulder & vanWeert, 2000); and,
- Organisational and End-user Information Systems Model Curriculum (O'Connor, 1996).

Also presented in this chapter is the literature relating to the terminology that defines the concept of generic attributes and its relationship to the concept of competence and competency.

The research methodology of the study is presented and compared with previous studies using a similar methodology in Chapter Three.

A two part survey of industry and academics was conducted to identify and validate the desired attributes of IS graduates. The first survey was conducted in Queensland, Australia and the second was conducted, as a national study of all the universities that offer IS courses of study. The first phase of the research methodology is used to meet the first research objective of identifying the generic attributes of entry-level employees.

The second phase of the research method involved the identification of a set of key words from texts used in the different units offered within the course of study. The second phase of the research methodology met the second research objective of analysing the offerings of eduction providers.

The third and final stage involved the mapping of the unit objectives against the identified generic attributes to give a relative strength of treatment of each of the attributes. The results were tabulated and graphed. Statistics were calculated and factor analysis performed on the data. A worked example of the mapping process and the output from the research methodology is included. This last phase of the research methodology met the third research objective of developing a replicable methodology for mapping the objectives against the identified generic attributes.

Chapter Four contains an analysis and discussion of current and perceived industry skill requirements. The key findings are presented of the Queensland Study and Australian studies that identified and ranked generic attributes of graduates of undergraduate degree courses with majors in Information Systems (IS). Results of the statistical analysis including factor analysis of the generic attributes as identified by both industry representatives and academics in Australia are included.

Major findings of the pilot study include use of email as a medium for the conducting of Delphi studies and the expansion of the rating scale from a five point Likert-type scale to a seven point Likert-type scale. Major findings of the Queensland study and the Australian study include the rating, by both industry and academics, of the attributes of information retrieval, team work, self-motivation, continued learning, intellectual development and the development of critical, reflective and creative thinking, problem definition and analysis and evaluation of various solutions, along with written and oral communications as more important than a comprehensive knowledge of IS. There is a strong correlation between the Queensland study and the Australian study.

Chapter Five describes the outcome of the process of mapping the generic attributes against the unit objectives for the courses of study involved in this project. Also included in this chapter are mappings of the major curriculum documents in the IS community including IS'97, ISCC'99, and the ACS Core Body of Knowledge against the generic attributes identified in earlier chapters. This chapter is an example of the application of the methodology as it relates to the third research objective.

The major findings of these mappings are that the curriculum offered at the universities studied offers little development of the generic attributes identified as important by both industry and academics. The curriculum documents, the ACS Core Body of Knowledge and the courses of study at the four universities that formed this study showed a similar pattern in the treatment of the generic attributes.

The curriculum documents offer only a slightly better coverage of the generic attributes.

There are a significant number of the generic attributes that receive little or no coverage within university courses of study. The major curriculum documents offer only very limited coverage of these same attributes, as listed below:

- Ability to participate in continued learning and intellectual development and develop critical, reflective and creative thinking;
- Time management skills;
- Business operations, structure and orientation;
- Understand the profit motive of business;
- Ability to reflect on own strengths and weaknesses;
- Confidence about their ability to learn independently;
- Self-motivation;
- Work independently;
- Sensitivity to differences in gender, culture and customs;
- Possess a sense of basic curiosity about technology;
- Research skills;
- Participate in on-going professional development;
- Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology;
- Interpersonal skills; and,
- Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment.

Chapter Six presents the conclusion of the study. This chapter also discusses the limitations of the study as well as directions for further research. The major outcome from the research is the use of email as a medium for conducting a Delphi study.

Comparisons are made between the major IS curriculum documents IS'97 and ISCC'99. These documents showed a similar pattern of treatment of the attributes. The attribute of IS discipline knowledge was given the greatest treatment with written communications and oral communications skills also receiving significantly higher coverage than all the other attributes.

The ACS Core Body of Knowledge was also examined. It may be viewed as the core or minimal set of knowledge an institution is required to provide to gain accreditation from the Australian Computer Society. This, as expected, showed a treatment of the attributes less than that of the two major curriculum documents for most of the generic attributes.

The four universities examined in this study showed a similar pattern to the coverage of the generic attributes to the curriculum documents, IS'97 and ISCC'99, and the ACS Core Body of Knowledge. The lack of coverage of a large number of the attributes was noted across all five courses of study examined from the four institutions.

The generic attributes are the qualities that students should be developing during the course of study of their studies at the tertiary level. An important outcome from this study is the need for the unit writers to be explicit in their writing of the unit objectives to include the coverage of the generic attributes. This conclusion supports the research hypothesis that

- Tertiary IS programs of study do not meet IS industry needs.

What has become evident in the conduct of this study is the lack of a clear understanding of the need to include specific detail within unit objectives in relation to the generic attributes agenda.

The diagram in Figure 1.1 presents the research plan across the bottom of the diagram. The chapters of the thesis are shown above the research plan. This allows the reader to easily relate the content of each chapter to the different phases of the research plan. The diagram in Figure 1.1 identifies the position of the current chapter in blue. Chapter Two in green on the diagram in Figure 1.1 will present a systematic review of the literature relating to the research.

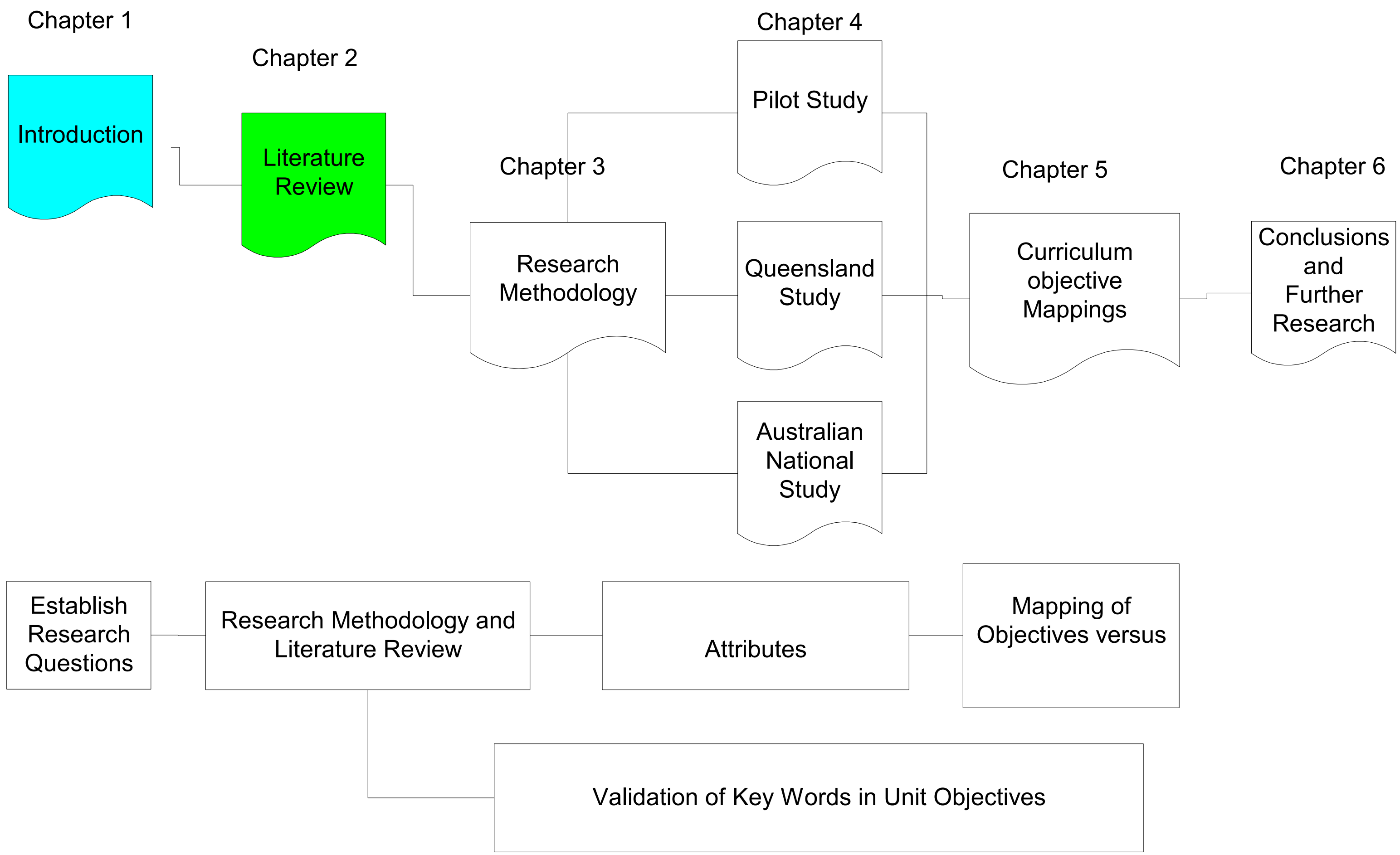

Figure 1.1
Diagrammatic View of the Thesis and Research Plan

Chapter 2

Literature Review

List of Figures

List of Tables

Abstract

This chapter presents a systematic review of important literature in relation to the topics of generic attributes, the major curriculum documents currently available (IS'95, IS'97, ISCC'99, ICF2000 and OEIS model curricula) and previous literature of similar studies conducted over a decade ago. The different curriculum development methodologies are discussed as they apply to the major Information Systems (IS) curriculum documents. The generic attributes were defined initially from a working party paper at the Queensland University of Technology in 1995 (Crebert, 1995).

The chapter is divided into three sections. The first defines and discusses the generic attributes agenda. The second reviews the related research to the topic and the third presents the literature related to the methodology of the study.

The results of the systematic review of literature have identified the key elements required for inclusion in curricula from around the world to enable the development of the generic attributes in IS graduates.

2 Introduction

As we move into the new millennium, the world, as we knew it even five years ago, is rapidly changing. Values and business processes are also rapidly changing. Westfall (2001) states that as the technology of the Information Systems (IS) discipline is rapidly changing the curriculum associated with the discipline must also change rapidly. Phukan (2001) suggests that educational institutions are attempting to keep up with the rapidly changing business environment by changing their curriculum to meet the needs of the world we live in. He suggests that some of the changes may not be in the most appropriate direction. Phukan concludes that

> "Managing information and its associated technology on a global scale is likely to be a complex process that will need IS personnel with special skills and attributes.

> Educators and businesses are going to have to cooperate on the creation of these individuals; neither can achieve the desired results on their own.
>
> Assuming that education is the preliminary step in this process, curriculum changes will be necessary and resources must be made available to bring about these changes." (Phukan, 2001, p 413)

The 2002 Australian Minister for Education, Science and Training, The Hon Brendan Nelson, MP (2002a) in a series of papers on the review of higher education, states that the higher education system needs to be reformed to ensure that graduates meet the needs of the industry that employs them. Nelson specifically identifies the need for curriculum change when he states:

> "We need a system that produces graduates who can think critically and have adaptable skill sets as well as technical expertise. In many ways, that will require significant transformation of approaches to curriculum and pedagogy to stimulate and stretch students and accommodate their varying needs" (Nelson, 2002a, para 68).

Nelson (2002a) further stresses the need to express the educational outcomes from a program of study in terms of the generic attributes of the graduate. Institutions offering courses of study need to be able to assess the generic attributes. The issue of assessment of generic attributes is beyond the scope of this thesis.

The above statements support the redefinition of IS curricula to incorporate more generic attributes, skills, knowledge, knowledge use, and technological capabilities demanded by employers of graduates from the IS courses of study in the coming years. These are the areas that the above statement is inferring are currently not covered in the context of the current IS curricula. The next section will discuss the term "***attribute***" and its various meanings and synonyms.

The Generic Skills in the Undergraduate Study Teaching, Reflection and Collaboration network (GENIUS TRAC) group at QUT spent three years defining the attributes or generic competencies that a graduate should possess at the completion of a degree course of study. The GENIUS TRAC group adopted the definition that generic attributes comprise skills, competencies, attributes, capabilities and values that are transferable from the learning environment to the world of work. This fundamentally embraces the concept of lifelong learning.

2.1 **The Emerging Generic Attribute Agenda**

Many words and phrases are used to describe and define the concept of competency of an individual at the end of a course of study. Each author of a text, article or curriculum document has their own concept or definition of the word competency and of the relationship between the words used to define or describe competency. This section attempts to resolve some of the issues associated with the emerging generic attributes agenda as reflected in the different terminology used.

The term competency is interpreted in each part of the tertiary sector as having a vastly different meaning. Therefore, the following definitions are provided as a starting point for the discussion about what constitutes competency. These definitions help resolve, for the purposes of this study, the different terms used in the major IS curriculum documents from around the world.

The term "competency based education" is used in the Australian Technical and Further Education (TAFE) context to relate to the successful, unsuccessful or not able to be successful, result that a student obtains while participating in an examination process. The Australian Standards Framework (ASF) (Young, 2001) has defined 12 levels of qualifications at each level of competency. These range from the Secondary school completion of 12 years of education through to the completion of a PhD. At the TAFE level of education the awards are at levels one through six. These levels are Certificates, Levels 1-5, Diplomas, Level 6, and Advanced Diplomas, Level 7.

At the university level, the Bachelor Degree is Level 8, Graduate Certificate is Level 9, Graduate Diploma is Level 10, Masters degree is Level 11, PhD is Level 12. All of the qualifications attempt in some manner to develop the attributes of the graduate to a level of mastery commensurate with the qualification they are studying.

Crebert (1995) suggests that generic competencies may be defined as skills transferable across disciplines, skills specific within a particular discipline, or skills that are transferable from the academic environment to the work environment. Within the university sector the term "competency based outcome" may be defined as a core or generic set of skills, knowledge, understanding, attitudes or abilities that are essential to developing a successful career in a particular discipline. The term "capability" is a relatively new term that has currency in the generic attribute agenda. Capability implies the potential to be able to possess a particular skill as distinct from having currency in the skill (Snoke, 1997). This is in line with Crebert's (1995) third aspect of generic competencies. By 2001 the term "generic attributes" had been replaced by "generic capabilities" at QUT (Queensland University of Technology, 2001).

The implementation of competency based education results in students receiving graded results in a specific unit. It does not specify particular tasks that the student is capable of performing nor the standard to which they are performed. One of the objectives of this study is to resolve these differences in definitions. In the previous discussion, it is noted that there was a shift from the concept of generic skills, which implied a statement of what a person has previously performed, to the concept of what they might be able to do in the future. The later concept has evolved from the use of the term generic capabilities, which stresses the potential that a person possesses rather than what they have previously accomplished.

The list of attributes identified by Crebert (1995) are listed in Table 2.1. This list forms the basis of the development of a much richer list of attributes as used in this study.

Table 2.1

Queensland University of Technology Generic Attributes

Knowledge/problem-solving	
	Possess coherent, extensive, theoretical and practical knowledge in at least one discipline area
	Be able to retrieve, evaluate and use relevant information
	Be able to use current technologies to advance their own learning
	Be able to define and solve problems in at least one discipline area
	Be equipped for lifelong learning, intellectual development and critically reflective and creative thinking
	Be able to adapt to an unfamiliar culture and operate in a socially and culturally diverse environment
	Possess effective written and oral communication skills
	Know how to manage time and prioritise activities
	Be aware of their own strengths and limitations
Ethical/attitudinal	
	Possess a sense of community and professional responsibility
	Value and promote truth, accuracy, honesty, accountability and ethical standards
	Be confident about their ability to learn independently and interdependently
	Desire continued intellectual development
	Be willing to deal with ambiguity and initiate and participate in change as appropriate
	Appreciate differences in gender, culture and customs
Social/relational	
	Be able to work independently
	Be able to fill the role of a cooperative, productive team member or leader
	Accept responsibilities and obligations, assert individual rights and respect the rights of others
	Be able to participate in social commentary and contribute to intellectual, social and cultural activities in the local and international community
	Be able to work effectively and sensitively within the Australian and international community.

Barnett defines three types of competence: Operational, Academic and Reflective competence.

> "Operational competence is the ability of a person to actually perform a task. Terms such as insight, understanding, critique, reflection, wisdom are being replaced by terms such as skills, competence, outcome, information, technique and flexibility" (Barnett, 1994, p 160).

> “Academic competence is an internal form of competence built around a sense of the student’s mastery within a discipline" (Barnett, 1994, p 159)

> "Reflective competence is the complex set of activities which respond to the demands of the related forms" (Barnett, 1994, p 59).

Barnett's third definition suggests that competence also includes the idea of being able to explain why a particular action was taken and the events that affected that action. Barnett argues that reflective competence should form the real outcome of university / higher education. Barnett also includes the concept of transferability to operational competence. Figure 2.1 provides a diagrammatic view of the elements and dimensions of competence as defined by Barnett.

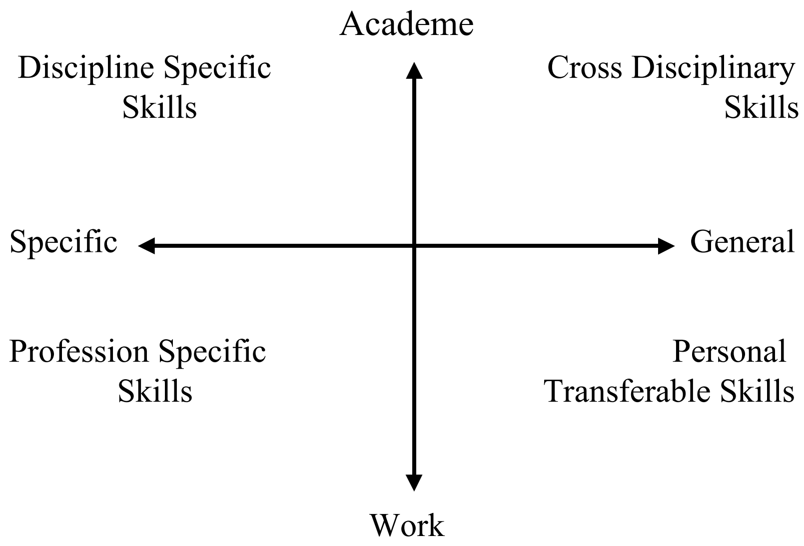

Figure 2.1
The Concepts of Competence adapted from (Barnett, 1994, p 62)

Universities are essentially in the business of imparting knowledge to the students (Nelson, 2002a). Employers expect that by some means they acquire the skills required to implement the knowledge gained at university and be able to apply it in the workplace (Crebert, 1995; Nelson, 2002a).

Employers are interested in what an employee can do, not just what they know (Queensland University of Technology, 2001). Employers would like the university sector to develop the necessary skills and capabilities of graduates so that they are productive when they start work and do not need to be trained before they start being productive.

The (Australian) Higher Education Council Report defines generic attributes within the context of higher education as "Generic skills, attributes, and values. These are the skills, personal attributes and values that should be acquired by all graduates regardless of their discipline or field of study. In other words, they should represent the central achievements of higher education as a process." (Higher Education Council, 1992, p 20)

The Generic Skills Subcommittee at George Brown College in Canada defines generic skills as “practical life skills essential for both personal and career success” (General Education Task Force, 1994, p 4). They further argue that the concepts of generic skills are both practical and portable. This definition is not inconsistent with others in the literature. The report identifies a small set of generic skills to be communications, mathematics, computer literacy and analytical skills. This definition evolves from the idea that the council of George Brown College initially saw generic skills as inseparable from the general education component of their course of study. This has now changed and they have a separate group that works on generic skills.

Generic skills are now taken to include the coverage of a discipline specific knowledge, skills and attitudes. This broadening of the concept of generic skills really is identifying the fundamental qualities of an individual when they finish a program of study. This is not to detract from the previous definitions but enhances the employment prospects of a graduate.

Generic attributes are transferable from one work environment to another and provide the basis for lifelong learning by the graduate. Generic attributes of graduates form a subset of the lifelong learning agenda. This thesis will not examine the lifelong learning agenda further than to point out the relationship between the two agendas (Organisation for Economic Co-operation and Development, 2001) previously mentioned.

Additional terms evolved over time and came to be associated with the concept of generic skills (Borthwick & Wissler, 2003). Capabilities and capacity started to appear as synonyms in relation to the phrase, generic skills or generic attributes or competency. In South Africa the term used to represent the concept of generic attributes or generic skills is ***critical cross-field outcomes*** (Schalkwyk, 2002). This term highlights the generic nature of the attributes or skills that a student develops over the time spent in a course of study.

The Organisation for Economic Co-operation and Development (OECD) in 1996 adopted the objective of lifelong learning for all members of society. They further defined the role that generic attributes play in the lifelong learning agenda. The OECD identified the fact the generic attributes developed in the educational environment are further developed in the world of work (Organisation for Economic Co-operation and Development, 2001).

Some of the generic attributes identified are transferable across or between academic disciplines while others are considered to be more specific to the discipline. The relationship between attributes, skills, and knowledge and understanding as three overlapping circles is depicted in the Venn diagram in Figure 2.2. Skills such as written communication are transferable from one domain to another with some specific adaptation where necessary. The intersection of the three circles represents the concept that a portion of each element of generic competence are transferable from one domain to another whether the domain be from one discipline to another discipline or from the world of academic study to the world of work.

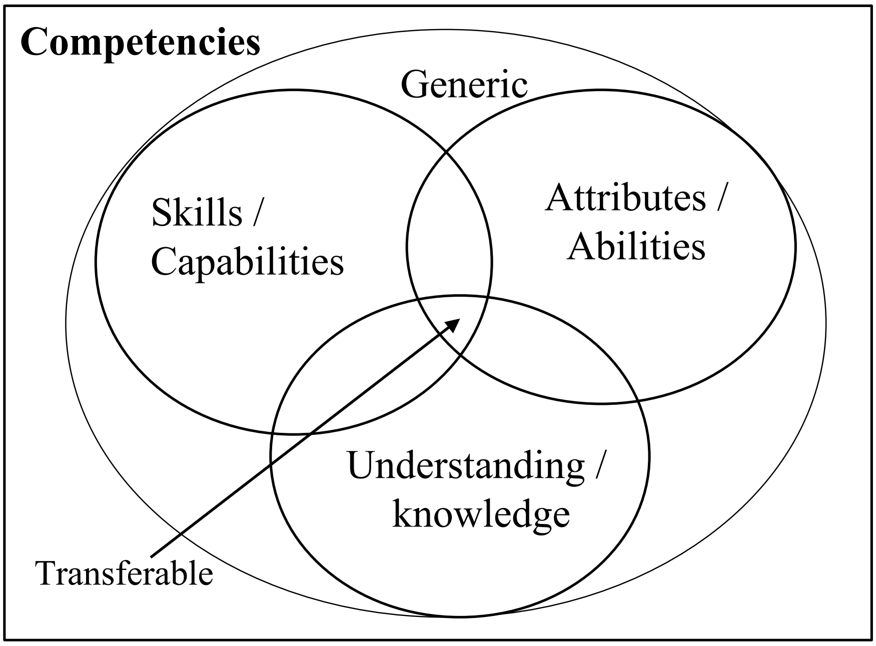

Figure 2.2

Elements of Generic Competencies

From another perspective the intersection of the three circles are the transferable generic attributes that a graduate will bring to the job. To be classed as academically competent, a person must possess personal attributes, skills and knowledge/understanding as well as discipline specific knowledge and skills. The later group in recent years has been defined as exit attributes of graduates. This is the fundamental knowledge that the person needs to have acquired from the university course of study to be able to perform the tasks for which the course was designed.

For a person to be identified as being competent it is implicit that they must possess the referent competencies. Competence refers to the concept that a person may possess a particular skill plus the required knowledge and understanding plus the personal attributes to perform a specified task. The concept of being competent implies that the person has, in fact, actually performed the specified task, in a specified set of circumstances, to the standard identified in the definition of the performance standard of the skill. It is noted in the literature and research discussion of generic attributes that little attention or mention has been given to the standards which a person must attain to be deemed to possess competence in the identified generic attributes.

The concept of competence and a person being competent in a task are also related to the associated concept of transferability of these competencies from one environment to another environment. The part of the competence, as stated earlier, which is transferable, is depicted in Figure 2.2.

The Venn diagram also depicts the relationship between the component of competence and the terms used to define and describe competency in different disciplines. It should be noted from the diagram that the overlapping centre portion of the diagram represents the core set of generic competencies that would be applicable to any discipline. It also represents the concept of transferability from one occupation to another occupation.

In summary, today's tertiary institutions are in the business of educating students and developing a set of generic skills to the level where employers can further develop them when they are in the workforce. These generic attributes should be transferable from one work environment to another and provide the basis for lifelong learning.

As the research has progressed new phrases such as multi-literacies have begun to appear in the context of attributes of graduates from courses of study. These literacies are portrayed as a new concept and are beyond the scope of this thesis.

Since the advent of IS as a discipline, the technology used to process and manage information has exploded in terms of the speed of processing, the diversity of the technology, and the array of applications that now use Information Technology (IT). The discipline of Information Systems is a multi-disciplinary subject (Grimshaw, 1992) that draws on the associated reference disciplines of computer science, behavioural science, decision science, organisations and management, organisational functions, management accounting, and micro-economics, as listed by Davis (1983). Through examining the keywords in the major IS journals of the 1980s, Barki, Rivard and Talbot (1988; 1993) identify the following as the key reference disciplines of Information Systems as follows:

- Behavioural science, psychology, decision theory;
- Computer science, artificial intelligence, ergonomics, systems theory;
- Social science, political science;
- Management science, organisational theory, management theory;
- Information theory, language theories; and,
- Accounting, economic theory.

The researcher is cognisant of the differences in definition of the terms information systems and information technology. The distinction used in this study relates to a program of study having a major in information systems. Information systems cover two broad areas as defined by Davis "(1) acquisition, deployment and management of information technology resources and services (the information systems function) and (2) development and evolution of infrastructure and systems for use in organisation processes (system development)” (Gordon B Davis, Gorgone, Couger, Feinstein, & Longenecker Jr, 1997, p 7). Information technology relates to other areas such as computer science, data communications and software engineering. However, for the purposes of this study the terms IS and IT are used synonymously.

2.2 Related Research and Literature

The literature search relating to this study of generic attributes and university sector IS curriculum covered a broad spectrum of research and practice that will be discussed under the following headings:

- Studies Using the Delphi Technique;
- Curriculum Documents and Reports;
- Industry and Academic Comparison of Curricula; and
- Industry Needs Analysis.

2.2.1 Studies Using the Delphi Technique

A discussion of the key issue studies in information systems management is included because this study adopted a similar research approach to identifying the importance of the generic attributes of IS graduates. The key issue studies often used a Delphi questionnaire to obtain a consensus view of the importance of issues facing management.

Studies of the key issues facing Information Systems management have been carried out on a regular basis since the early 1980s when Ball and Harris (1982) conducted the first study in conjunction with the Society of Information Management (SIM). The study was a membership survey of the members’ satisfaction of the services provided by SIM and included a questionnaire on the importance of 18 management issues. Responses were received from 417 of the 1400 members of the society. Participants included executives from both middle and upper management. The response rate was good, considering the survey was a paper-based questionnaire that took 20 – 30 minutes to complete. This was an internal membership survey of the

SIM and thus is not considered to be a national survey of key issues facing IS management.

Most of the key issue surveys used a modified form of the Delphi nominal group technique (Delbecq, Gustafson, & Andrew H Van de Ven, 1986) for gaining consensus amongst diverse groups of individuals. A traditional Delphi study consists of a number of rounds of questionnaires in which the respondents are asked to give their opinion about a particular topic usually in the form of ranking or rating a list of topics.

The first round questionnaire often begins with a single open-ended question and asks respondents to respond to the statement. Space is usually provided at the end of the survey instrument for respondents to make any additional comments they feel are relevant to the topic in question.

For example, "List in order of priority what you consider to be the most important factors in the development of information technology within your organisation?" The researcher would then collate the list of factors identified by the respondents and calculate a variety of statistics for future data analysis.

The second round questionnaire would consist of the collated responses in the mean order of priority and ask the respondents to rank the list using a 1 to 10 point scale. Again the researcher would collate the responses and calculate the mean and other statistics.

The third and subsequent rounds of the survey would contain questionnaires that contained the items to be ranked and be similar to the second round questionnaire. The researcher would continue with the survey until they felt they had gained consensus. This would generally be when participants would return their questionnaire with no changes to their responses.

Researchers often choose to stop the Delphi techniques after three or four rounds as a significant number of participants have agreed on the importance of the issue being surveyed. Final closure of the research process occurs when participants are provided with some form of feedback on the questionnaire and the information being investigated. This may be done via a formal report or a short summary of the final round responses, which is sent to all participants in the study.

Several modifications to the Delphi technique have been used by various researchers including Brancheau, et al. (1996), Pervan (1996), Watson (1989), and others. The fundamental change to the questionnaires is that the second and subsequent rounds of the survey contain the items to be ranked, the mean from the previous round and the individual respondents' rankings from the previous round.

The respondents are then asked to reconsider their replies in light of this new additional information. The process is continued until consensus is reached or the researcher has obtained sufficient information for their purposes (Brancheau et al., 1996). In many of the applications of the Delphi technique it has taken 3-4 rounds to gain consensus. In practice, however, the researcher frequently decides to end the process after two or three rounds, by which time firm trends have generally emerged (Pervan, 1993).

Chang (2000) suggests that the Delphi method has gained recognition in the field of information systems as an appropriate method for gaining consensus amongst a diverse group of experts. It has the advantage of obtaining individual opinion without the problems associated with interviews or other methods of data collection.

A summary of some of the key issue studies including the comments on the data collection method is listed in Appendix A. These studies show the variety of modifications to the traditional Delphi method. Some of the researchers used a single survey instrument followed by supplementary information enrichment activities while others used the multiple round questionnaire of the traditional Delphi method. Most researchers made some modification to the method adopted by the previous key issue study methodology. The most significant modification adopted by many of the researchers was the inclusion of the summary data from the previous round when the second and subsequent round survey instruments were sent out. These modifications were done to enable the researchers to gain a richer understanding of the data from the surveys.

The second modification to the Delphi method was to have the respondents rate each issue on a 1-10 scale where 1 represented very low importance and 10 represented very high importance. This change from ranking to rating issues allowed the participants to concentrate on each individual issue rather than compare the importance of one issue against another. This approach of rating rather than ranking allows for the respondent to rate several issues as equally important. In current times there will often be more than one item that will have importance equal to a second or third item. The use of rating rather than ranking is based on Miller's (1956) article on the limits of the human brain to process large quantities of information.

Miller (1956) suggests that people have a limited capacity to transmit information. Humans have difficulty in identifying the relative relationships between issues when the number of issues is large. Miller (1956) identifies the significance of the magical number seven as being the number of items a human can compare with a high degree of accuracy. Miller summarizes the findings on the number of items to be accurately ranked with his comments on the number seven,

> *"And finally, what about the magical number seven? What about the seven wonders of the world, the seven seas, the seven deadly sins, the seven daughters of Atlas in the Pleiades, the seven ages of man, the seven levels of hell, the seven primary colours, the seven notes of the musical scale and the seven days of the week? What about the seven-point rating scale, the seven categories of absolute judgement, the seven objects in the span of attention, and the seven digits in the span of immediate memory? For the present I propose to withhold judgement. Perhaps there is something deep and profound behind all these sevens, something just calling out for us to discover it. But I suspect that it is only a pernicious, Pythagorean coincidence."* (Miller, 1956, p 96)

The above quote really implies that the limit of the human to accurately transmit information about different items is related to the number seven. Often the expression is used in the field of Systems Analysis, that the number of processes that can be placed on a data flow diagram is limited by the number seven plus or minus two. This is because this is the amount of information that a human can process at one time (Miller, 1956).

Psychologists have long used a seven-point scale to rate items, noting that rating into finer categories does not really produce a greater quantity of useful interpretation of the ratings. Miller points out “that, as we add more variables to the display, we increase the total capacity, but we decrease the accuracy for any particular variable” (Miller, 1956, p 88). Miller states that “immediate memory is limited by the number of items and absolute judgment is limited by the amount of information supplied” (Miller, 1956, p 92).

What is clear from the above studies is, that although they all used modified form of the Delphi method as the starting point for the investigation of key issues, some form of further investigation is needed to gain a richer and better understanding of the issues and the relationship between them in any study. This further investigation may take the form of interviews, focus groups or other forms of sampling of the respondent population.

The Delphi method as used in the key issue studies has been used in this study because it has retained its value for gathering information and gaining consensus amongst diverse groups of people. This method will be further examined in Chapter 3 on the research methodology of this study.

2.3 **Curriculum Documents and Reports**

Any study into the content of programs of study and the output from those programs of study must examine the current curriculum documents as they relate to the discipline area being studied. As the discipline is constantly changing, new revised versions of the curriculum documents are constantly being issued by the relevant professional association. This study relates to the information systems discipline and therefore the following curriculum documents relating to IS will be discussed:

- IS'95 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems (IS’95);

- IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems (IS’97);
- ISCC’99 - Information Systems-Centric Curriculum;
- ICF-2000 – Informatics Curriculum Framework;
- OEIS - Organizational & End-user Information Systems Curriculum Model; and,
- IRMA/DAMA 2000 IRM Curriculum Model - IRMA/DAMA 2000 Information Resources Management Curriculum Model: An International Curriculum Model For a 4-Year Undergraduate Program.

The IS’95 and IS’97 curriculum documents are the de facto standard for information systems programs of study in the United States of America. These documents are supported by the Association for Information Systems (AIS), which has its base and very strong support in the United States. Table 2.2 lists the above curriculum documents along with the associated professional body and the year of publication.

Table 2.2
Curriculum Documents

Curriculum Document	Country of Authorship	Professional Association	Year
IS’95 (IS'95 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems)	USA	Association for Information Systems Association for Computing Machinery Association for Information Technology Professionals	1995
IS’97 (IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems)	USA	Association for Information Systems Association for Computing Machinery Association for Information Technology Professionals	1997
ISCC’99 (ISCC'99 An Information Systems-Centric Curriculum'99 Program Guidelines for Educating the Next Generation of Information Systems Specialists, in Collaboration with Industry)	USA	Association for Information Systems Association for Computing Machinery Association for Information Technology Professionals	1999
ICF2000 (International Federation of Information Processing Informatics Curriculum Framework 2000)	France	International Federation of Information Processing	2000
OEIS (The Organisational & End-user Information Systems Curriculum Model for Undergraduate Education in Information Technology)	USA	Office Systems Research Association	1996
IRMA/DAMA 2000 (IRMA/DAMA 2000 Information Resources Management Curriculum Model: An International Curriculum Model For a 4-Year Undergraduate Program)	USA	Information Resources Management Association	2000
ACS Core Body of Knowledge	Australia	Australian Computer Society	1997

2.3.1 IS'95 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems (IS'95)

IS'95 (J. D. Couger et al., 1995) provides a review and integration of the existing Information Systems curricula from the Association for Information Systems (AIS), Association for Computing Machinery (ACM) and Data Processing Management Association (DPMA). IS'95 is an amalgam of the curriculum documents of the sponsoring organisations in that it has not included substantial new topic areas. The curriculum model involves a four level hierarchy of units as depicted in Figure 2.3.

Figure 2.3 represents a common approach adopted by many curricula where there is a set hierarchy of types of knowledge required of the student to complete their study. The lowest level of the diagram starts with the fundamental knowledge or pre-requisites that students must have in order to succeed in the discipline. The second tier of the diagram represents what today has been phrased as the common core of the discipline where all students take these courses. This is then followed by a minor study in the discipline, which gives limited knowledge breadth while at the same time introducing higher-level concepts to the student. The top tier of the diagram represents the in-depth study of the discipline where the students specialise in one or more facets of the discipline.

The **Business or Co-requisite** (J. D. Couger et al., 1995) level provides the theoretical underpinning of Business and reference discipline subject material. The **All Students** level builds on the lower level and provides the basic skills for the end-user of IS systems. Specifically students receive advanced skills in the six areas of basic knowledge plus advanced training in the application packages that apply to their specific discipline.

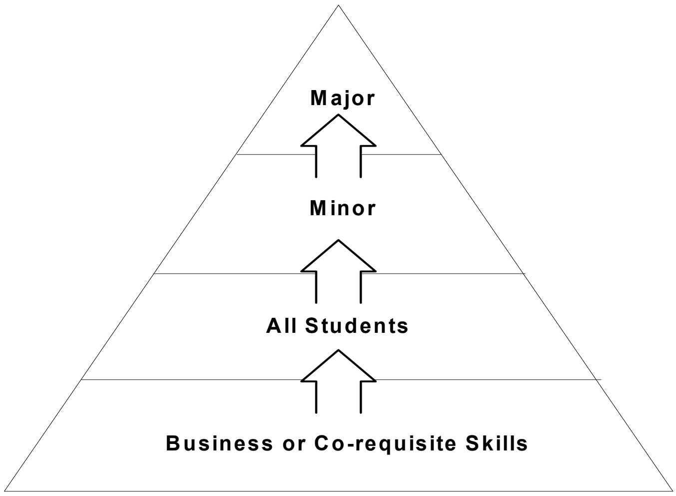

Figure 2.3
Educational Levels of IS Academic Programs of Study
IS'95 Curriculum Model (J. D. Couger et al., 1995, p 8)

The **Minor** level (J. D. Couger et al., 1995) provides competency development for students who will be user representatives on development teams of major business related applications. Topics include personal and work group computing for other members of the work area. The units studied will be a subset of the IS major depending on the students' interests and needs.

The **Major** level (J. D. Couger et al., 1995) provides competency development for the student for a career in the IS field. It includes the necessary specialization required for the student to become a successful IS professional. Couger states that the "IS major includes project management in a team environment, designing and implementing systems and integrating solutions into a functional system" (J. D. Couger et al., 1995, p 7).

Couger (1996) states that the curriculum development methodology used in creating IS'95 was a "systems based" approach. What was actually done could more accurately be described as "systematically based" methodology of merging an existing number of curricula into a unified single entity (D. Couger, 1996).

IS'95 was revised and further developed and finally issued as IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems (IS'97). IS'97 used a similar systems approach to the development of the curriculum which involved surveying both academics and industry representatives to identify and prioritise the competencies required of successful graduates in the workplace (Gordon B Davis et al., 1997). Currently, a new version of the curriculum, IS'2000 is under review by the IS community. Initial information from the IS community indicates that there is little change to the IS'97 document, and in particular to the generic attributes of the graduates.

2.3.2 IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems (IS'97)

The IS'97 model curriculum was produced with the intent of providing updated guidelines for universities in the creation of courses of study that would meet the needs of the IS community that employs graduates from the universities. The IS'97 model curriculum for Information Systems was written in the United States of America by a committee headed by Gordon Davis, John T Gorgone, J Daniel Couger, David L Feinstein and Herbert E Longenecker, Jr, (Gordon B Davis et al., 1997).

IS'97 is designed in a similar hierarchical manner to IS'95 as shown in Figure 2.4. IS'97 starts with a broad base of knowledge and each successive higher level is smaller and more refined. The expectation is that students at each level are more competent than students at the lower level. Figure 2.4 also depicts the increasing degree of specialisation that a student gains as they progress through the course of study.

The diagram below shows the relationship between the business or related subject areas that are important in a person's overall general education. The IS'97 curriculum document when released contained a list of "exit characteristics" that the authors of IS'97 also refer to as "exit attributes" as listed in Table 2.3 below. These exit attributes are the qualities that a person completing an IS course of study using the IS'97 curriculum model is expected to possess.

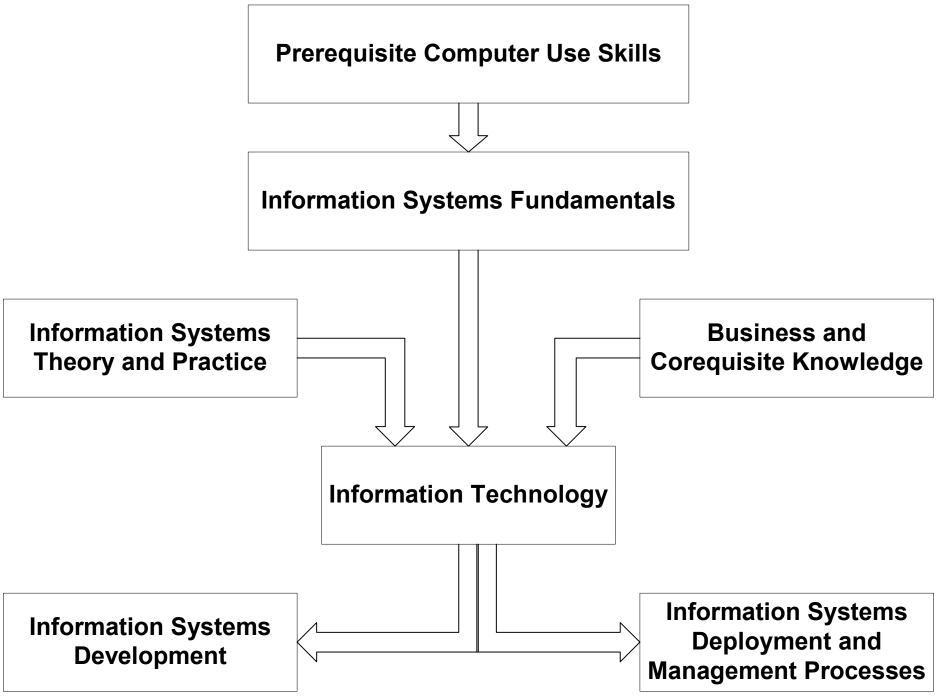

Figure 2.4
Structure of IS'97
(Gordon B Davis et al., 1997, p 13)

The exit attribute list is further described in terms of what the graduate will have the ability to do and what knowledge is expected to be used in the performance of these characteristics or attributes. These are described at a high level with little detail given to the more general concept of generic attributes of graduates from IS courses of study.

Table 2.3
IS'97 Exit Attributes

Communication
Computer Applications Systems
Information Technology and Tools
Interpersonal Relationships
Management
Problem Solving
Systems Development Methodologies
Systems Theory and Concepts
Professionalism

(Gordon B Davis et al., 1997, p 12)

Davis states “the basic idea is that graduates of IS courses should have competencies, skills and attitudes that are necessary for success in the workplace and lifelong learning as an IS professional or to provide the basis for graduate courses. Surveys of the members of task force and others have identified and prioritised these characteristics. Many of these competencies are shared within the computing professions, as indicated by this data.” (Gordon B Davis et al., 1997, p11)

From the above list of exit characteristics, a sequence of units that aimed to develop the desired competencies in graduates was designed. The curriculum in IS’97 was developed in a top down manner from broad curriculum areas to specific units of study. It should be noted that the development of IS'97 used a method of surveying both academics and industry to identify and prioritise the competencies required of successful graduates in the workplace (Gordon B Davis et al., 1997).

The model curriculum has an intended audience of university schools offering undergraduate degree courses of study with a major in information systems. In the model curriculum there are 240 objectives listed in 10 units.

In the American system of education there exist schools that offer units in semesters that vary in length from 15 to 18 weeks as well as quarters that are 10 to 12 weeks long. It should be noted that in the American education system, in general, it is considered best practice to write an objective for each hour of class contact of a course. For example, a unit that has for example, five hours of lectures and four hours of practical classes would have a total of nine hours of class contact per week. This nine hours per week is then multiplied by the number of weeks within the teaching term, which in many cases is 10, to give the total number of hours per unit. This would then give 90 objectives for this particular unit. This is consistent with Volger’s (1987) and Spanbauer’s (1987) theories on educational objective writing for competency based education.

In the Australian context a unit has a standard length defined as the number of hours a student is expected to spend in learning the subject matter of the unit. This time frame includes formal lectures, tutorials usually conducted at the institution as well as the additional required study time the student is expected to undertake outside of the formal contact time. It is noted that the Australian model for writing objectives is not as rigorously defined as in the USA.

The results of the examination of the IS'97 exit characteristics (Gordon B Davis et al., 1997) as they compared to the generic attributes of IS graduates identified in Chapter 4 showed that the exit characteristics are statements of content and discipline specific skills that the curriculum is designed to cover in an undergraduate course of study. They are generalised statements of characteristics of individuals whereas the generic attributes provide a more specific profile of the competencies a person is expected to possess on completion of the course of study at the undergraduate level.

From the exit attributes shown in Table 2.4 it should be noted that the competencies listed are very generalised statements of the content knowledge that the student should have acquired during the completion of the course of study. This is not exactly the same as the concept of a generic attribute, which has the fundamental underlying concept of transferability from one environment to another environment.

2.3.3 **Information Systems-Centric Curriculum (ISCC'99)**

The Information Systems-Centric Curriculum (ISCC'99) was developed in response to the National Science Foundation of the United States (NSF) report "Educating the Next Generation of Information Specialists: A Framework for Academic Programs in Informatics in 1994" (M. Mulder & Lidtke, 1999b, p 3). The NSF report highlighted the need for a four year curriculum to prepare information systems specialists for the next generation of the national workforce. One of the specific aims of the project was to

> "Develop a four year curriculum to better emphasize the learning activities that would produce graduates that would better meet the needs of the IS industry." (M. Mulder & Lidtke, 1999b, http://www.iscc.unomaha.edu/Section2.html, Accessed 15 February, 2002)

ISCC'99 was a collaborative effort with industry. The industry development team members identified the attributes of a graduate and created a profile of the desirable graduate. This profile was then used to identify and develop the educational learning required to meet the required graduate profile.

The ISCC'99 curriculum is intended for use in institutions offering “existing or new degrees in Computer Information Science, Information Science, Information Systems, Information Technology, Information Systems Specialist, Information Systems Engineering and related computer programs” (Lidtke, Stokes, Haines, & Mulder, 1999, http://www.iscc.unomaha.edu/Endorsement.html, Accessed 15 February, 2002).

The ISCC'99 curriculum documents contain 157 objectives spread across 13 unit areas with an average of 20 objectives per unit. As with the IS'97 curriculum document, ISCC'99 was written in the United States of America, at the University of Omaha, under the guidance of Michael Mulder and Doris Lidtke.

The development process of ISCC’99 (M. Mulder & Lidtke, 1999b) included the consultation with an equal number of industry and academic representatives who drafted the initial version. This was followed with wide consultation amongst the universities offering IS courses of study. The outcome of this consultative process was a curriculum that included courses in Information Systems and a pedagogy for teacher and student learning. An additional benefit from this curriculum is that a focus on lifelong learning is engendered in students. The process of developing ISCC’99 is shown in Figure 2.5.

This development process employs an action research approach. The important concept to be identified from Figure 2.5 is that the curriculum development process is a circular one. When we finish one development process we are again at the start of the beginning phase of the next version of the curriculum.

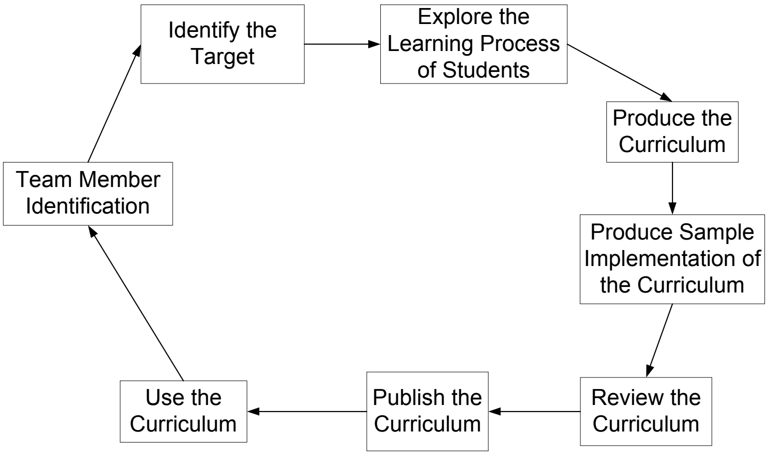

Figure 2.5
ISCC'99 Development Process
Adapted from (Lidtke et al., 1999, http://www.iscc.unomaha.edu/Section3.html, Accessed 15 February, 2002)

The phrase "information systems-centric domain" is defined "as an educational or enterprise activity that relies heavily on information derived cooperating by computing systems" (M. Mulder & Lidtke, 1999a, p 5).

The ISCC'99 industry view of the essential elements of a new curricula are shown in Figure 2.6. What is important to be gained from this diagram is the underlying principle that there is a common core of computing knowledge that is also fundamental to the broader ISCC'99 curriculum. It is also important to note the placement of the reference and related discipline knowledge as a basis for the ISCC'99 curriculum.

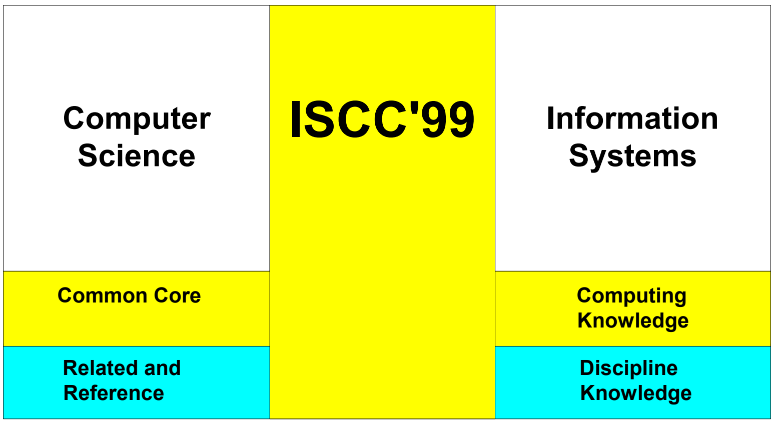

Figure 2.6
ISCC'99 Curriculum Model
(Lidtke et al., 1999, http://www.iscc.unomaha.edu/Section2.html, Accessed 15 February, 2002)

The purpose of the ISCC'99 curriculum document is to provide a curriculum framework or guide for the preparation of information specialists at the beginning of the new millennium. The ISCC'99 curriculum is designed to prepare students to:

- Work in teams with process owners and users;
- Identify information systems solutions;
- Develop communication skills both written and oral;
- Identify problems and propose solutions;
- Build, test, validate and deliver large or complex information systems in a team environment; and,
- Understand the social and ethical implications of the IT environment. (M. Mulder & Lidtke, 1999a, http://www.iscc.unomaha.edu/section1.html. Accessed 28 August 2000)

The ISCC'99 (Lidtke et al., 1999, http://www.iscc.unomaha.edu/Section3.html. Accessed 28 August 2000) curriculum uses an inverted curriculum model. A traditional curriculum starts with the smallest building blocks and considers the relation between them. As the student masters the relationship with the small building block they are then introduced to larger and more complex relationships. This process is repeated until the student has mastered the concepts and competencies that are essential to the course of study. This mastery will allow them to operate efficiently and effectively in the current work environment.

In an inverted curriculum the student performs the above process in reverse order. Students are first introduced to the big picture first and gradually taught how the big picture is composed of smaller components. When the students have mastered the smaller components they are then able to create the big picture from its components.

The development team for the ISCC'99 Information Systems Centric Curriculum consisted only of ten people, five academics and five industry representatives (Lidtke et al., 1999, http://www.iscc.unomaha.edu/Section3.html#3.1 accessed 10 December 2002). This may be considered a shortcoming of the development process in that there were not more industry and academic representatives involved in the development process.

Lidtke (1999, http://www.iscc.unomaha.edu/Section3.html. Accessed 28 August 2000) identified many different problems with existing graduates which included:

- Problem solving skills;
- The ability to apply systematic thinking to complex problems;
- Business case preparation;
- Written communication skills;
- Oral communication skills;
- Team and group skills; and,
- Listening skills.

These abovementioned skills are amongst the list of generic attributes that form part of this study. These abovementioned skills are also commonly mentioned by employers as weaknesses found in new employees (Snoke & Underwood, 1998a, 1998b). These skills are also identified as weaknesses in many of the current curriculum documents and programs of study. These identified shortcomings in the curricula were addressed in the curriculum model documents in the manner in which the units were assessed and delivered. Specific emphasis is placed on the oral and written communications skill development.

The industry representatives involved with the development of ISCC'99 defined the following attributes of a graduate at the end of a course of study using the ISCC'99 curriculum. These are listed in Table 2.4 (Lidtke et al., 1999).

Some of the attributes below are consistent with those identified by Crebert (1995). The significant difference between Crebert's list and the list above is the grouping of the attributes. Some of the terminology is non-specific and does not clearly enunciate what the graduate will be able to do. For example, how do we know if a person demonstrates curiosity? Also, how would we measure a person's curiosity?

Table 2.4

Industry Identified Attributes of IS Graduates

(Lidtke et al., 1999, http://www.iscc.unomaha.edu/Section4.html. Accessed 15 February 2002).

Personal Skills
• Systemic-thinking skills • Problem-solving skills • Critical-thinking skills • Risk-taking skills • Personal-discipline skills • Persistence • Curiosity
Interpersonal Skills
• Collaborative skills • Communications skills (oral, written, listening and group) • Conflict resolution skills
Technical Knowledge and Skills
• Information abstraction, representation, and organisation • Enterprise computing architectures and delivery systems • Concepts of information and systems distribution • Human behaviour and computer interaction • Dynamics of change • Process management and systems development • Some Information Systems domain knowledge • Use of computing tools to apply knowledge

The ISCC'99 curriculum development used a modified version of Bloom's taxonomy of educational objectives. In Bloom's taxonomy (Hosseini, 1993, http://www.gise.org/JISE/Vol1-5/APPLICAT.htm. Accessed 15 February 2002) of educational objectives, the six levels of the cognitive domain are:

1. Knowledge;
2. Comprehension;
3. Application;
4. Analysis;
5. Synthesis; and,
6. Evaluation.

Northwest Center for Emerging Technologies, (Lidtke et al., 1999) uses the following version of the above taxonomy:

0. Follow instructions;
1. Remembering;
2. Comprehension;
3. Application;
4. Analysis;
5. Synthesis/design; and,
6. Evaluation.

Lidtke (1999) has added the basic level objective of Following Instructions. This is a fundamental skill that all people need to be able to perform. It is noted in the curriculum document that the level of mastery that the industry requires for each attribute is no higher than 3 or 4 on the 0 to 6 scale above. This implies that the individual can apply (3) the knowledge learnt in a new and unfamiliar situation while at the same time being able to perform some analysis (4) operations in a business environment.

2.3.4 **IFIP - Informatics Curriculum Framework 2000 (ICF-2000)**

The International Federation for Information Processing (IFIP) produced a curriculum framework document, Informatics Curriculum Framework 2000 for Higher Education (ICF-2000) (F. Mulder & vanWeert, 2000) at the request of UNESCO in 1999. The document outlines a framework for the development of an Informatics curriculum at the local institutional level. The ICF-2000 framework relies on and refers to the other major curriculum documents and reports listed below:

- IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems;

- ACM / IEEE-CS Computing Curricula 1991: Report of the ACM/IEEE-CS Joint Curriculum Task Force;

- ECDL Foundation: The European Computer Driving License Standard of Competence (since 1997). The ECDL is an internationally recognised standard of competence certifying that the holder has the knowledge and skills needed to use the most common computer applications efficiently and productively;

- ISCC'99: An Information Systems-Centric Curriculum '99. Program Guidelines for Educating the Next Generation of Information Systems Specialists in Collaboration with Industry; and,

- UCSI: Unified Classification Scheme for Informatics (released 1/2/97).

The above reports identify the standard that is required of the person completing the qualification and the terminology used in classifying the discipline of IS.

The process used in the development of ICF-2000 could be best described as a traditional curriculum development process involving action research methods. The process involves four steps (F. Mulder & vanWeert, 2000, pp 2-16), which are briefly described below:

1. The local need for informatics-trained professionals is established.

2. The local providers of education and training identify the qualification to meet the above determined need. They also identify and propose the method of delivery of this qualification.

3. Course unit outlines and programs of study descriptions are produced using the world wide accepted informatics curricula.

4. The curriculum is implemented using the most appropriate teaching and learning materials and styles as specified in the informatics curriculum document.

The unit descriptions, which are in some countries called unit outlines, refer to the content of the unit. The ICF-2000 standard for a unit length is to define it in terms of credit points where one credit point is equal to one eight hour day's worth of work (F. Mulder & vanWeert, 2000). It is therefore expected, depending on the outcome desired, that the length of the units using the ICF-2000 framework may vary quite substantially. The unit outlines specify the competencies to be achieved at the completion of the unit. They do not list any objectives on how these competencies are going to be achieved.

Specific objectives for the unit are available from some of the other curriculum documents. The ISCC'99 curriculum document also contains a large number (157) of very specific objectives for its units as compared with the 240 identified in IS'97.

The unit descriptions in ICF-2000 relate to competencies that should be achieved and then reference the existing curricula from around the world. The curriculum document does not specify its own objectives for its own units.

ICF-2000 is an attempt to link the existing curriculum documents to provide developing countries and institutions with the flexibility to develop local curriculum based on the many efforts of information professionals and educators from around the world.

2.3.5 The Organisational & End-User Information Systems (OEIS) Curriculum Model for Undergraduate Education in Information Technology

The Organisational & End-User Information Systems (OEIS) Curriculum Model for Undergraduate Education in Information Technology is produced by the Office Systems Research Association (OSRA). The OEIS Curriculum (O'Connor, 1996) identified competencies that a graduate should have on completion of a four-year degree for a professional who uses information technology in the workplace.

The curriculum development method involved the use of focus groups to gather, input and validate the design process and the final curriculum model. The OSRA curriculum (Office Systems Research Association Curriculum Revision Group, 2000) identified seven core competencies, which the OSRA considered essential for a person to work effectively in the information systems environment. These included:

- Information systems concepts including knowledge of business operations and end user technologies;
- Systems analysis skills in identifying the most appropriate solution for a business situation;
- Project management including group work;
- Managing change;
- Present training including individual and group sessions;
- Use electronic communications technologies including emerging technologies; and,
- Perform as a team member in identifying the most appropriate business solution to meet the organisational goals of the business.

The above competencies are the main components of the seven core units within the curriculum. The other four units within the curriculum document form the basis of the elective components of the curricula.

2.3.6 IRMA/DAMA 2000 Information Resources Management Curriculum Model: An International Curriculum Model For a 4-Year Undergraduate Program

The IRMA/DAMA curriculum (Cohen, 2000) focuses on the information resource management discipline and is complementary to the more generic and general IS'97 Model curriculum for Information Systems. It is intended for all business students and those who wish to further their knowledge of information resource management (Cohen, 2000).

The IRMA/DAMA model curriculum is designed to be more detailed than IS'97 and cater for the specific needs of the information resource management and management information systems courses of study (Cohen, 2000). As a model curriculum it provides an overarching structure to the discipline. Universities need to select which parts of the model curriculum they wish to use to cater for local IS industry needs. The IRMA/DAMA model curriculum is a partial subset of IS'97.

The model curricula overlap, as can be depicted graphically, is shown in Figure 2.7

It should be noted that the diagram in Figure 2.7 illustrates a significant amount of overlap between the major curriculum models and that each has a component that is specific for the association or organisation that has sponsored the development of the curriculum. The ellipses in the diagram do not represent a proportional representation of objectives or content but are used to show the overlapping nature of the curricula.

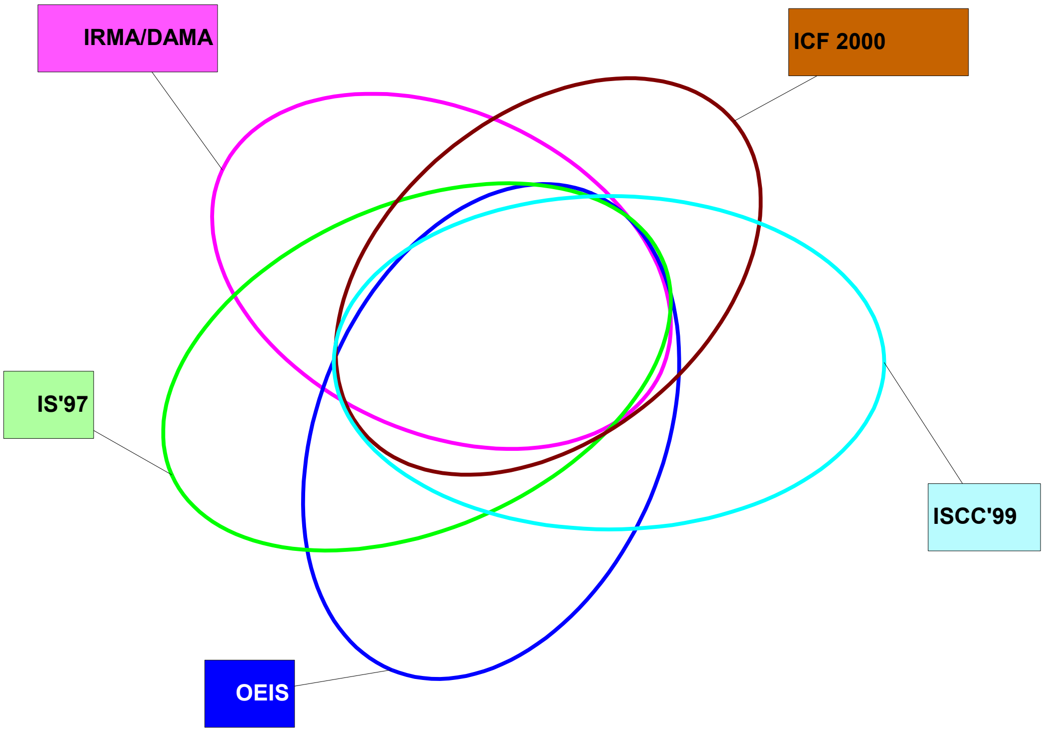

Figure 2.7

Relationships between the Different Model Curricula

Cohen (2000) suggests that traditional Management Information Systems (MIS) curricula stress the hardware and software components of an information system at the expense of the human element that is always part of any information system. The IRMA/DAMA model curriculum is an attempt to redress this situation. The emphasis in an MIS course of study is on the components that affect the management aspect of the information system.

The curriculum consists of 10 units with six of these being considered as required for courses of study in information resources management or MIS. Two additional units are required to be taken from the remaining four as electives to give a balanced undergraduate course of study (Cohen, 2000).

2.3.7 **Summary**

In summation, the curriculum documents provide a set of guidelines for institutions offering IS programs of study. These curriculum documents have much in common and represent the views of the associations and organisations that had input into their design. The IS'95 and IS'97 curricula represent the views of the AIS where IS is viewed as the backbone of the discipline.

The IRMA/DAMA curriculum represents the views of the information resources management sector of the larger IS community. The ICF2000 curriculum represents the view of the International Federation of Information Processing (IFIP). These different curricula are represented in Figure 2.7 to show the concept that all have a common core of knowledge that students are expected to acquire as well as having separate knowledge content emanating from the supporting professional organisations.

2.3.8 **Australian Computer Society (ACS) Core Body of Knowledge**

Underwood (1996) states that the ACS Core Body of Knowledge is the minimum set of subject material required to be in all IT courses that seek accreditation from the ACS. The ACS Core Body of Knowledge is not intended to be a substitute for a curriculum definition. The Core Body of Knowledge specifies 15 areas of knowledge as listed in Table 2.5 below. The topics listed below are those that specifically apply to IS courses.

The ACS Core Body of Knowledge does not list specific attributes that they expect graduates to possess on completion of the program of study in information systems. The expectation from the ACS is that the graduates will be able to put into practice the knowledge they have acquired during the course of study.

Table 2.5

ACS Areas of Knowledge for All IT Courses

Code	Topic Area
ACS1	Computer Organisation and Architecture
ACS2	Conceptual Modelling
ACS3	Database Management
ACS4	Data Communications and Networks
ACS5	Data Structures and Algorithms
ACS6	Discrete Mathematics
ACS7	Ethics/Social Implications/Professional Practice
ACS8	Interpersonal Communications
ACS9	Program Design and Implementation
ACS10	Project Management
ACS11	Information Security
ACS12	Software Engineering and Methodologies
ACS13	Software Quality Principles
ACS14	Systems Analysis and Design
ACS15	Systems Software

This concludes the discussion of the various curriculum documents from around the world. The next section will discuss the related studies similar to this study which were conducted by Bruce Lo and Ang Ang in the early 1990s.

2.4 **Industry and Academic Comparison of Curricula**

In the curriculum development process an industry representative reference body is often used to validate the content of the proposed course of study. This is done to aid the recognition of the course of study in the wider community. Grant and Main developed an Information Systems curriculum and identified through "a review of the literature abundant support for the concept of an Information Systems course and the need for higher education to be more responsive to the realities of the information age" (Grant & Main, 1986, p 14) which we live in. It is this need for education to be responsive to the industry and the world we live in that currently drives this study.

Grant and Main (1986) developed the theory and methodology of using IS practitioners and academics to validate the IS curriculum design. This study uses the above approach in validating the generic attributes that form the basis of the curriculum at the different universities that offer IS courses of study. It is now a de facto requirement for most universities to gain approval of the relevant IS professional organisation before the course of study is approved by the academic boards of the universities. In Australia the federal government has assigned this responsibility to the ACS.

2.4.1 **The Ang and Lo Studies**

Ang Yang Ang and Bruce Lo (Ang, 1992a, 1992b; Ang & Lo, 1991a, 1991b; B. Lo, 1996; B. W. N. Lo, 1991) conducted a three part study of academic and industry views of the content of IS curriculum in the early 1990s.

Ang and Lo (1991a) in the first of the three part study attempted to identify what Australian tertiary institutions' thought was a common core of IS knowledge that was desired at the completion of an IS course of study. The study conducted in 1989 – 1990 sampled 57 tertiary institutions in Australia. The respondents were asked to rank the present and future importance, in five years time, of 51 topics selected from the model curricula from the Data Processing Management Association (DPMA), the International Federation of Information Processing/British Computer Society (IFIP/BCS) and the Association for Computing Machinery (ACM).

Ang and Lo (1991a) use a three layer taxonomy to define the work done by IS professionals. This taxonomy is also used by the ACM curriculum committee and the IFIP/BCS curriculum group. The three categories of the taxonomy are:

- Information technology - the equipment that is used to perform the work done by the IS person;
- Integrative systems processes - the methodologies and procedures used by the IS person; and,
- Organisational functions and management - the end-users of the technology used by the IS person and includes the management of these functions. This category

also includes the social issues related to IT and the impact of these on society as well as quantitative and operational research techniques.

The results of the survey indicated that fourth generation programming languages (4GL's), expert systems, application generators and project management would have a drastic increase in the near future. Also of importance was the corresponding drop in the traditional concept of programming languages (Ang & Lo, 1991a).

The second of the Ang and Lo (1991b) studies conducted in early 1990 sought the views of 200 organisations within Australia selected from the Top 500 Computer Users as listed in the Australian Business 1989 edition. Ang and Lo used a similar methodology to that used in their previous study (Ang & Lo, 1991a) which involved the participants ranking items using a four point Likert-type scale where 1 represented unimportant and 4 represented extremely important. Some of the significant results from these studies in the early 1990s include the essential rating of the topics:

- Systems design;
- Information analysis;
- Data modelling;
- Database concepts and theory;
- Programming languages;
- Database management systems;
- Data and file structures;
- Programming methodology;
- Software engineering and systems development;
- MIS theory and concepts;
- Business and accounting systems; and,
- Interpersonal communications skills.

Also of importance are the rankings of the respondents when asked to rank the future importance of the topic. The most significant finding is the drop from 6 to 19 (out of 28) for the topic programming languages. Topics showing a significant increase in importance were Expert Systems, 4GLs and Application Generators.

The third study conducted by Ang (1992b) in 1991 replicated the previous two Australian studies (Ang, 1992b; Ang & Lo, 1991a, 1991b) in identifying the present and future importance of 51 essential elements of an IS curriculum as defined by Lo (1991). As in the previous surveys, respondents were asked to rank each item using a four point scale on a single questionnaire. The significant result from this study was that there was no significant change in the perceived importance of the major categories from the earlier Australian studies.

This study looks at the unit objectives and relates them to the generic attributes of the IS entry level graduates. This study differs from the earlier Ang and Lo (Ang, 1992a, 1992b; Ang & Lo, 1991a, 1991b; B. W. N. Lo, 1991) studies in that the curriculum data was based on the description of units as listed in the university handbooks. These descriptions are short abstracts of the content of the units and do not list the objectives. The studies were conducted using the content of the units as distinct from the objectives of the units.

The vast difference in the quality of information provided to students by the offering institutions has been identified in this study. Some institutions provided only scant unit descriptions while others provided detailed objectives with correlating weekly outlines of content and links to the assessment of the content and how it related to the unit objectives. The IS'97 model curriculum lists many objectives for each unit.

This research uses a graphical representation to show how the objectives of a set of units that comprise a course of study relate to the generic attributes as identified in the first part of the study. A mapping of the fifteen topic areas of the ACS Core Body of Knowledge (Underwood, 1996), ISCC'99 (Lidtke et al., 1999), and IS'97 (Gordon B Davis et al., 1997) will also be included in the graphical representation as overlays. This graphical representation allows for the easy depiction of the strengths of individual courses of study in terms of how much treatment they give to the teaching of the generic attributes.

2.5 **Industry Needs Analysis**

In order to identify the industry requirements of the content and generic attributes of graduates of courses of study it is necessary to consult with and survey the appropriate industry organisations that employ the graduates from the local universities. Often the local industry groups will conduct their own studies of the entry level skills required by a new employee as part of their marketing strategy to attract suitably qualified and experienced staff. These studies often concentrate on the content knowledge and experience that the local members require in recruiting new staff. The Australian Information Industries Association (AIIA) is the national association with members mainly drawn from large multinational companies with offices in Australia or national companies with a headquarters in Australia.

2.5.1 **Australian Information Industries Association (AIIA) Study 1995**

The Australian Information Industries Association (AIIA), in July 1995, commissioned a survey (Factotum Research, 1995) of the IT industry in Australia to identify both the current and emerging employment needs in the Information Technology and Telecommunications (IT&T) sector for the next five years. The major findings of the report were:

- Demand for specific skill sets in the Year 2000 varied according to industry category;
- Network integration skills ranked first in the year 2000 while modular programming ranked last in the year 2000;
- Little change in the demand for a specific skill set between now and the year 2000 with two exceptions- these were Information Managers and Systems Administrators where the demand was for a significant increase in employment; and,
- The only change in the qualifications of the IT&T workforce is expected to be by the year 2000 when a larger percentage of the workforce will hold tertiary qualifications.

Australia's Science and Engineering Base for Information and Communications Services and Technologies Report (Williams, 1995) recommended that government and industry more closely cooperate in the provision of education and training at the post-compulsory level of education.

2.5.2 **Graduate Attribute Studies**

The identification of the required attributes of graduates from IS courses of study is a continual process. Lee (1995) suggests that industry demands an entry level employee has specific skills or competencies including communications, business skills, technology skills and interpersonal skills, to be effective in the workplace. The following studies overview the related identification and validation of the attributes of graduates and the industry need for continuous review of the skill demand by the IS industry.

Turner and Lowry (1999) replicated previous studies (Snoke & Underwood, 1998a, 1998b, 1999, 2000) using a population of students and employers of IS graduates. Turner and Lowry (1999) sought the views of students enrolled in the Information Systems Department, Victoria University of Technology, and employers who advertised for entry level graduates and had Melbourne, Australia postal addresses listed in their advertisement. Turner and Lowry's (1999) results were supported by (Snoke & Underwood, 1998a, 1998b, 1999, 2000) research which identified a similar order to the generic competencies sought by industry in entry-level employees.

The researcher is cognisant of the common practice of tertiary institutions to conduct graduate destination surveys after graduates finish their course of study. The graduate destination survey focuses on how the student was able to obtain a job as a result of their studies. Course experience questionnaires are also used by tertiary institutions to gain feedback on the courses offered. These studies focus on the usefulness of the program of study in terms of how students perceive the courses in their current employment situation. These studies do distinguish the level of a course of study.

Once having identified the industry requirements in terms of attributes of graduates it is necessary to examine the process of developing a curriculum. This will be discussed in the next section.

2.6 Curriculum Development Methodologies

To fully understand the curricula discussed above it is important to have an understanding of the curriculum development methodologies that are used in the creation of the model curricula.

The development methodologies utilised in the production of the IS'97 Model Curriculum for Information Systems can be best described as a systems approach (D. Couger, 1996). This involved cyclic consultation with industry and curriculum developers.

The curriculum development methodologies used in many tertiary institutions involves an action research model similar to that depicted in Figure 2.8 below.

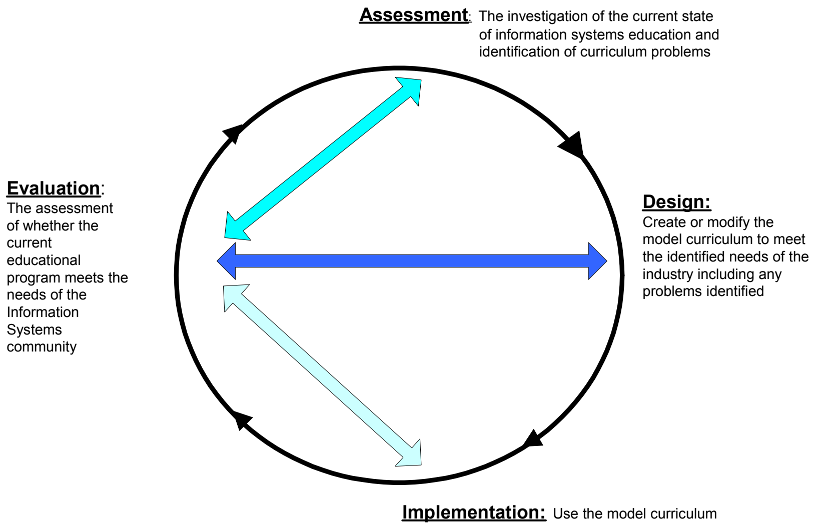

Figure 2.8

Action Research Curriculum Development Model

(O'Connor, 1996, p19)

The action research curriculum development model involves a system development approach to the development of the curriculum. Firstly, the current curriculum is evaluated to determine whether the current curriculum meets the demands of industry. Secondly, the curriculum is assessed to identify the changes that should be implemented. Note that in this process, items for inclusion are determined and given a priority rating, as not all items will be able to be included in the curriculum. The third phase of the development process is the design of the new curriculum. This involves the grouping of the items selected for inclusion into meaningful units of work. Finally, the new curriculum must be implemented. At the completion of the fourth step the process begins again with step one.

In each of the above steps it is important to have regular interaction with the stakeholders involved with the curriculum. This often takes the form of meetings where an expert gives a presentation on one aspect of the content or methodology of the curriculum. This allows the curriculum developers to provide responsive model curricula to meet the needs of the industry that they serve.

MacDonald & Swearingen (1990) used a method of simple counting of the number of occurrences of key words that related to the key issues in MIS in textbooks used in MIS courses to determine the depth and breadth of treatment of the key issues in a course. From this study they identified that the topic of Decision Support Systems was far more widely covered in the textbooks than the importance given to the topic within the courses or as ranked in the key issue studies done to that time. Most other topics received similar treatment in the textbook as in IS programs of study.

MacDonald & Swearingen's (1990) methodology of identifying the key issues covered in MIS courses is used in this study to identify the coverage of the generic attributes of graduates covered in IS courses. The methodology modified for this study consists of three steps: (1) identify the generic attributes of graduates, (2) selection of the texts, and (3) analysis of the texts with regards to the coverage of the generic attributes using the objectives from the texts set for the units within the courses of study.

2.7 **Chapter Summary**

This chapter has examined the related literature under the headings of terminology relating to generic attributes, curriculum reports, the key issue studies that relate to the Delphi method of gaining consensus. The next chapter will present the research methodology of the study.

The results of the systematic review of literature has been to identify the key elements required to be included in curricula from around the world to enable the development of the generic attributes in IS graduates. The methods used to identify and gain consensus amongst a diverse group of individuals has also been examined. Related studies of the industry identified needs versus the content of the courses of study have been examined.

In conclusion this chapter has discussed the relevant literature related to generic attributes, IS curriculum, the Delphi method of gaining consensus.

The diagram in Figure 2.9 presents the research plan across the bottom of the diagram. The chapters of the thesis are shown above the research plan. This allows the reader to easily relate the content of each chapter to the different phases of the research plan. Figure 2.9 below positions this chapter in blue and the next chapter in green, which discusses the research methodology, as they relate to the overall research plan.

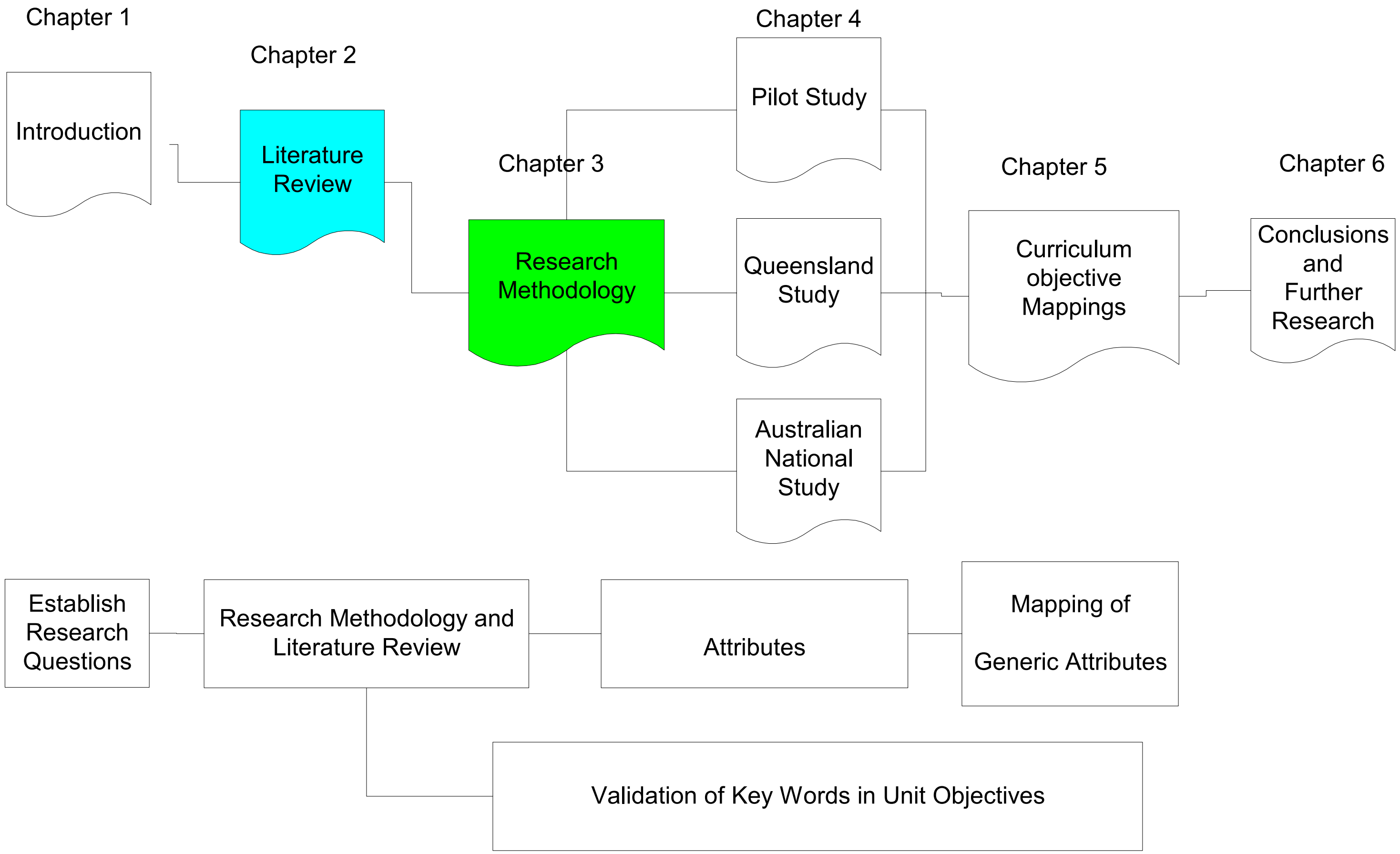

Figure 2.9
Diagrammatic View of the Thesis and Research Plan

Chapter 3

Research Methodology

List of Figures

List of Tables

Abstract

This chapter presents the research methodology used in the study. A two part survey of industry and academics was conducted to identify and validate the desired attributes of IS graduates. The first survey was conducted in Queensland, Australia and the second was conducted as a national study of all the universities that offer Information Systems (IS) courses of study in Australia. The second phase of the research method involved the identification of a set of keywords from texts used in the different units offered within the course of study. The third and final stage involved the mapping of the unit objectives against the identified generic attributes to give a relative strength of treatment of each of the attributes. These were then tabulated and graphed. Statistics were calculated and a factor analysis was performed on the data. A worked example of the mapping process and the output from the research methodology is included.

3. **Introduction**

The previous chapter presented a survey of the important literature relating to the research objectives. These research objectives are to:

1. Identify the generic attributes of the entry level IS graduate employee;
2. Identify the relevant courses of the education providers; and,
3. Develop a replicable methodology for associating the objectives with the identified generic attributes.

This chapter will discuss the research method used in this study to achieve the abovementioned objectives. The research method adopted in this study consists of three phases.

The first phase is the identification and validation of the generic attributes of the graduates. This has been done using a three round Delphi technique involving both industry and academic staff at several higher education institutions.

The second phase is the identification of the keywords used in the texts prescribed for the units of study within the degree courses offered in IS and generic attributes.

The third phase is a mapping of the objectives using the keywords against the generic attributes to give a relative weighting to the coverage of the knowledge associated with the attribute within the courses of study.

The output from this mapping is then graphed using a Kiviat chart to produce a graphical representation of the generic attribute content within a course. The graph can then be overlayed with a similar graph produced using the ACS Core Body of Knowledge to identify strengths and weaknesses within the curriculum. Deficiencies would need to be addressed prior to the curriculum being accredited by the ACS. The graphs also allow a longitudinal look at the changing nature of the curriculum in IS.

The Kiviat chart (Borovits & ein-Dor, 1979) is referred to by Microsoft Corporation as a radar chart and is a two dimensional graph which allows multiple axes or dimensions to be represented. This graph type was selected because it consists of a number of radii each of which represents an item to be measured. Each radius will represent one generic competency.

The Kiviat chart will allow easy representation of the depth of treatment given to each of the competencies that are desired in graduates. This allows the easy examination of the attributes treatment when an overlay is created using the ACS Core Body of Knowledge (Underwood, 1996). The ACS Core Body of Knowledge overlay represents the minimum treatment required of each competency in order for the course of study to be accredited by the ACS.

For each of the courses of study examined, three graphs are produced. These include a Kiviat chart of the raw data with the axes representing the generic attributes, a Kiviat chart using a logarithmic scale to give a more interpretive view of the data and finally, a line graph that is used to compare the particular course of study with the various curriculum documents from around the world and the ACS Core Body of Knowledge.

One of the pitfalls in using the Kiviat graph is that all the axes are treated equally and therefore there is no comparison of the relative importance or significance of individual competencies in the curriculum. It does, however, provide a means of comparing the individual institution IS curricula against the industry accreditation curriculum.

The strength of the Kiviat chart is that it gives an easy to read representation of the depth of treatment allocated to each generic competency both by the ACS and the institution seeking accreditation.

This study uses the generic attributes of entry-level employees as the radii on the Kiviat chart. This use of the generic attributes as the radii allows for easy comparison of the extent and appropriateness of treatment of the competencies within the curriculum. The generic attributes were validated by the local industry that employs the graduates as well as the academics who teach the students.

3.1. **Identification and Validation of the Generic Attributes**

The first step in the research process involved the identification of the generic attributes required of IS graduates. An initial list of generic attributes was compiled from a list produced by the Generic Attributes Working Party at QUT (Crebert, 1995).

This list was expanded to give a richer interpretation of the attributes of graduates from IS courses of study. Attributes were added to distinguish the difference between IS discipline knowledge and knowledge of the related and reference disciplines as defined by Barki, Rivard and Talbot (1988; 1993) in their keyword classification system for IS. The expansion of the list allowed for the inclusion of attributes that may be specific to the IS discipline and industry and that are not generally covered by the university in general.

The expanded list of attributes is shown in Table 3.1. This list was used in a pilot study involving the Information Systems Management Research Centre (ISMRC) at

Queensland University of Technology (QUT). The results of the pilot study are discussed in Chapter 4.

Table 3.1
Generic Attributes of IS Graduates

Competency
With respect to the Information Systems discipline possess coherent, extensive, theoretical and practical knowledge
With respect to the Information Systems discipline be technologically competent (the person is able to use the current technology competently)
With respect to the Information Systems discipline possess theoretical and practical knowledge in at least one reference discipline which includes behavioural science, computer science, decision theory, information theory, organisational theory, management theory, language theories, systems theory, social science, management science, Artificial Intelligence, economic theory, ergonomics, political science, psychology and accounting.
With respect to the Information Systems discipline possess the theoretical and practical knowledge of related disciplines. For example, business, law, education, data communications, computer science or leisure recreation
Retrieve, evaluate and use relevant information
Define problems in a systematic way
Analyse, synthesise and evaluate the various solutions
Consider the quality of the solution and its timeliness
Demonstrate practical knowledge and understanding in at least one computer language
Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking
Time management skills
Knowledge of how a business operates, is structured or is orientated
Understand the profit motive of business
Ability to reflect on own strengths and weaknesses
Confidence about their ability to learn independently
Self-motivation
Work independently
Value the ethics of the Information Technology profession
Sensitivity to differences in gender, culture and customs
Possess a sense of basic curiosity about technology
Work as part of a team in a productive and cooperative manner
Written and oral communication skills
Research skills
Participate in on-going professional development
Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology
Interpersonal skills
Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment

As a result of the pilot study the list was further expanded to include separate entries for written communications, oral communications and project management. This list became the fundamental list of generic attributes of IS graduates for the remainder of the study. This list is shown in Table 3.2.

Table 3.2

Generic Attributes of IS Graduates for Queensland and Australian Studies

	Attribute
1	With respect to the IS discipline possess coherent, extensive, theoretical and practical knowledge
2	With respect to the IS discipline be technologically competent (the person is able to use the current technology competently)
3	With respect to the IS discipline possess theoretical and practical knowledge in at least one reference discipline which includes behavioural science, computer science, decision theory, information theory, organizational theory, management theory.
4	With respect to the IS discipline possess the theoretical and practical knowledge of related disciplines. For example, business, law, education, data communications, computer science or leisure recreation
5	Retrieve, evaluate and use relevant information
6	Define problems in a systematic way
7	Analyse, synthesise and evaluate the various solutions
8	Consider the quality of the solution and its timeliness
9	Demonstrate practical knowledge and understanding in at least one computer language
10	Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking
11	Time management skills
12	Knowledge of how a business operates, is structured or is orientated
13	Understand the profit motive of business
14	Ability to reflect on own strengths and weaknesses
15	Confidence about their ability to learn independently
16	Self-motivation
17	Work independently
18	Value the ethics of the Information Technology profession
19	Sensitivity to differences in gender, culture and customs
20	Possess a sense of basic curiosity about technology
21	Work as part of a team in a productive and cooperative manner
22	Written communication skills
23	Oral communication skills
24	Research skills
25	Participate in on-going professional development
26	Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology
27	Interpersonal skills
28	Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment
29	Project Management Skills

The numbers in the first column of the above table represent the order of appearance in the survey questionnaire as sent to industry and academics in Australia.

Validation of the attributes in terms of their importance to employers was done using a three round Delphi technique. The Delphi method was selected to validate the set of generic competencies, as it is a proven method for gaining consensus amongst a diverse group of individuals. It has been widely used in the field of information systems in the many studies of the key issues facing IS managers. Researchers around the world (J. Brancheau & Wetherbe, 1987; J. C. Brancheau, Janz, & Wetherbe, 1996; Caudle, Gorr, & Newcomer, 1991; Chang & Gable, 2000; Dickson, Leitheiser, Wetherbe, & Nechis, 1984; Fink & Shaftman, 1994; Galliers, Merali, & Spearing, 1994; Hartog & Herbert, 1986; MacDonald & Swearingen, 1990b; Morgado, Reinhard, & Watson, 1994; Niederman, Brancheau, & Wetherbe, 1991; Graham Pervan, 1993; G Pervan, 1994; Graham Pervan, 1996; Phukan, 2001; Raho, 1985; R. Watson, 1989; R. T. Watson, 1990; R. T. Watson & Brancheau, 1991) have conducted key issue studies using the Delphi method as a starting point for their studies.

Many of the IS researchers mentioned above have modified the Delphi method to enable them to gain a richer and more meaningful understanding of the data obtained in the initial study. Some of the modifications to the method include follow-up interviews, focus groups, the use of rating rather than ranking within the survey instrument itself, and the use of other methods of ranking the issues.

I have adopted the method used by Richard Watson in his Australian key issue study of 1989 (R. Watson, 1989). Watson's method of asking respondents to rate each individual issue allowed them to focus on the particular issue and its absolute importance rather than its relative importance compared to other issues. Allowing participants to focus on the individual issue to be rated when the number of issues is greater than ten is important, as identified by Miller (1956).

The Delphi method used in this study was a traditional one using as the opening question, a list of the generic attributes as defined by Crebert (1995) for the pilot study and the modified list as shown in Table 3.2 for the Queensland and national studies. Further discussion of the Delphi method is in Section 2.21.

The validation process as shown in Figure 3.1 involved a pilot study of the Information Systems Management Research Concentration (ISMRC) at Queensland University of Technology (QUT). Results of the pilot study were analysed. The findings from the pilot study were presented at the 1998 European Conference on Information Systems (Snoke & Underwood, 1998a) and may be found in Appendix B.

Based on the feedback from the participants in the pilot study, the wording of the questionnaire was modified and three additional attributes as mentioned above included.

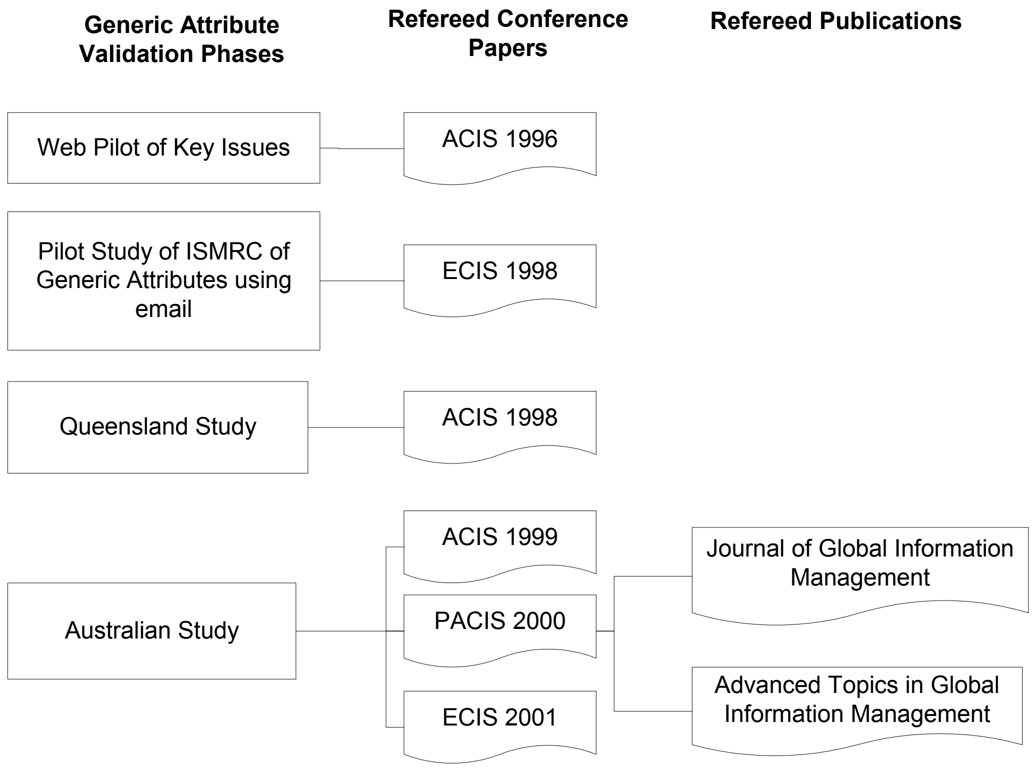

Figure 3.1

Publications Arising from the Generic Attribute Validation

Analysis of the results of the data indicated that a wider range of values on the rating scale was critical in obtaining useful data in future surveys. Using a larger scale such as a ten-point scale would make it difficult for participants to identify the importance of each competency, as they would have to choose from ten different ratings as compared to a smaller number. The pilot study used a five-point Likert-type scale. The rating scale selected for the remainder of the validation process was a seven point Likert-type scale for the reason that humans can differentiate between degrees of importance of an issue. This modified questionnaire was then used in the remaining surveys that formed part of the validation process.

The second step in the validation process involved a survey of a wider sample population using academics and industry representatives from Queensland, Australia. This Queensland study (Snoke & Underwood, 1998b) was conducted to identify and confirm the competencies used in the pilot study. The Queensland study allowed for the analysis of the relative importance of the identified competencies. The results of the Queensland study supported those of the pilot study and will be further discussed in Chapter 4.

The third and final step in the validation process involved a follow-up study to the Queensland study on a national basis (Snoke & Underwood, 1999, 2000, 2001a, 2001b, 2002a). This national study was conducted to validate the Queensland results using all universities that offered IS courses of study at the undergraduate level. The results of the national study will be discussed in Chapter 4. The participants in the national study included academics from the universities offering IS courses of study and industry representatives who were members of the Australian Computer Society (ACS) (Underwood, 1996).

3.2. **The Delphi Survey Method**

A survey of industry representatives and academics was conducted to identify the importance of the generic attributes of IS graduates. Prior to the pilot study involving the Information Systems Management Research Concentration (ISMRC) staff and industry contacts, a pre-pilot methodology study was conducted, in 1996, using the World Wide Web (WWW). This was done to test the suitability of the WWW as a medium for conducting a Delphi study to validate the generic attributes.

The pre-pilot study conducted using the WWW involved a survey of IS industry representatives and academics. Academic participants (107) were selected from the Asia Pacific Directory of Information Systems Researchers (APDISR) (Gable & Clarke, 1996). Industry participants were selected from the ACS consultant list obtained from the ACS homepage.

The study initially was intended to be five (5) Delphi round questionnaires to identify the competencies essential to IS entry-level employees. The participants were sent an email inviting them to participate in the study. Links to the survey page were also placed in the Alta Vista database and the ACS homepage.

In the six months of the pre-pilot study there were 156 hits on the introductory page of the survey. Of the 22 people responding, only 17 had been sent emails inviting participation. The other participants were people who found the page by searching the WWW for keywords.

At the end of the six months pre-pilot trial only one round was deemed to have been completed as insufficient responses were received for round 2. The results of the pre-pilot study were inconclusive as only 22 of 107 possible participants replied to the questionnaire.

A number of significant results should be noted from the pre-pilot study. The first significant finding was that the sample population was not controllable. A number of responses were received from participants in other countries who were not part of the target population.

A second significant finding was the relative length of time for data collection. The response rate in the pre-pilot study was at best one reply every two days. At this reply rate it would mean that each round of the survey would need to be available on the WWW for approximately one year to give sufficient responses to have adequate data for a Delphi study. The implication of this is that the data collection process would take three years to give meaningful data for analysis. This timeframe was deemed excessive.

The third significant finding was the wide variety of applications in use by the target population. It was discovered during the pre-pilot study that of the 22 respondents there were 11 different formats in which the participants requested copies of the instrument. It was decided that as this was only a pre-pilot study that the large number of different formats would cause a significant processing problem.

A fourth significant finding was the relative difficulty or lack of use of the WWW as a research tool for finding information at the time (1996). It should be noted that most respondents requested either a hardcopy or a copy in a specific application format. Few participants completed the survey online.

The abovementioned significant findings of the pre-pilot study including consideration of the year in which it was conducted, the WWW was deemed not suitable for the purpose of gaining consensus from a large diverse group of individuals within a reasonable timeframe. It was decided to use email as a medium for the purposes of data collection. It was also noted that the use of email at this time may have limited the participation of some of the target audience. Although email was in common use in 1996 not everyone used email as much as it is used today (2003).

The validation process of the generic attributes involved a three round Delphi technique questionnaire conducted using email as the medium. Email was selected as the preferred method for data collection because it provided the features of being able to easily personalise the email message, provided a fast and easy method for participants to respond to the survey instrument and the total time for completing a multiple round survey would be significantly reduced from the time taken for a hard copy postal survey.

3.3. **Survey Instrument**

The survey instrument (Appendices C-H) used in this study was personally addressed and emailed to those participants whose first names could be identified. Personally addressing each email is a feature of this study and was done with the express purpose of increasing the participation rate. Other researchers who wish to remain anonymous have indicated that they received a much lower response rate varying from 0 percent to 15 percent for surveys that were not personally addressed. Questionnaires sent to industry representatives differed to those survey instruments sent to academics.

The survey instrument began with a brief overview of the project, stressing the importance of the study and the need for a larger sample size to validate the generic attributes. This section was then followed with directions on how to complete the survey. It was stressed that there was space provided at the end of the survey for the insertion of additional generic attributes not listed or for comments about the attributes listed.

The instrument was structured in such a manner that by using the Reply To function in the respondents email package, respondents would quickly be able to complete the survey with a minimum number of keystrokes. This facility included the listing of the response area at the left-hand margin one line below the question. All that was required of the participant was to use the down arrow key and enter their response on the appropriate line for each question.

The response time to complete the questionnaire was approximately 10-15 minutes for the first round and a shorter time for subsequent rounds as the subsequent rounds asked the participants to reconsider their response to the previous round. The initial questionnaire was sent to all participants listing the generic attributes along with a description of each attribute. This initial list was compiled from the QUT list of generic attributes (Crebert, 1995) and modified to reflect the competencies, as they would apply to IS graduates, as described earlier.

Fourteen days were allowed for each round of the study. After 10 days non-respondents were sent a reminder notice requesting them to reply. Seven days were allowed for the processing of the data from each of the rounds. Processing included the entry of all results into Statistical Package for the Social Sciences (SPSS) and calculation of simple statistics, which included the mean, median, mode, and standard deviation of each of the attributes.

The pilot study survey instrument asked participants to rate the importance of each of the competencies or attributes in terms of the essential nature of the competency in the workplace for an entry-level graduate during their first year on the job. A five point Likert-type scale was used where 1 = unimportant, 2 = of little importance, 3 = neutral, 4 = very important, 5 = of major importance (essential).

Results from the pilot study gave mean values greater than 4 for 16 of the 27 attributes. This did not allow for meaningful analysis of the results. Several of the participants requested a larger scale be used in the main studies. These results of the pilot study indicated that a larger Likert-type scale would provide more meaningful information and allow for greater discrimination between the values.

The Queensland and Australian national studies used a seven point Likert-type scale in order of increasing importance, where:

1 = extremely unimportant;
2 = unimportant;
3 = of little importance;
4 = neutral;
5 = very important;
6 = of major importance; and,
7 = extremely important (essential).

Space was provided at the end of the survey instrument for additional attributes to be added or for other comments.

3.4. **The Survey Process**

The survey instrument was designed so that minimum time and effort would be needed to complete the questionnaire and therefore increase the response rate. The participants were asked to use the standard reply function on their email application. This was helpful in that it also gave the author the first name of the respondents and therefore helped in the personalising of the subsequent rounds of the Delphi technique.

The target audience was sent the first round questionnaire with a list of the generic attributes and were asked to rate the attributes as to their importance to an entry-level employee in their first year on the job.

Respondents to the first round were sent the second round questionnaire that contained the mean response for each of the competencies as well as their individual responses to the first round questionnaire. Non-respondents to the first round were sent a similar questionnaire with only the mean response for each of the competencies included as additional information. The data from the second round was collated and the mean, median, mode and standard deviation were calculated for each of the competencies.

Round three questionnaires were sent to respondents of either round one or round two. Respondents to round two received questionnaires that contained the mean and their individual responses to each of the competencies. Non-respondents to round two or round one received questionnaires with the mean response of each competency in the previous round questionnaire. Reminder notices were sent to only 10 percent of the academics in round three asking them to complete the questionnaire. The industry representatives did not require any prompting to complete the questionnaires. This method was followed for both the Queensland and national studies. Interim feedback on the results of the study was provided to participants on request.

3.5. **Participants**

This section briefly describes the sample population for each of the three studies that forms part of the validation process of the generic attributes. Each of these sample populations will be further described in Chapter 4.

3.5.1. **Participants - Pilot Study**

A total of 18 participants were selected for the pilot study with nine participants chosen from the Information Systems Management Research Concentration (ISMRC) at Queensland University of Technology (QUT) as academic representatives. An equal number of IS industry practitioners affiliated with the ISMRC were selected as the industry representatives.

3.5.2. **Participants – Queensland Study**

Participants in the Queensland study included both academics and industry representatives from Queensland, Australia. Academic participants in the study were selected from Queensland universities that offered undergraduate courses in IS. These universities were Queensland University of Technology (QUT), University of Southern Queensland (USQ), and Central Queensland University (CQU). It is noted that the University of Queensland (UQ) at the time of this study did not offer an undergraduate degree in Information Systems. UQ did, however, offer selected units in IS within its Commerce department.

Industry participants were selected from the Queensland Branch of the Australian Information Industries Association (AIIA) and employers from the local communities of the universities that were involved in the study. The list of participants from the AIIA was restricted to those who had email addresses.

Access to the AIIA list was via the AIIA secretariat that forwarded an invitation to participate in the study to its members, as well as a reminder notice for the first two rounds. The lack of direct access to the list presented problems because of the inability to send individually addressed reminder notices. The feature of the research methodology was that individually addressed questionnaires were used. A more complete sample would have been obtained had the entire AIIA membership list been used. This was not done due to the access restrictions put on the list by the AIIA.

3.5.3. **Participants - Australian Study**

The Australian Computer Society (ACS) sponsored this study and participants were selected from the ACS membership list as well as selected national industry representatives. The list of participants from the ACS (approximately 1000) was restricted to those who had email addresses and did not have an "edu" extension in their email address in order to exclude academics from this phase of the study. A request to have an invitation to participate in the study sent to selected members of the ACS membership list was approved by the executive of the ACS.

Access to the ACS list was through the ACS secretariat who forwarded an invitation to participate in the study to its members. This invitation to participate was issued only once. The lack of direct access to the list prevented the sending of reminder notices for successive rounds of the study.

The invitation to participate was addressed to ACS members generally rather than to individual members. This was done to maintain the confidentiality of the ACS membership mailing list. A facet of the research methodology involving non-ACS members was that the questionnaires were individually addressed. This was done in an effort to increase the participation rate. The academics were selected from the faculties teaching Information Systems from the universities that offered IS undergraduate degree programs of study as at January 1998. Email addresses for the academic participants were obtained from the Asia Pacific Directory of Information Systems Researchers (APDISR) (Gable & Clarke, 1996).

3.6. **Data Analysis Methods**

Data from each round of each study was collected from the emails and stripped of extraneous text and then stored in an Excel spreadsheet. Simple statistical analysis including mean, median, mode and standard deviation were undertaken for each of the competencies. The data was then exported into Statistical Package for the Social Sciences (SPSS) where factor analysis was performed in an attempt to identify the existence of any underlying factors. The data was further analysed in SPSS with multiple factor analysis methods including Principle Component (PC) and Principle Axis Factoring (PAF). For each of the methods the results were similar.

T-Tests were performed. Cronbach's alpha test of reliability was performed on each set of data to identify the internal reliability of the survey. Details of the results of the analysis are presented in Chapter 4 as part of the discussion of each of the sub-studies that form part of this thesis.

The object of the study was to gain consensus from a wide sample of industry and academics on the importance of the generic attributes of entry level IS graduates.

The method used to gain consensus was the Delphi method, which over time has maintained its reputation for providing accurate results. The data analysis can provide a deeper and richer understanding of the views of the industry and academic participants in the study.

Having identified and validated the importance of the generic attributes using the Delphi method, the next phase of the study was to map the generic attributes against the unit objectives within a course of study.

3.7. **Identification of Keywords**

Following the identification and validation of the generic attributes desired of graduates, keywords relating to the generic attributes were identified by using the words from within the phrasing of the generic attributes. This list was expanded using a standard thesaurus. See Appendix I for a list of the words that have been identified from the generic attributes.

A list of words was compiled using Barki, Rivard and Talbot's (BRT) An Information System Keyword Classification Scheme (H Barki et al., 1993) and objectives of each chapter of the prescribed texts used for the units of study within the IS curriculum from the participating universities. This list of words is used to help describe the content of the IS course (see Appendix J).

3.8. **Mapping the Objectives against the generic attributes**

Following the identification of the keywords for the generic attributes and the unit objectives, each of the unit objectives was examined to identify which of the generic attributes were covered by the objective.

This last phase of the research methodology involved the mapping of the unit objectives against the generic attributes. The unit objectives were obtained from the different universities' courses of study documentation submitted to the ACS for accreditation purposes. This mapping process involved the use of the abovementioned keyword lists from the unit objectives and a similar keyword list based on the generic attributes. A count of the number of times a generic attribute(s) was related to objectives provided a numeric score that indicated the extent of treatment of the attribute within the course of study.

The mapping involved the listing of the keywords from the chapters of the prescribed text for units of study against the keywords found in the description of the generic attribute. This mapping was validated as suggested by Middleton (1991) by means of interviews with a small representative sample of the academics who wrote the study guides from which the information was taken. Five of the academics representing approximately 20 percent of the unit writers were interviewed and asked to validate the mapping of the objectives against the attributes. This list was then tallied to give a relative indicator of the extent of treatment of each of the attributes within the course of study.

The total for each generic attribute count representing the mapping of the extent of treatment was graphically represented using a Kiviat chart for each course. A similar mapping was also done for the ACS Core Body of Knowledge, IS’97, ISCC’99 and ICF'2000 and used as an overlay to identify the strengths and weaknesses of the course of study for the purposes of accreditation by the ACS. It should be noted that a course of study exceeding the ACS rating only indicates that the course exceeded the minimum required for accreditation and does not represent endorsement by the ACS of the extent of treatment in a particular course of study.

Having identified and validated the importance of the generic attributes, the next phase of the study describes the process for mapping the unit objectives against the generic attributes.

3.9. **Mapping Methodology**

This section describes the second part of the project, which is the creation of a method for mapping the unit objectives from the course against the generic attributes. This will give us, by means of a simple count, an indication of the relative amount of treatment each attribute receives within a course. This same procedure is then applied to the ACS Core Body of Knowledge, IS'97, and ISCC'99. It should be noted that ICF2000 is not included in the analysis because the curriculum document does not contain specific objectives for the units within its curriculum.

A graph of each of the mappings is then produced on the same chart thus giving a graphical representation of how the institution course compares with the ACS Core Body of Knowledge, IS'97, and ISCC'99 to show any deficiencies as well as areas of strength.

It should be noted that the ACS Core Body of Knowledge is a minimum set of knowledge required of an IT professional, whereas the IS'97, ISCC'99, ICF2000 are curriculum guidelines from which institutions select units to make up their courses of study. It may be viewed that the curriculum documents are idealistic views of what should be included in an IS course of study. Particular note should be made that the curriculum documents are, as their titles suggest, guidelines for model curriculum in the undergraduate framework. This suggests that the model curricula are designed to be flexible and provide a model, or suggest areas of coverage. The curriculum documents are not intended to be prescriptive of the content that is to be included in a course of study. It should also be noted that the number of times a generic attribute is mentioned or referenced in a curriculum document might have no direct reflection on the amount of coverage this attribute receives within a course of study. It does not also reflect what the graduate will be able to do.

This study uses a modification of the methodology and model used by MacDonald and Swearingen (1990a) of identifying the desired outcomes from the MIS courses of study. The mapping of the generic attributes against the objectives of the units is introduced to give a graphical representation of the extent of treatment of the generic attributes within the courses of study.

MacDonald & Swearingen's (1990a) methodology of identifying the key issues covered in a MIS course is used to identify the coverage of the generic attributes of graduates covered in IS courses. This methodology is modified for this study and consists of three steps: (1) identifying the generic attributes of graduates, (2) selection of the texts, and (3) analysis of the texts with regards to the coverage of the generic attributes using the objectives from the texts set for the units within the courses of study.

The selection of the generic attributes is done using a survey of industry and academics in institutions that offer IS courses of study. The methodology of these surveys uses a modified Delphi technique originally used by the Management Information Systems Research Center (MISRC) and subsequent key issue studies around the world.

The selection of texts was done from the study guides provided by the institutions offering the different IS courses. All texts were viewed and a list of the words relating to each generic attribute was compiled from the table of contents, and the objectives at the beginning of each chapter. Because the terminology varies from author to author a list of keywords was compiled to represent the words used by various authors to represent the treatment of the different generic attributes within their texts. The list of keywords used in the mapping was further expanded using The Macquarie Thesaurus (1991). The list of words from the text also helped in the definition of the content of the subject area.

The last phase of the research methodology (mapping process) involved four stages as listed below:

Stage 1: Identify the keywords from the objectives, content description and assessment sections of the unit outline.

Stage 2: Identify the keywords from the generic attributes as identified by academics and the industry representatives that employ graduates from the courses.

Stage 3: Match the keywords from the unit objectives against the attributes.

Stage 4: Count the number of times that the generic attribute is covered in all units within the course of study and plot this using a Kiviat chart.

The first stage in this process is the identification of a set of criteria or keywords from the literature and texts used in the unit. The criteria (keywords) are taken from the objectives listed in the unit outlines and the chapters of texts listed as required or recommended references for the individual units of study within a course. The list is expanded by the use of a thesaurus and computer terminology dictionaries to give a more complete list of terms including synonyms.

This list will form the basis of the content of the discipline and the courses taught and will also form the basis of a mapping of the objectives stated in each unit against the generic competencies identified by both industry and academics. The list of keywords is further expanded by addition and reference to the Barki, Rivard and Talbot's (BRT) An Information System Keyword Classification Scheme (Henri Barki et al., 1988; H Barki et al., 1993). For example, a list of the texts used in the QUT Bachelor of Information Technology course IT20 is listed in Appendix K. The content knowledge keyword list is in Appendix J.

3.10. **Example of the Mapping Methodology**

The following is an example of the methodology as applied to the unit ISB003 (Applications Development), a third year subject with a prerequisite of Laboratory 4 (Commercial Programming) in the Bachelor of Information Technology (IT20) course of study at QUT. Note that the unit number is from the accreditation submission and indicates the page number of the unit outline.

Stage 1: Identify the keywords from the objectives, content description and assessment sections of the unit outline.

The unit objectives are:

1 Demonstrate an understanding of the issues involved in implementing an online system;
2 Demonstrate an understanding of concurrency control;
3 Demonstrate an understanding of transaction design;
4 Demonstrate an understanding of the evaluation of different system development environments; and,
5 Perform as a productive member of a group project.

The keywords from the objectives above are:

Demonstrate	Understanding
Perform	Member of a group project
Implementing	Online system
System	Concurrency control
Transaction design	Evaluation
System development environments	

From the content description and assessment process section of the unit outline the following keywords are identified and added to the words identified from the objectives:

Programming skills	Implementing
Enforcing integrity constraints	Criteria for evaluating environments
Written	Project
Recovery	Security

The following is a combined list of keywords from the objectives and the content and assessment sections of the unit outline:

Demonstrate	Understanding
Perform	Member of a group project
Implementing	Online system
System	Concurrency control
Transaction design	Evaluation
System development environments	Programming skills
Implementing	Enforcing integrity constraints
Criteria for evaluating environments	Written
Project	Recovery
Security	

The text recommended for this unit was Fowler, G. (1990). ***COBOL: Structured Programming Techniques for Problem Solving***. Boston, Boyd & Fraser.

The keywords listed at the beginning of each chapter are listed below:

Comprehensive	Programming
Documentation standards	Problem solving
Practical	Writing reports
Logic	Testing

The above keywords were then expanded using a thesaurus developed from computer dictionaries, Barki-Rivard-Talbot Keyword Classification Scheme for IS Research Literature (Henri Barki et al., 1988; H Barki et al., 1993) and the texts identified in the unit outline to give the following list of words which will be used in the matching of the objectives against the attributes.

Demonstrate	Authenticate
Display	Teach
Understanding	Insight
Appreciation	Awareness
Recognition	Perform
Accomplish	Do
Member of a group project	Team
Group	Implementing
Operate	Satisfy
Put into working condition	Online system
System	Concurrency control
Transaction design	Evaluation
Assess	Examine
Measure	Test
System development environments	Environments
Surroundings	Programming skills
Programming languages	Enforcing integrity constraints
Criteria for evaluating environments	Standard
Principles	Write
Written	Designed
Authored	Composed
Scheme	Project
Recovery	Restoration
Re-establishment	Correction
Improvement	Security

Stage 2: Identify the keywords from the generic attributes as identified by the industry and academic representatives that employ graduates from the courses.

In a similar manner to the previous step a list of keywords that relate to the generic attributes was compiled. This helped in the mapping of the generic attributes against the unit objectives. Table 3.3 gives a sample of the keywords identified from the generic attributes for the attribute of written communications. A full list of the keywords identified from the generic attributes is found in Appendix I.

Table 3.3

Keywords Associated With the Generic Attribute of Written Communications

Attribute	Term	Related Terms	
Written communication skills	Written	Readable	
	Communication	Contact Dialogue Dissemination Information	Transmission Liaison Message
	Skills	Ability Attainment Cause Competence Competency Competent Excellence Expertness	Knack Mastery Proficiency Talent Technical Knowledge Understanding
	Written Communication Skills	Contact Describe Dialogue Dissemination Document Explain Information Transmission	Liaison List Message Outline Prepare Proficiency State Write

Following the identification and validation of the generic attributes desired of graduates, keywords related to the generic attributes were identified by using the words from within the phrasing of the generic competency. These keywords were then used as search words within the texts that are used in the courses (MacDonald & Swearingen, 1990a).

A list of words was compiled from the BRT An Information System Keyword Classification Scheme (Henri Barki et al., 1988) as listed in the objectives of each chapter of the prescribed texts used for the units of study within the IS curriculum from the participating universities. The list of words from the texts based on the generic attributes became the vehicle for comparison with a second list compiled in a similar manner, but based on the unit objectives as listed in the unit outlines. The number of times that a word appears on the second list indicates the strength of treatment of the topic within the context of the generic attribute. This will give a numeric value to the extent of treatment of the attribute within the course.

Stage 3: Match the keywords from the objectives against the attributes.

The keywords identified in Steps 1 and 2 are now matched against the attributes, to identify which attributes actually relate in an explicit stated manner, in addition to those that have an implied relationship.

Table 3.4

Summary of Attribute Coverage by Objective

ISB0003 – Applications Development	**Attribute Number as per Table 3.3**
Demonstrate an understanding of the issues involved in implementing an online system	1, 3, 4, 8, 10, 12, 13, 18, 19, 5, 7
Demonstrate an understanding of concurrency control	1, 5
Demonstrate an understanding of transaction design	1, 5
Demonstrate an understanding of the evaluation of different system development environments	1, 10, 12, 5, 7, 8, 19, 23, 18
Perform as a productive member of a group project	21

This step is repeated for each unit within the course of study.

Stage 4: Count the number of times that the generic attribute is covered in all units within the course of study and plot this on a Kiviat chart.

The generic attribute coverage was counted for all units within the course of study IT20 at QUT. The result of the count of the generic attribute coverage for IT20 is shown in Table 3.5.

Table 3.5

Objectives That Relate to the Generic Attributes in IT20

Attribute Number	Attribute	TOTAL	Percent
1	With respect to the IS discipline possess coherent, extensive, theoretical and practical knowledge	82	27%
2	With respect to the IS discipline be technologically competent (the person is able to use the current technology competently)	37	12%
3	With respect to the IS discipline possess theoretical and practical knowledge in at least one reference discipline which includes behavioural science, computer science, decision theory, information theory, organizational theory, management theory.	31	10%
4	With respect to the IS discipline possess the theoretical and practical knowledge of related disciplines. For example, business, law, education, data communications, computer science or leisure recreation	8	3%
5	Retrieve, evaluate and use relevant information	26	9%
6	Define problems in a systematic way	6	2%
7	Analyse, synthesise and evaluate the various solutions	21	7%
8	Consider the quality of the solution and its timeliness	17	6%
9	Demonstrate practical knowledge and understanding in at least one computer language	13	4%
10	Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.	2	1%
11	Time management skills	0	0%
12	Knowledge of how a business operates, is structured or is orientated	11	4%
13	Understand the profit motive of business	2	1%
14	Ability to reflect on own strengths and weaknesses	1	0%
15	Confidence about their ability to learn independently	0	0%
16	Self-motivation	0	0%
17	Work independently	0	0%
18	Value the ethics of the Information Technology profession	2	1%
19	Sensitivity to differences in gender, culture and customs	3	1%
20	Possess a sense of basic curiosity about technology	0	0%
21	Work as part of a team in a productive and cooperative manner	5	2%
22	Written communication skills	12	4%
23	Oral communication skills	5	2%
24	Research skills	4	1%
25	Participate in on-going professional development	1	0%
26	Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology	2	1%
27	Interpersonal skills	5	2%
28	Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment	4	1%
29	Project Management Skills	0	0%
	Total	300	100%

The data from IT20 was then graphically represented on a Kiviat chart as shown in Figure 3.2 using the raw count of the coverage for each attribute. Figure 3.3 is a similar representation using the raw data count and a logarithmic scale to give a more meaningful representation of some of the smaller differences between the counts.

The process is repeated for the ACS Core Body of Knowledge, IS'97, and ISCC'99. The graph from IT20 is now overlayed on each of the above graphs to allow for comparison graphically of the relative depth of treatment of each of the generic attributes. Figure 3.4 shows the comparison of the IT20 course as compared with the international curriculum documents and the ACS Core Body of Knowledge. A graph using normalised data in order of the means of the generic attributes is included for ease of interpretation. Figure 3.5 shows the normalised data for IT20, the ACS Core Body of Knowledge, IS’97 and ISCC’99.

Analysis of the individual graphs and the comparison graphs are then discussed and conclusions drawn from the data presented. This discussion is presented in Chapter 5 - Mapping of Generic Attributes Against Unit Objectives

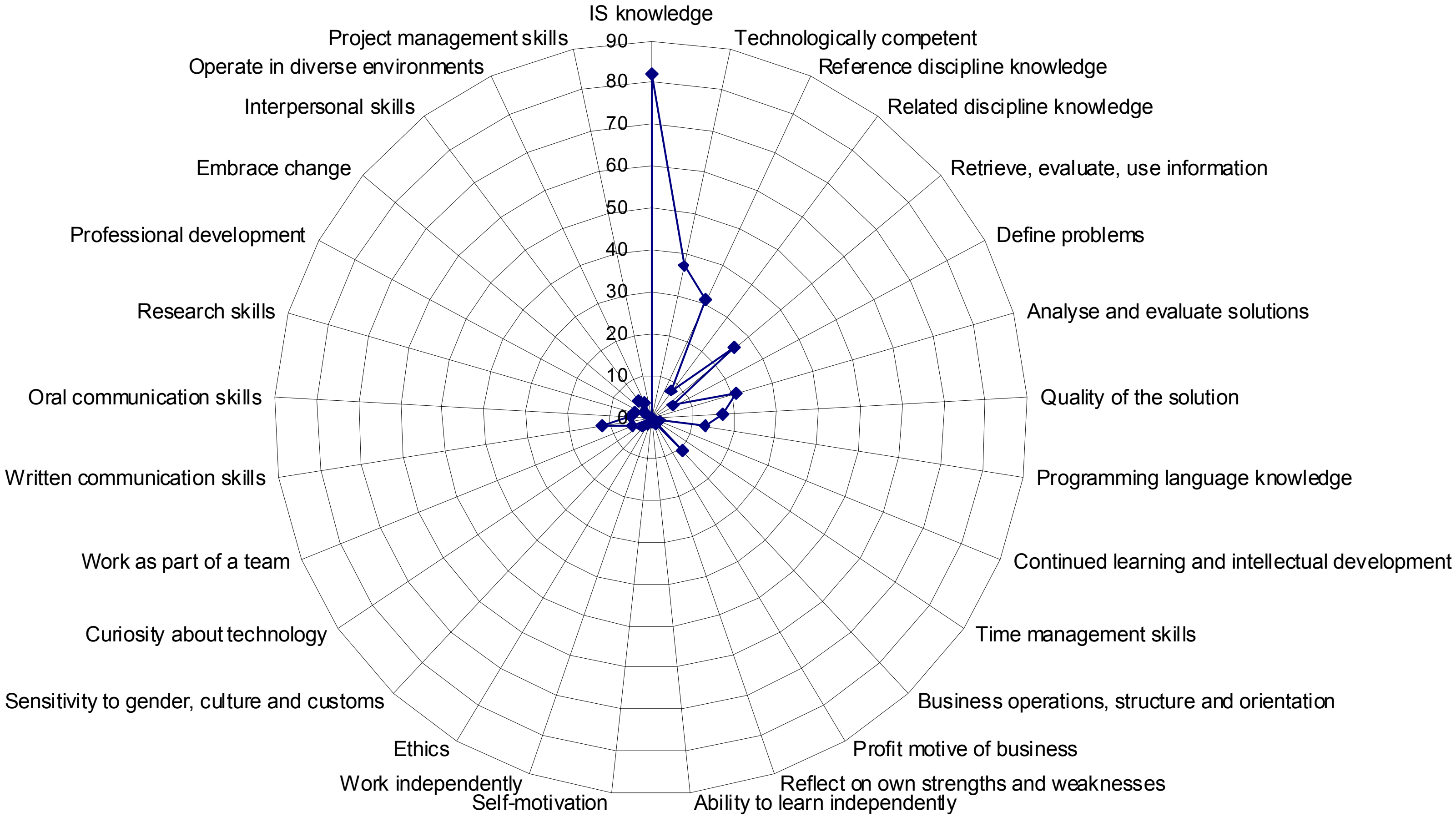

Figure 3.2
IT20 – QUT Generic Attribute Coverage - Raw Data

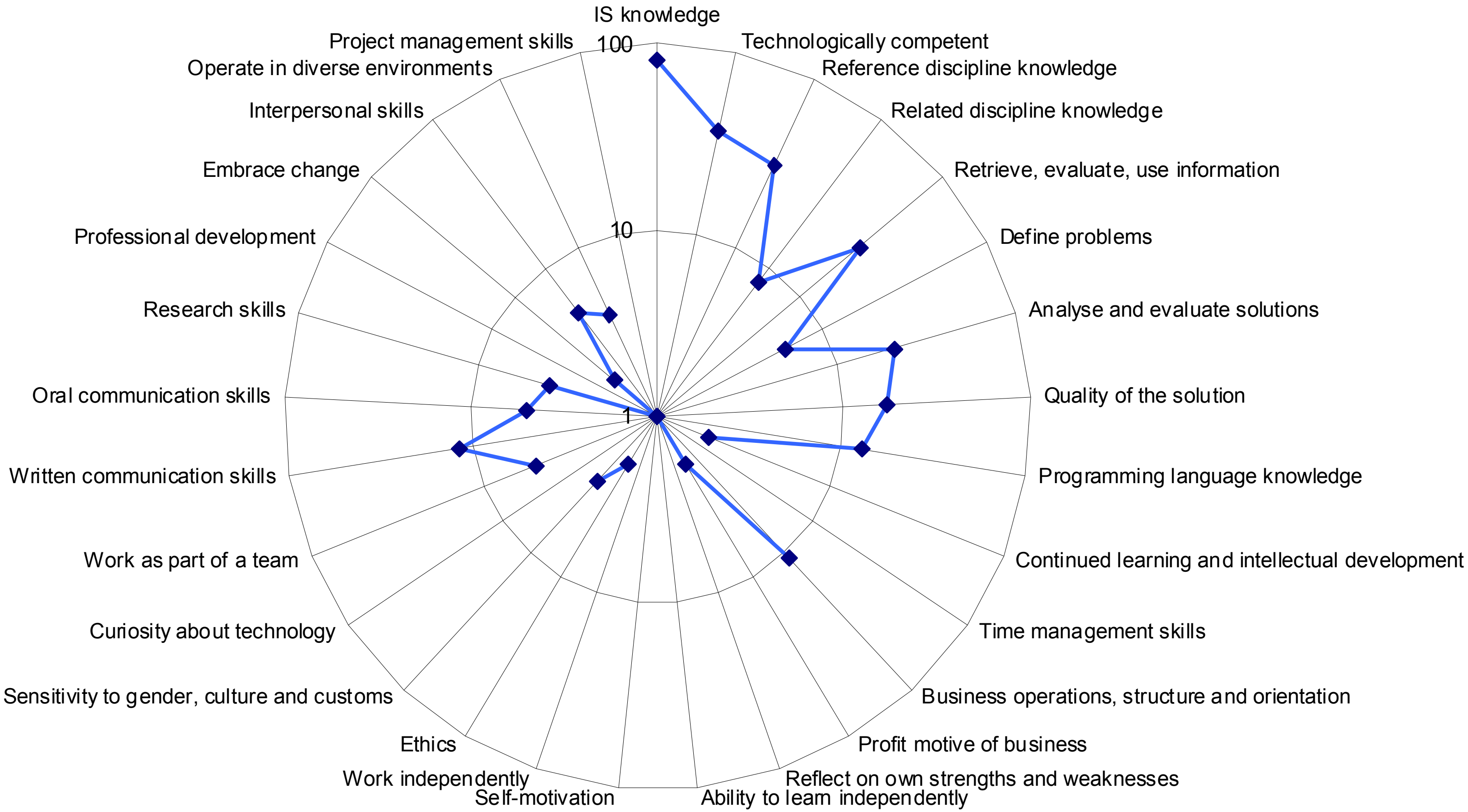

Figure 3.3
Logarithmic Graph of IT20 Attribute Coverage

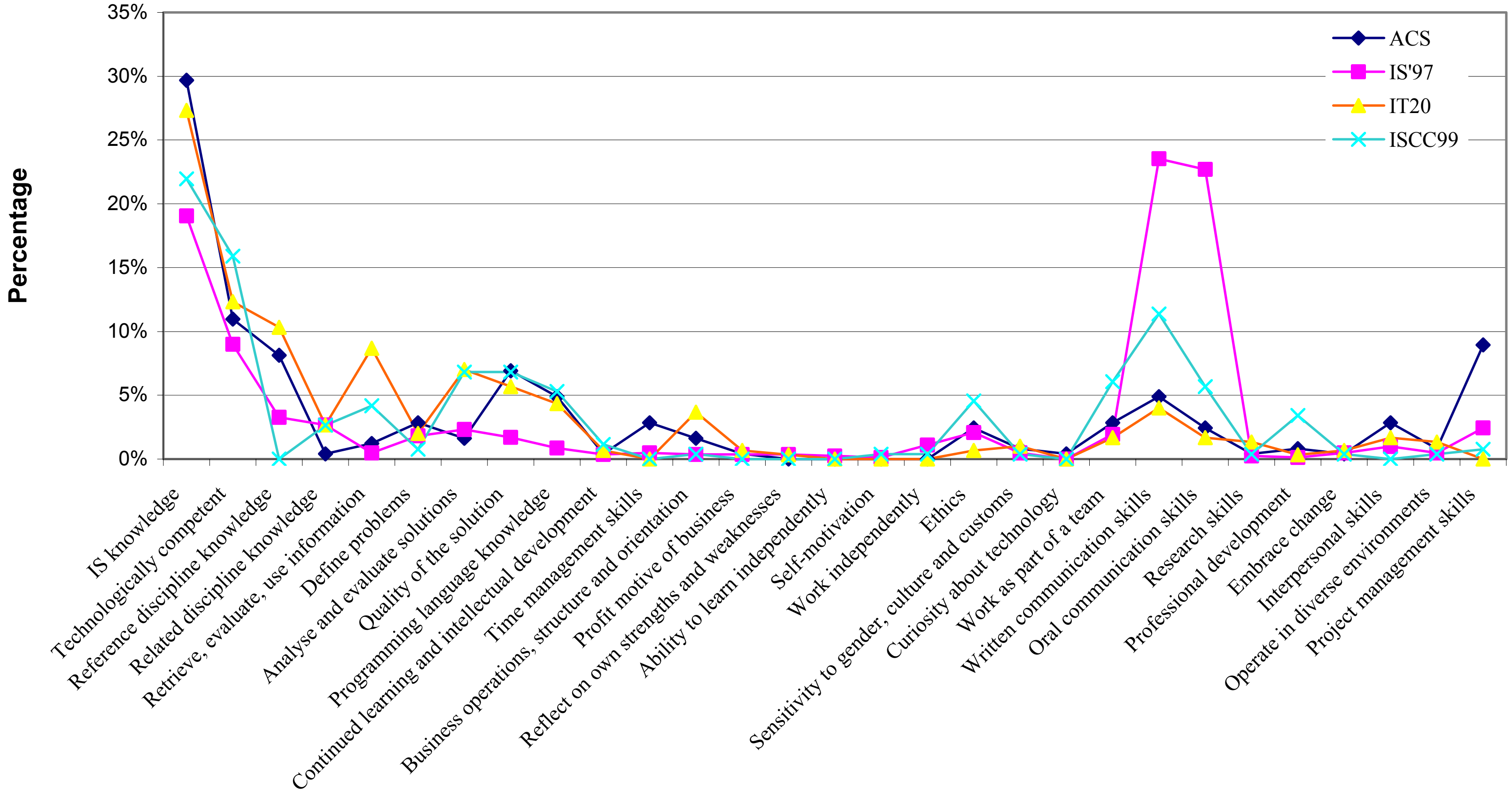

Figure 3.4

Graphical Representation of IT20: ACS: IS'97: ISCC'99

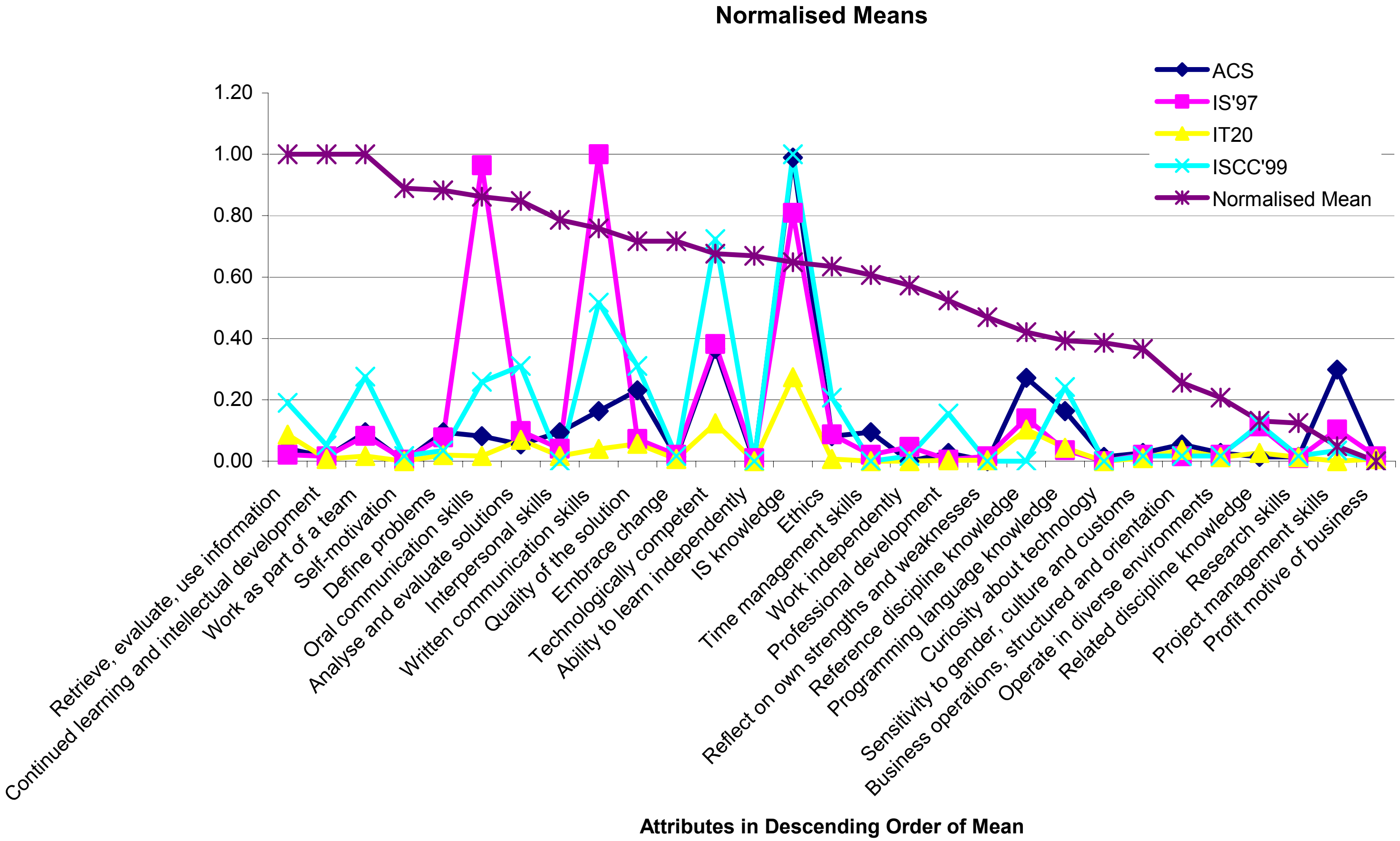

Figure 3.5
Normalised Graphical Representation of IT20: ACS: IS'97: ISCC'99

3.11. **Chapter Summary**

This chapter has described the methodology of the study. The processes involved in the identification and validation of the generic attributes have been presented. The survey instrument structure and process have been explained. This included the use of personalised emails in an attempt to increase the participation rate. The method for mapping the unit objectives against the generic attributes has been detailed.

The chapter concluded with a detailed example of how the methodology can be applied to a single unit within a course of study.

The diagram in Figure 3.6 presents the research plan across the bottom of the diagram. The chapters of the thesis are shown above the research plan. This allows the reader to easily relate the content of each chapter to the different phases of the research plan. Figure 3.6 below positions this chapter, in blue, and the next chapter in green, which presents the results of the pilot study, the Queensland study and the Australian study for the identification and validation of the generic attributes of IS graduates as they relate to the overall research plan.

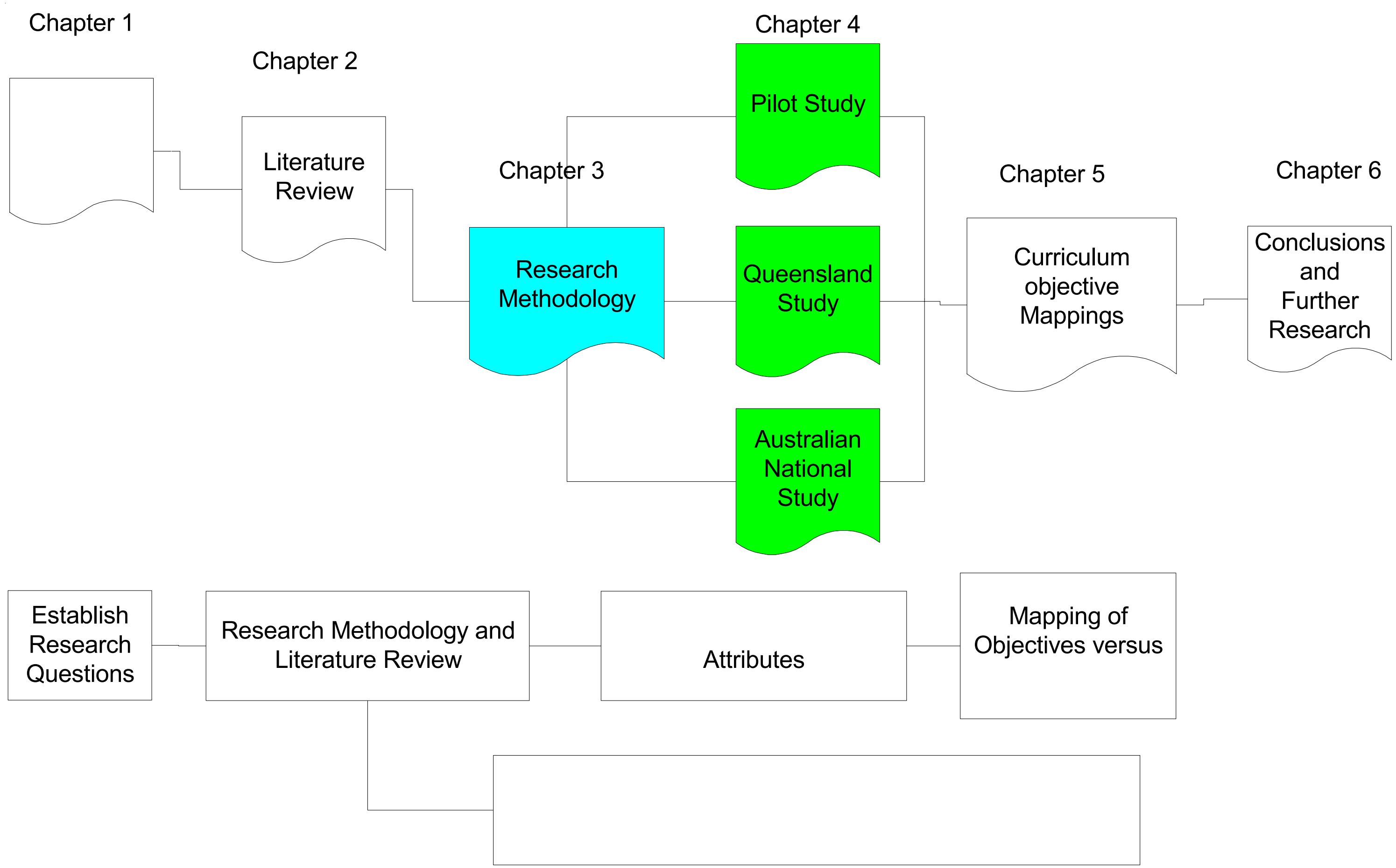

Figure 3.6
Diagrammatic View of the Thesis and Research Plan

Chapter 4
Identification and Validation of the Generic Attributes

List of Figures

List of Tables

Abstract

This chapter presents the results of the Queensland study and Australian studies that identified and ranked generic attributes of graduates of undergraduate degree courses with majors in Information Systems (IS). A three round Delphi questionnaire was used in each study. Major findings of the pilot study include the rating of continued learning, intellectual development and the development of critical, reflective and creative thinking along with written and oral communications as more important than a comprehensive knowledge of IS. Major findings of the Queensland study and the Australian study include the rating of the attributes of information retrieval, teamwork, self-motivation, continued learning, intellectual development and the development of critical, reflective and creative thinking, problem definition and analysis and evaluation of various solutions along with written and oral communications as more important than a comprehensive knowledge of IS. There is a strong correlation between the Queensland study and the Australian study.

4. Introduction

The purpose of this chapter is to present the results of the Queensland study of the generic attributes of graduates from tertiary Information Systems (IS) courses of study. This is then followed by a discussion of a larger follow-up Australian study of the generic attributes of graduates.

The research method as discussed in the previous chapter is implemented and the findings from the two studies are analysed and compared. The results of the two studies are used as validation of the list of generic attributes of IS graduates in their first year of employment.

The validation of the generic attributes is the rating by both industry and academics of the relative importance of these attributes in terms of their importance to an employer in the first year of work after completing an undergraduate degree. Factor analysis is performed in an effort to identify any emerging trends or clusters of attributes.

4.1. The Pilot Study

The pilot study was conducted in 1997 using the Information Systems Management Research Concentration (ISMRC) at QUT. The sample population includes both representatives from industry who employ the graduates of the courses and academics. The study was conducted using a modified three round Delphi technique and resulted in a response rate of 83 percent for the final round. The study rates a previously identified set of attributes and then ranks them according to their mean rating. Details of the pilot study may be found in Appendix B.

The significant outcomes from the pilot study include the addition of project management as an attribute and the inclusion of separate attributes for written communication and oral communication. A second significant change to be implemented from the pilot study was the increase in the size of the Likert-type scale from 5 to 7 as discussed in the previous chapter.

4.2. The Queensland Study

The Queensland study represents the second phase of a study (Snoke and Underwood 1998) that validates a group of generic attributes of graduates of Queensland tertiary Information Systems (IS) courses of study. The list of competencies was taken from a list prepared by a working party at QUT (Crebert 1995) and, based on the feedback from the pilot study survey discussed above and further analysis of the generic attributes, the following changes were made for the Queensland study.

The rating scale was expanded to allow respondents a wider range of values. One additional attribute, ***project management,*** was added and the separation of communication skills into the two new attributes of ***oral communications skills*** as a separate attribute from ***written communications skills***. A list of the attributes used in the Queensland study is found in Appendix L.

4.3. Participation Results

The sample population included both academics and representatives from industry who employ the graduates of IS courses. The total sample population of 238 consisted of 58 academics and 180 industry representatives. A high number of academics (78 percent) responded to all three rounds while only 29 percent of industry representatives participated. The number of respondents per round for both industry and academics is shown in Table 4.1. As can be seen from the Table there was an increase in the number of participants per round of approximately 2 percent. The final round participation rate of 41 percent is well within the accepted range for survey studies (Wallace & Mellor 1988).

The mean, median, mode and standard deviation for each attribute were calculated for each round of the study. A response rate of 36 percent was achieved in the first round with industry representation being 61 percent and academic representation 39 percent.

Table 4.1
Respondent Rates per Round

	Total		Industry		Academic	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Round 1	87	36	53	61	34	39
Round 2	91	38	52	57	39	43
Round 3	98	41	53	54	45	46

It should be noted from the Table above that there was an increase in the response rate of 2 percent for the second round and 3 percent in the third round, giving an overall response rate of 41 percent. This response rate is well within the generally accepted range of responses to surveys. Other researchers have reported response rates to email questionnaires as high as 80 percent (Ridley, 1996[1]) (private communication).

Reminder notices were sent to 9 percent of the academics in round three asking them to complete the questionnaire. Four percent of industry representatives required prompting to complete the questionnaires. If a modified Delphi technique had not been used the final round response rate would have been at best 36 percent, which is still a very acceptable response rate.

4.4. Key Findings from the Queensland Study

The competencies are listed in overall rank order in Table 4.2 using the mean of the third round to rank them as well as the ranking from the pilot study. It should be noted that the Queensland study used an expanded seven point Likert-type scale, in order of increasing importance, where 1 = extremely unimportant, 2 = unimportant, 3 = of little importance, 4 = neutral, 5 = very important, 6 = of major importance. 7 = extremely important (essential). Space was provided at the end of the survey instrument for additional attributes to be added or for other comments. This was done to provide respondents with a greater flexibility to discriminate between the importance of the different attributes.

From the mean values listed in Table 4.2 it can be seen that the top 24 competencies are rated as being at least very important (mean rating of 5.00 or greater) with the top six being rated as being of major importance with a mean rating of 6.00 or greater. The important result is that the knowledge and skills in IS are rated fifteenth below many of the more general personal attributes such as oral communications skills (ranked 7th) and written communications skills (ranked 11th).

With the advent of the information society it is not surprising to see that the ability to use information retrieval skills is ranked number one. In today's society it is not surprising to see that the 'people' skills, which include written and oral communications skills, working as part of a team, and interpersonal skills are rated

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[1] G Ridley 1996, personal communication, 20 September

highly. This is consistent with anecdotal evidence that employers value the 'people' skills more highly than the traditional intellectual skills, which include knowledge of the specific discipline.

Table 4.2

IS Generic Competencies

Competency	Queensland		Pilot	
	Mean	Rank	Mean	Rank
Retrieve, evaluate and use relevant information	6.31	1	4.63	4
Work as part of a team in a productive and cooperative manner	6.29	2	4.53	6
Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.	6.25	3	4.73	1
Self-motivation	6.16	4	3.80	20
Define problems in a systematic way	6.14	5	4.40	8
Analyse, synthesise and evaluate the various solutions	6.11	6	4.27	10
Oral communication skills	5.96	7	4.67	2
Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology	5.93	8	4.43	7
Consider the quality of the solution and its timeliness	5.90	9	4.07	13
Time management skills	5.90	9	3.87	17
Written communication skills	5.87	11	4.67	2
Interpersonal skills	5.85	12	4.20	12
With respect to the Information Systems discipline be technologically competent	5.77	13	4.33	9
Confidence about their ability to learn independently	5.74	14	3.87	17
With respect to the Information Systems discipline possess coherent, extensive, theoretical and practical knowledge	5.72	15	4.60	5
Work independently	5.68	16	4.27	10
Participate in on-going professional development	5.68	16	4.00	15
Value the ethics of the Information Technology profession	5.61	18	4.07	13
Ability to reflect on own strengths and weaknesses	5.52	19	4.00	15
Possess a sense of basic curiosity about technology	5.38	20	3.60	23
Demonstrate practical knowledge and understanding in at least one computer language	5.34	21	3.20	26
With respect to the Information Systems discipline possess theoretical and practical knowledge in at least one reference discipline	5.27	22	4.67	2
Sensitivity to differences in gender, culture and customs	5.19	23	3.80	20
Knowledge of how a business operates, is structured or is orientated	5.03	24	3.53	24
Research skills	4.95	25	3.87	17
Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment	4.92	26	3.73	22
Project management skills	4.92	26	NR	NR
With respect to the Information Systems discipline possess the theoretical and practical knowledge of related disciplines.	4.85	28	3.30	25
Understand the profit motive of business	4.77	29	2.80	27

NR = not rated in the pilot study

The data in the above Table suggests that the attributes could be broadly grouped based on their ranking proximity to each other and breaks in the means as follows:

- Opportunity attributes;
- Personal attributes;
- Business knowledge;
- Discipline knowledge; and,
- Flexibility.

4.4.1. Opportunity Attributes

The most important finding from the data is that the opportunity attributes of:

- Retrieve, evaluate and use relevant information;
- Working as part of a team in a productive and cooperative manner;
- Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking;
- Self-motivation;
- Define problems in a systematic way; and,
- Analyse, synthesise and evaluate the various solutions.

are all rated as essential. This may suggest that the employer is really interested in employees who have the ability to solve problems, which may involve the use of critical, reflective and innovative thinking and practices. This may be a reflection of the modern business environment in which new business opportunities are at the core of the business operations. It is no longer suitable for business to solely rely on doing business as they did in the past if they plan to stay in business in the future. This is brought about by the constantly changing society in which we live.

4.4.2. Personal Attributes

Personal attributes listed below are sometimes referred to as ‘people’ skills in that they relate to an individual’s personal characteristics and personal values such as ethics. These attributes are:

- Oral communication skills;
- Consider the quality of the solution and its timeliness;
- Time management skills;
- Written communication skills;
- Interpersonal skills;
- Confidence about their ability to learn independently;
- Work independently;
- Participate in on-going professional development;
- Value the ethics of the Information Technology profession; and,
- Ability to reflect on own strengths and weaknesses.

4.4.3. Business Knowledge Attributes

Business knowledge attributes listed below are ranked relatively low, but still with a mean greater than 4.7 out of 7. This is inconsistent with the anecdotal evidence from industry representatives that they value business knowledge as the most important attribute in a new employee. Business knowledge attributes include:

- With respect to the Information systems discipline possess theoretical and practical knowledge in at least one reference discipline;
- Knowledge of how a business operates, is structured or is orientated;
- Research skills;
- Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment;
- Project management skills;
- With respect to the Information systems discipline possess the theoretical and practical knowledge of related disciplines; and,

- Understand the profit motive of business.

4.4.4. Discipline Knowledge Competencies

Discipline knowledge competencies are listed below. These are the attributes that relate to the specific field of IS in terms of the skills that an employer requires in a new employee. These are:

- With respect to the Information Systems discipline be technologically competent;
- With respect to the Information Systems discipline possess coherent, extensive, theoretical and practical knowledge;
- Possess a sense of basic curiosity about technology;
- Demonstrate practical knowledge and understanding in at least one computer language; and,
- With respect to the Information Systems discipline possess theoretical and practical knowledge in at least one reference discipline.

4.4.5. Flexibility Attributes

Flexibility attributes relate to the individual's ability to be adaptable and flexible within the workplace. The attributes that fall into this category include:

- Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology;
- Ability to reflect on own strengths and weaknesses;
- Sensitivity to differences in gender, culture and customs; and,
- Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment.

The attributes will be further examined in the statistical analysis section later in this chapter where any underlying factors will be identified.

The results of the Queensland study are generally supported by the results of the pilot study. Of the top six in the Queensland study only the attribute of self-motivation showed marked differences as compared with the pilot study. The attributes that were ranked lowest also tended to be ranked in a similar order between the two studies.

This section has discussed the overall results from the Queensland study. This will now be expanded to examine the industry and academic views of the generic attributes or competencies.

4.5. Industry Versus Academic Results

A comparison of the views of the industry representatives and the academics was done to identify significant differences and trends that may emerge from the data. The results of the industry and academic views of the relative importance of the attributes are shown in Table 4.3 in the order the attribute appeared in the survey instrument. This order of presentation is for ease of comparison of the data. Care must be taken when interpreting the results due to the relatively small sample size.

Table 4.3

Queensland Industry and Academic Comparison of Generic Attributes

		Industry		Academic		Overall		Difference in Rank	Significance of Mean T-test
Attribute No	**Attribute**	**Rank**	**Mean**	**Rank**	**Mean**	**Rank**	**Mean**	**I - A Rank**	
5	Retrieve, evaluate and use relevant information	1	6.33	3	6.28	1	6.31	-2	0.466
21	Work as part of a team in a productive and cooperative manner	2	6.28	2	6.30	2	6.29	0	0.306
10	Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.	3	6.22	3	6.28	3	6.25	0	0.218
16	Self-motivation	4	6.19	6	6.13	4	6.16	-2	0.439
6	Define problems in a systematic way	5	6.02	3	6.28	5	6.14	2	0.032
7	Analyse, synthesise and evaluate the various solutions	7	5.94	1	6.31	6	6.11	6	0.007
23	Oral communication skills	8	5.93	8	6.00	7	5.96	0	0.259
26	Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology	5	6.02	13	5.83	8	5.93	-8	0.791
8	Consider the quality of the solution and its timeliness	11	5.81	8	6.00	9	5.90	3	0.063
11	Time management skills	10	5.87	11	5.93	9	5.90	-1	0.168
22	Written communication skills	14	5.72	7	6.05	11	5.87	7	0.032
27	Interpersonal skills	9	5.89	14	5.80	12	5.85	-5	0.654
2	With respect to the IS discipline be technologically competent (the person is able to use the current technology competently)	12	5.79	15	5.74	13	5.77	-3	0.536
15	Confidence about their ability to learn independently	16	5.63	12	5.89	14	5.74	4	0.101
1	With respect to the IS discipline possess coherent, extensive, theoretical and practical knowledge	18	5.50	10	5.99	15	5.72	8	0.008
25	Participate in on-going professional development	13	5.74	19	5.62	16	5.68	-6	0.628
17	Work independently	15	5.69	16	5.67	16	5.68	-1	0.460
18	Value the ethics of the Information Technology profession	17	5.59	18	5.63	18	5.61	-1	0.511
14	Ability to reflect on own strengths and weaknesses	20	5.45	20	5.59	19	5.52	0	0.165
20	Possess a sense of basic curiosity about technology	19	5.48	23	5.26	20	5.38	-4	0.923

4.10

Attribute No	Attribute	Industry		Academic		Overall		Difference in Rank	Significance of Mean T-test
		Rank	Mean	Rank	Mean	Rank	Mean	I - A Rank	
9	Demonstrate practical knowledge and understanding in at least one computer language	23	5.07	16	5.67	21	5.34	7	0.012
3	With respect to the IS discipline possess theoretical and practical knowledge in at least one reference discipline which includes behavioural science, computer science, decision theory, information theory, organizational theory, management theory.	21	5.16	21	5.40	22	5.27	0	0.066
19	Sensitivity to differences in gender, culture and customs	22	5.13	23	5.26	23	5.19	-1	0.358
12	Knowledge of how a business operates, is structured or is orientated	27	4.81	22	5.28	24	5.03	5	0.006
24	Research skills	25	5.04	27	4.84	25	4.95	-2	0.909
29	Project management skills	23	5.07	29	4.74	26	4.92	-6	0.504
28	Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment	26	4.83	26	5.02	26	4.92	0	0.145
4	With respect to the IS discipline possess the theoretical and practical knowledge of related disciplines. For example, business, law, education, data communications, computer science or leisure recreation	29	4.69	25	5.06	28	4.85	4	0.007
13	Understand the profit motive of business	28	4.78	28	4.76	29	4.77	0	0.557

4.11

From the data in Table 4.3 it should be noted that there is general agreement on the six most important competencies all of which are rated as being essential for an employee to possess at the completion of an IS course of study. The difference between the industry ranking and the academic ranking of the first six attributes is only in the order of importance. Both industry and academics rank ***working as part of a team in a productive and cooperative manner*** as the second most important competency.

There are seven of the attributes that have a significant difference in their means as noted by the highlighted t-test value in Table 4.3. For the majority of these attributes there is also a large difference in their rankings in general. This may be due in part to the different work environment from which the respondents have come. Industry ranks all of the above seven attributes lower than academics. This may reflect the industry view that they value the more personal attributes more highly than the technical attributes. Industry often requires new employees who they can mould into their specific style of employee. Thus they value the general attributes such as ***working as part of a team*** and ***self-motivation*** more than the IS related attributes.

4.5.1. Industry's Most Important Attribute

Industry placed the most importance on the attribute of ***retrieve, evaluate and use information*** while academics placed the most importance on the attribute of ***analyse, synthesize and evaluate various solutions***. This difference may be a reflection of the different environments within which they work and the expectations of those environments. Industry expects employees to be able to obtain information from a variety of sources and evaluate its usefulness to the business situation while the academic expects the student to be able to evaluate the most appropriate solution to a given problem within the academic environment.

4.5.2. **Attributes Ranked More Important By Academics**

It should be noted that the competency ***with respect to the IS discipline possess coherent, extensive, theoretical and practical knowledge*** is rated 10th by academics and 18th by industry. This is well below the attributes considered to be essential of any employee. These attributes all received a mean rating of 5.7 or greater from both industry and academics. The attributes that are rated higher than the discipline knowledge attributes are:

- Retrieve, evaluate and use relevant information;
- Working as part of a team in a productive and cooperative manner;
- Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking;
- Self-motivation;
- Define problems in a systematic way;
- Analyse, synthesise and evaluate the various solutions;
- Oral communication skills;
- Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology;
- Consider the quality of the solution and its timeliness;
- Time management skills;
- Written communication skills;
- Interpersonal skills;
- With respect to the Information Systems discipline be technologically competent (the person is able to use the current technology competently); and,
- Confidence about their ability to learn independently.

These attributes include the personal and motivational attributes that drive many individuals in the working environment. There is agreement between industry and academics on the importance of oral communications skills both in the workplace and in the academic environment. However, there is a significant difference of opinion on the ranking of written communications skills importance. Industry ranked written communication skills 14th as compared to the academic ranking of 7.

The academics place a greater importance on the individual's ability to communicate in both written and oral media than those in industry. This may be partially due to the expectation in the academic environment that students will be competent at the presentation of material. While in the industry environment the emphasis is placed on the individual's ability to orally communicate, as the environment of many businesses does not want time spent on expressing all communications in written form. It is quicker and easier to communicate in an oral manner than in a written manner.

The fundamental skill of all IS professionals of being able to program in at least one computer language is ranked very low by both industry (23) and academics (16). This may be in part due to a common practice in industry of wanting to take employees and mould them in the particular business operating environment and methodologies used in the particular business.

There is general agreement on the attributes that are considered relatively unimportant. It should be noted that the following discussion does not imply that any of the attributes are not important as they all received a mean ranking of 4.69 or higher from both industry and academics. The attributes of ***project management skills, with respect to the IS discipline possess the theoretical and practical knowledge of related disciplines such as business, law, education, data communications, computer science or leisure recreation*** and ***understand the profit motive of business*** are ranked as the bottom three by both industry or academics.

The competency of ***project management skills*** is ranked 29th by academics while industry rank it 23rd. This relatively low rating may be a reflection of the fact that project management is a set of skills usually developed over time and with experience.

4.5.3. Attributes with a Large Difference in Ranking

From the above data it should be noted that 9 of the 29 attributes listed have a difference in ranking of 5 or more. Those attributes with a difference in ranking of 5 or more are shown in Table 4.4.

The data in Table 4.4 indicates that most of the attributes with a large difference in ranking are the attributes that are rated relatively towards the bottom of the list of attributes. The attributes ranked higher by academics include the knowledge of the IS discipline along with the ability to program. This may be considered somewhat surprising given the nature of the IS industry that the fundamental skills of the discipline are rated rather low.

Table 4.4

Industry versus Academic Results
Attributes with a difference in ranking of 5 or more

Attribute No	Attribute	Industry Mean	Industry Rank	Academic Mean	Academic Rank	Difference in Ranking	Significance of Mean T-test
12	Knowledge of how a business operates, is structured or is orientated	4.81	27	5.28	22	5	0.006
7	Analyse, synthesise and evaluate the various solutions	5.94	7	6.31	1	6	0.007
22	Written communication skills	5.72	14	6.05	7	7	0.032
9	Demonstrate practical knowledge and understanding in at least one computer language	5.07	23	5.67	16	7	0.012
1	With respect to the IS discipline possess coherent, extensive, theoretical and practical knowledge	5.50	18	5.99	10	8	0.008
27	Interpersonal skills	5.89	9	5.80	14	-5	0.654
25	Participate in on-going professional development	5.74	13	5.62	19	-6	0.628
29	Project management skills	5.07	23	4.74	29	-6	0.504
26	Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology	6.02	5	5.83	13	-8	0.791

An interesting finding from Table 4.4 is that the five attributes ranked higher by academics have a significant difference in their means while the attributes ranked higher by the industry respondents do not have a significant difference in their means.

A significant ranking difference is the number one ranking given to the attribute of ***analyse, synthesise and evaluate the various solutions*** while the industry representatives ranked it as still important but ranked it at number seven.

Industry ranks the attributes of e***mbracing change and engage in incremental improvement to keep with the rapid change in technology, interpersonal skills, project management skills***, and ***participate in on-going professional development*** significantly higher than the academics.

These differences in the relative importance of the attributes may be a reflection of the differences within the environments of the industry workplace as compared to the academic learning environment. Industry appears to value the practical skills more highly than the more analytical skills valued by the academics.

There is general agreement of the importance of ***oral communication skill*****s**. However, industry places a significantly lower importance on the ***written communication*** attribute than academics. Both industry and academics ranked the attribute of ***working as part of a team*** as being of extreme importance. Industry rates ***retrieve evaluate and use relevant information*** as the most important attribute.

4.6. Statistical Analysis – Queensland Study

As mentioned earlier SPSS was used to analyse the data obtained from the Queensland study. The sample size in the pilot study was too small to provide any meaningful statistical output. Factor analysis was conducted to identify the existence of any underlying trends or factors. The correlation matrix had most correlation exceeding .3 and therefore the matrix is considered suitable for factoring (Coakes, 1996). The other indicators of suitability for factoring are the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy (0.81618) and the Bartlett Test of Sphericity being significantly greater than 1000 at 1511.8989.

A KMO rating in the data is significant if it is greater than 0.60 (Coakes, 1996). A KMO measure greater than 0.6 is generally considered the minimum for determining the adequacy of a sample size for factoring. The Bartlett test of sphericity is significant if it is greater than 1000 (Coakes, 1996). The higher the two values, the greater the usefulness of the data and the more appropriate the interpretation. Table 4.5 by Kaiser (Kaiser, 1974, p 35) gives the following interpretation to the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO).

Table 4.5

Kaiser-Meyer-Olkin Measure of Sampling Adequacy Descriptions

Range	Degree of Usefulness
0.90 - 0.99	marvelous
0.80 – 0.89	meritorious
0.70 – 0.79	middling
0.60 – 0.69	mediocre
0.50 – 0.59	miserable
0.00 – 0.49	unacceptable

The industry data is not suitable for separate factor analysis as it had a KMO sampling adequacy of 0.43422 and Bartlett Test of Sphericity of 723.00178. These tests indicate that the data for identifying factors would not be reliable.

The data for the academic representatives for Queensland had a KMO sampling adequacy value of 0.7705 and a Bartlett Test for Sphericity of 1107.5648. These values indicate that the data is suitable for factoring. The academic data provided six underlying factors as depicted in Figure 4.1.

4.6.1. Common Factors from an Academic Perspective

The data presented in Figure 4.1 identifies six common factors from the data. It is noted that the largest number of attributes (13) may be grouped generally under a heading of ***General Work Performance Skills*** and includes the attributes of interpersonal skills, oral communications and written communications, working as part of a team, working independently, self-motivation, quality of the solutions, analyse and evaluate the various solutions, retrieve evaluate and use information, ability to learn independently, programming language knowledge, problem definition and time management skills. This group of attributes with the exception of the programming language ability attribute are generally applicable to any work environment.

The attributes of ***Project Management Skills*** and technical competence are grouped under a heading of project management. What is important to note about this group of attributes is that time management is missing from the group. Time management is an integral part of project management. The inclusion of the attribute of technical competence with the ***Project Management*** factor is interesting, as many people would think it is more closely related to the Information Systems discipline knowledge factor.

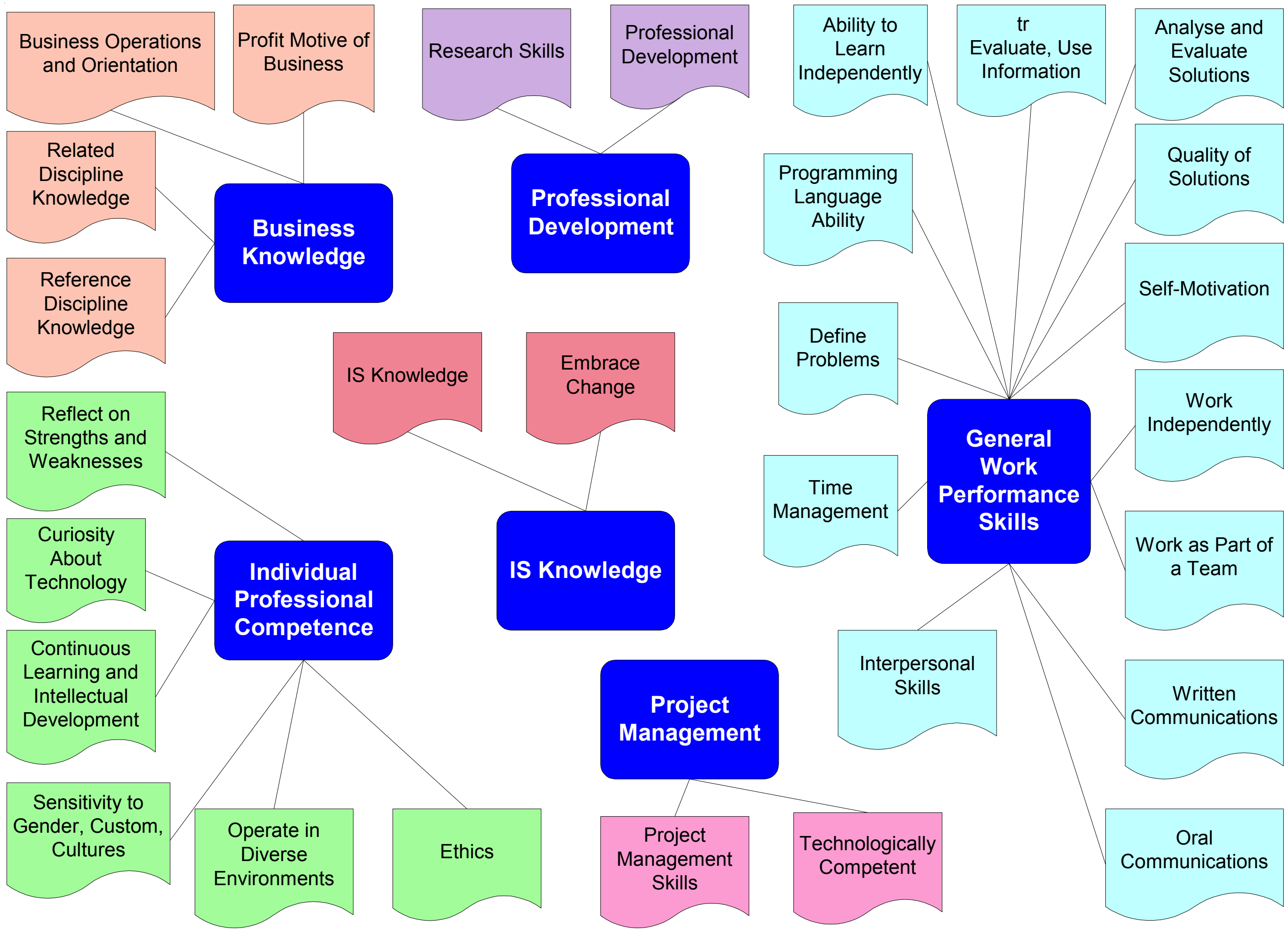

Figure 4.1
Queensland Academic Factor Analysis

The Individual Professional Competencies include reflection on one's strengths and weaknesses, curiosity about technology, continuous learning and intellectual development, sensitivity to gender, cultures and customs as well as the attribute of being able to operate in diverse environments. The attribute of ethics is also included with this group of competencies. The individual professional competencies group relates to the moral and ethical attitudes that are desired in a new employee.

The Business Knowledge attributes relate to the knowledge of how a business operates and the place of business a larger view of the world. The business knowledge attributes include understanding the profit motive of business, knowledge of the operation and orientation of the business, related discipline knowledge and reference discipline knowledge.

The Professional Development group of attributes includes the attributes of professional development and research skills. These two attributes are essential for an IS person to expand their career in the IS field.

The last, and by no means the least important group is the IS discipline knowledge factors. The attributes included with this factor include the extensive and practical knowledge of the IS discipline as well as the attribute of embracing change. What is important to note from the attributes in this factor is the absence of the programming ability attribute. The inclusion of the attribute of embracing change is significant as it is a clear statement that the IS field has as a fundamental feature the fact that change is an essential component of the discipline.

The factor analysis using the combined data for both industry and academics indicated that there are eight underlying factors that account for 70 percent of the variance of the means. Several methods of extraction were used including Principal Component (PC) and Principal Axis Factoring (PAF). Similar results were achieved with each of the methods of extraction. The eight identified factors are shown in Figure 4.2 along with the generic competencies that underpin them.

4.6.2. Common Factors from Queensland Perspective

When the industry data is combined with the academic data, a slightly different set of underlying factors appears. These Queensland underlying factors are shown in Figure 4.2.

The Business Knowledge underlying factor for the combined data consists of the attributes ***time management, understanding the profit motive of business, project management skills*** and ***understanding the business operations and orientation***. What is important to note is that using the combined data the reference discipline and related discipline knowledge attributes are no longer linked to the business knowledge factor. They have been replaced by the attributes of ***time management*** and ***project management***.

The Professional Competencies factor includes the attributes of related discipline knowledge, sensitivity to gender, cultures and customs curiosity about technology and ethics. Most of these were included in the factor identified by the academic factor analysis.

The Professional Development group of attributes includes the attributes of professional development, interpersonal skills, embracing change and continuous learning and intellectual development. These attributes are essential for an IS person to expand their career in the IS field and indicate the need for an IS professional to be a lifelong learner.

Figure 4.2
Underpinning Factors from the Queensland (Industry and Academic) Perspective

The IS discipline knowledge factor is linked with the attributes of extensive and practical knowledge of the IS discipline, technical competence in the IS discipline as well as the attribute of reference discipline knowledge. What is important to note from the attributes in this factor is the absence of the programming ability attribute. This group of three attributes is a clear indication that employers require the new employee to have an extensive knowledge of IS but also they must be able to use the knowledge in a competent manner.

New underlying factors have emerged from the combined data. The factor identified in the academic analysis as individual professional competencies has been split into factors called individual competencies and professional competencies. The general work performance skills factor identified in the academic analysis has been replaced by the factors of information use, programming skills, and problem solving.

The new group of underlying factors called Programming Skills has evolved. The attributes included with this factor are programming language ability and working independently. These are two attributes that are often linked to programming, as programmers need to have knowledge and ability in the language they work in as well as being able to work by themselves to complete a task.

The individual competency factor includes the attributes of self-motivation, reflection on one's strengths and weaknesses and the ability to learn independently. These are attributes that relate to the individual and their individual ability.

The information use factor includes the attributes required to gather and use information in the current information age. The attributes included with this factor are research skills, retrieval evaluation and use of information and the ability to operate in diverse environments.

Last and by no means the least important factor is that of problem solving. The current business environment requires that a person be able to use problem-solving skills in the workplace. The attributes included with this factor are working as part of a team, analyse and evaluate the various solutions, problem definition, written communications skills, oral communications skills, and evaluation of the quality of the solutions to a problem. This group of attributes could also have been called teamwork, as the current work environment requires individuals to work in teams. Also both written and oral communications are essential in the modern work environment.

4.7. Australian Study

The Queensland study was followed by a larger Australian study involving all the universities that offered IS programs of study. The Australian study was conducted for two purposes. Firstly, to validate the data from the Queensland study. Secondly, to identify any trends that may emerge from surveying a population in the much larger southern states of New South Wales and Victoria in Australia and thus giving a national perspective to the relative importance of the identified generic attributes.

The previous sections highlighted the Queensland study that identified the generic attributes of IS graduates. This section describes the Australian study results. These identify the importance on a national scale, of the generic attributes used in the Queensland study. Comparison of these national study results from both industry and academic perspectives are discussed as well as a comparison with the previous Queensland study.

As in the Queensland study a seven point Likert-type scale was used where the participants were asked to rank the attributes in order of increasing importance, where 1 = extremely unimportant, 2 = unimportant, 3 = of little importance, 4 = neutral, 5 = very important, 6 = of major importance. 7 = extremely important (essential). Space was provided at the end of the survey instrument for additional attributes to be added or for other comments.

The section proceeds as follows. Firstly, the respondent distribution and representation of the national study will be described. Secondly, the results of the study will be discussed using the following headings.

- Key findings - an academic perspective;
- Key findings - an industry perspective;
- Combined national academic and industry findings and discussion; and,
- Discussion of the combined results of the Queensland and Australian studies.

Factor analysis is used to identify common factors or groups of attributes in each of the abovementioned sections.

4.8. Sample Population Australian Study

The sample population included both academics from all universities that offer an undergraduate degree in IS or an undergraduate degree with a major in IS as of July 1998 and representatives from industry who employ the graduates of IS courses. The total sample population of 449 consisted of 354 academics and 95 industry representatives. A significant number of academics (30 percent) responded to all three rounds while a high number of industry representatives (51 percent) participated giving an overall participation rate of 34 percent.

4.9. Participants – Academic

The number of participants from each state is shown in Table 4.6

Table 4.6

Participation by State – Australian Study

State	Number of Participants
Queensland	4
New South Wales	29
Victoria	30
Tasmania	3
Western Australia	25
South Australia	9
Total	100

From the data in the Table above it should be noted that the larger states in terms of the number of institutions which offer IS courses of study had approximately equal representation in the study. The states with a relatively small number of IS courses of study had few participants. Queensland was represented in this study by the University of Queensland as it was just introducing an IS program of study within its Commerce department. Queensland academics' views of the importance of the generic attributes were the subject of a separate survey instrument and study as reported in the previous section.

The number of respondents per round is shown in Table 4.7. As can be seen from the Table there was a slight increase in the number of participants per round. This is similar to the participation trends observed in the earlier studies generic attributes (Snoke & Underwood, 1998a, 1998b). The final round participation rate of 30 percent is well within the accepted range for survey studies (Wallace & Mellor, 1988).

Table 4.7

Academic Participation Rates per Round

	Number of Respondents	Response Percentage of Population
Round 1	91	26
Round 2	100	28
Round 3	105	30

A small increase in the response rate of 2 percent gave an overall response rate of 30 percent. Significant in the responses received were the number that did not change their opinion when given the additional information for the next round.

Reminder notices were sent to a small percentage of the participants in round three asking them to complete the questionnaire. If this modification to the Delphi technique had not been used the final round response rate would have been slightly less than 30 percent.

4.10. Key Findings - An Academic Perspective

As with the previous Queensland study the data was analysed using the Statistical Package for the Social Sciences (SPSS). The seven most important competencies are listed in overall rank order in Table 4.8 using the mean of the third round to rank them. The mean and ranking from the Queensland study is also presented for comparison purposes.

From the data in Table 4.8 it should be noted that the Australian study reflects the opinions expressed in the Queensland study. The only attribute to show any large difference is that of ***interpersonal skills*** which was more highly ranked in the national study than in the Queensland study. This may, in part, be due to the differences in the sample population and their view of the relative importance of the competency.

The important finding from the above data is that both studies view the individual's ability to work in a team environment, which involves the associated competencies of communication as essential. The national study also considered that for the individual to survive in the modern workplace they must keep their skills up to date and therefore have rated the attribute of ***be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking*** as essential.

What is noticeable by its absence in the top ranked attributes are the competencies that refer to discipline knowledge. This may be a reflection of the current trend in industry of requiring an employee that can be moulded into their specific style. Thus they prefer a generalist trained and educated person who they can develop in the specific company mould. This industry trend is reflected in the high ranking of the attributes of ***be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.*** One would have expected the competency of ***participate in on-going professional development*** to have been included in the above group.

Table 4.8

Academic Ratings of Essential IS Generic Competencies

		Australian			**Queensland**			**Significance of Mean T-test**	**Difference in Ranking**
Attribute No	**Competency**	**Mean**	**St Dev**	**Rank**	**Mean**	**St Dev**	**Rank**		**Aust - Qld**
21	Work as part of a team in a productive and cooperative manner	6.30	0.76	1	6.30	0.81	2	0.95	-1
10	Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.	6.28	4.05	2	6.28	0.87	3	0.96	-1
5	Retrieve, evaluate and use relevant information	6.22	0.86	3	6.28	0.83	3	0.73	0
23	Oral communication skills	6.17	0.75	4	6.00	0.85	8	0.33	-4
6	Define problems in a systematic way	6.11	0.84	5	6.28	0.88	3	0.34	2
22	Written communication skills	6.09	0.80	6	6.05	0.93	7	0.82	1
27	Interpersonal skills	6.02	0.84	7	5.80	0.95	14	0.25	-7

In today's society it is not surprising to see that written and oral communications skills are highly rated. ***Working as part of a team in a productive and cooperative manner*** and ***being able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking*** are the most desired attributes of graduates. This may reflect the growing industry trend of wanting new employees to have some basic skills, but more importantly be willing and able to be trained in the business procedures of the company.

Of importance is the high rating that the attribute ***retrieve, evaluate and use relevant information*** received. This highlights the importance of being able to obtain the necessary information and evaluate its appropriateness to a specific situation. The top three attributes' results are consistent with those obtained in the Queensland studies (Snoke & Underwood, 1998a, 1998b).

The T-test results do not indicate any significant statistical finding from the data at the 0.05 level of significance. This may be due in part to the relatively small sample size within the Queensland study as compared to the Australian study.

The attributes that are considered very important (mean greater than 5.0) are shown in Table 4.9 in rank order of the mean of the third round results.

Table 4.9

Academic Ratings of Very Important IS Generic Competencies

Attribute No	Competency	Australian			Queensland			Significance of Mean T-test	Difference
		Mean	St Dev	Rank	Mean	St Dev	Rank		Aust - Qld
7	Analyse, synthesise and evaluate the various solutions	5.95	0.96	8	6.31	0.94	1	0.04	7
16	Self-motivation	5.87	0.84	9	6.13	0.99	6	0.13	3
1	With respect to the Information Systems discipline possess coherent, extensive, theoretical and practical knowledge	5.80	10.3	10	5.99	0.97	10	0.28	0
8	Consider the quality of the solution and its timeliness	5.72	1.02	11	6.00	0.94	8	0.11	3
2	Technologically competent	5.71	0.94	12	5.74	1.10	15	0.88	-3
18	Value the ethics of the Information Technology profession	5.70	1.27	13	5.63	1.49	18	0.76	-5
26	Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology	5.67	0.99	14	5.83	0.93	13	0.34	1
15	Confidence about their ability to learn independently	5.61	1.01	15	5.89	1.38	12	0.24	-3
3	Theoretical and practical knowledge in at least one reference discipline	5.58	1.00	16	5.40	1.12	21	0.35	-5
11	Time management skills	5.51	1.04	17	5.93	0.87	11	0.01	6
17	Work independently	5.47	0.92	18	5.67	1.06	16	0.27	2
25	Participate in on-going professional development	5.38	1.20	19	5.62	0.93	19	0.20	0
9	Demonstrate practical knowledge and understanding in at least one computer language	5.37	1.45	20	5.67	1.30	16	0.22	4
19	Sensitivity to differences in gender, culture and customs	5.37	1.35	20	5.26	1.62	23	0.71	-3
12	Knowledge of how a business operates, is structured or is orientated	5.36	1.00	22	5.28	1.03	22	0.69	0
14	Ability to reflect on own strengths and weaknesses	5.33	1.08	23	5.59	1.11	20	0.19	3
20	Possess a sense of basic curiosity about technology	5.21	1.10	24	5.26	1.31	23	0.82	1
4	Possess the theoretical and practical knowledge of related disciplines.	5.16	0.91	25	5.06	0.79	25	0.48	0
28	Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment	5.14	0.97	26	5.02	1.17	26	0.57	0

From the mean values listed in Tables 4.8 and 4.9 it can be seen that the top 26 competencies are rated as being at least very important (mean rating of 5.00 or greater) with seven being rated as being of major importance with a mean rating of 6.00 or greater.

The important result is that the knowledge and skills in IS retained its tenth ranking as compared to its position in the Queensland study (Snoke & Underwood, 1998b), below many of the more general attributes such as oral communications skills (ranked 4th) and written communications skills (ranked 6th). The important finding is that the national study identified the discipline specific knowledge and skills to be ranked as very important but just below the previously mentioned attributes of working and communicating in a group environment.

The individual competencies of ***self-motivation*** and ***working independently*** which also require skills in ***time management*** are considered to be very important. It is noted that the competency of ***demonstrate practical knowledge and understanding in at least one computer language*** is ranked relatively low at 20. This is surprising given that programming languages form the backbone of nearly all IT environments.

The attributes that relate to how a business operates are ranked relatively low but they are still considered very important for a graduate to possess. The other groups of attributes that are ranked as very important are related to the individual's ability to operate in modern society, which involves flexibility and adaptability to different cultures and social customs. This involves the person being able to accept different gender roles within society and within the business environment.

From the T-test results in Table 4.9 it is noted that only two of the attributes ***analyse, synthesise and evaluate the various solutions*** and ***time management skills*** had a significant difference in their means at the 0.05 level. Both of these attributes were more highly ranked in the Queensland study than in the national study.

The attributes that were considered only important as compared to being very important are listed in Table 4.10.

Table 4.10

Academic Ratings of Important IS Generic Competencies

Attribute No	Competency	Australian			Queensland			Significance of Mean T-test	Difference in Ranking Aus-Qld
		Mean	St Dev	Rank	Mean	St Dev	Rank		
29	Project management skills	4.88	1.32	27	4.74	1.36	29	0.57	-2
24	Research skills	4.76	1.08	28	4.84	0.94	27	0.66	1
13	Understand the profit motive of business	4.70	1.16	29	4.76	1.32	28	0.77	1

A surprising result from the data shown in Table 4.10 is the relatively low ranking of the attribute of ***research skills*** by academics, given that the academic environment requires significant research activity. The academics obviously feel that the real world of work does not require the same skill sets as required in academia. Even though this attribute is ranked 28th it still has a mean of 4.76 which means that it is still considered to be important in the workplace.

The ranking of ***understand the profit motive of business*** at 29 is surprising given the anecdotal evidence from interviews with employers. The employers suggest that this attribute is the one attribute considered by business owners to be fundamental to a person staying in business and that all employees need to understand that the profit motive is often the driving force for a person to stay in business. The results of the T-test are insignificant.

4.10.1. Summary of the Australian Academic View

The attribute of having knowledge of IS reference disciplines, such as Decision Support Systems and management, improved its position by five places from 21 to 16 in the Queensland study. This may indicate that academics value the student's intellectual contribution and group participation more than their individual abilities and specific knowledge of the subject area.

There were four attributes, ***oral communications, ethics, interpersonal skills*** and ***knowledge of a reference discipline***, that showed an increase in ranking of five or more while only the attribute of ***time management*** showed a significant drop of six places.

The attributes of ***value the ethics of the Information Technology profession*** and ***with respect to the Information Systems discipline possess theoretical and practical knowledge in at least one reference discipline*** showed a significant difference to their ranking in the Queensland study by increasing their ranking by five places. This improvement in position may be a reflection of the different sample populations rather than a significant difference in the absolute importance of these competencies.

As previously mentioned the top ranked attributes involved the competencies required to work and communicate within a team environment, which is essential in the work environment of modern business.

The academic data was analysed using factor analysis and indicated that there are seven underlying factors that account for 64.8 percent of the variance. Several methods of extraction were used including Principal Component (PC) and Principal Axis Factoring (PAF). Similar results were achieved with each of the methods of extraction.

The KMO Measure of Sampling Adequacy (MSA) for the academic data was 0.73964 which according to Kaiser's (1974) interpretation above, is a middling result and indicates that the data is suitable for factoring although not too much emphasis should be placed on the results. The principle component method of factor analysis was used, as it is the most commonly used method. The principle component method accounted for 64.8 percent of the variance. Bartlett's test of sphericity is 1464.9961 which is significantly greater than 1000 (Coakes, 1996) and therefore the data obtained from the factor analysis may be interpreted. The seven factors identified by the academic participants and their associated competencies are shown in Figure 4.3.

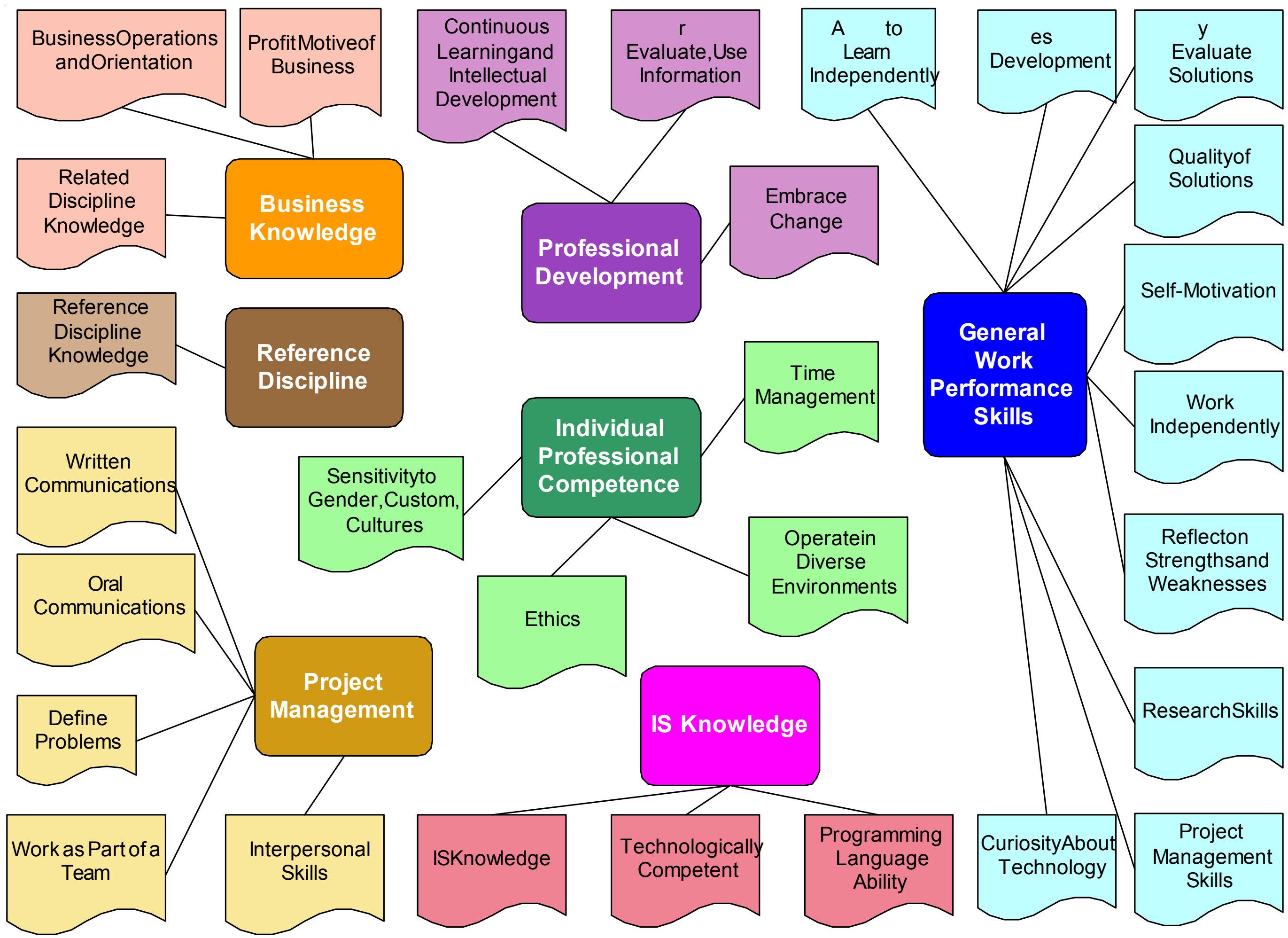

Figure 4.3
Academic Factors Australian Study

It should be noted that the naming of the factors is based on a common theme emerging from the competencies that define the associated skills for each of the factors. For example the ***Project Management*** factor has as associated skills, knowledge of both written and oral communications and interpersonal skills including working as part of a team. These are all skills that allow a person to practice the knowledge and skills relating to project management.

As noted by the Queensland study there are a large number of attributes associated with the factor of ***General Work Performance Skills***. The associated attributes for this factor include the ability to learn independently, professional development, analyse and evaluate the various solutions, quality of solutions, self-motivation, working independently, reflecting on strengths and weaknesses, research skills, project management skills, and curiosity about technology. Of these attributes the project management attribute seems to be out of place and should be associated with the project management factor.

The ***Business Knowledge*** factor identifies the need for employees to have a general education component within their degree courses to give them knowledge of general business operations as well as knowledge of the related disciplines to IS. This is important so that the employee knows where IS fits within the larger framework of disciplines within society as well as within the business world. The attribute of reference discipline knowledge is a considered to be a separate factor.

The ***Professional Development*** factor identifies the need for continued professional development during the course of a person's career. The second associated competency of embracing change identifies the fact that the IS discipline and environment is rapidly changing and will continue to change in the future. It is therefore necessary for any employee or graduate of an IS course of study to embrace change as this is at the very core of the discipline.

The ***IS Knowledge*** factor clearly identifies that IS knowledge is an important factor in modern society. The other associated attributes include technical competence and programming language ability. These two attributes may be considered to be traditional skills required of an IS professional.

The ***Individual Professional Competency*** factor identifies the personal and professional traits that are needed in a new employee in modern society. These include the need to value the ethics involved with the IS industry, the recognition that modern society is a global society and therefore we need to be able to work and interact with different genders and accept the cultural practices of other societies we may come in contact with.

Table 4.11 lists the seven Mayer Competencies as identified by the Mayer Committee which was formed as part of the Finn Review (Finn, 1991) by the Australian Education Commission to examine the competencies required of entry level employees. The eighth Mayer competency (Cultural understandings) was agreed on and added by the state ministers of education in 1993 (Mayer, 2000).

Table 4.11

Mayer Key Competencies

Collecting, analysing and organising ideas and information
Expressing ideas and information
Planning and organising activities
Working with others and in teams
Using mathematical ideas and techniques
Solving problems
Using technology
Cultural understandings

All of the Mayer competencies were identified in the study with the exception of using mathematical ideas and techniques. One could include this if we define the methods used in the study of information systems as including mathematical methods.

4.11. Australian Academic Conclusions

The academic view of the competencies identified in this Australian study showed that the personal and group attributes are consistently more highly valued than the technical knowledge competencies identified in the Queensland study. What is apparent is the desire of employers to have employees able to work in teams and communicate and continue their learning and intellectual development once they start work.

The high ranking of oral communications and team participation suggests that more group work and oral presentations should form part of the IS curriculum as this is a required skill in industry. The most important conclusion to be drawn from this study is the very strong correlation between the Queensland study (Snoke & Underwood, 1998b) and this Australian study. This suggests that the Queensland study reflected the national view.

4.12. Key Findings – An Industry Perspective

The findings from the industry perspective include a discussion of the participants and the sector of the IT industry they represent as well as statistical analysis of the results of the survey.

4.12.1. Participants - Industry

The Australian Computer Society (ACS) sponsored this study and participants were selected from the ACS membership list as well as selected national industry representatives. The number of respondents per round is shown in Table 4.12. As can be seen from the Table there was a slight decrease in the number of participants per round. This is in contrast to the previous generic attribute studies (Snoke & Underwood, 1998a, 1998b), which saw a slight increase in the participation rate per round. The final round participation rate of 51 percent is at the top end of the accepted range for participation in survey studies (Wallace & Mellor, 1988).

A significant number of respondents (31 percent) did not change their opinion between round two and round three.

Table 4.12

Respondent Rates per Round – Australian Study

	Number	Percent
Round 1	51	54
Round 2	47	49
Round 3	48	51

Reminder notices were only sent to 5 percent of the participants in round three asking them to complete the questionnaire. This was done to increase the participation rate and to improve the validity of the results. If a modified Delphi technique had not been used the final round response rate would have been at best 46 percent. This is still a very good participation rate.

The participation distribution by size and type is shown in Table 4.13. The type of business is defined to be either government or non-government. There is little general agreement on what constitutes a particular size of a business. Most definitions are local or industry specific definitions depending on the type of industry. The definition used in this paper for the size of the business entity is from the Australian Bureau of Statistics (ABS) (Australian Bureau of Statistics, 1993), which defines a small business as one that employs less than 20 people. The ABS also defines a medium size business as one that employs less than 50 and a large business as one that employs more than 50.

Table 4.13

Participation by Size and Type

	Small	Medium	Large
Government	1	0	14
Non-Government	7	3	26
Totals	8	3	40

The participation by ACS industry groupings (Australian Computer Society, 1998) is shown in Table 4.14. The ACS uses this industry classification scheme on their annual membership survey at the beginning of each calendar year. It should be noted that most industry classifications are represented. Five respondents identified with more than one classification, and are therefore counted twice. This may give a slight bias when comparing results across classification groups. As may be expected the largest number of participants was from the Information Technology Service classification.

Table 4.14

Participation by ACS Industry Classification

Classification	Number	Percentage
Accounting	5	9%
Agriculture	1	2%
Communications	3	5%
Construction	0	0%
Education	6	11%
Financial Banking & Investment	4	7%
Health	0	0%
Information Technology Hardware	4	7%
Information Technology Software	5	9%
Information Technology Services	10	18%
Insurance	1	2%
Legal	5	9%
Manufacturing	2	4%
Public Administration	2	4%
Recreation	0	0%
Resources	1	2%
Retail Trade	0	0%
Wholesale Trade	0	0%
Transportation	4	7%
Utilities	0	0%
Others (Consultants)	3	5%
Total	57	100

The industry ranking of the competencies are listed in overall rank order in Table 4.15 using the mean of the third round. Also included is the ranking from Queensland study of industry representatives (Snoke & Underwood, 1998b) as discussed in the previous section.

Table 4.15
Industry Rating of the IS Generic Competencies

Attribute No	Competency	Australian Mean	Australian Rank	Queensland Mean	Queensland Rank	Significance of Mean T-test	Difference in Ranking Aust -Qld
16	Self-motivation	6.22	1	6.19	4	0.715	-3
5	Retrieve, evaluate and use relevant information	6.00	2	6.33	1	0.091	1
10	Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.	5.99	3	6.22	3	0.170	0
7	Analyse, synthesise and evaluate the various solutions	5.88	4	5.94	7	0.517	-3
15	Confidence about their ability to learn independently	5.88	4	5.63	16	0.118	-12
8	Consider the quality of the solution and its timeliness	5.85	6	5.81	11	0.896	-5
26	Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology	5.84	7	6.02	5	0.264	2
21	Work as part of a team in a productive and cooperative manner	5.83	8	6.28	2	0.047	6
2	With respect to the Information Systems discipline be technologically competent	5.78	9	5.79	12	0.818	-3
18	Value the ethics of the Information Technology profession	5.77	10	5.59	17	0.478	-7
6	Define problems in a systematic way	5.75	11	6.02	5	0.080	6
23	Oral communication skills	5.75	11	5.93	8	0.349	3
27	Interpersonal skills	5.71	13	5.89	9	0.373	4
17	Work independently	5.63	14	5.69	15	0.973	-1
22	Written communication skills	5.53	15	5.72	14	0.171	1
1	With respect to the Information Systems discipline possess coherent, extensive, theoretical and practical knowledge	5.48	16	5.50	18	0.815	-2
14	Ability to reflect on own strengths and weaknesses	5.48	16	5.45	20	0.744	-4
25	Participate in on-going professional development	5.47	18	5.74	13	0.168	5

Attribute No	Competency	Australian Mean	Australian Rank	Queensland Mean	Queensland Rank	Significance of Mean T-test	Difference in Ranking Aust -Qld
20	Possess a sense of basic curiosity about technology	5.43	19	5.48	19	0.727	0
11	Time management skills	5.40	20	5.87	10	0.0.13	10
19	Sensitivity to differences in gender, culture and customs	5.29	21	5.13	22	0.313	-1
24	Research skills	5.23	22	5.04	25	0.175	-3
9	Demonstrate practical knowledge and understanding in at least one computer language	5.22	23	5.07	23	0.561	0
3	With respect to the Information Systems discipline possess theoretical and practical knowledge in at least one reference discipline	5.15	24	5.16	21	0.973	3
28	Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment	5.10	25	4.83	26	0.126	-1
12	Knowledge of how a business operates, is structured or is orientated	4.98	26	4.81	27	0.761	-1
13	Understand the profit motive of business	4.88	27	4.78	28	0.682	-1
4	With respect to the Information Systems discipline possess the theoretical and practical knowledge of related disciplines.	4.69	28	4.69	29	0.942	-1
29	Project management skills	4.58	29	5.07	23	0.019	6

From the mean values listed in Table 4.15 it can be seen that the top 25 competencies are rated as being at least very important (mean rating of 5.00 or greater) with only the first two being rated as being of major importance with a mean rating of 6.00 or greater. These are the competencies of ***Self-motivation*** and ***Retrieve, evaluate and use relevant information***. The high ranking of these attributes reflects a commonly held view in industry that employers want self-starting people as employees. This also requires that they be able to gather and use information, which is the basis of most business.

An interesting result is that the competency of ***with respect to the Information Systems discipline be technologically competent*** is ranked 9th as compared to the 16th ranking of the competency of ***with respect to the Information Systems discipline possess coherent, extensive, theoretical and practical knowledge***.

In today's society it is surprising to see that ***written and oral communications skills*** are not rated more highly. The interpersonal attributes of ***working as part of a team*** and ***interpersonal skills*** were not ranked highly. Individual competencies of ***being willing to participate in continued learning*** and ***self-motivation*** are rated in the top three. This may indicate that employers value the employee's individual abilities more than their group abilities. This result is consistent with the results of a Sydney, Australia study by Turner and Lowry (1999).

The attributes which had a difference of ranking between the Australian study and the Queensland study of 5 or more are listed in Table 4.16.

The attributes which showed a large increase in ranking between the national study and the Queensland study were ***confidence about their ability to learn independently, consider the quality of the solution and its timeliness*** and ***value the ethics of the Information Technology profession***. Of these the largest change was in the competency of ***confidence about their ability to learn independently*** which was ranked 4th in the national study, up 12 places from its ranking in the Queensland study.

Table 4.16

Attributes With a Ranking Difference of Five or More

Attribute No	Competency	Australian Mean	Australian Rank	Queensland Mean	Queensland Rank	Difference in Ranking Aust - Qld	Significance of Mean T-test
15	Confidence about their ability to learn independently	5.88	4	5.63	16	-12	0.118
8	Consider the quality of the solution and its timeliness	5.85	6	5.81	11	-5	0.896
21	Work as part of a team in a productive and cooperative manner	5.83	8	6.28	2	6	0.047
18	Value the ethics of the Information Technology profession	5.77	10	5.59	17	-7	0.478
6	Define problems in a systematic way	5.75	11	6.02	5	6	0.080
25	Participate in on-going professional development	5.47	18	5.74	13	5	0.168
11	Time management skills	5.40	20	5.87	10	10	0.013
29	Project management skills	4.58	29	5.07	23	6	0.019

Five attributes showed a drop in their ranking. These included the attributes of ***working as part of a team in a productive and cooperative manner, define problems in a systematic way, participate in on-going professional development, time management skills,*** and ***project management skills***.

Three of the above five attributes had a significant difference in their means. This may suggest that on a national level the teamwork and personal management skills are less important than was suggested in the Queensland study.

The difference identified in the above attributes may be attributed to the differences in the sample population. The Queensland study's industry sample population consisted of 25 representatives of large multi-national corporations with a head office in Brisbane and 25 from the ACS consultant list with telephone area codes from Queensland.

An important result is that the knowledge and skills in IS are rated sixteenth below many of the more general attributes such as oral communications skills (ranked 11th) and written communications skills (ranked 15th). These results are consistent with the results obtained in the previous Queensland studies (Snoke & Underwood, 1998a, 1998b) and the Turner (1999) study which identified acquiring new skills, working as part of a team and accepting direction as being more important.

Factor analysis results for the industry groupings indicated that there were three underlying factors. The factors together with the associated attributes that comprise them are shown in Figure 4.4. The KMO Measure of Sampling Adequacy (MSA) for the industry data was 0.92246, which according to Kaiser's (1974) interpretation above is a marvellous result and indicates that the data is suitable for factoring. The principle component method of factor analysis was used as it is the most common. The principle component method indicates that three factors account for 80.6 percent of the variance.

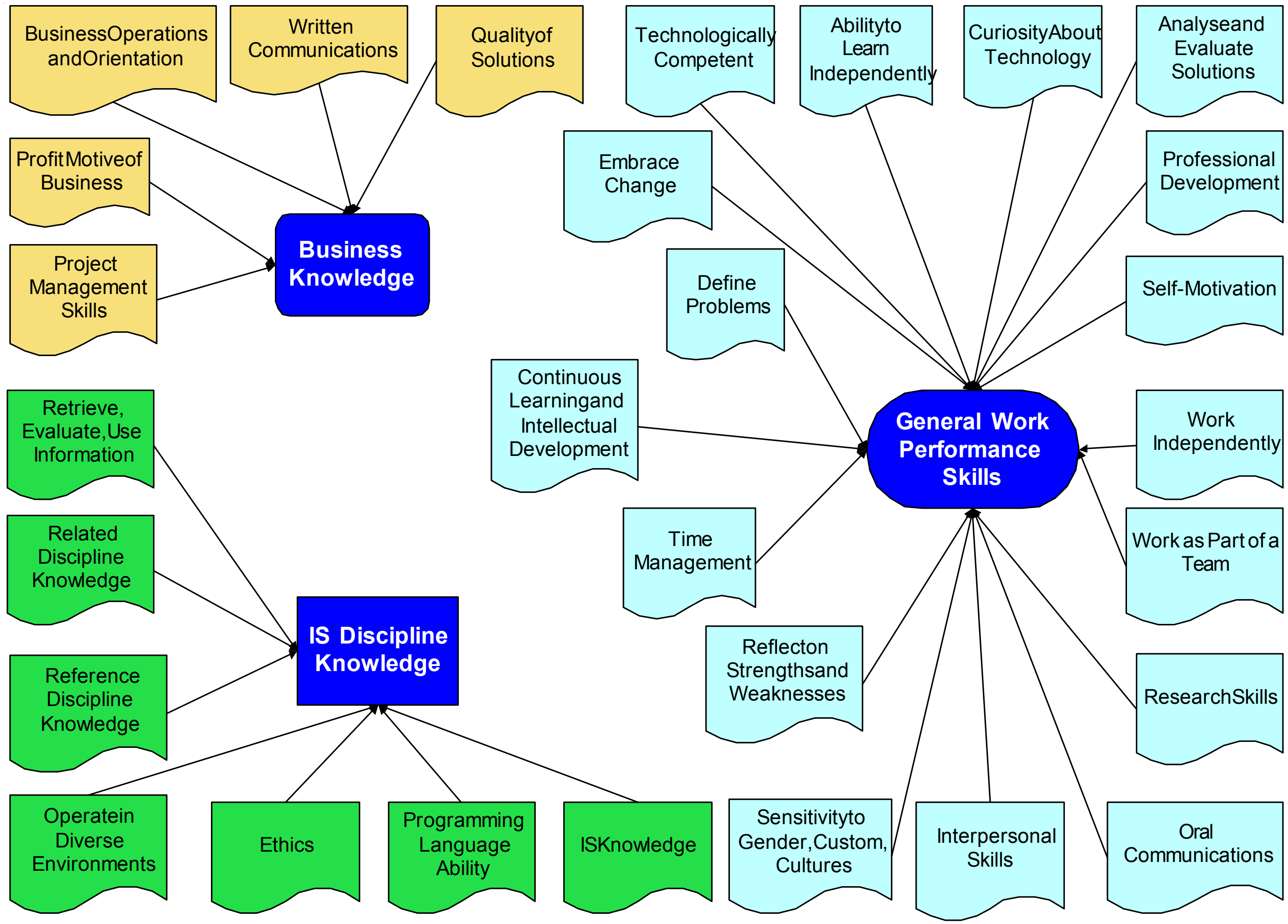

Figure 4.4
Industry Factors - Australian National Study

From the above diagram it can be seen that there are three sets of factors that can be identified from the industry data. The names of the factors reflect the associated attributes that are linked to the factor.

The ***Business Knowledge*** factor identifies the need for employees to have a clear understanding of the operations of a business. Most important is the attribute of Understanding the profit motive of business. Anecdotal evidence from industry representatives suggests this attribute is considered to be the most essential of all attributes. Aligned with the above attribute is the attribute of ***quality of solutions***. This is associated with the ability of a business to make a profit as quality products and solutions are the prerequisite for a profitable business operation.

Project management and ***written communications*** are also essential in IS business operations as most work involves a significant amount of project work. Communications in the written form are essential for a employee communicating with clients in the information age when a significant amount of communications takes place via e-mail.

Of importance also is the grouping of 17 of the competencies to form one factor, ***General Work Performance Skills.*** The attributes that compose the elements of the factor, ***General Work Performance Skills*** include good ***oral communications*** skills, the ability to get the tasks of the job done and work with other people as part of a team. ***Self-motivation*** is an important attribute of an employee who is to be successful in modern society.

The splitting of the two communications competencies into different factors may infer a question as to how they are perceived in the workplace. The competency of ***technical competence*** may be misplaced as it maybe more appropriately be associated with the factor of IS discipline knowledge rather than general work performance skills.

The other competencies that compose the ***General Work Performance Skills*** are competencies that would apply to any employee in any career in modern society.

Specific note is made of the competencies of ***Sensitivity to gender, cultures and customs*** as this relates to the attribute of interpersonal skills and working as part of a team. In the current world environment, tolerance of different cultures and customs is an essential attribute to survive not only in the workplace, but in the broader society of the first decade of the 21st century.

Embracing change and continuous learning and intellectual development are facts of modern working life. The only certainty in the modern work environment is that it will change and continue to change as we move through the information age.

The ***IS Knowledge*** factor clearly identifies the concept that the modern IS professional not only needs to have a sound knowledge of the IS discipline knowledge, but also needs competence and knowledge of the related and reference disciplines to IS. The modern employee needs to have a sound knowledge of where the information system discipline fits within the large scheme of society and other disciplines.

Comparing the results of the factor analysis from the academics' perspective to the industry view it is noted that academics identified a factor called workplace communications as a distinct factor group required of graduates. The industry representatives identified these same component underlying attributes as belonging to the underpinning factor group called IS knowledge and competence.

The academics also identified a total of seven factors compared to the three industry factors. The KMO value of 0.73964 for the academic factors was relatively low as compared to the industry rating of 0.92246. Therefore more credence could be placed on the industry factors than the academics.

4.13. Australian Industry - Conclusions

The study showed that the more generic personal attributes are consistently more highly rated than the technical knowledge competencies. The ranking of oral communications above written communications skills suggests that more oral presentation should form part of the IS curriculum as this is a required skill in industry. This suggests that industry requires an employee to be able to work from the first day on the job and to be able to productively interact with other employees.

The three lowest ranking attributes of ***research skills, project management and understanding the profit motive of business*** are the attributes that are often considered to be the characteristics that distinguish between IS graduates and graduates from other Information Technology (IT) disciplines such as computer science. Knowledge of business and how it operates including understanding the profit motive of business is rated very low. A recent study by AC Nielsen Research Services (2000) and anecdotal evidence suggests that the most important competency that industry desires in an employee is an understanding of the profit motive of business and how the business operates. The significant differences between the earlier Queensland study and the national study reflects the differences in the sample populations.

Overall what the results of the study suggest is that all of the competencies are required of graduates but that industry simply views some as more important and essential than others. The next section discusses the overall results from the national study and includes industry and academic comparisons.

4.14. Combined National Academic and Industry Findings and Discussion

This section will discuss the findings from the national study. Statistical analysis of the findings will be presented.

4.14.1. Participants

Academic participants in the study were selected from Australian universities that offered undergraduate courses in IS. Industry participants were selected from the Australian Computer Society (ACS) membership list (1000) as well as selected national industry representatives.

The number of respondents per round for both industry and academics is shown in Table 4.17. As can be seen from the Table there was an increase in the number of participants per round of approximately 2 percent. The final round participation rate of 34 percent is well within the accepted range for survey studies (Wallace & Mellor, 1988).

Table 4.17

Respondent Rates per Round – Australian Study

	Total		Industry		Academic	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Round 1	141	31	51	36	90	64
Round 2	147	33	47	32	100	68
Round 3	153	34	48	31	105	69

4.15. Key Findings

The five most essential competencies are listed in Table 4.18. The ranking from the Queensland study is also presented for comparison purposes.

Table 4.18

Essential IS Generic Competencies – Australian study

Attribute No	Competency	Australian Mean	Australian Rank	Queensland Mean	Queensland Rank	Difference in Ranking Aust - Qld	Significance of Mean T-test
10	Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.	6.19	1	6.25	3	-2	0.549
21	Work as part of a team in a productive and cooperative manner	6.16	2	6.29	2	0	0.266
5	Retrieve, evaluate and use relevant information	6.15	3	6.31	1	2	0.165
23	Oral communication skills	6.04	4	5.96	7	-3	0.472
6	Define problems in a systematic way	6.00	5	6.14	5	0	0.184

The ranking of the top three competencies in this national study is reversed as compared to the Queensland study. This may possibly be attributed to the difference in the composition of the sample population. The Queensland study used members of the Australian Information Industries Association (AIIA) while the national study used members of the Australian Computer Society (ACS). The participants of the national study included organisations with their head office in the more densely populated southern states of Australia while the Queensland study used only participants whose head office was in Brisbane, Queensland or in regional areas of the state.

The above essential attributes are associated competencies to ***working as part of a team***, which has been identified as an essential attribute. The national study as compared to the Queensland study showed similar results with no large difference in ranking amongst the essential competencies. This implies that the Queensland views reflect the national views. The attributes that are rated as very important (with a mean rating of 5 or more) are listed in Table 4.19.

Table 4.19

Very Important IS Attributes – Australian Study

Attribute No	Competency	Australian Mean	Australian Rank	Queensland Mean	Queensland Rank	Significance of Mean T-test	Difference in Ranking Aust - Qld
16	Self-motivation	5.98	6	6.16	4	0.109	2
7	Analyse, synthesise and evaluate the various solutions	5.93	7	6.11	6	0.081	1
27	Interpersonal skills	5.92	8	5.85	12	0.505	-4
22	Written communication skills	5.91	9	5.87	11	0.940	-2
8	Consider the quality of the solution and its timeliness	5.76	10	5.90	9	0.179	1
2	With respect to the Information Systems discipline be technologically competent	5.73	11	5.77	13	0.720	-2
18	Value the ethics of the Information Technology profession	5.73	11	5.61	18	0.483	-7
26	Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology	5.72	13	5.93	8	0.065	5
15	Confidence about their ability to learn independently	5.70	14	5.74	14	0.855	0
1	With respect to the Information Systems discipline possess coherent, extensive, theoretical and practical knowledge	5.70	14	5.72	15	0.777	-1
17	Work independently	5.52	16	5.68	16	0.229	0
11	Time management skills	5.48	17	5.90	9	0.000	8
3	With respect to the Information Systems discipline possess theoretical and practical knowledge in at least one reference discipline	5.44	18	5.27	22	0.187	-4
25	Participate in on-going professional development	5.41	19	5.68	16	0.0.35	3
14	Ability to reflect on own strengths and weaknesses	5.38	20	5.52	19	0.322	1
19	Sensitivity to differences in gender, culture and customs	5.34	21	5.19	23	0.308	-2
9	Demonstrate practical knowledge and understanding in at least one computer language	5.32	22	5.34	21	0.929	1
20	Possess a sense of basic curiosity about technology	5.28	23	5.38	20	0.458	3
12	Knowledge of how a business operates, is structured or is orientated	5.24	24	5.03	24	0.207	0
28	Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment	5.13	25	4.92	26	0.094	-1
4	With respect to the Information Systems discipline possess the theoretical and practical knowledge of related disciplines.	5.01	26	4.85	28	0.167	-2

From the mean values listed in Tables 4.18 and 4.19 it can be seen that the top 26 competencies are rated as being at least very important (mean rating of 5.00 or greater). The top five attributes are rated as being of major importance with a mean rating of 6.00 or greater.

A significant finding is the difference in the ranking of the ***time management*** and ***professional development*** attributes. As with other significant differences the respondents to the Queensland study ranked their attributes higher than the national study.

An important finding is that knowledge and skills in IS are rated 14th below many of the more general attributes such as oral communications skills (ranked 4th) and written communications skills (ranked 9th). These results are generally consistent with the results obtained in the previous Queensland studies (Snoke & Underwood, 1998a, 1998b) and Turner and Lowry's (1999) study of third year students and employer groups in Victoria, Australia.

In today's society it is not surprising to see that ***written*** and ***oral communications skills*** are rated highly. Both these attributes relating to communication have improved their relative ranking as compared to the earlier studies. **Oral communications** is now ranked 4th (up from 7th) and **written communication** is now ranked 9th (up from 11th).

The personal attributes of ***being willing to participate in continued learning*** and ***working as part of a team*** are rated at number one and two respectively. This is consistent with anecdotal evidence and Turner and Lowry's study (1999) that employers value 'people' skills more highly than traditional intellectual skills.

The attributes that were ranked as being least important are listed in Table 4.20.

Table 4.20

Australian Least Important IS Attributes

Attribute No	Competency	Australian		Queensland		Difference in Ranking
		Mean	Rank	Mean	Rank	Aust - Qld
24	Research skills	4.91	27	4.95	25	2
29	Project management skills	4.78	28	4.92	26	2
13	Understand the profit motive of business	4.75	29	4.77	29	0

The three lowest ranking attributes of ***research skills, project management*** *and* ***understanding the profit motive of business*** are the attributes that are often considered to be the characteristics that distinguish between IS graduates and graduates from other Information Technology (IT) disciplines such as computer science. Anecdotal evidence and interviews with some industry representatives suggests that the most important competency that they desire in an employee is understanding the profit motive of business and how the business operates.

Three of the attributes had a difference of ranking between the national study and the Queensland study of 5 or more. The attribute of, ***value the ethics of the Information Technology profession*** was more highly rated in the national study (ranked 12) than in the Queensland study (ranked 18) (Snoke & Underwood, 1998b). *Time management* skills and the attribute of **embracing change and being obliged to keep up-to-date** were more highly rated in the Queensland study (ranked 8 and 9 versus 13 and 17).

The competency of ***possess coherent, extensive, theoretical and practical knowledge of IS*** and ***possess theoretical and practical knowledge in at least one reference disciplines*** were ranked 14 and 18 respectively in the national study while they were ranked 15 and 22 respectively in the Queensland study. This difference in ranking may be due in part to the difference in the sample size of the two studies.

Factor analysis results for the combined industry-academic data indicated that there were five underlying factors. The factors together with the associated attributes that comprise them are shown in Figure 4.5. The KMO Measure of Sampling Adequacy

(MSA) for the combined industry-academic data was 0.93779, which according to Kaiser's interpretation above is a marvellous result and indicates that the data is suitable for factoring. The principle component method of factor analysis was used, as it is the most commonly used method. The principle component method of factor analysis accounts for 71 percent of the variance.

As can be seen in Figure 4.5 there are five factors that represent the combined industry and academic view of the key competencies to be covered in a program of study.

The **Business Knowledge** factor has the associated attributes of ***understanding the profit motive of business, knowledge of business operations and orientation, project management skills, analyse and evaluate solutions*** and ***the quality of solutions***. These attributes identify the key components required of a business to survive in the modern world.

These key components are that the business must provide a quality solution and in doing this an employee must analyse and evaluate the variety of possible solutions for a client. As previously mentioned businesses do not stay in operation long if the employees do not understand the fundamental principle that a business exists to make a profit. This must be one of the key principles underlying business operations.

The Adaptability and Professional Skills factor has the associated attributes of ***related discipline knowledge, embracing change, ethics, sensitivity to gender, cultures and customs*** and the ***ability to operate in diverse environments.*** All of these attributes relate to the concept of adaptability and are essential skills in the current world environment.

The ***IS Discipline Knowledge*** factor has the associated attributes that are commonly linked to professional competence within the IS community. These include a sound ***knowledge of the IS discipline, programming language ability, technical competence*** and ***knowledge of the reference disciplines*** upon which the IS discipline is based. The attribute of ethics in the IT environment may possibly have been associated with this factor group as it relates directly to the IS environment.

The ***Personal Competence*** factor has the associated attributes that relate to an individual's learning ability and may reflect on how far they will progress in the industry. The attributes included with this factor group include ***research skill, curiosity about technology, ability to learn independently, reflection on one's strengths and weaknesses, professional development, working independently*** and ***self-motivation.*** All of these attributes are essential for a person in the modern workforce where it is common practice to link a person's pay to their performance. Many companies implement a practice of performance planning and review (PPR) to maximise the output from their employees.

The ***Workplace Communications*** factor has the associated attributes of ***working as part of team, define problems, continuous learning and intellectual development, written communications, time management, interpersonal skills, oral communications,*** and ***retrieve, evaluate and use information.*** These attributes reflect the communications required in the modern workplace. ***Time management*** is an essential skill for an employee to enable them to be productive in a competitive environment. The two communications attributes of ***written*** and ***oral communications*** are closely linked to the attribute of ***interpersonal skills*** as at least one of the communications attributes is often the source of conflict when relationships break down.

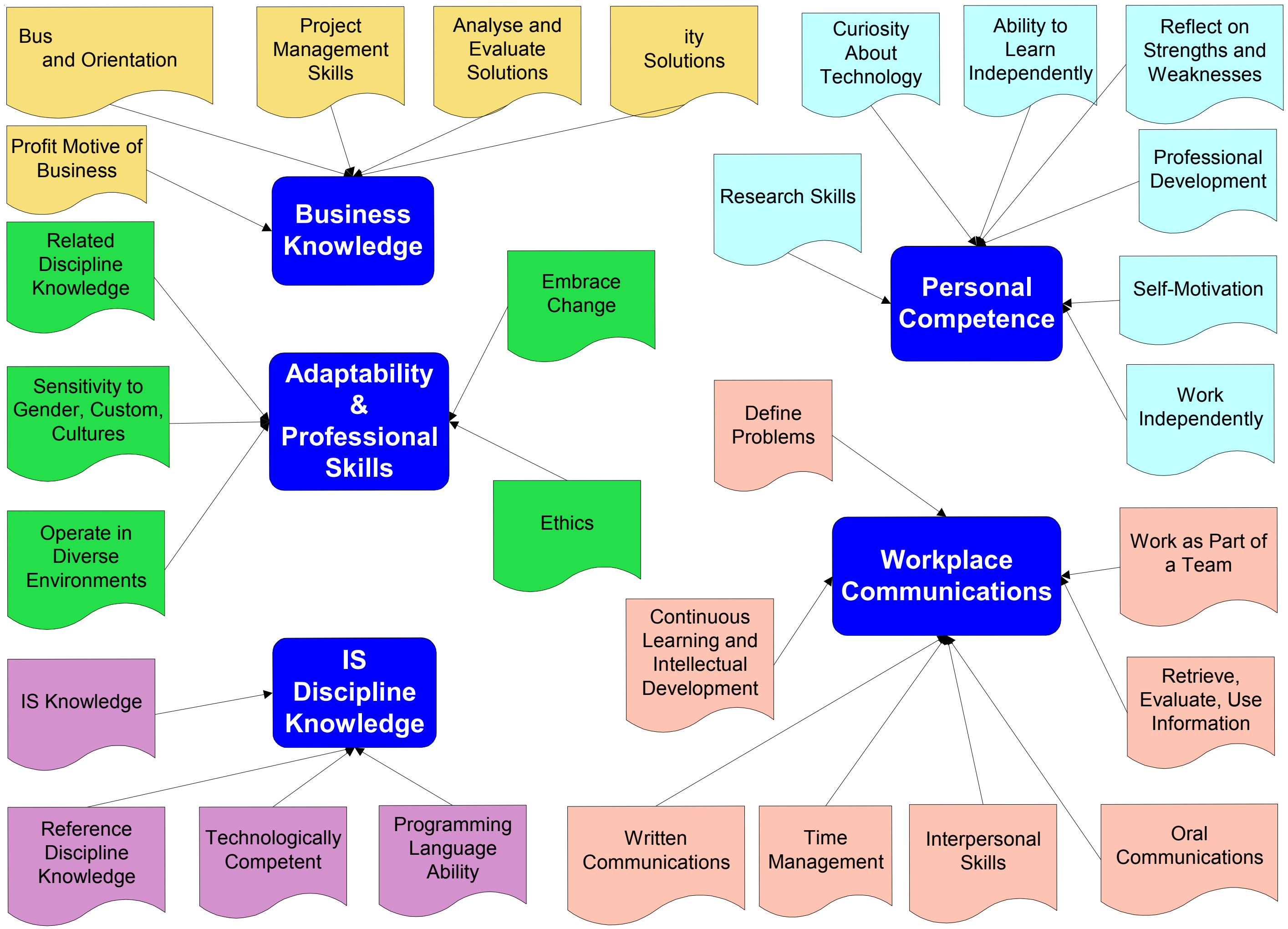

Figure 4.5
Factors from Australian Study (Industry and Academic)

This section has described the combined results from the Australian study including the underlying factors identified from the factor analysis. The next section will examine academic and industry comparisons.

4.16. Academic and industry comparison

The results of the industry and academic views of the relative importance of the attributes are shown in Table 4.21 in order of importance as identified by industry.

From the data in the Table 4.21 it should be noted that 14 of the 29 attributes listed have difference in ranking of 5 or more. Academics ranked the attributes of ***working as part of a team in a productive and cooperative manner, oral communication skills, define problems in a systematic way, written communication skills and with respect to the Information Systems discipline possess theoretical*** and ***practical knowledge in at least one reference discipline*** significantly higher than the industry respondents. Other attributes that were more highly ranked by academics include ***interpersonal skills, with respect to the Information Systems discipline possess coherent, extensive, theoretical and practical knowledge.*** These attributes reflect the modern working environment in which teams play an important role in getting the job done. They also reflect the essential nature of the successful team in that successful teams have good communications and interpersonal relationships within the team.

There is general agreement on the importance of ***oral communication skill*****s**. Both industry and academics rank ***written communications skills*** lower than ***oral communications skills***. Academics rank ***written communications skills*** higher than the ranking of ***oral communications skills*** by industry. This may reflect the use of written assignments as a means of assessment in academia and the relatively lower importance on writing in industry as a means of communication.

Table 4.21

Australian Industry and Academic Comparison of Generic Attributes

Attribute No	Competency	Australian Mean	Australian Rank	Queensland Mean	Queensland Rank	Significance of Mean T-test	Difference in Ranking Aust - Qld
21	Work as part of a team in a productive and cooperative manner	6.30	1	5.83	8	0.028	-7
10	Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.	6.28	2	5.99	3	0.092	-1
5	Retrieve, evaluate and use relevant information	6.22	3	6.00	2	0.227	1
23	Oral communication skills	6.17	4	5.75	11	0.012	-7
6	Define problems in a systematic way	6.11	5	5.75	11	0.014	-6
22	Written communication skills	6.09	6	5.53	15	0.002	-9
27	Interpersonal skills	6.02	7	5.71	13	0.079	-6
7	Analyse, synthesise and evaluate the various solutions	5.95	8	5.88	4	0.517	4
16	Self-motivation	5.87	9	6.22	1	0.008	8
1	With respect to the Information Systems discipline possess coherent, extensive, theoretical and practical knowledge	5.80	10	5.48	16	0.060	-6
8	Consider the quality of the solution and its timeliness	5.72	11	5.85	6	0.710	5
2	With respect to the Information Systems discipline be technologically competent	5.71	12	5.78	9	0.838	3
18	Value the ethics of the Information Technology profession	5.70	13	5.77	10	0.817	3
26	Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology	5.67	14	5.84	7	0.278	7
15	Confidence about their ability to learn independently	5.61	15	5.88	4	0.051	11
3	With respect to the Information Systems discipline possess theoretical and practical knowledge in at least one reference discipline	5.58	16	5.15	24	0.017	-8
11	Time management skills	5.51	17	5.40	20	0.538	-3
17	Work independently	5.47	18	5.63	14	0.220	4
25	Participate in on-going professional development	5.38	19	5.47	18	0.602	1
19	Sensitivity to differences in gender, culture and customs	5.37	20	5.29	21	0.898	-1
9	Demonstrate practical knowledge and understanding in at least one computer language	5.37	20	5.22	23	0.594	-3
12	Knowledge of how a business operates, is structured or is orientated	5.36	22	4.98	26	0.040	-4
14	Ability to reflect on own strengths and weaknesses	5.33	23	5.48	16	0.277	7

Attribute No	Competency	Australian Mean	Australian Rank	Queensland Mean	Queensland Rank	Significance of Mean T-test	
20	Possess a sense of basic curiosity about technology	5.21	24	5.43	19	0.176	5
4	With respect to the Information Systems discipline possess the theoretical and practical knowledge of related disciplines.	5.16	25	4.69	28	0.007	-3
28	Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment	5.14	26	5.10	25	0.869	1
29	Project management skills	4.88	27	4.58	29	0.170	-2
24	Research skills	4.76	28	5.23	22	0.003	6
13	Understand the profit motive of business	4.70	29	4.88	27	0.384	2

Industry ranked the individual competencies of ***self-motivation, consider the quality of the solution and its timeliness, embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology, confidence about their ability to learn independently, ability to reflect on own strengths and weaknesses, possess a sense of basic curiosity about technology,*** and ***research skills*** higher than the academic respondents. This is a reflection of the modern business environment in which an employee is expected to be a self-motivated person who is adaptable, can learn quickly and is confident. This difference may also be due to the tendency of group assignments being used for assessment in tertiary institutions.

Industry comments have also indicated that they require an individual to be productive in the workplace from the first day. This requires a high degree of self-motivation by the individual.

Academics ranked the attribute of ***working as part of team*** as being of extreme importance. Industry and academics both ranked ***Participate in continued learning and intellectual development and develop critical, reflective and creative thinking*** as very important (3 and 2 respectively). This indicates that industry and academics both require individuals to keep up with the continual changes in technology and to gain new and diverse skills.

The above indicates a common preference for lifelong attributes in IS graduates by industry and academia alike, however industry ranks the lifelong competencies more highly than academics. Lifelong learning attributes are those that are common to any role a person takes in life. Increasingly however, the clients of tertiary institutions, viz., graduands, expect that completion of a tertiary course of study will lead them into a field that utilizes the competencies developed during the course of study. Nevertheless students should also be prepared for continued lifelong learning and to be positive contributors to society in a general sense.

A possible explanation of the difference in ranking between the ***technical*** and ***human*** attributes may be found in the controversial motivational theory of Herzberg

(Herzberg, 1968). Herzberg developed a theory of motivation related to work situations that proposed two groups of factors, which related to job satisfaction.

One group comprising environmental factors (hygiene) do not, by themselves, motivate satisfaction, but their absence will cause dissatisfaction. The other group are determinants of job satisfaction, which are believed to result in improved performance and are termed ‘motivators’. Thus, the technical skills/knowledge attributes will be expected to have been gained through the academic process, that is the ‘hygiene factors’ in terms of Herzberg's motivation theory, while the more highly rated attributes represent ‘motivators’ because they are determinants of job satisfaction which are assumed to lead to superior performance.

4.16.1. Summary National Combined Industry Academic Results

The same three competencies were ranked in the top three in both the Queensland study and the national study, however their ranking in the national study are reversed as compared to the Queensland study. This may possibly be attributed to the difference in the composition of the sample population. The Queensland study used members of the Australian Information Industries Association (AIIA) while the national study used members of the Australian Computer Society (ACS).

The participants in the national study included organisations who had their head office in the more densely populated southern states of Australia while the Queensland study used only participants whose head office was in Brisbane, Queensland or in regional areas of the state.

Three of the attributes had a difference in ranking between the national study and the Queensland study of 5 or more. The attribute of, ***value the ethics of the Information Technology profession*** was more highly rated in the national study (ranked 12*)* than in the Queensland study (ranked 18) (Snoke & Underwood, 1998b). ***Time management skills*** and the attribute of ***embracing change and being obliged to keep up-to-date*** were more highly rated in the Queensland study (ranked 8 and 9 versus 13 and 17).

The competencies of ***possess coherent, extensive, theoretical and practical knowledge of IS*** and ***possess theoretical and practical knowledge in at least one reference discipline*** were ranked 14 and 18 respectively in the national study while they were ranked 15 and 22 respectively in the Queensland study. This difference in ranking may be due in part to the difference in the sample size of the two studies. This Australian study surveyed 105 academics and 53 industry representatives while the earlier Queensland study had equal participation from industry and academia, namely, 50 industry representatives and 50 academics.

4.17. Conclusions - National Combined Industry Academic Results

The study showed that the more generic interpersonal attributes involving teamwork, interpersonal skills, oral and written communications are consistently more highly rated (a difference in ranking of 5 or more) by academics than industry. Industry consistently rated the individual motivational attributes ***ability to reflect on own strengths and weaknesses, confidence about their ability to learn independently, self-motivation,*** and ***possess a sense of basic curiosity about technology*** higher than academics.

Technical knowledge competencies **(*with respect to the IS discipline possess coherent, extensive, theoretical and practical knowledge, with respect to the IS discipline possess theoretical and practical knowledge in at least one reference discipline which includes behavioural science, computer science, decision theory, information theory, organisational theory, management theory,*** and ***define problems in a systematic way*)** were significantly more highly rated by academics. This may suggest that academics are concerned with the graduate actually being able to do a specific task in a business environment, which involves working with others. This implies that the assessment in IS units of study should contain more group work than individual work.

The high ranking of ***written and oral communication skill*** implies a need for a significant amount of written assignments and oral presentations in IS units. The higher ranking of oral communications suggests that more oral presentation should form part of the IS curriculum. Finally, the overall strong correlation with the previous Queensland study (Snoke & Underwood, 1998b) reinforces the significance of the results reported in this chapter.

The disparity of results between academic and industry reinforces the view that academics need to interact more closely with industry in the development and maintenance of IS course syllabi.

4.18. Discussion of the Combined Results of the Queensland and Australian Studies

As mentioned previously the Queensland study had a very high value for Cronbach's alpha at 0.9269 and the national study also had a very high value for Cronbach's alpha at 0.8938. This high value of Cronbach's alpha for both studies allows the data to be combined for analysis purposes. The value of Cronbach's alpha for the combined data is also high at 0.9008. Factor analysis was performed on the data resulting in eight factors being identified. These factors and their associated attributes are shown in Figures 4.6 – 4.8 for the academic view, industry view and the combined view of both industry and academics.

The following discussion demonstrates the general agreement of the respondents' views between the Queensland and Australian studies. The attributes that were ranked high in the Queensland study were also ranked high in the Australian study. The attributes of ***Working as part of a team in a cooperative and productive manner, Retrieve, evaluate and use information,*** and ***Participation in continued learning, intellectual development and critical and reflective thinking*** were all rated as essential in both studies. There is also general agreement on the relative importance of all the attributes.

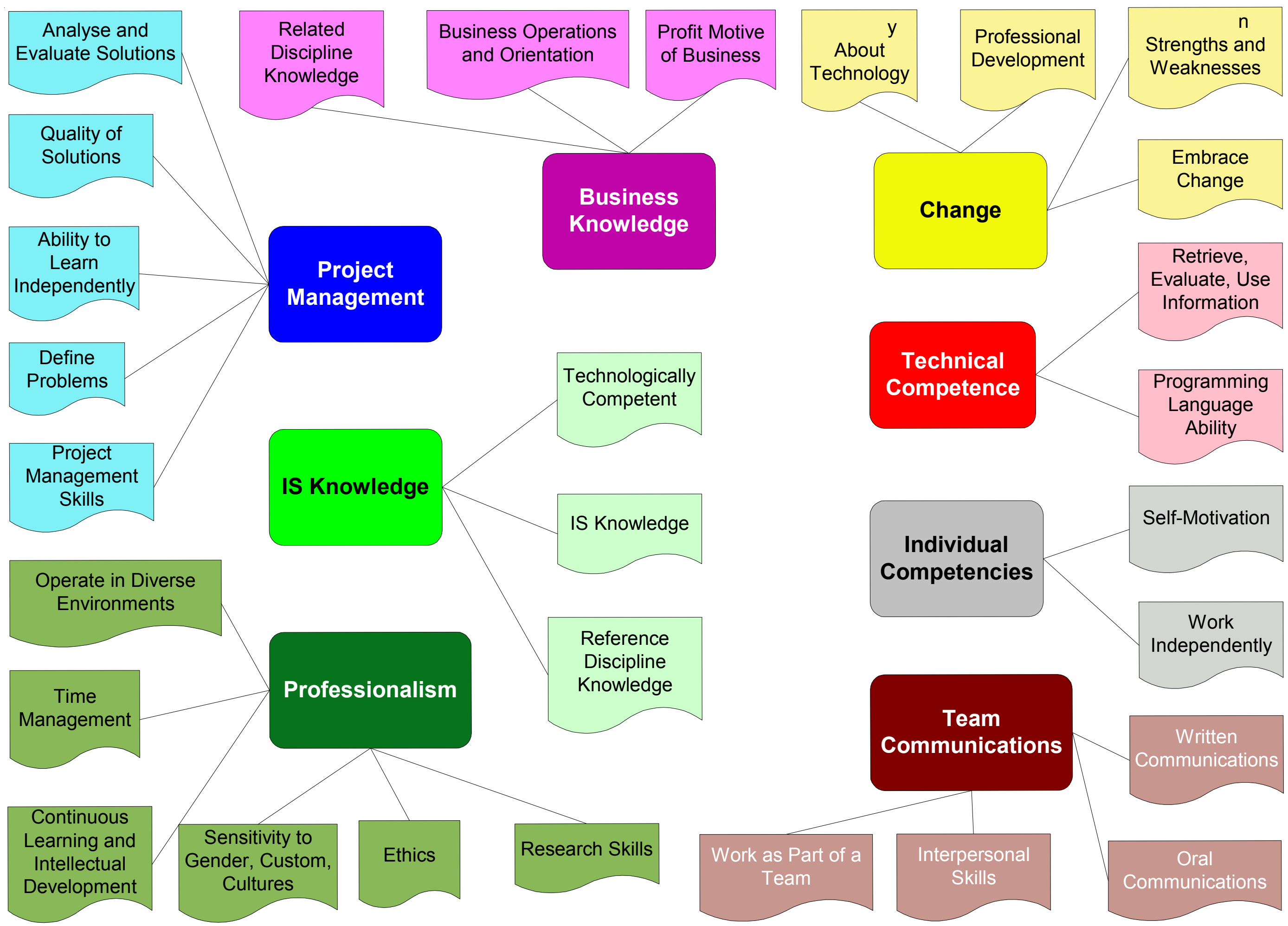

Figure 4.6
Academic View of the Underpinning Factors - Combined Study

Figure 4.7
Industry View of the Underpinning Factors - Combined Study

Figure 4.8
Combined Industry and Academic View of the Underpinning Factors

Examination of each factor and its associated attributes was performed by calculating the average of the means of the associated attributes for each factor. Each factor and its average is shown in Table 4.22.

Table 4.22

Means of Combined Study Factors

Factor	Mean	St Dev
Team Communications	5.92	0.96
Information Use	5.75	1.15
Individual Competencies	5.64	0.96
IS Knowledge	5.55	1.14
Professionalism	5.40	1.08
Project Management	5.29	1.11
Diversity	5.13	1.05
Professional Development	4.96	1.03

From the data in Table 4.22 it should be noted that the ***Team Communications*** factor is rated as the most important of the factors. It should also be noted that none of the factors has an average mean of greater than 6, which is the criteria for a factor to be classified as essential. The only factor to be rated as 'only important' (4-5) is ***Professional Development***. This factor is rated lowest. This may be caused by it consisting of only the two attributes of ***research skills*** and ***related discipline knowledge***.

The results of the T-test performed on the combined data are shown in Table 4.23. It should be noted that there are significant differences in the means and rankings for nine of the attributes. These are highlighted in blue in the Table. The results shown in Table 4.23 reflect the national study results.

Table 4.23

T-Test of Significance for Combined National and Queensland Studies

Attribute No	Attribute	Academic Mean	Industry Mean	Significance of Mean T-test Academic vs Industry	Government	Non Government	Significance of Mean T-test Gov vs Non Gov
1	With respect to the IS discipline possess coherent, extensive, theoretical and practical knowledge	5.86	5.48	0.002905	5.54	5.46	0.738035
2	With respect to the IS discipline be technologically competent (the person is able to use the current technology competently)	5.72	5.77	0.690074	5.75	5.77	0.928689
3	With respect to the IS discipline possess theoretical and practical knowledge in at least one reference discipline which includes behavioural science, computer science, decision theory, information theory, organizational theory, management theory.	5.53	5.15	0.003514	5.41	5.06	0.161385
4	With respect to the IS discipline possess the theoretical and practical knowledge of related disciplines. For example, business, law, education, data communications, computer science or leisure recreation	5.13	4.69	0.000137	4.71	4.68	0.884062
5	Retrieve, evaluate and use relevant information	6.24	6.17	0.554683	6.14	6.18	0.897675
6	Define problems in a systematic way	6.16	5.88	0.009271	5.57	5.99	0.050727
7	Analyse, synthesise and evaluate the various solutions	6.06	5.90	0.140056	5.61	6.00	0.058006
8	Consider the quality of the solution and its timeliness	5.81	5.80	0.98894	5.36	5.96	0.020116
9	Demonstrate practical knowledge and understanding in at least one computer language	5.46	5.15	0.091138	5.07	5.18	0.753286
10	Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.	6.28	6.11	0.14728	6.07	6.12	0.824146
11	Time management skills	5.64	5.64	0.986911	5.43	5.71	0.182116
12	Knowledge of how a business operates, is structured or is orientated	5.34	4.85	0.000859	4.18	5.09	0.00492
13	Understand the profit motive of business	4.71	4.82	0.465714	4.36	4.99	0.028718
14	Ability to reflect on own strengths and weaknesses	5.41	5.48	0.541102	5.55	5.46	0.551388
15	Confidence about their ability to learn independently	5.69	5.78	0.541115	5.82	5.76	0.763611

Attribute No	Attribute	Academic Mean	Industry Mean	Significance of Mean T-test Academic vs Industry	Government	Non Government	Significance of Mean T-test Gov vs Non Gov
16	Self-motivation	5.94	6.21	0.007768	6.21	6.21	0.973184
17	Work independently	5.53	5.68	0.183769	5.71	5.67	0.80838
18	Value the ethics of the Information Technology profession	5.68	5.67	0.957925	5.68	5.67	0.972486
19	Sensitivity to differences in gender, culture and customs	5.34	5.23	0.514357	5.00	5.32	0.160837
20	Possess a sense of basic curiosity about technology	5.22	5.45	0.069016	5.25	5.53	0.182035
21	Work as part of a team in a productive and cooperative manner	6.30	6.07	0.065384	6.00	6.10	0.678226
22	Written communication skills	6.07	5.57	0.000223	5.18	5.70	0.137864
23	Oral communication skills	6.12	5.85	0.011847	5.75	5.89	0.493824
24	Research skills	4.79	5.16	0.00284	5.14	5.16	0.918507
25	Participate in on-going professional development	5.45	5.61	0.220185	5.75	5.56	0.418584
26	Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology	5.71	5.93	0.056758	6.07	5.88	0.291053
27	Interpersonal skills	5.96	5.81	0.216141	5.75	5.84	0.672441
28	Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment	5.10	5.00	0.447877	4.93	5.03	0.711726
29	Project Management Skills	4.84	4.83	0.979931	4.46	4.96	0.052089

It is noted from the data in Table 4.23 that nine of the attributes have a significant difference in their means from the academic and industry perspectives. This is most likely due to the different work environments in which academics and industry representatives operate.

The only attribute to have a significant difference in its mean value by both academics and industry as well as the government and non government respondents is ***knowledge of how a business operates, is structured or is orientated***. It is noted from the data in Table 4.23 that the mean value of each of the means is not significantly different. This simply means that the academic respondents showed a faster drop in their rating of the attributes compared to the industry respondents.

In summary, there is general agreement shown between the Queensland study results and the Australian study on the relative importance of the attributes.

4.19. Chapter Summary

This chapter has described the process of the initial identification and validation of the generic attributes of IS graduates via a pilot study of the ISMRC at QUT, a larger study in Queensland and finally the Australian study. The Queensland study involved both academics from Queensland universities that offer IS programs of study and industry representatives. The industry representatives were from the AIIA and the local industry from the regions that employ the graduates from the universities in Queensland.

The Australian study involved a survey of academics from all the universities in the country that offered IS programs of study. Industry representatives were selected from the Australian Computer Society to give a balanced view of the attributes required of entry-level employees.

The major findings of these studies were that the Queensland study was supported by the Pilot study. There was a strong correlation between the Australian study and the

Queensland study. All of these studies identified that the attributes of ***information retrieval, working as part of a team, self-motivation, continued learning and intellectual development, the development of critical, reflective and creative thinking, problem definition and analysis and evaluation of various solutions along with written and oral communications*** as more important than knowledge of the Information Systems discipline.

The diagram in Figure 4.9 presents the research plan across the bottom of the diagram. The chapters of the thesis are shown above the research plan. This allows the reader to easily relate the content of each chapter to the different phases of the research plan. Figure 4.9 identifies the position of current chapter in the research plan in blue and the discussion of the mapping of the objectives of the various curriculum documents and the objectives from selected university programs of study against the generic attributes of IS graduates (in green). The next chapter will discuss the results of the mapping of the objectives of the various curriculum documents and the objectives from selected university programs of study against the generic attributes of IS graduates.

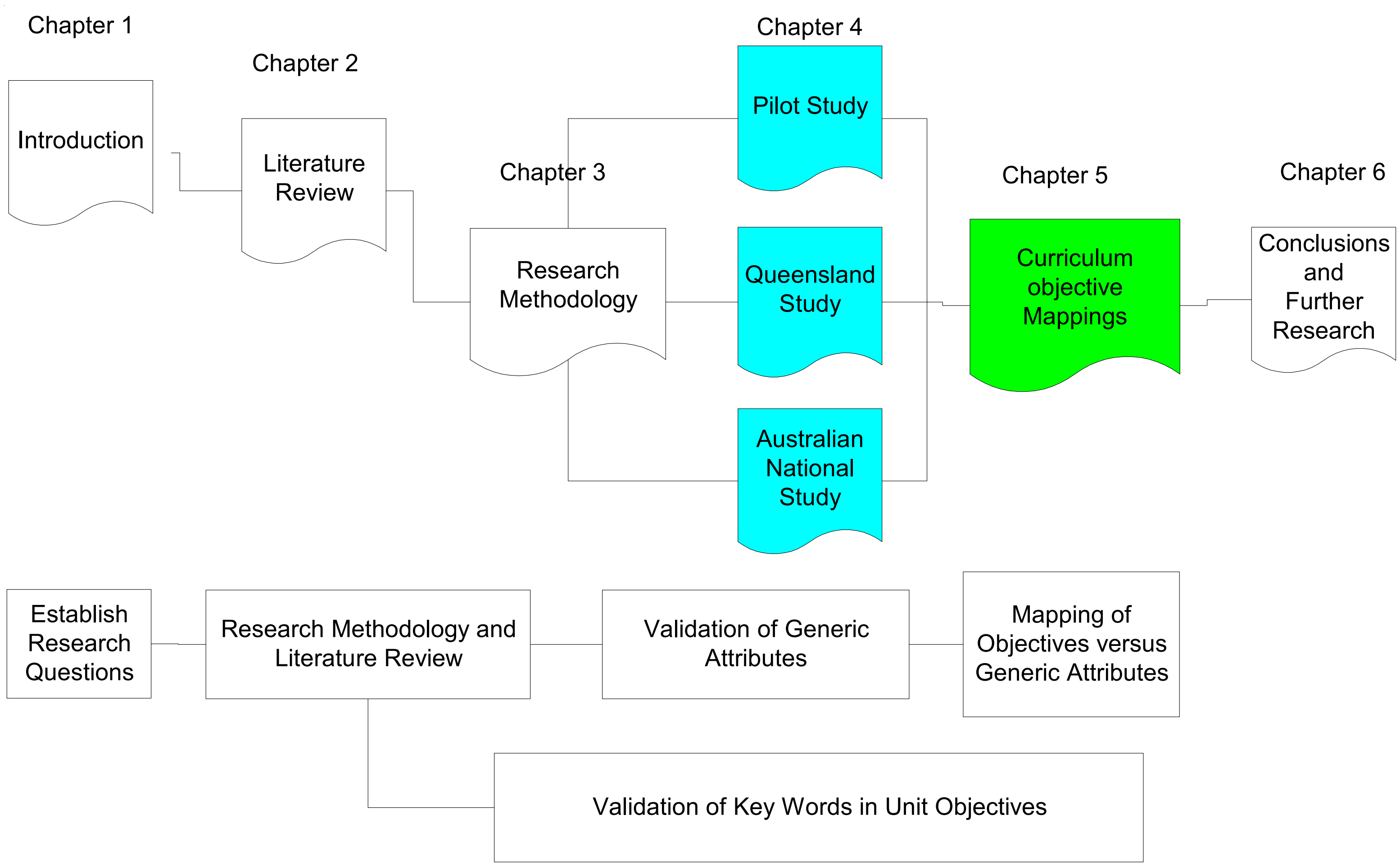

Figure 4.9
Diagrammatic View of the Thesis and Research Plan

Chapter 5

Mapping of Generic Attributes Against Unit Objectives

List of Figures

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Abstract

This chapter presents the mappings of the objectives of the major curriculum documents in the Information Systems (IS) community including IS'97, ISCC'99, and the ACS Core Body of Knowledge against the generic attributes identified in the earlier chapters. Mappings are also included for courses of study at QUT. Mappings for three additional universities that offer IS courses of study in Australia are included in Appendix N. The major findings of these mappings are that the IS curricula offered at the universities studied offer limited development of the identified generic attributes. Both of the curriculum documents, the ACS Core Body of Knowledge and the courses of study at the four universities that formed this study showed a similar pattern in the treatment of the generic attributes. The curriculum documents offer only a slightly improved coverage of the generic attributes. There are a significant number of the generic attributes that receive little or no coverage within the courses of study. The curriculum documents offer only very limited coverage of these same attributes.

5. Introduction

This chapter is substantially based on papers presented at the Higher Education Research Development Society of Australasia Conference, the Americas Conference on Information Systems and the Pacific Asia Conference on Information Systems in 2002.

This chapter applies the methodology described in Chapter 3 for the mapping of the generic attributes against the unit objectives from the course unit outlines, the major curriculum documents and the ACS Core Body of Knowledge.

The chapter is organized as follows. Firstly, the particular curriculum document is described and discussed in terms of its structure, its intended audience, its coverage of generic attributes, and finally the mapping of the objectives against the generic attributes. Following each graph is a discussion of the results and comparison to the other documents presented in this study. The documents to be discussed will be presented in the following order:

- IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems (IS'97);
- Information Systems-Centric Curriculum (ISCC'99);
- ACS Core Body of Knowledge;
- Bachelor of Information Technology Course of study (IT20) from Queensland University of Technology; and,
- Bachelor of Information Technology Course of study (IT21) from Queensland University of Technology.

For each of the above documents the data will be presented using a Kiviat chart. This will then be followed by a comparison line graph to show differences between the documents, and for ease of interpretation. These graphs will then be followed by a discussion of the information obtained from the graphs.

This chapter describes the mapping of generic attributes against unit objectives. Emphasis will be on interpretation of the results. Each of the courses examined has been mapped as described in Chapter 3.

5.1. IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems (IS'97)

The mapping performed on the IS'97 curriculum model using the 29 identified competencies from this study is shown in Figure 5.1. The data presented in the graph represents the number of times the attribute is mentioned or covered by an objective in the unit outline. Figure 5.2 presents the same data using logarithmic scales on the axes. A percentage chart is shown in Figure 5.3 to give a clear representation of the coverage of the generic attributes within the curriculum document.

The data is presented using logarithmic scales to allow a clearer interpretation of the relationships identified in the mapping. Three circles are presented on the graph. The first circle represents 10 occurrences of the attribute with the second circle representing 100 occurrences of the attribute. The outside circle is the 1000 mark. It is noted that three of the attributes have relatively large absolute Figures. This is the reason a logarithmic scale has been used. Logarithmic scales also allow for the easy interpretation of small values. Care however should be taken when interpreting any graph which uses a logarithmic scale. It should be noted that if a variable has a value of zero on a logarithmic graph, no line would be drawn to or from that point. This may give the appearance of a non-connecting line. The interpretation is that the variable clearly has a value of zero. It is not an error on the part of the writer.

The discussion that follows uses percentages, where the number of objectives is large, for ease of comparison of the data with other curriculum documents or courses of study. The raw number of objectives that relate to a generic attribute is used when the number is relatively small.

From the Kiviat chart in Figure 5.1 for IS'97 it should be noted that three of the attributes are represented by 19 percent or more of the objectives. These are ***oral communications*** at 23 percent (187), ***written communications*** at 24 percent (194) and ***IS discipline knowledge*** at 19 percent (157).

A fourth objective ***technological competence*** is represented by nine percent (74) of the objectives. All the other competencies are covered by less than five percent of the objectives within the curriculum document.

Two of the attributes are represented by three percent of the objectives. These are ***reference discipline knowledge*** and ***related discipline knowledge***. The remaining attributes are covered by two percent or less of the objectives.

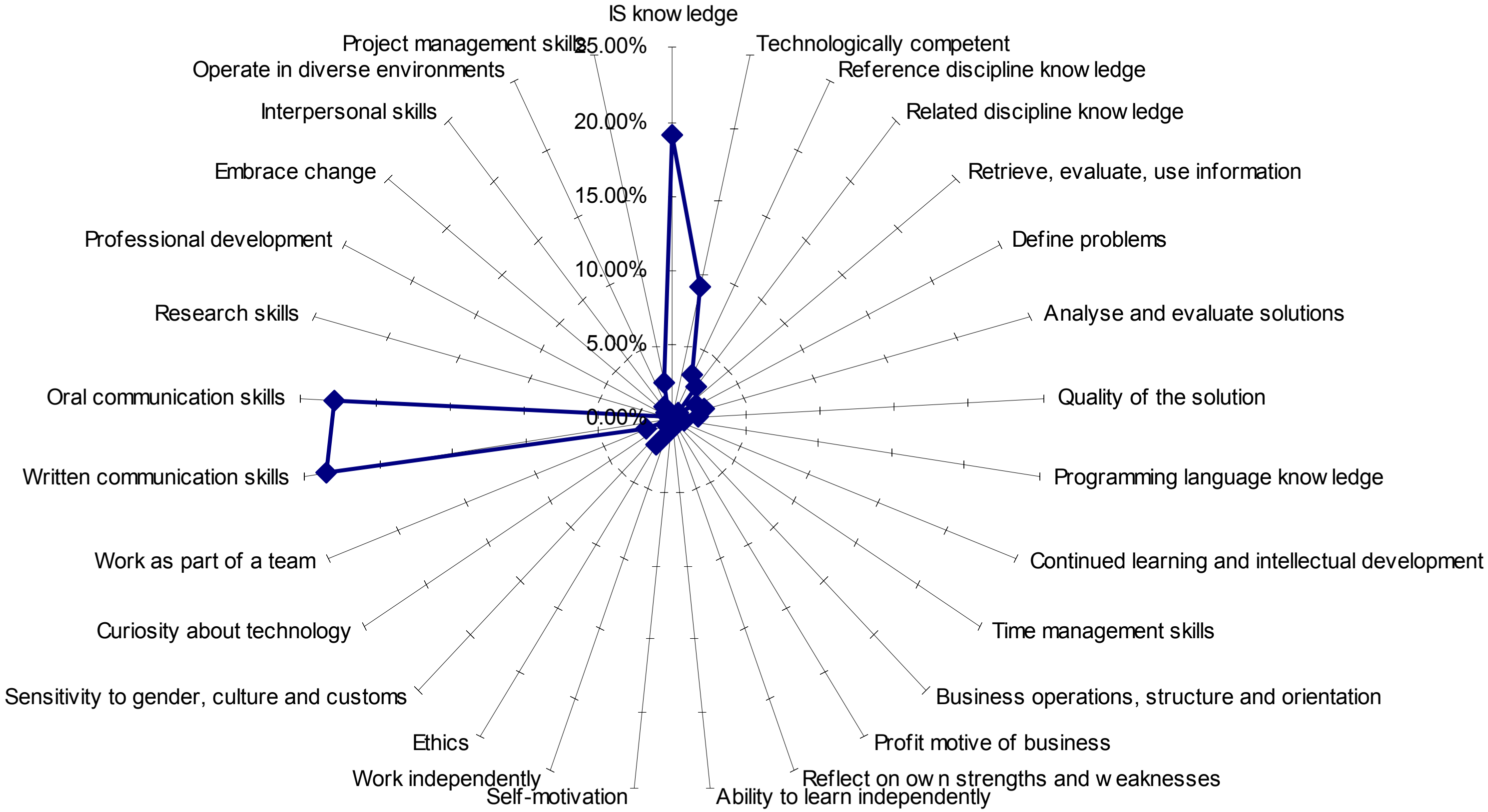

Figure 5.1

IS'97: Generic Attributes Raw Data Representation

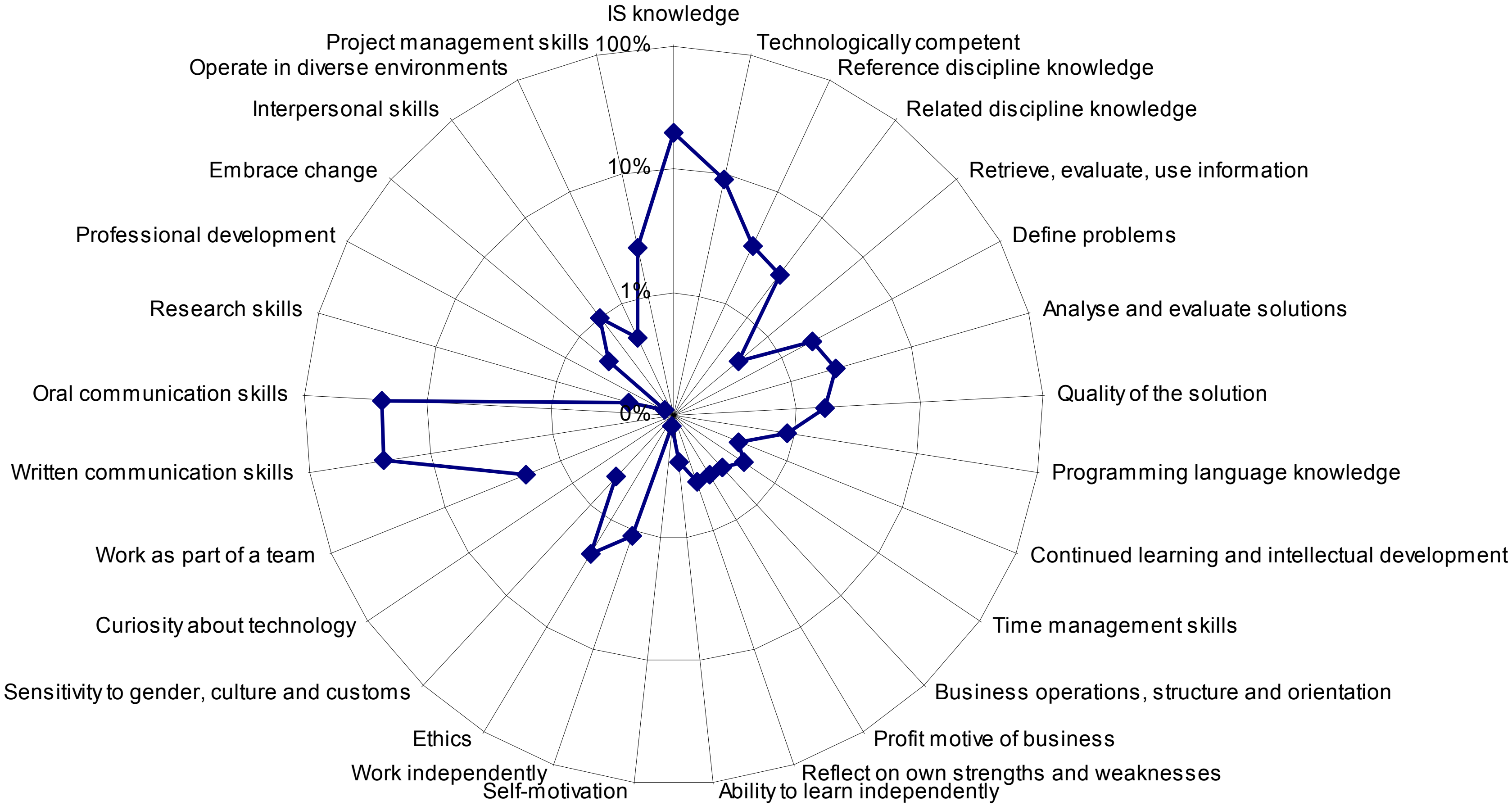

Figure 5.2

Logarithmic Graph of IS'97

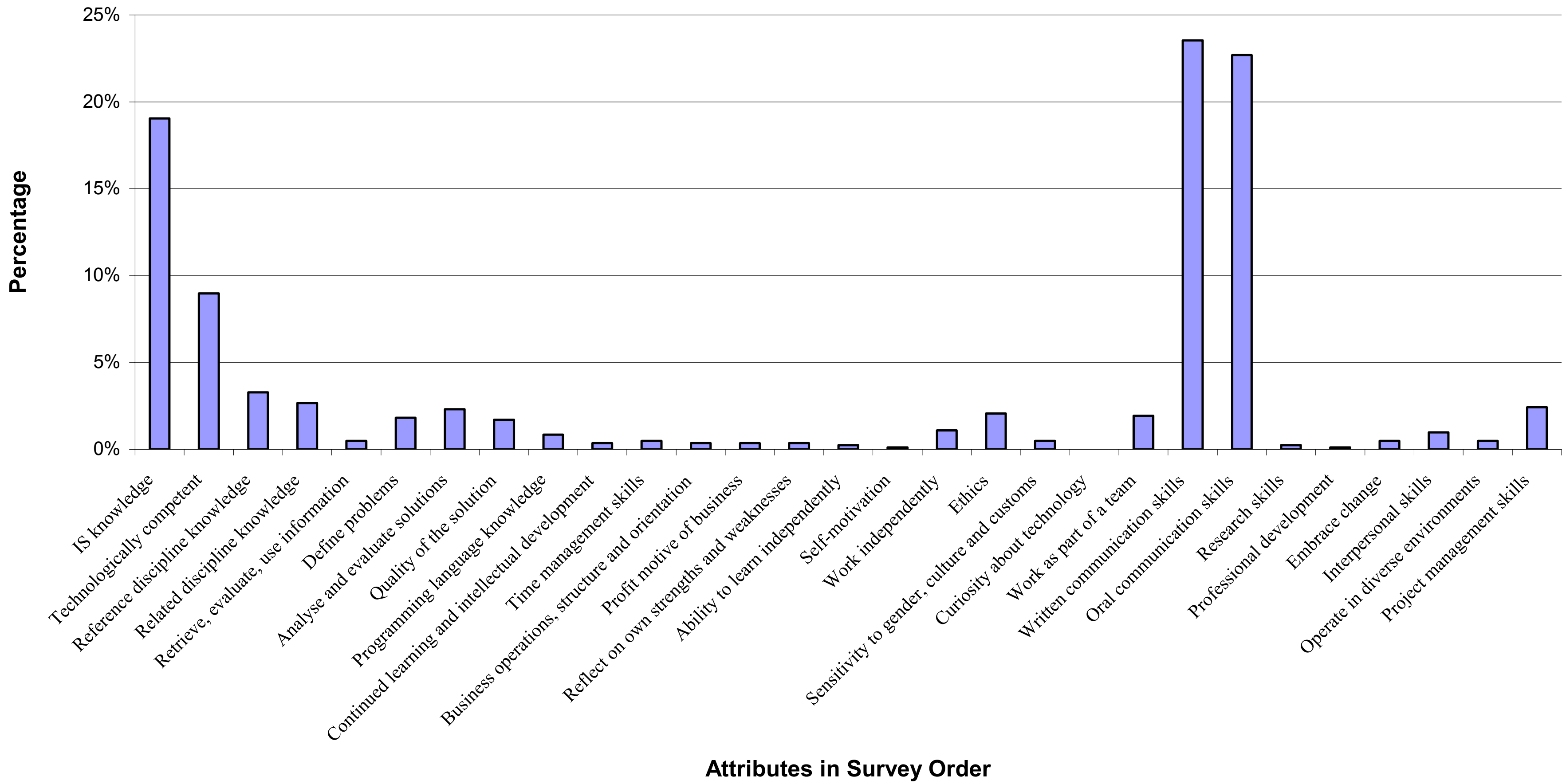

Figure 5.3

Percentage Coverage of Generic Attributes in IS'97

The six attributes which receive coverage at the two percent level in the IS'97 curriculum documentation are shown in Table 5.1.

Table 5.1

IS'97 Attributes Receiving Two Percent Coverage

Competency
Work as part of a team
Analyse and evaluate solutions
Quality of a solution
Ethics
Define problems
Project management skills

A generic attribute objective is an objective that develops the generic attribute. It is noted that one unit objective may have many generic attribute objectives. 824 generic attribute objectives were identified in the curriculum document, which allows it to give an in-depth treatment to all topics. Only one competency, ***curiosity about technology***, is not explicitly covered by any objective. This may be due to an implied coverage in units within the curriculum.

The intense treatment of oral and written communications skills within the IS'97 curriculum documentation is identified from the manner in which the objectives are written. A large number of objectives specify an oral or written manner for the demonstration of competence in the objective. Based on a careful analysis of the curriculum material forming the basis for this research the frequent use of written and oral communication skills appears to be a characteristic of objective writing in the United States of America.

Figure 5.2 and Figure 5.3 present different views of the treatment of each of the attributes. Figure 5.2 uses logarithmic scales of the raw data. Figure 5.3 shows a percentage representation of the coverage of the attributes by the objectives using a bar graph.

It should be noted from the graphs that 12 of the attributes receive mention more than 10 times in the curriculum document objectives with the three ***oral***

communications, ***written communications*** and ***IS discipline knowledge*** mentioned above receiving more than 100 objectives. The attributes that were mentioned more than 10 times in addition to the above three are:

- Work as part of a team;
- Analyse and evaluate solutions;
- Quality of a solution;
- Ethics;
- Technological competence;
- Define problems;
- Reference discipline knowledge;
- Related discipline knowledge; and,
- Project management skills.

Seventeen of the attributes that were mentioned 10 times or less include:

- Self-motivation;
- Retrieve, evaluate and use information;
- Continued learning and intellectual development;
- Work independently;
- Embrace change;
- Interpersonal skills;
- Work independently;
- Reflect on own strengths and weaknesses;
- Professional development;
- Curiosity about technology;
- Time management skills;
- Research skills;
- Sensitivity to gender, culture and customs;
- Programming language knowledge;
- Understanding of the profit motive of business;
- Business operations, structure and orientation; and,
- The ability to operate in diverse environments.

The only attribute to receive no specific coverage within IS'97 is ***curiosity about technology.*** This may be caused by the curriculum writers having difficulty writing objectives that would be assessable and would cover this attribute.

The data displayed in the graphs gives a clear indication that many attributes receive only minimal coverage within the curriculum document. This may not be a reflection on the authors' of the curriculum document's view of the importance of the generic attributes within the curriculum. It may however, reflect the writing style of the curriculum writers in the early 1990s, when IS'97 was written. It is also important to note that IS'97 is a model curriculum document for IS courses of study at the undergraduate level. As a model curriculum it suggests the ideal information to be covered within a course of study and is not intended to be prescriptive in any manner.

5.2. Information Systems-Centric Curriculum (ISCC'99)

The ISCC'99 information systems-centric curriculum model mapping against the 29 generic attributes used in this study is presented in Figures 5.4 –5.6. As with the diagrams for IS'97 Figure 5.4 presents the information as raw data. Figure 5.5 presents the same information using logarithmic scales. Figure 5.6 presents the data using percentages and a Column Graph format. 264 generic attribute objectives were identified in the ISCC'99 curriculum documentation, which is one-third of the number identified in IS'97.

From the data shown in the graphs in Figures 5.4 – 5.6 the attribute of ***IS Knowledge*** clearly stands out as the most important attribute for the ISCC'99 curriculum document with a representation of 22 percent. The second most important attribute, is that of being ***technologically competent***. This is followed by the only other attribute to receive double figure representation of ***written communications skills.*** This would be the normal expectation for a curriculum in Information Systems, that the person undertaking a course would study a high amount of discipline knowledge and be technically competent at using the tools and methodologies of the discipline.

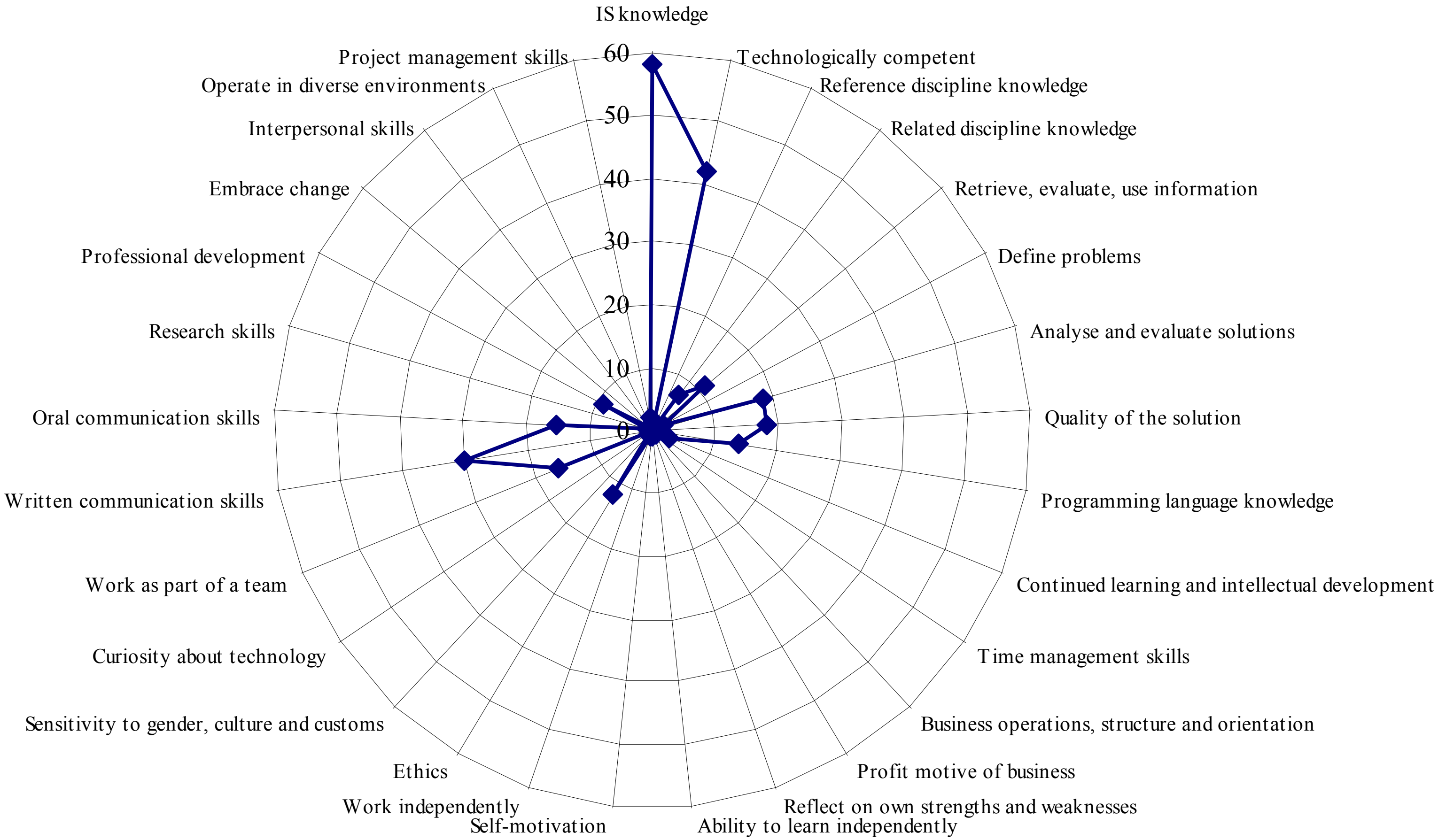

Figure 5.4

ISCC'99 Raw Data

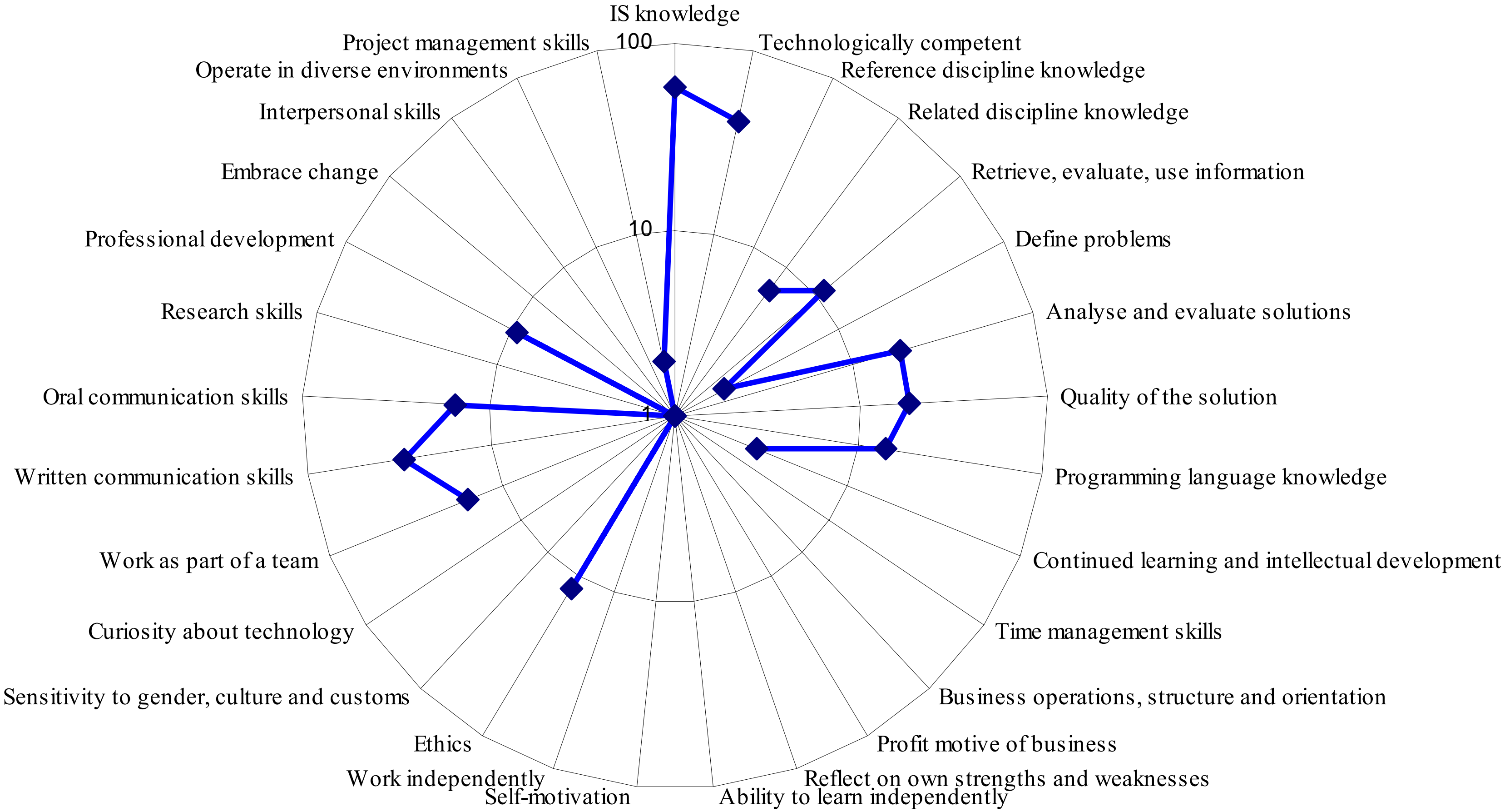

Figure 5.5

ISCC'99 Logarithmic Data

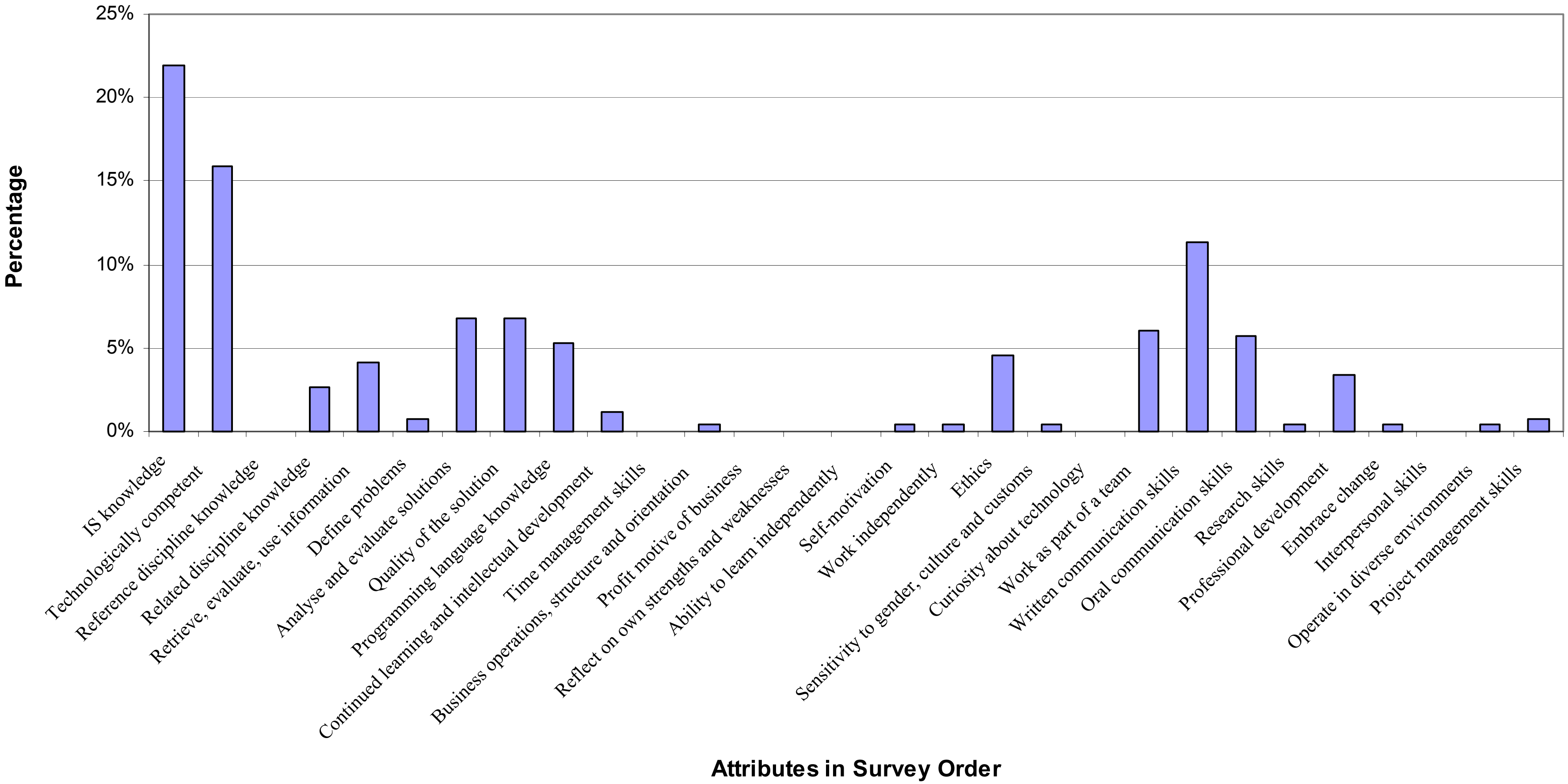

Figure 5.6

ISCC'99 Column Graph Percentage Data

Other attributes that received more than four percent representation in the objectives of the curriculum are:

- Work as part of a team – 7 percent;
- Quality of the solutions – 7 percent;
- Oral communications – 6 percent;
- Analyze and evaluate the various solutions – 6 percent;
- Ethics – 5 percent;
- Programming language knowledge – 5 percent; and,
- Retrieve, evaluate and use information – 4 percent.

From the above list it is noted that the programming language attribute is not specifically mentioned more frequently. The third most important attribute identified in the study ***retrieve, evaluate and use information*** was considered by all respondents to be essential but yet it received only four percent coverage in the objectives of the curriculum.

Six of the attributes were not represented by any objectives within the curriculum. These included:

- The ability to learn independently;
- Interpersonal skills;
- Professional development;
- Time management skills;
- Reference discipline knowledge; and,
- Understanding the profit motive of business.

The above result is not consistent with the other curriculum document IS'97 which has only one attribute with no representation in the objectives of the courses.

Oral communications skills are represented by only six percent of the objectives. The result that written communications is more highly represented in the curriculum at 11 percent is inconsistent with the overall identified relative importance it received in the identification and validation phase of the study. In the validation phase of the study written communications was ranked ninth as compared to fourth for oral communications out of the 29 attributes.

The surprising result is the coverage given to the attribute of IS knowledge when industry ranked it 16th and academics ranked it 10th with an overall ranking of 14.

Technological competence is ranked 9th by industry and 12th by academics with an overall ranking of 11. This attribute received 16 percent of the coverage by the objectives, which places it in the second position, which is inconsistent with its overall ranking in the study.

Mapping the identified competencies from the ISCC'99 curriculum document against the objectives listed in each of the unit descriptions has not been done. The identified competencies in ISCC’99 are general content related statements of what a graduate will be able to do from an IS perspective, rather than a generic attribute perspective where the IS content is but one of the aspects of the qualities the new employee possesses.

5.3. A Comparison of IS’97: ISCC’99

It is useful to compare the two curriculum documents identified above. A Comparison graph is shown in Figure 5.7. Particular note should be made that the curriculum documents are, as their titles suggest, guidelines for model curriculum in the undergraduate framework. This suggests that the model curricula are designed to be flexible and provide a model, or suggest areas of coverage. The curriculum documents are not intended to be prescriptive of the content that is to be included in a course of study.

From the graph in Figure 5.7 it should be noted that the two curricula have, in general, very similar patterns in their treatment of the generic attributes of IS graduates.

It should be noted that there is a significant difference in the number of objectives that deal with the attribute of ***oral communications skills.*** IS'97 curriculum document rates the attribute of oral communications at 19 percent while the ISCC'99 curriculum document rates it at 6 percent.

It should also be noted that many of the attributes receive a slightly higher percentage coverage in the ISCC'99 curriculum document than in the IS'97 model curriculum. This may be caused by a slightly different focus within the writers' minds in terms of writing objectives that explicitly relate to the generic attributes of IS graduates.

Other differences such as the higher treatment of ***information retrieval, team work, technological competence, quality of a solution and programming language skills*** may reflect the changing times as we moved closer to the new millennium. Care should also be taken when interpreting the graph in percentage terms, as the number of generic attribute objectives in IS'97 (824) is over three times the number used in ISCC'99 (264).

Both curriculum documents give little treatment to what some employers consider to be very important workplace skills such as self-motivation and retrieve, evaluate and use information. Other attributes that receive little mention in the curriculum documents are:

- Continued learning and intellectual development;
- Ability to learn independently;
- Embrace change;
- Interpersonal skills;
- Work independently;
- Professional development;
- Curiosity about technology;
- Time management skills;
- Sensitivity to gender, culture and customs;
- Research skills;
- Operate in diverse environments;
- Knowledge of how a business is operated, structured and orientated; and,

- Profit motive of business.

The ISCC'99 rates the attributes of ***technological competence, retrieve, evaluate and use information, define problems in a systematic way, consider the quality of the solution, be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking, self-motivation*** and ***oral communications*** higher than IS '97. This research rates the above attributes as very important (means greater than 6) as they comprise the top five attributes from an overall perspective.

IS'97 rate the attributes of ***sensitivity to difference in gender, culture, and customs, demonstrated practical knowledge and understanding in at least one programming language*** and ***participation in on-going professional development*** higher than the ISCC'99 curriculum document. This does not imply that these particular attributes are not important, but rather the previous list is explicitly treated in more detail in ISCC'99 than in IS'97.

The important fact to be gleaned from the graph in Figure 5.7 is the lack of treatment of the attributes of ***curiosity about technology*** by both the curriculum documents. ISCC'99 also give no treatment to the attributes of ***reference discipline knowledge, time management skills, understanding the profit motive of business, the ability to reflect on one's strengths and weaknesses, confidence in one's ability to learn independently*** and ***interpersonal skills***. This lack of treatment may be an oversight from the writers or it may be due to the lack of explicit writing of these attributes into the limited number of objectives within the curriculum document.

One possible explanation for the identified differences between IS'97 and ISCC'99 is the time in which they were written. IS'97 was written in the mid- 1990s at a time when changes to the IT industry were just beginning, while ISCC'99 was written several years later when the changes were being implemented and the move to the technology and processes of the next millennium were being developed and implemented.

As mentioned in chapter 2 the exit statements that are referred to as attributes of graduates in the curriculum documents are very heavily content oriented. The attributes identified in this research are the IS industry and academic identified generic set of skills or attributes that an employee needs in the first year of employment. This is the significant difference between this research and the curriculum documents IS'97 and ISCC'99.

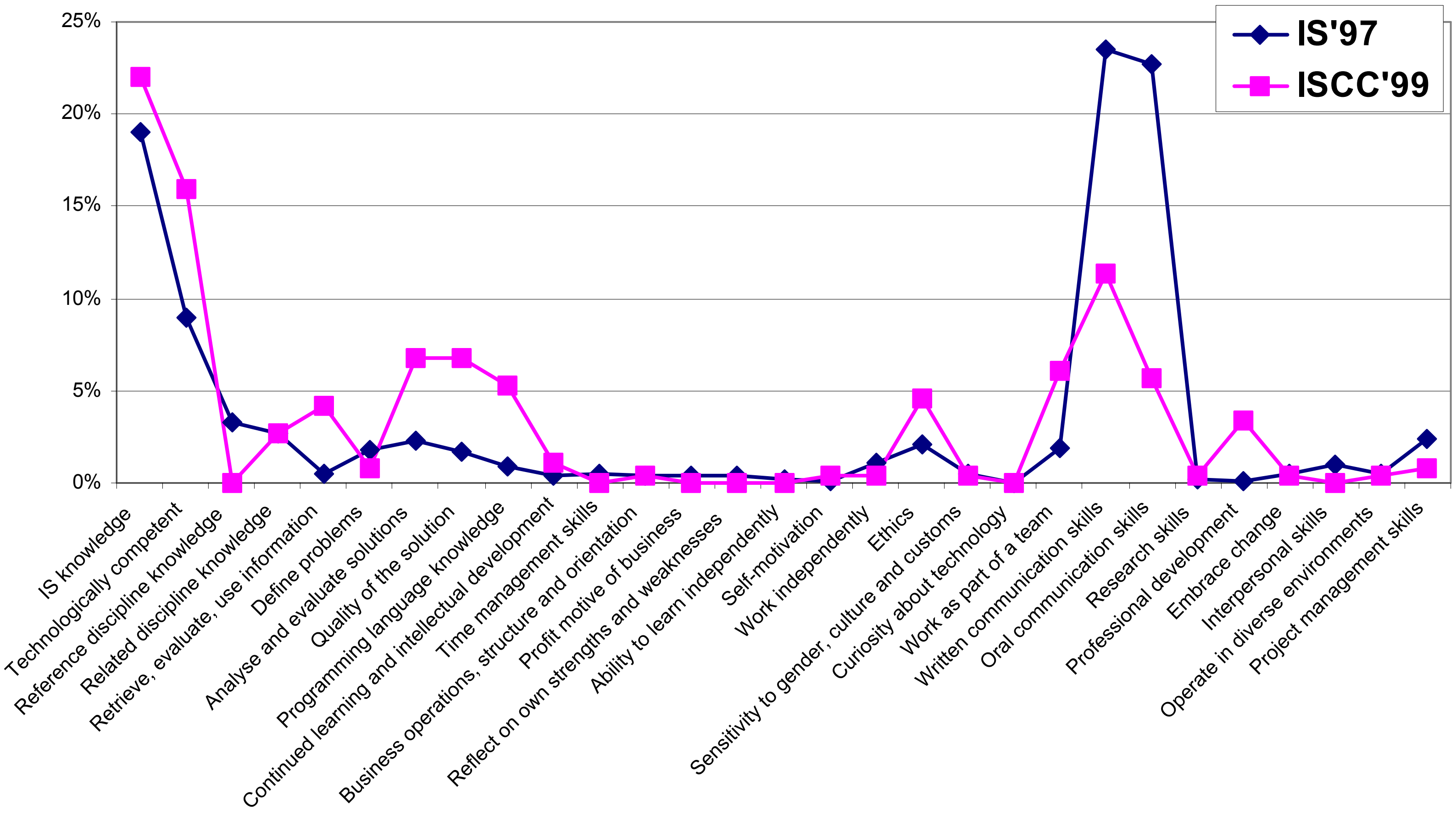

Figure 5.7

IS'97: ISCC'99

5.4. ACS Core Body of Knowledge

The generic attributes representation in the ACS Core Body of Knowledge is shown in Figure 5.8. Care should be taken when reading or making inferences from the above graphs in Figures 5.8 to 5.10. The first seven graphs (IS'97 and ISCC'99) represent idealistic curriculum content whereas the following graphs represent a minimalist view of what is required of an institution offering a course of study preparing the IS student for employment.

The ACS Core Body of Knowledge represents the minimum required for an institution to gain accreditation with the ACS. The expectation is that the two curriculum documents will show a higher rating than the ACS core body of knowledge as the former represents the ideal scenario for a curriculum while the latter represents the minimalist view of what is required in a curriculum. It should be noted that a course of study exceeding the ACS rating only indicates that the course exceeded the minimum required for accreditation and does not represent endorsement by the ACS of the extent of treatment in a particular course of study.

From the above three graphs it should be noted that the ACS requires for accreditation a significant treatment of the IS discipline within the objectives of the units of study as outlined in the core body of knowledge.

Other attributes that show a significant treatment within the ACS Core Body of Knowledge are attributes of ***technical competence, reference discipline, project management, written communications skills, quality of the solution*** and ***programming language competence.*** Only four of the attributes receive no mention in the core body of knowledge. These are:

- Self-motivation;
- Ability to learn independently;
- Work independently; and,
- Reflect on own strengths and weaknesses.

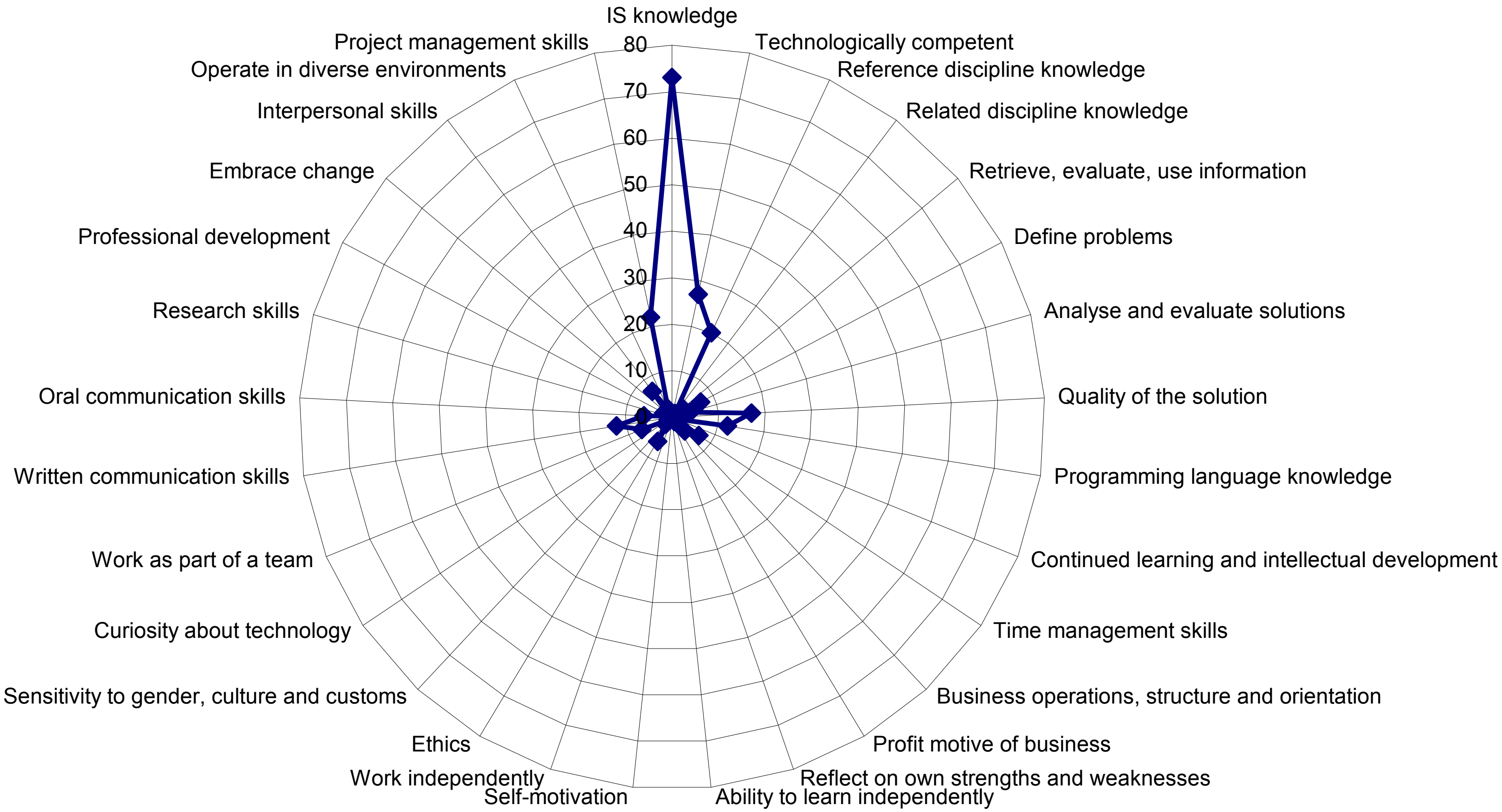

Figure 5.8

ACS Core Body of Knowledge - Raw Data

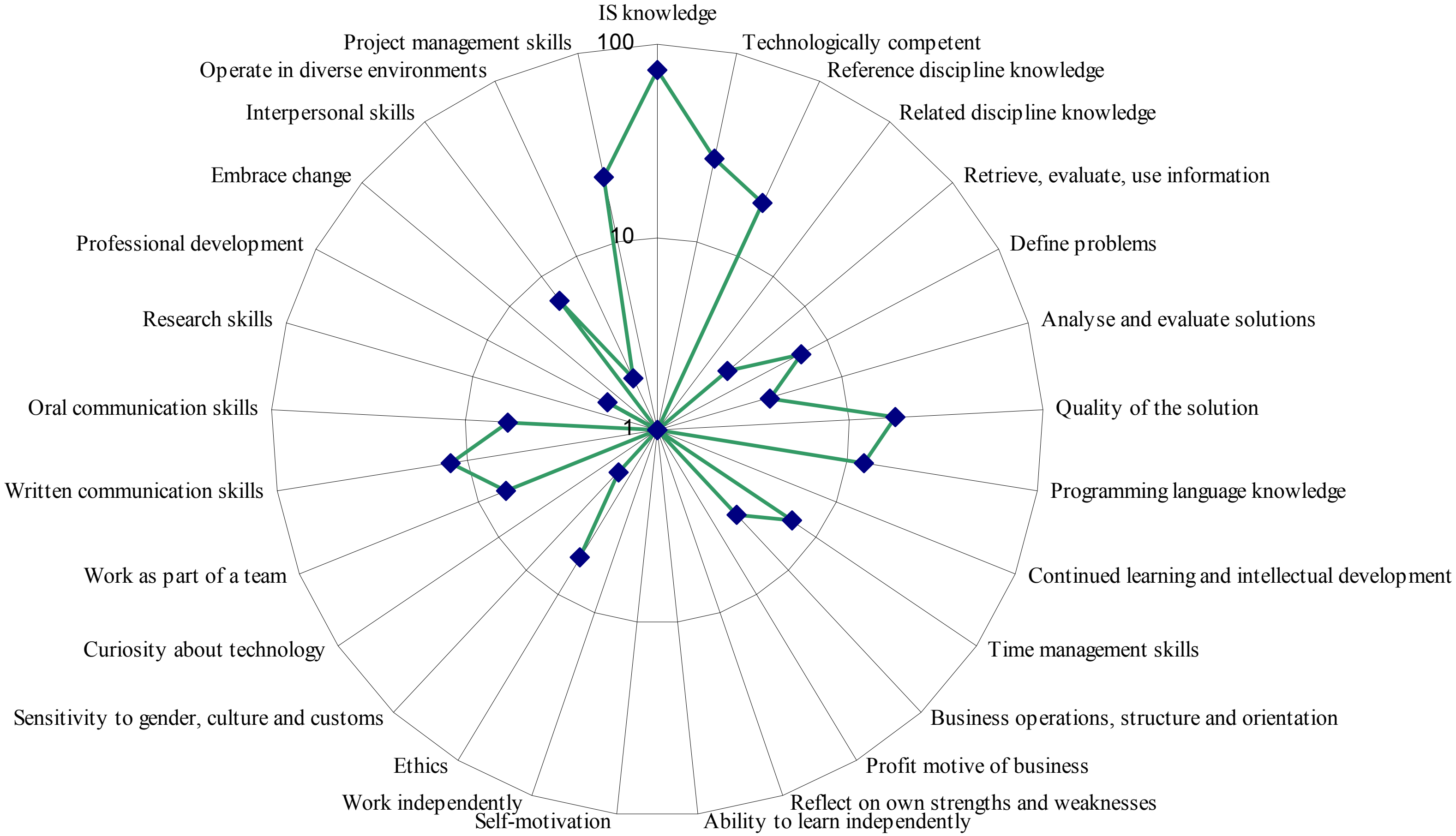

Figure 5.9

ACS Core Body of Knowledge – Logarithmic Scales

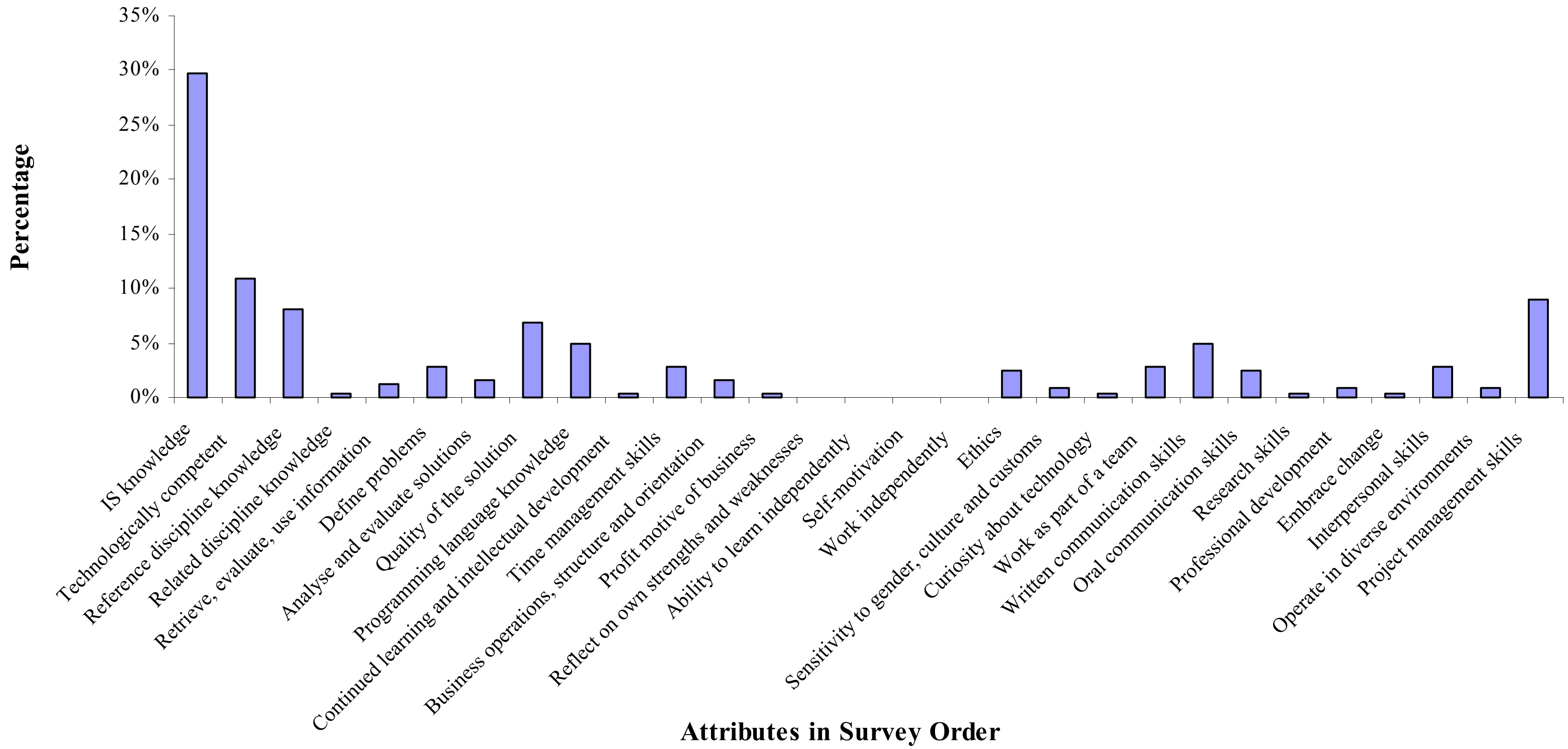

Figure 5.10

ACS Core Body of Knowledge – Column Graph

The lack of coverage of the above four attributes may reflect what the ACS Core Body of Knowledge is designed for, rather than implying a statement that these attributes are not important. The expectation from the ACS may be that these attributes are expected of employees and members of the ACS before they start an accredited course. The issue with all generic attributes is that at times it is difficult to 'teach' the particular skills identified in an attribute. Due to this difficulty some curriculum writers simply leave out the attributes that are difficult to teach.

The mappings shown in Figure 5.11 is a comparison of the curriculum documents IS'97 and ISCC'99 with the ACS Core Body of knowledge.

From the graph in Figure 5.11 it should be noted that there is a similar trend in treatment of a small number of the attributes in detail, while at the same time giving little or no treatment to the vast majority of the attributes. The ACS Core Body of Knowledge in general appears to give very similar treatment to that given in ISCC'99.

Specifically the attribute of ***possess coherent, extensive, theoretical and practical IS knowledge*** is given more treatment in the ACS Core Body of Knowledge than either of the curriculum documents. The ISCC'99 and the ACS Core Body of Knowledge give significantly less treatment to the attributes of ***written communications*** and ***oral communications.*** The pattern of the treatment of these attributes is similar in all three documents, however the IS'97 gives a significantly larger treatment than the others. ISCC'99 shows a larger drop in the treatment of oral communications skills than either the ACS Core Body of Knowledge or IS'97.

The ACS (Underwood 1997) requires for accreditation purposes mandatory coverage in the generic areas of IS/IT knowledge, interpersonal communications, ethics, social implications, professional practice, project management and quality principles.

The ACS Core Body of Knowledge specifies a greater treatment of project management skills and knowledge than the other curriculum documents. This is an interesting result given that this study ranked the attribute of project management last and relatively unimportant with an industry ranking of 29, and an academic ranking of 27 with an overall ranking of 28 out of the 29 attributes. One possible explanation of the greater emphasis given to the project management attribute may lie in the time in which the ACS Core Body of Knowledge was written. The ACS Core Body of Knowledge was written in 1997, which makes it the second of the three documents to be produced in terms of when they were written. A second explanation for the emphasis given project management is that ACS has identified the importance of project management in the IS industry in practical terms.

The ACS Core Body of Knowledge and ISCC'99 give similar and significantly more treatment to the attributes of defining problems, analysing and evaluating the solutions and considering the quality of the solution than IS'97. This again may be a reflection of the years in which each of the documents was written. It is a reflection of the changing nature of the IS work environment and that it will continue to change.

The ACS Core Body of Knowledge also gives more treatment to the attributes of time management skills and understanding business operation and orientation than either of the other curriculum documents. ISCC'99 treats the attributes of ethics and professional development more deeply than either IS'97 or the ACS Core Body of Knowledge.

This section has described the coverage of the generic attributes within the major curriculum documents and the ACS Core Body of Knowledge. The next section will examine the coverage of the generic attributes within undergraduate degree courses of study at four Australian universities.

This study also has examined the IS courses offered by several Australian business schools as well as courses offered in IT engineering schools. The IS courses examined are from Queensland University of Technology and include the previous two accredited undergraduate degree courses IT20 and IT21. The business schools' courses examined are from:

- RMIT;
- Southern Cross University; and,
- Bond University.

Details of the coverage of courses from the above institutions may be found in Appendix N.

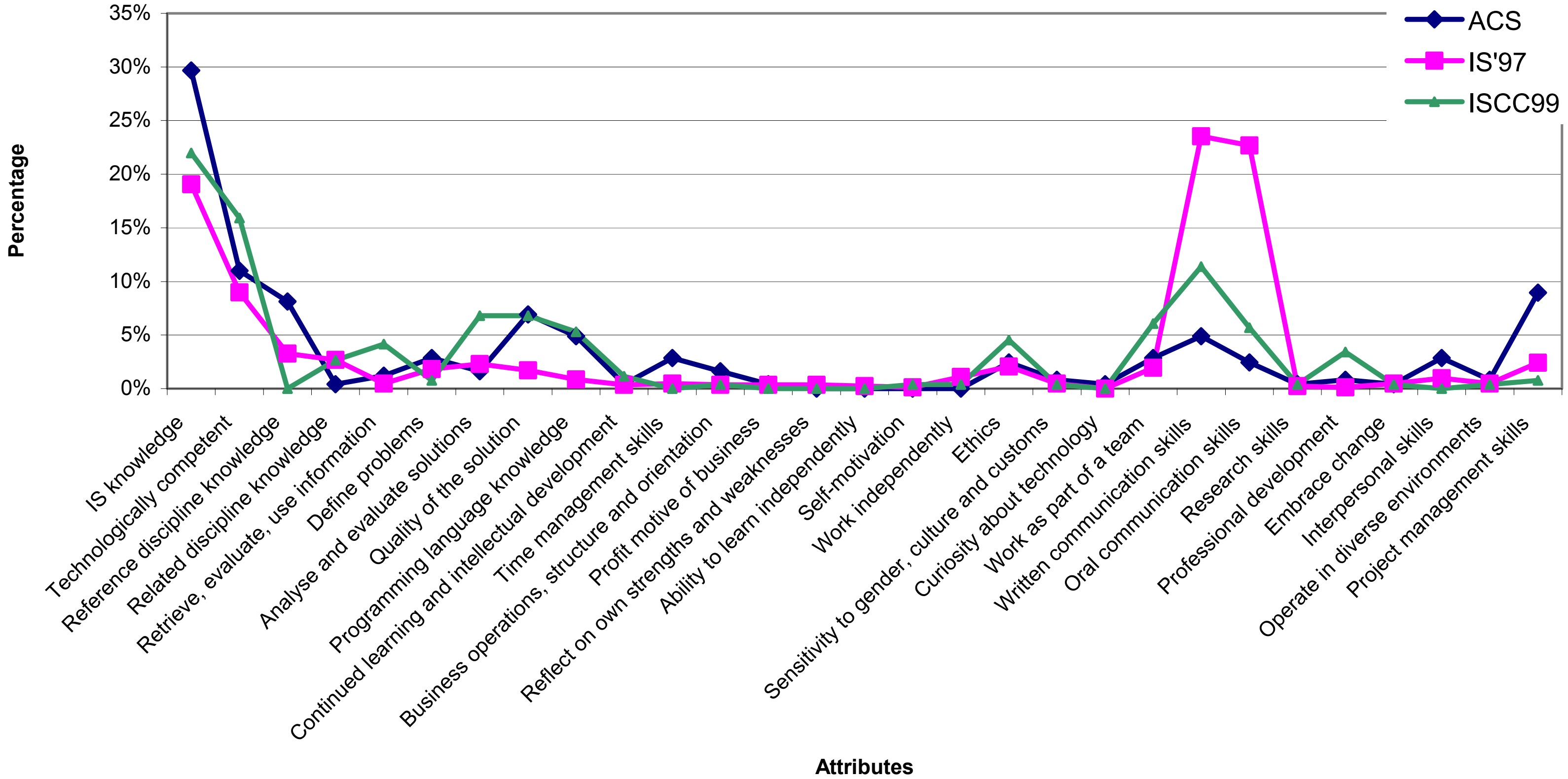

Figure 5.11
ACS: IS'97: ISCC'99

5.5. Undergraduate Courses of Study

This section will describe the coverage of the generic attributes within the QUT undergraduate Bachelor of Information Technology (BIT) course. Two versions of this course will be examined. It should be noted that the IS course of study at QUT is taught within an IT engineering school.

5.5.1. The IT20 Bachelor of Information Technology - QUT

The IT20 Bachelor of Information Technology at QUT is an undergraduate course of study with a variety of majors. The degree examined in this thesis is the IT20 degree with a major in Information Systems. The IT20 Bachelor of Information Technology (BIT) course from QUT is graphically represented in Figure 5.12.

From the data displayed in the graph in Figure 5.12 it should be noted that the content of IS is treated strongly. The attributes of ***possess coherent, extensive, theoretical and practical IS knowledge***, ***technical competence*** and ***knowledge of the IS reference disciplines*** all receive greater than 10 percent treatment within the objectives of the courses.

The other attributes that received significant treatment are ***quality of the solution, analyze and evaluate the various solutions, retrieve, evaluate and use information, programming language knowledge***, and ***written communications skills.*** From the graph in Figure 5.13 it should be noted that the following attributes are mentioned less than ten times within the objectives of the course of study:

- With respect to the IS discipline possess the theoretical and practical knowledge of related disciplines, for example, business, law, education, data communications, computer science or leisure recreation;
- Define problems in a systematic way;
- Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking;
- Time management skills;
- Understand the profit motive of business;

- Ability to reflect on own strengths and weaknesses;
- Confidence about their ability to learn independently;
- Self-motivation;
- Work independently;
- Value the ethics of the Information Technology profession;
- Sensitivity to differences in gender, culture and customs;
- Possess a sense of basic curiosity about technology;
- Work as part of a team in a productive and cooperative manner;
- Oral communication skills;
- Research skills;
- Participate in on-going professional development;
- Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology;
- Interpersonal skills;
- Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment; and,
- Project management skills.

This may suggest that the unit objective writer was primarily focused on the discipline content of the unit rather than the holistic lifelong learning of the student and the place their particular course fits within the student's lifelong learning path. 300 generic attribute objectives were identified in the IT20 course with 27 percent being devoted to the content specific attribute of ***possess coherent, extensive, theoretical and practical IS knowledge.***

Figure 5.14 displays in a Column Graph the percentage coverage of all the generic attributes within the IT20 course of study. From this graph it is clear that three of the attributes account for approximately 50 percent of the objectives within the course of study. These objectives are ***possess coherent, extensive, theoretical and practical IS knowledge, technical competence*** and ***knowledge of reference disciplines.***

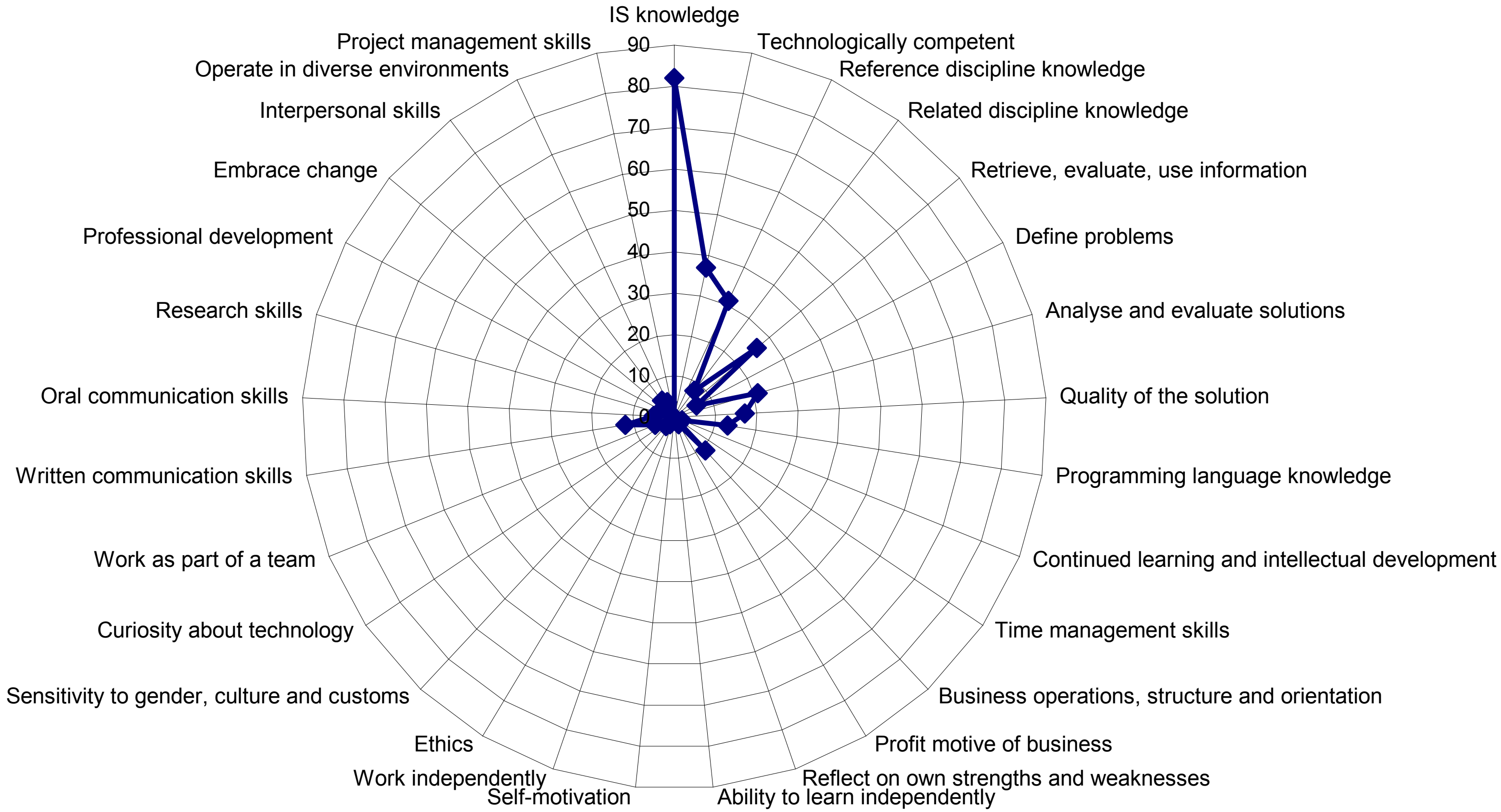

Figure 5.12

QUT's Bachelor of Information Technology (IT20) - Raw Data

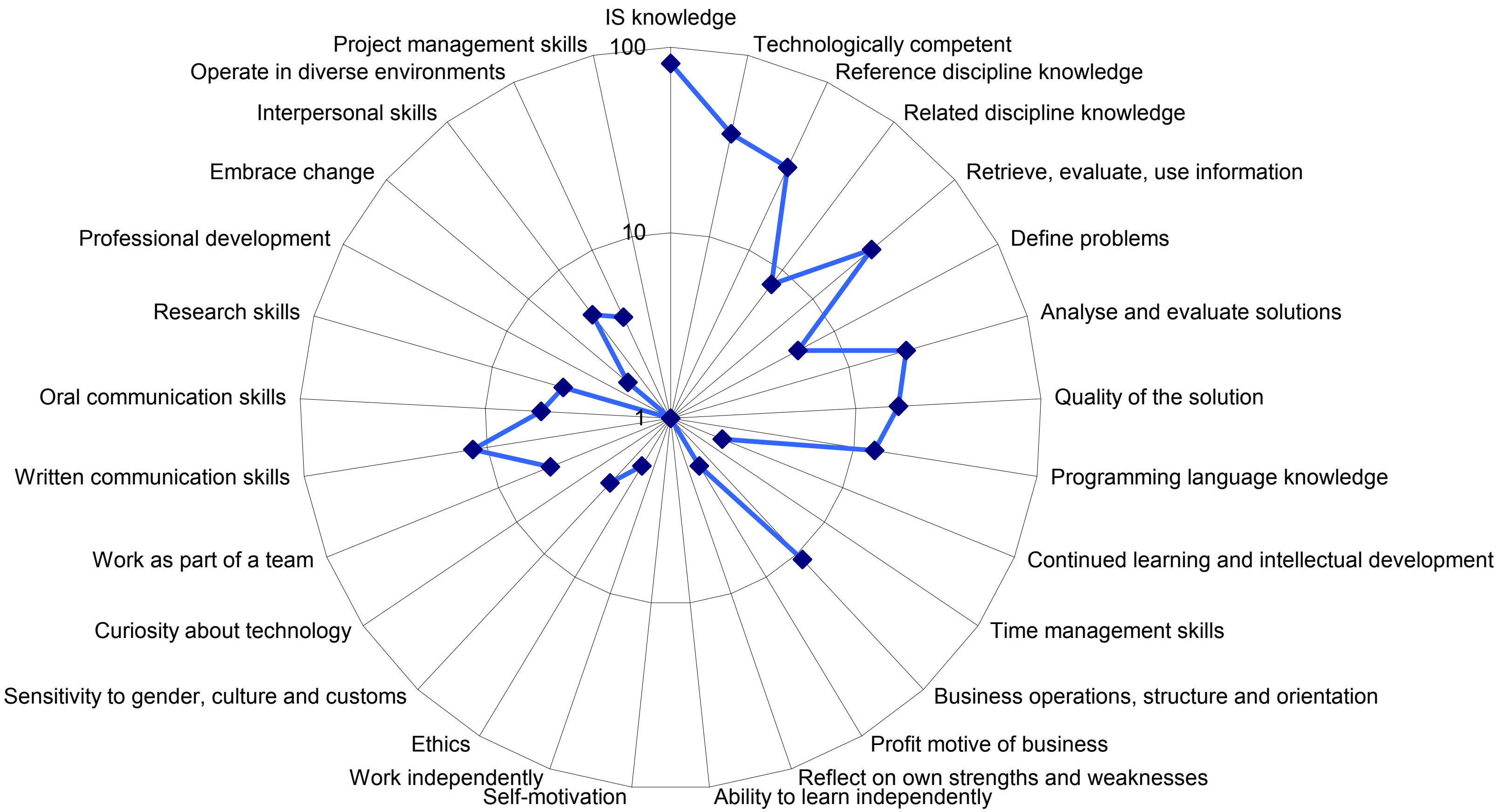

Figure 5.13

QUT's Bachelor of Information Technology (IT20) - -Logarithmic Scales

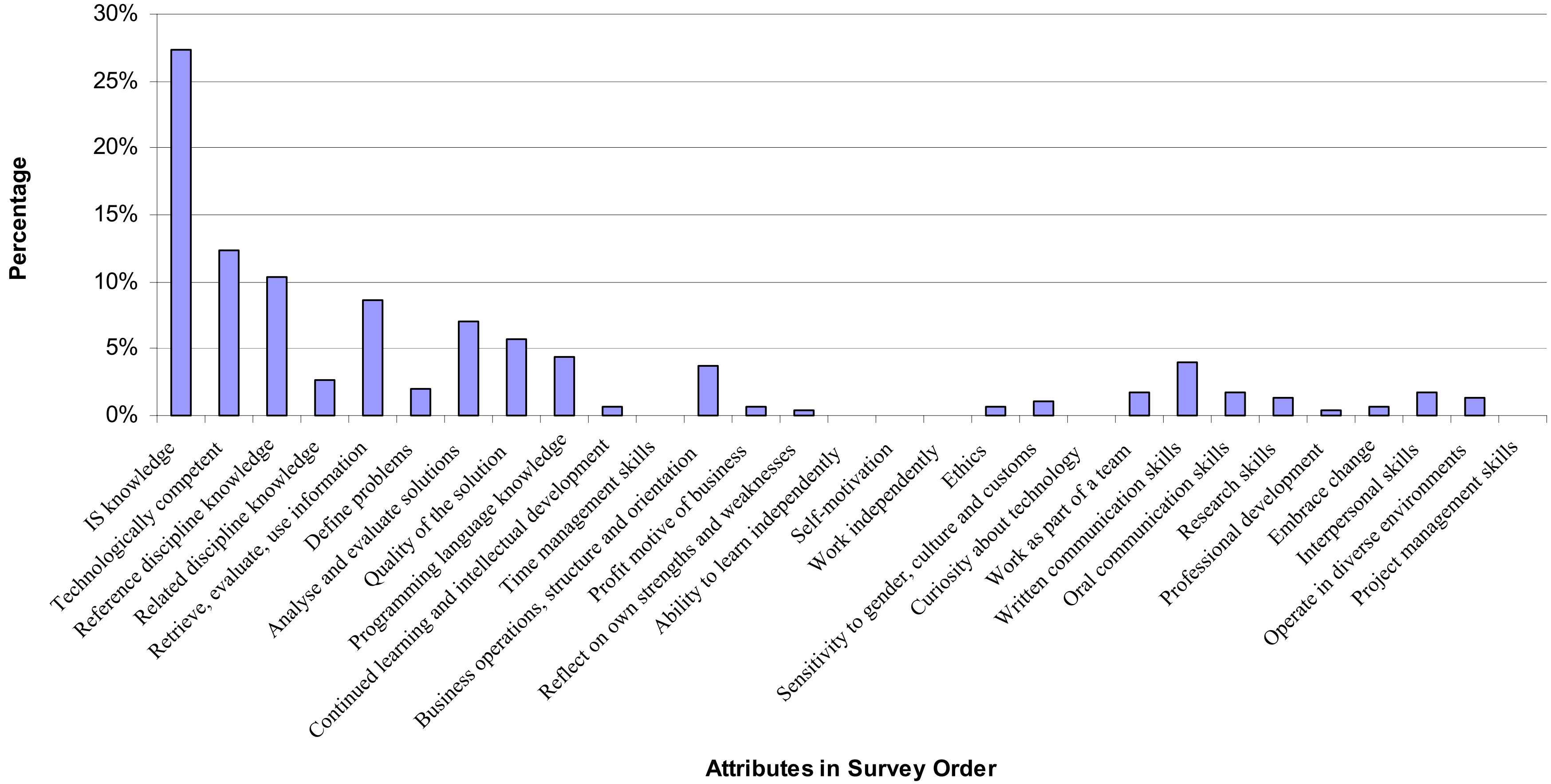

Figure 5.14

QUT's Bachelor of Information Technology (IT20) - Column Graph

Figure 5.15 shows a comparison of IT20 with the ACS Core Body of Knowledge, IS'97 and ISCC'99. From the graph it should be noted that the IT20 course of study from QUT has a similar pattern to the ACS Core Body of Knowledge. The graph in Figure 5.16 shows the same comparison using normalised data. This graph clearly demonstrates that educational courses as stated in their unit objectives do not meet IS industry needs as identified in the generic attributes of entry-level employees.

The attribute of ***analyse and evaluate the various solutions*** has a similar treatment to that given in ISCC'99 rather than that of the ACS Core Body of Knowledge. The attribute of ***retrieve, evaluate and use information***, received nine percent coverage in the objectives, which is higher than either of the curriculum documents or the ACS Core Body of Knowledge.

Reference discipline knowledge and technical competence receive slightly more treatment than the ACS Core Body of Knowledge. It is interesting to note that written communications skills receives the least amount of coverage in IT20 compared to the curriculum documents or the ACS Core Body of Knowledge. Again it should be noted that a course of study exceeding the ACS rating only indicates that the course exceeded the minimum required for accreditation and does not represent endorsement by the ACS of the extent of treatment in a particular course of study.

As with the curriculum documents and the ACS Core Body of Knowledge, a significant number of generic attributes receive only minimal treatment. Six of the generic attributes receive no coverage within the IT20 course of study. These are:

- Project management skills;
- Time management skills;
- Curiosity about technology;
- Ability to learn independently;
- Self-motivation; and,
- Work independently.

Anecdotal evidence suggests that project management skills and the others mentioned above are expected to be applied in many units but are not stated in the objectives. One possible explanation for the omission of these generic attributes from the unit objectives is that the IT20 course of study was written prior to the generic attributes agenda making an impact on the tertiary scene.

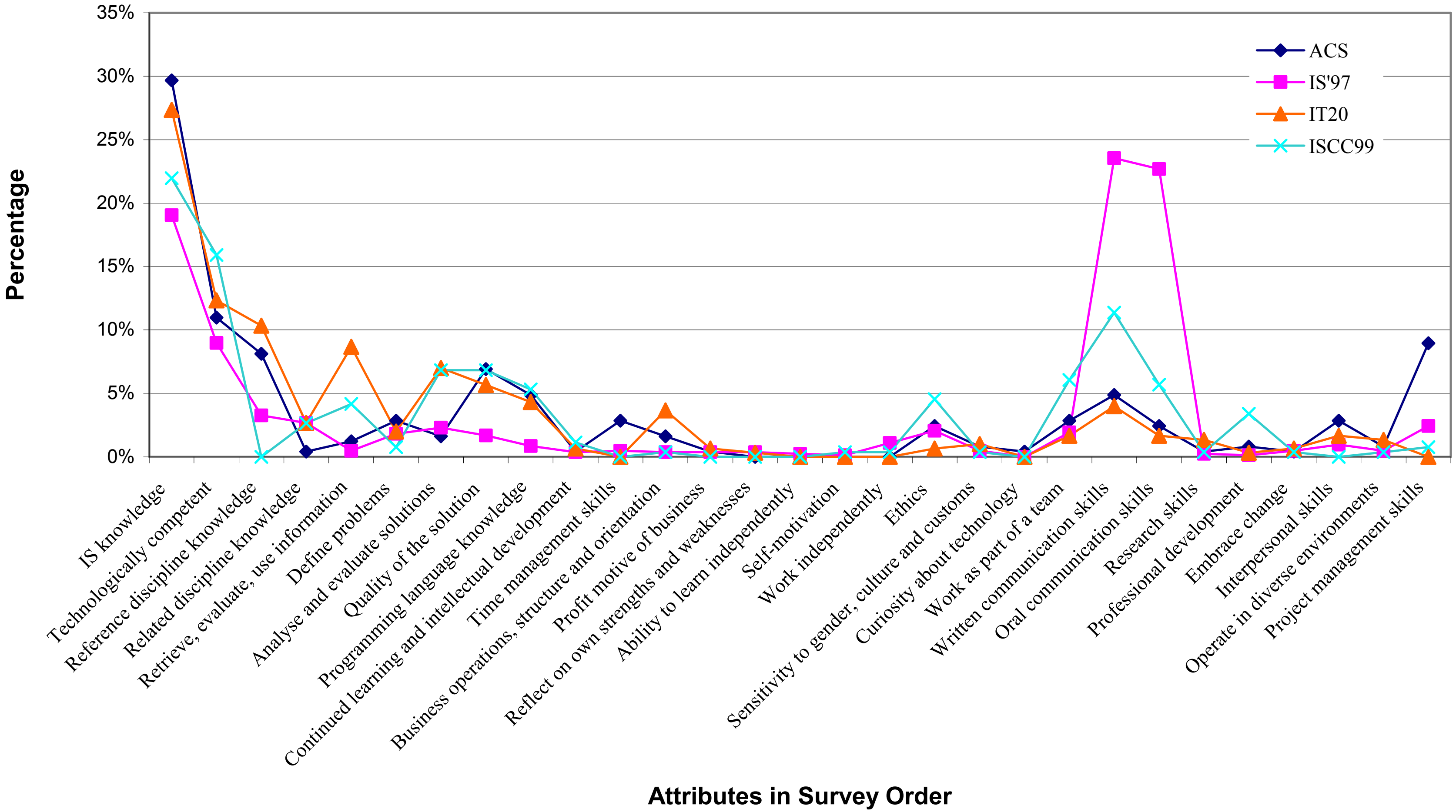

Figure 5.15
QUT's Bachelor of Information Technology (IT20): ACS Core Body of Knowledge: IS'97: ISCC'99

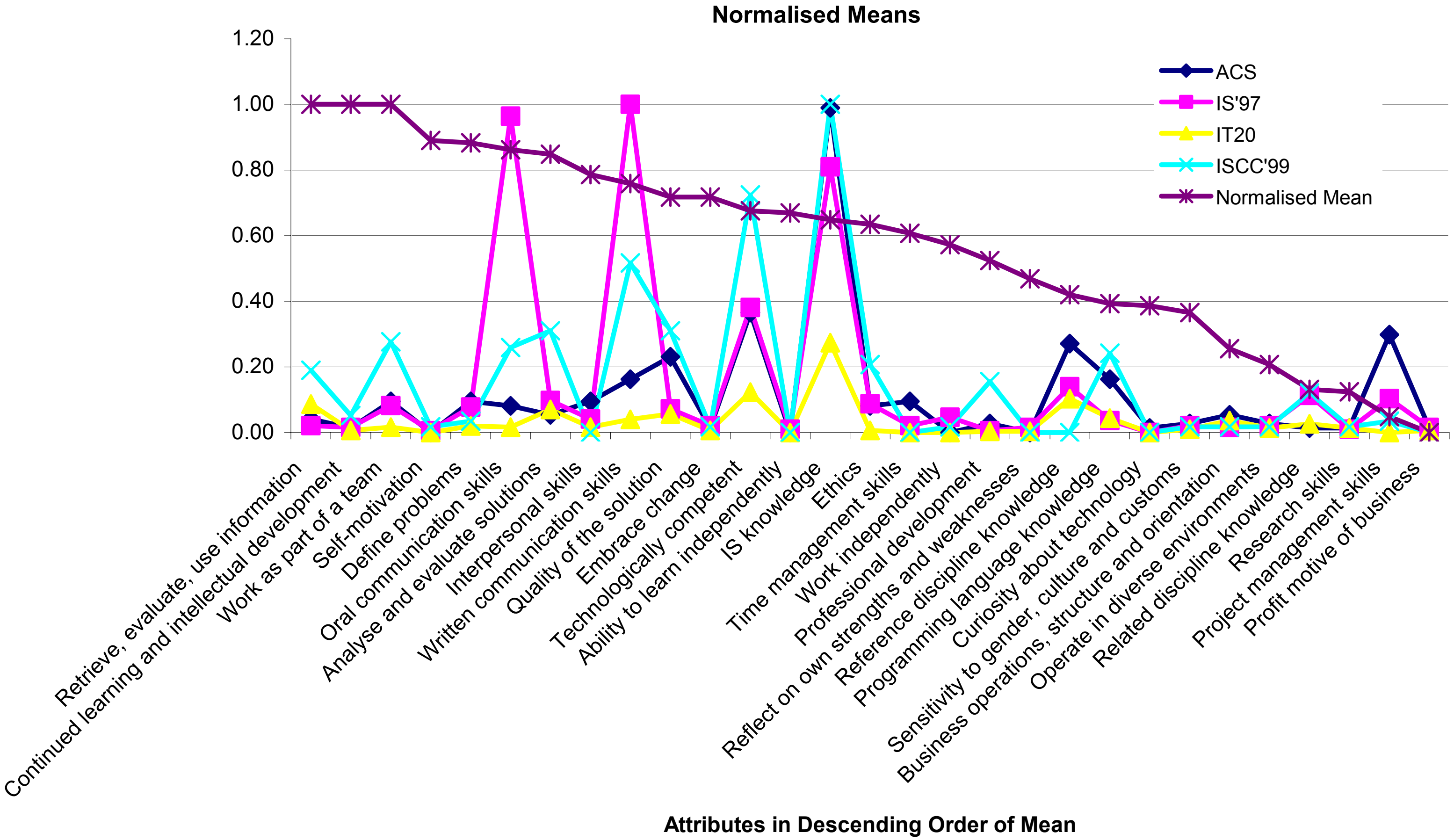

Figure 5.16

QUT's Bachelor of Information Technology (IT20): ACS Core Body of Knowledge: IS'97: ISCC'99 – Normalised Data

5.5.2. The IT21 Bachelor of Information Technology - QUT

The IT21 Bachelor of Information Technology at QUT is an undergraduate course of study with a variety of majors. The degree examined in this thesis is the IT21 degree with a major in Information Systems. The IT21 course of study is the revision of the previously described IT20 course of study at QUT. The IT21 Bachelor of Information Technology (BIT) course from QUT is graphically represented in Figure 5.17.

The data for the IT21 course of study at QUT as displayed in Figures 5.17 - 5.20 shows a strong coverage of basic IS discipline knowledge. The IT21 course of study was written to include 399 generic attribute objectives. This is the second largest number of objectives amongst all the courses of study or curriculum documents examined in this study. It represents an increase of 25 percent over the previous course of study at QUT, IT20.

The treatment of the ***IS discipline knowledge*** is double that of the coverage of written communications and technical competence. The IS knowledge treatment is 30 percent of the content of the course. ***Written communications*** is covered by 15 percent of the objectives of the course of study while ***technical competence*** is covered by 14 percent.

The only other attributes to receive a mention greater than ten times in the unit objectives are:

- ***Reference discipline knowledge;***
- ***Retrieve, evaluate and use information;***
- ***Analyse and evaluate the various solutions;***
- ***Programming language knowledge;***
- ***Work as part of a team; and,***
- ***Oral communications.***

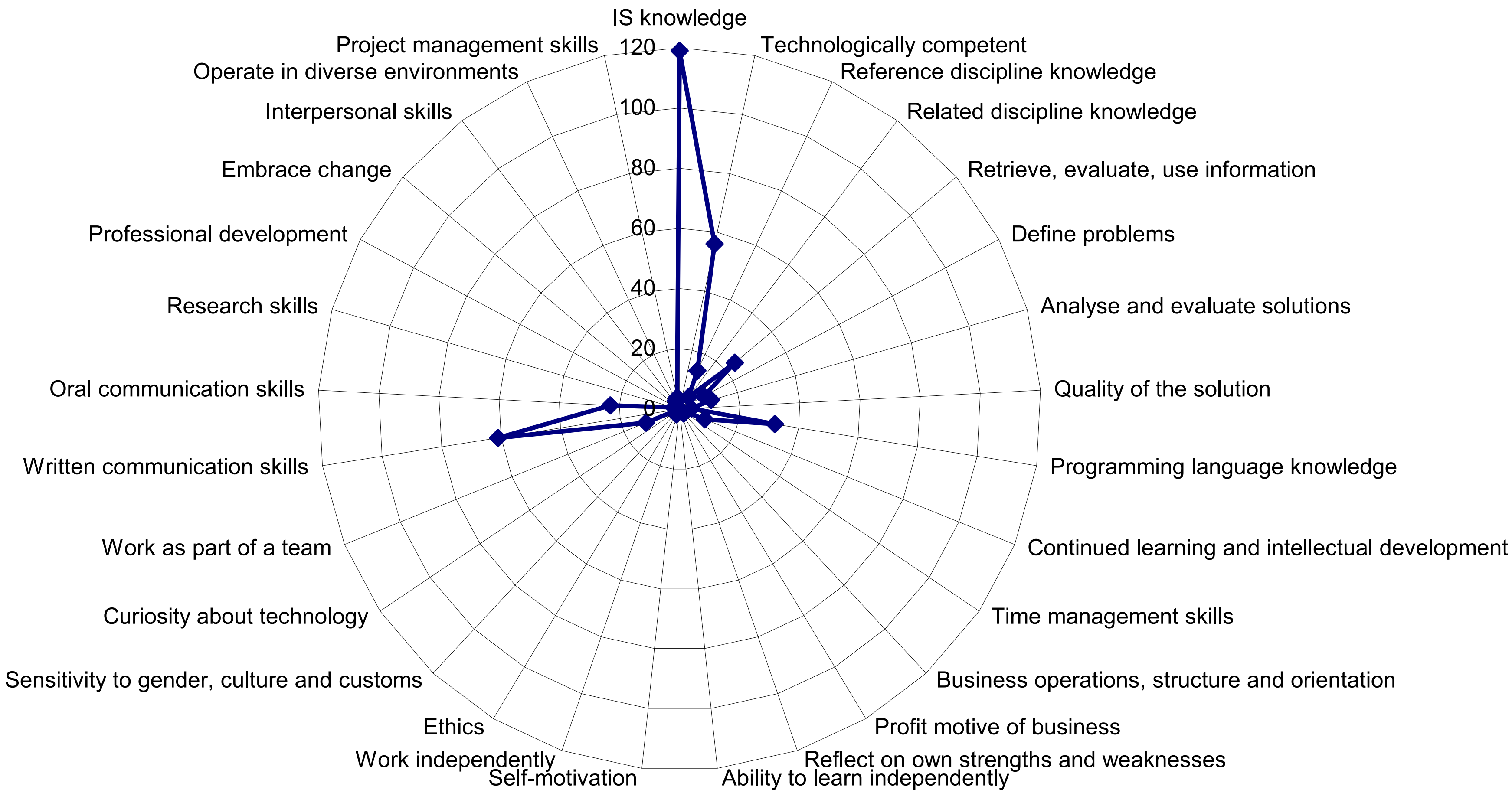

Figure 5.17

QUT's Bachelor of Information Technology (IT21) - Raw Data

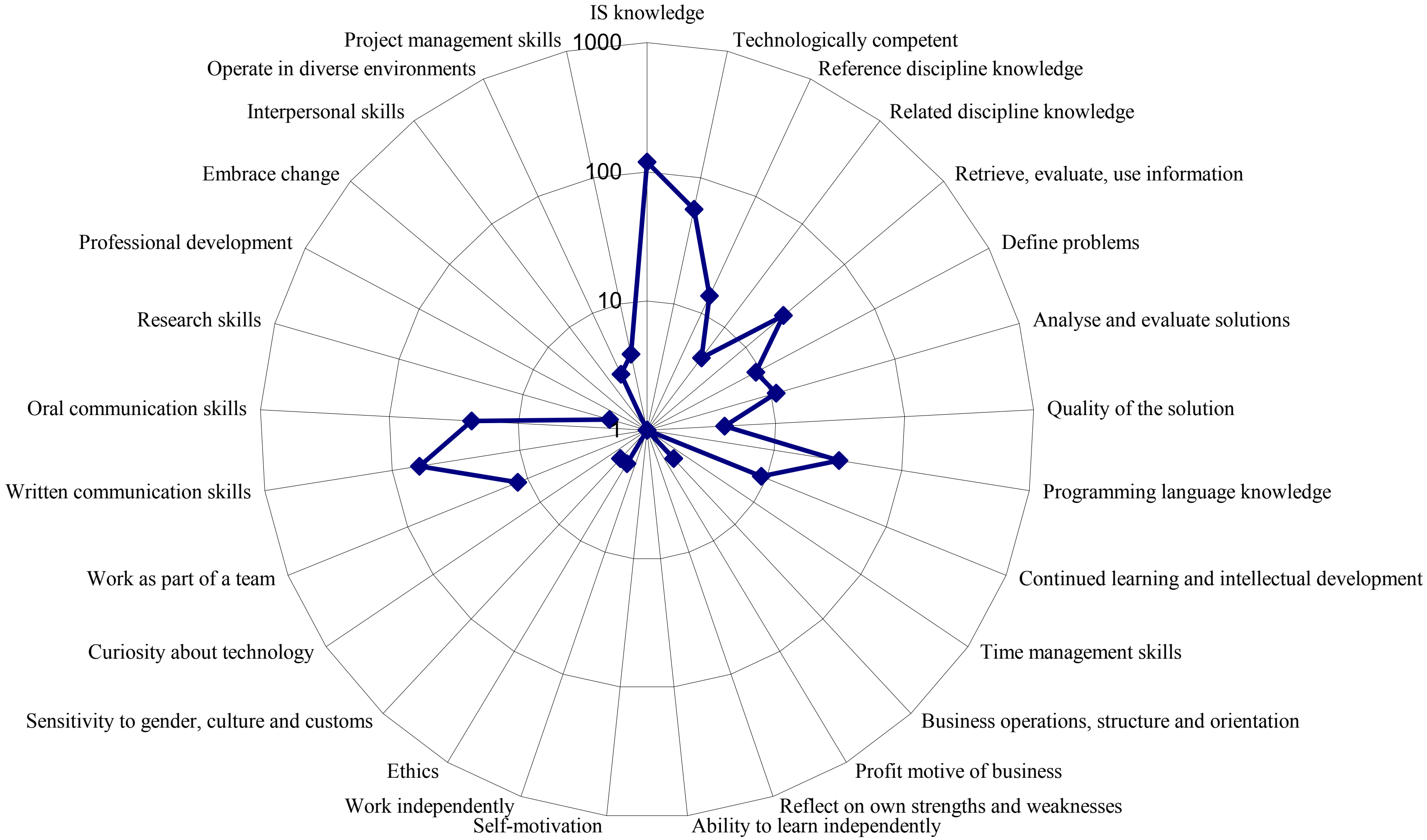

Figure 5.18

QUT's Bachelor of Information Technology (IT21) – Logarithmic Scale

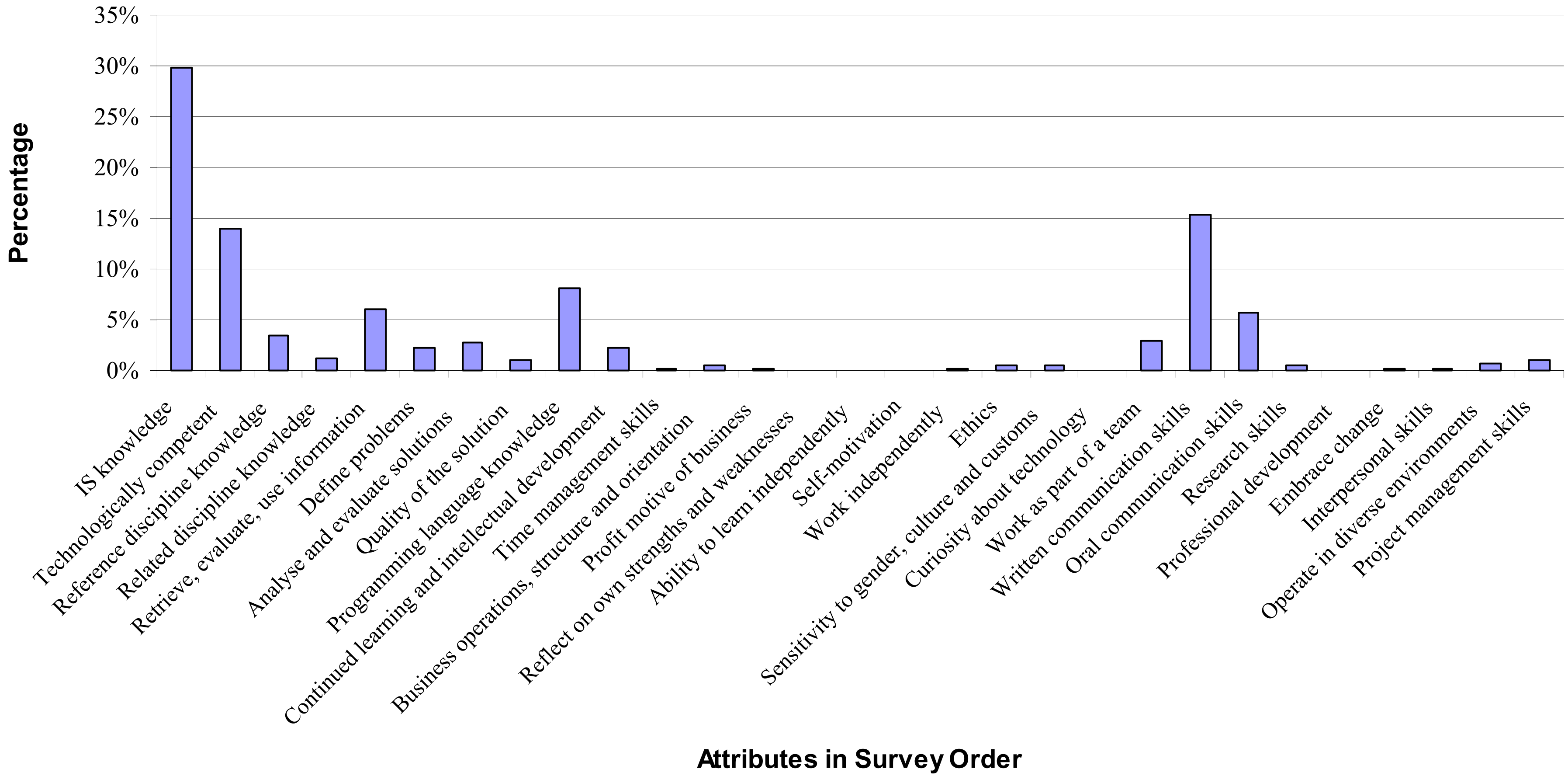

Figure 5.19

QUT's Bachelor of Information Technology (IT21) -Column Graph

From the data in Figure 5.17 the following attributes received coverage less than ten times:

- ***Related discipline knowledge;***
- ***Define problems;***
- ***Quality of the solution;***
- ***Continued learning and intellectual development;***
- ***Time management;***
- ***Business operations, structure and orientation;***
- ***Profit motive of business;***
- ***Work independently;***
- ***Ethics;***
- ***Sensitivity to gender, culture and customs;***
- ***Research skills;***
- ***Embrace change, and operate in a diverse environment;***
- ***Interpersonal skills;***
- ***Operate in a diverse environment; and,***
- ***Project management.***

The attributes to receive no treatment include:

- ***Ability to reflect on own strengths and weaknesses;***
- ***Confidence about their ability to learn independently;***
- ***Self-motivation;***
- ***Possess a sense of basic curiosity about technology, and***
- ***Participate in on-going professional development.***

The current course does not address the number one ranked industry attribute at all- ***self-motivation***. This suggests that the course of study needs to be rewritten to more accurately reflect the attributes that the industry employers require of new employees.

From the data in Figure 5.19 it should be noted that the generic attributes of IS discipline knowledge, technical competence and reference discipline knowledge account for 47 percent of the generic attribute objectives within the course of study.

This is a small but significant change from the previous course of study at QUT, IT20 described earlier.

Comparison of the data in the graphs in Figures 5.14 and 5.19 reveal that two attributes had significant change from IT20 to the revised course of study IT21. Written communications skills showed an increase of 11 percent. Reference discipline knowledge showed a drop in objective coverage of 6.5 percent.

Figure 5.20 shows a comparison of IT21 with the ACS Core Body of Knowledge, IS’97 and ISCC’99. From the graph it should be noted that the IT21 course of study coverage of the generic attributes is similar to that of ACS Core Body of Knowledge, IS'97 and ISCC'99. Both IT21 and the ACS Core Body of Knowledge give similar treatment to the attribute of IS discipline knowledge which is higher than either of the curriculum documents.

Programming languages and ***retrieve evaluate and use information*** are given more emphasis than in the ACS Core Body of Knowledge, IS'97 and ISCC'99. **Written communications skills** is well above the ACS Core Body of Knowledge but below IS’97.

The attribute of ***quality of the solution*** has a similar coverage to IS’97 which is well below that of the ACS Core Body of Knowledge. ***Reference discipline knowledge*** receives less treatment than the ACS Core Body of Knowledge.

As with the curriculum documents and the ACS Core Body of Knowledge a significant number of generic attributes receive only minimal treatment. Five of the generic attributes receive no coverage within the IT21 course of study. These are:

- Professional development;
- The ability to reflect on one’s strengths and weaknesses;
- Curiosity about technology;
- Ability to learn independently; and,
- Self-motivation.

It is surprising to note that the above listed attributes receive no coverage within the objectives of the IT21 course of study. Most academics would expect that a student would have to have the ability to learn independently and be self-motivated if they are to succeed in the tertiary environment.

One possible explanation for the omission of these generic attributes from the unit objectives is that the IT20 course of study was written prior to the generic attributes agenda making an impact on the tertiary scene.

The graph comparing the previous QUT course of study, IT20, and the current course of study IT21 is shown in Figure 5.21. From the graph it should be noted that the two courses of study in general give similar treatment to most of the attributes.

The noted exceptions are that IT21 gives a greater treatment to the attributes of ***written communications skills*** and ***programming language skills*** than the previous course of study IT20. ***Written communication skills*** showed an 11 percent increase in the coverage by the objectives of the units.

The newer course of study (IT21) however has shown a lesser treatment of three of the attributes. These include knowledge of ***reference disciplines, analyse and evaluate the various solutions,*** and ***quality of the solution.***

The graph in Figure 5.22 is a normalised representation of the data comparing IT20, IT21, ACS Core Body of Knowledge, IS'97, ISCC'99 and the generic attributes in descending order of mean. This graph clearly illustrates that extent of coverage of the generic attributes is below the level of importance place on them by industry. One clear exception to this is the coverage of the attribute of ***IS discipline knowledge.*** The data presented in the graph supports the hypothesis of this research that educational courses of study, as stated in their objectives, do not meet the IS industry and academic requirements in relation to generic attributes

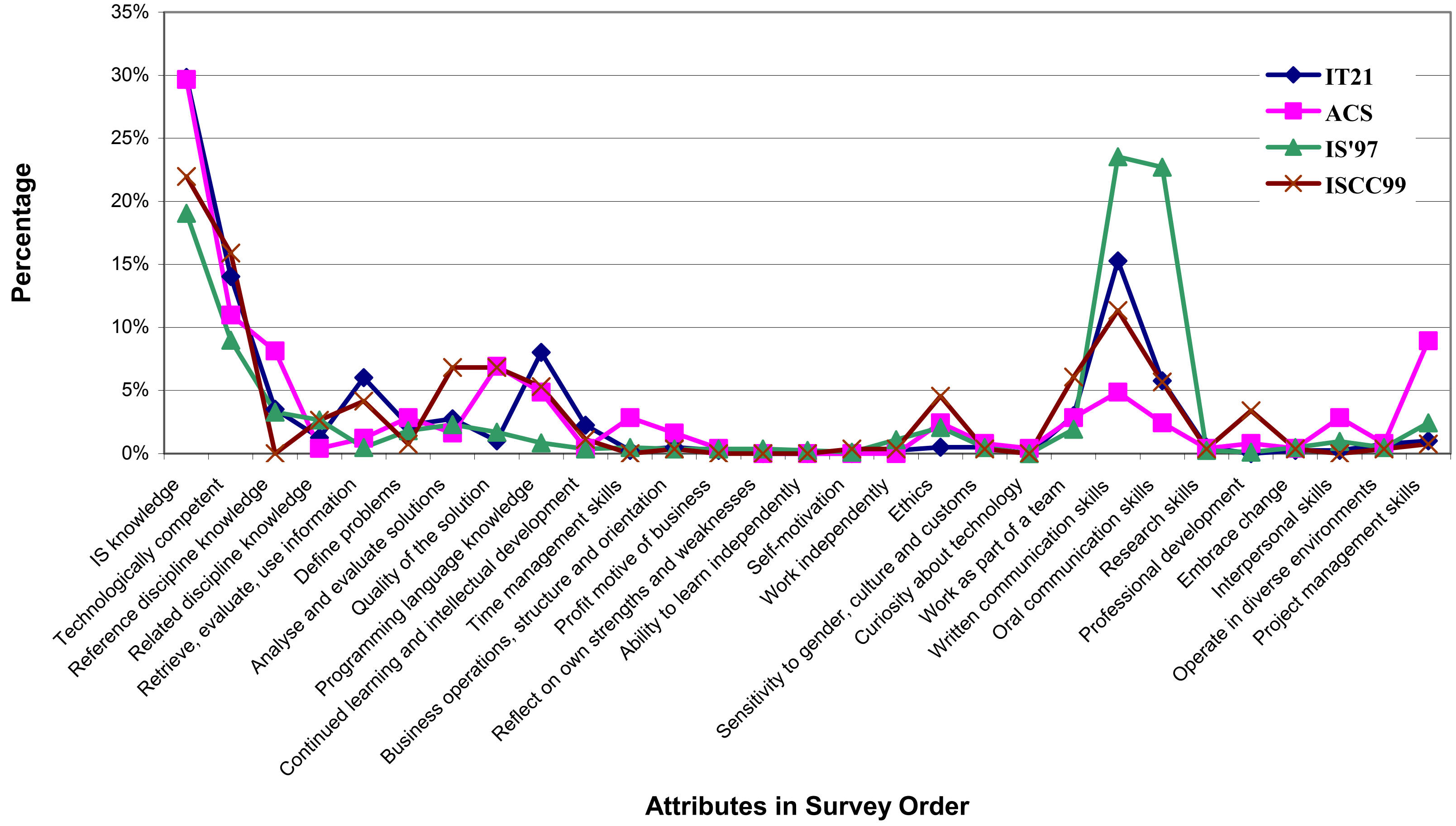

Figure 5.20

QUT's Bachelor of Information Technology (IT21): ACS Core Body of Knowledge: IS'97: ISCC'99

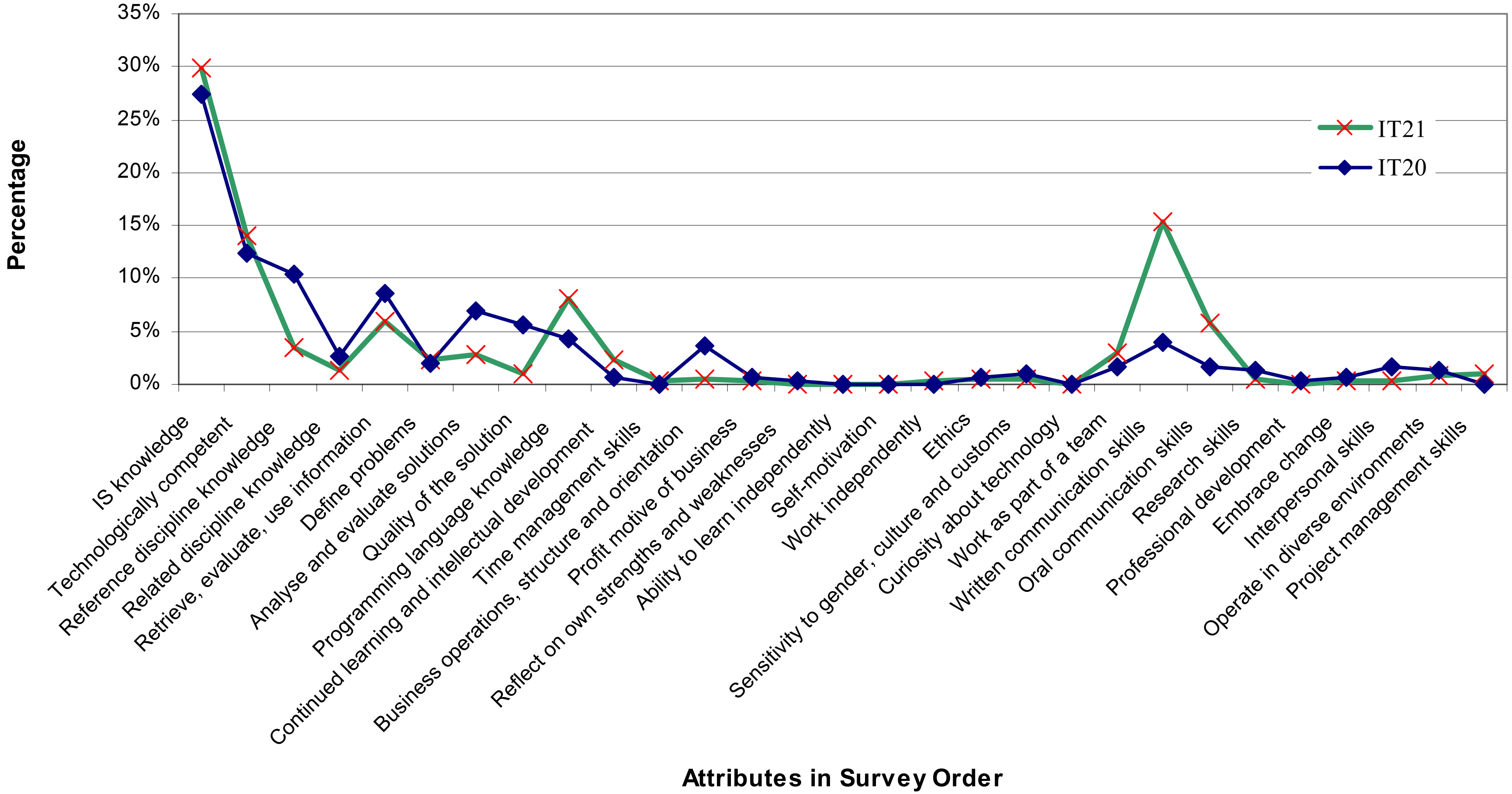

Figure 5.21

QUT's Bachelor of Information Technology (IT21): QUT's Bachelor of Information Technology (IT20)

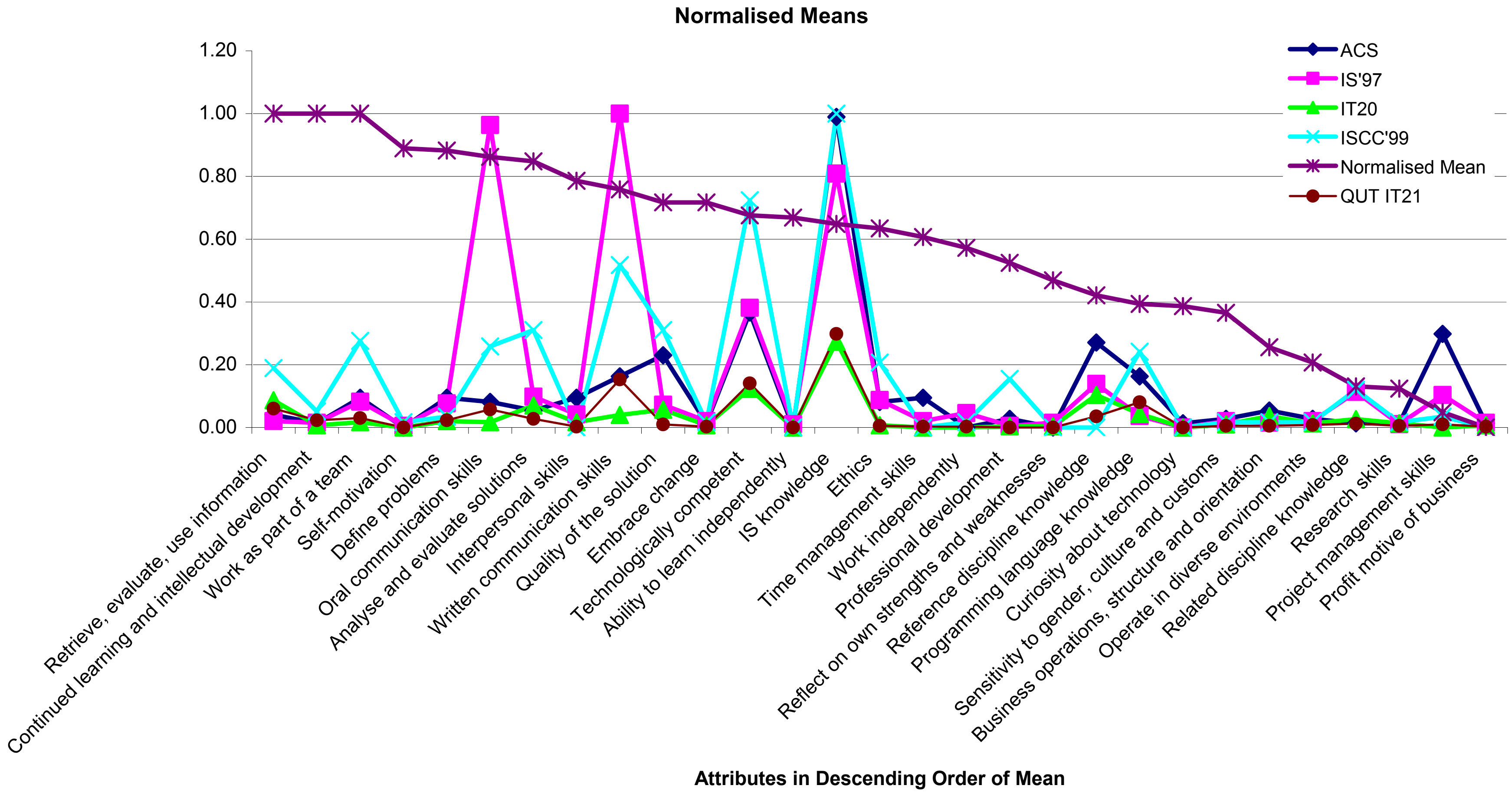

Figure 5.22

QUT's Bachelor of Information Technology (IT21): (IT20): ACS: IS'97: ISCC'99 - Normalized Data

5.6. Validation of the Process

The examination of the courses of study at three leading business schools within Australia is used as a method of validation of the process. These include the private university set up by Bond Corporation, Bond University, in southern Queensland, Australia, Southern Cross University (SCU) in northern New South Wales, Australia and Royal Melbourne Institute of Technology (RMIT) in Victoria, Australia. The expectation from the courses of study at business schools is that they will show a greater percentage of treatment of reference and related discipline attributes than the non-business oriented schools examined above. Details of the examination of the abovementioned courses are contained in Appendix N.

All of the courses of study from the business-oriented schools follow a similar pattern in their treatment of the generic attributes. There is a general pattern of high treatment of the content of the IS discipline with a smaller peak in the attribute of written communications skills. Most the other attributes are treated with a similar small percentage across all four courses of study.

The only university to show a significant difference in the treatment of the attributes is SCU which places less emphasis on technical competence than either RMIT, QUT or Bond university. SCU also places significantly more emphasis on the reference and related disciplines than the other universities used in this study.

RMIT places higher emphases on the attributes of define ***problems, analyse and evaluate solutions*** and ***the quality of a solution*** than SCU, QUT and Bond university. RMIT places only slightly more emphasis on the attribute of ***project management*** than the other universities in this study.

Bond University places significantly higher emphasis on the technical competence of a person than the other universities. QUT places the most emphasis on ***written communications skills*** of the four institutions examined by more than six percent. It should also be noted that all four institutions gave a large number of the attributes little or no coverage within their courses of study.

5.7. Chapter Summary

This Chapter has presented a systematic examination of the coverage of the generic attributes within the undergraduate courses of study at four Australian universities, the ACS Core Body of Knowledge, IS’97 and ISCC’99. In summary there is a consistent pattern of treatment of the attributes by all the institutions examined in this study.

Comparisons were made between the major IS curriculum documents IS'97 and ISCC'99. These documents showed a similar pattern of treatment of the attributes. The attribute of IS discipline knowledge was given the greatest treatment with written communications and oral communications skills also receiving significantly higher coverage than all the other attributes.

This, as previously mentioned, may be due to the manner in which the objectives are written in the United States of America, where an objective is written for each hour of instruction within a course. Also it must be remembered that the curriculum documents IS’97 and ISCC’99 are model curriculum documents and therefore may be viewed as an idealistic view of the content of an IS course of study.

The ACS Core Body of Knowledge was also examined. It may be viewed as the core or minimal set of knowledge an institution is required to provide to gain accreditation from the Australian Computer Society. This, as expected showed a treatment of the attributes less than that of the two major curriculum documents for most of the generic attributes.

The four universities examined in this study showed a similar pattern in the coverage of the generic attributes to the curriculum documents, IS’97 and ISCC’99, and the ACS Core Body of Knowledge. The lack of coverage of a large number of the attributes was noted across all five courses of study examined from the four institutions.

5.8. Conclusion

From the above discussion it may be concluded that the courses of study give little explicit treatment to most of the generic attributes required of graduates from the courses of study as stated in the objectives for the units that make up the courses of study. The above mappings of the curriculum objectives against the generic attributes give an indication of the depth of treatment of each of the generic attributes within the specific units that make up the courses of study. It is important to note that the objectives are often written with the subject content in mind rather than what the student should be able to do at the end of the course of study.

The generic attributes are the qualities that students should be developing during the course of study of their studies at the tertiary level. An important outcome from this study is the need for the unit writers to be explicit in their writing of the unit objectives to include the coverage of the generic attributes. This conclusion supports the research hypothesis that

- Educational courses of study, as stated in their objectives, do not meet the IS industry needs as expressed in generic attributes of entry-level graduate employees.

What has become evident in the conduct of this study is the lack of a clear understanding of the need to include specific detail within unit objectives in relation to the generic attributes agenda.

The diagram in Figure 5.23 presents the research plan across the bottom of the diagram. The chapters of the thesis are shown above the research plan. This allows the reader to easily relate the content of each chapter to the different phases of the research plan. Figure 5.23 identifies the position of current chapter in the research plan in blue and the conclusions and further research chapter in green. The next Chapter will discuss the conclusions of the research, limitations of the study and directions for further research.

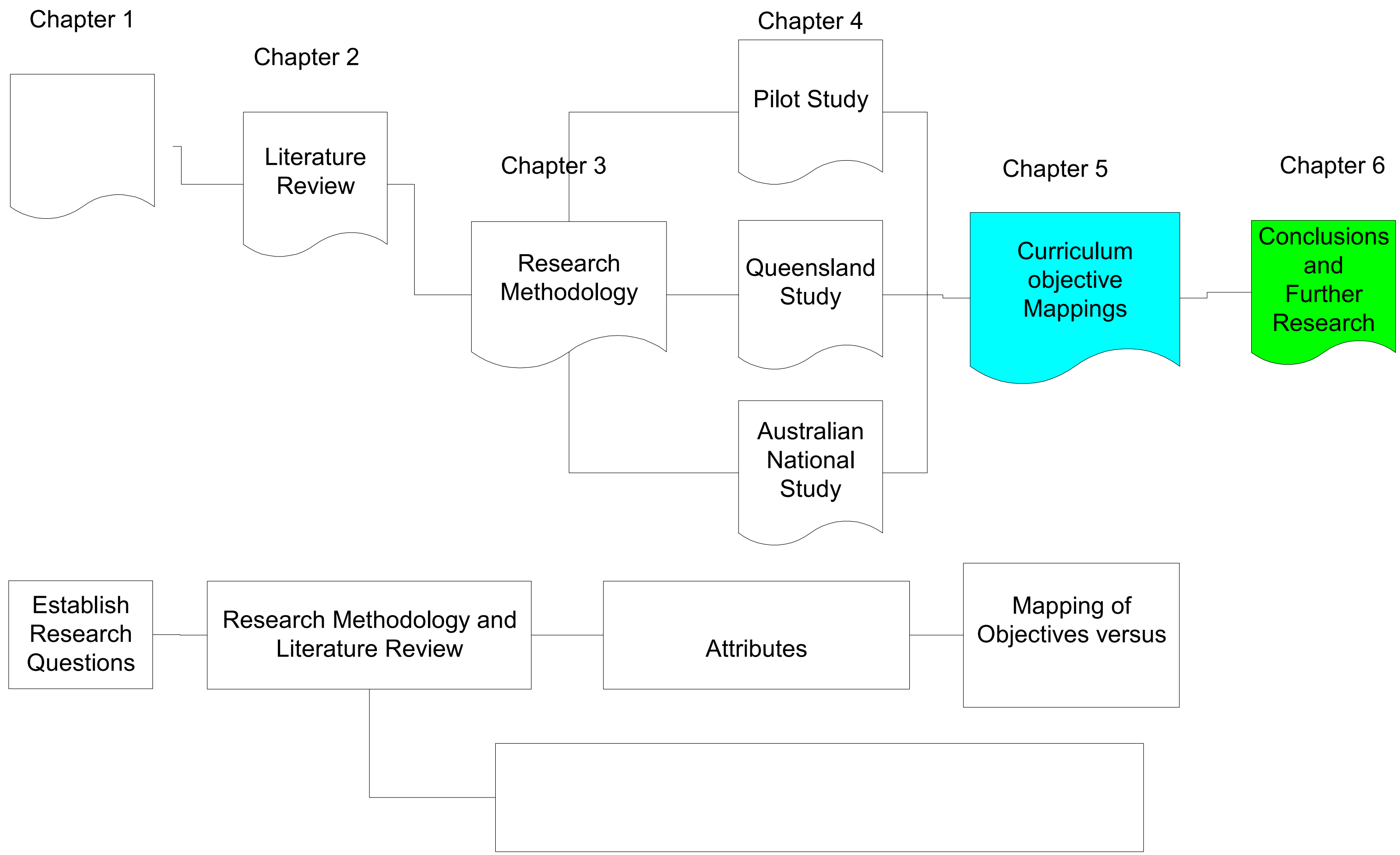

Figure 5.23
Diagrammatic View of the Thesis and Research Plan

Chapter 6

Conclusions and Further Research

List of Figures

List of Tables

Abstract

This chapter presents an overall summary of the findings of this empirical study into the generic competencies of Information Systems (IS) graduates. The research supports the hypothesis that ***educational courses of study, as stated in their objectives, do not meet IS industry needs as expressed in generic attributes of entry-level graduate employees****. This is followed by a discussion of the limitations of the study, recommendations for curriculum development and the direction that further research in this area should follow.*

6. Introduction

The previous chapter discussed the mapping of the objectives of various curriculum documents including IS'97, ISCC'99, the Australian Computer Society (ACS) Core Body of Knowledge and the courses of study unit outlines from four universities in Australia that formed this study. This chapter will summarise the content of this thesis and discuss the limitations of the study, recommendations for curriculum development and areas for further research in this area.

The research hypothesis for this thesis is:

- Tertiary IS courses of study do not meet IS industry needs.

Educational courses of study, as stated in their objectives, do not meet the IS industry and academic requirements in relation to generic attributes.

Based on the above research hypothesis the following specific objectives for the research have been formulated:

1. Identify the generic attributes required of the entry level IS graduate employee;
2. Analyse the offerings of the education providers; and,
3. Develop a replicable methodology for mapping the unit objectives against the identified generic attributes.

The research involved a number of studies to identify and validate the generic attributes. This was then followed by the association of the generic attributes with the objectives of the units within the courses of study. The first research objective was met by conducting Queensland and Australian studies to identify and validate a list of generic attributes. The results of these studies are discussed in Chapter 4 and summarised in the following section. The second research objective was achieved through analysis of the IS courses offered by QUT and the other universities that formed part of this study. The third research objective, of developing a replicable methodology, has been achieved through definition of the methodology of this study and its application to other disciplines as described in section 6.2 Strengths of the research.

6.1. Summary

The systematic review of literature identified the key elements required to be included in curricula from around the world to enable the development of generic attributes in IS graduates. The literature associated with the emerging generic attribute agenda was examined. A number of related terms and concepts have been identified as part of the generic attribute agenda. Some of these include the terms competency, capabilities, capacity and critical cross-field outcomes.

As identified in Chapter 2 Crebert (1995) suggests that generic competencies may be defined as skills transferable across disciplines, skills specific within a particular discipline, or skills that are transferable from the academic environment to the work environment. Within the university sector the term “competency based outcome” may be defined as a core or generic set of skills, knowledge, understanding, attitudes or abilities that are essential to developing a successful career in a particular discipline. The term “capability” is a relatively new term that has currency in the generic attribute agenda. Capability implies the potential to be able to possess a particular skill as distinct from having currency in the skill (Snoke, 1997). This is in line with Crebert's (1995) third aspect of generic competencies. By 2001 the term "generic attributes" had been replaced by "generic capabilities" at QUT (Queensland University of Technology, 2001).

In the previous discussion, it is noted that there was a shift from the concept of generic skills, which implied a statement of what a person has previously performed, to the concept of what they might be able to do in the future. The later concept has evolved from the use of the term generic capabilities, which stresses the potential that a person possesses rather than what they have previously accomplished.

Other terms emerged from different part of the world. In South Africa the phrase used to describe the capabilities that a graduate possesses at the completion of a course of study is referred to as critical cross-field outcomes. As the name implies this suggests a transferability of skills from one environment to another. It also suggests that there is a set of outcomes that is useable in a number of different scenarios and that are essential to be an active contributor to society. These will aid in the life long learning of members of society. This is one of the objectives of The Organisation for Economic Co-operation and Development (OECD) (Organisation for Economic Co-operation and Development, 2001).

Employers are interested in what an employee can do, not just what they know (Queensland University of Technology, 2001). Employers would like the university sector to develop the necessary skills and capabilities of graduates so that they are productive when they start work and do not need to be trained before they start being productive. It is noted that there is a perennial conflict between the objectives of training and education and the views of industry and academia.

The methods used to identify and gain consensus amongst a diverse group of individuals has also been examined. A modified Delphi study, using email as the medium was used to identify the important generic attributes for an entry-level employee. A traditional Delphi study consists of a number of rounds of questionnaires in which the respondents are asked to give their opinion about a particular topic usually in the form of ranking or rating a list of topics.

The Delphi method used in this study was a traditional one using as the opening question, a list of the generic attributes as defined by Crebert (1995) for the pilot study and the modified list as shown in Table 3.2 for the Queensland and national studies. Further discussion of the Delphi method is in Section 2.21.

A feature of this research methodology was the individual addressing of the emails in an attempt to increase the response rate. The overall response rate increased by two percent in each round of the Queensland and Australian studies. Related studies of the industry identified needs versus the content of the courses of study have been examined. These included the ACS Core Body of Knowledge, the Information Industries Association (AIIA) 1995 study, Australia's Science and Engineering Base for Information and Communications Services and Technologies Report and the Ang and Lo studies of the early 1990's.

The Australian Information Industries Association (AIIA), in July 1995, commissioned a survey (Factotum Research, 1995) of the IT industry in Australia to identify both the current and emerging employment needs in the Information Technology and Telecommunications (IT&T) sector for the next five years. The major findings of the report were:

- Demand for specific skill sets in the Year 2000 varied according to industry category;
- Network integration skills ranked first in the year 2000 while modular programming ranked last in the year 2000;
- Little change in the demand for a specific skill set between now and the year 2000 with two exceptions- these were Information Managers and Systems Administrators where the demand was for a significant increase in employment; and,
- The only change in the qualifications of the IT&T workforce is expected to be by the year 2000 when a larger percentage of the workforce will hold tertiary qualifications.

Australia's Science and Engineering Base for Information and Communications Services and Technologies Report (Williams, 1995) recommended that government and industry more closely cooperate in the provision of education and training at the post-compulsory level of education.

Ang Yang Ang and Bruce Lo (Ang, 1992a, 1992b; Ang & Lo, 1991a, 1991b; B. Lo, 1996; B. W. N. Lo, 1991) conducted a three part study of academic and industry views of the content of IS curriculum in the early 1990s.

Each of the studies conducted by Ang and Lo (Ang, 1992a, 1992b; Ang & Lo, 1991a, 1991b; B. Lo, 1996; B. W. N. Lo, 1991) (1991a)attempted to identify what Australian tertiary institutions' thought was a common core of IS knowledge that was desired at the completion of an IS course of study. The study conducted in 1989 – 1990 sampled 57 tertiary institutions in Australia. The respondents were asked to rank the present and future importance, in five years time, of 51 topics selected from the model curricula from the Data Processing Management Association (DPMA), the International Federation of Information Processing/British Computer Society (IFIP/BCS) and the Association for Computing Machinery (ACM). The significant result from this study was that there was no significant change in the perceived importance of the major categories from the earlier Australian studies.

This study looks at the unit objectives and relates them to the generic attributes of the IS entry level graduates. This study differs from the earlier Ang and Lo (Ang, 1992a, 1992b; Ang & Lo, 1991a, 1991b; B. W. N. Lo, 1991) studies in that the curriculum data was based on the description of units as listed in the university handbooks. These descriptions are short abstracts of the content of the units and do not list the objectives. The studies were conducted using the content of the units as distinct from the objectives of the units.

The research methodology used in this study consisted of a small pilot study followed by larger Queensland and Australian studies. These studies involved both industry and academic representatives from Australia. Statistical analysis involved the calculation of the mean, median, mode and standard deviation for each of the generic attributes in each round of the Delphi study. Factor analysis was used to identify key underlying factors that emerged from the data.

The essential attributes (defined as attributes with a mean ranking of 6 or more on a 7 point Likert-type scale) identified in the study are shown in Table 6.1.

Table 6.1

Essential IS Generic Competencies

Attribute No	Competency	Australian Mean	Australian Rank	Queensland Mean	Queensland Rank
10	Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.	6.19	1	6.25	3
21	Work as part of a team in a productive and cooperative manner	6.16	2	6.29	2
5	Retrieve, evaluate and use relevant information	6.15	3	6.31	1
23	Oral communication skills	6.04	4	5.96	7
6	Define problems in a systematic way	6.00	5	6.14	5

There are only marginal differences in the means of the top five ranking attributes between the Australian and Queensland studies. The ranking of the top three competencies in this national study is reversed as compared to the Queensland study. This may possibly be attributed to the difference in the composition of the sample population. The Queensland study used member organisation of the Australian Information Industries Association (AIIA) while the national study used individual members of the Australian Computer Society (ACS). The participants of the national study included organisations with their head office in the more densely populated southern states of Australia while the Queensland study used only participants whose head office was in Brisbane, Queensland or in regional areas of the state.

The attributes listed as important (mean ranking greater than 5) are listed in Table 6.2.

Table 6.2

Very Important IS Attributes – Australian Study

Attribute No	Competency	Australian Mean	Australian Rank	Queensland Mean	Queensland Rank
16	Self-motivation	5.98	6	6.16	4
7	Analyse, synthesise and evaluate the various solutions	5.93	7	6.11	6
27	Interpersonal skills	5.92	8	5.85	12
22	Written communication skills	5.91	9	5.87	11
8	Consider the quality of the solution and its timeliness	5.76	10	5.90	9
2	With respect to the Information Systems discipline be technologically competent	5.73	11	5.77	13
18	Value the ethics of the Information Technology profession	5.73	11	5.61	18
26	Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology	5.72	13	5.93	8
15	Confidence about their ability to learn independently	5.70	14	5.74	14
1	With respect to the Information Systems discipline possess coherent, extensive, theoretical and practical knowledge	5.70	14	5.72	15
17	Work independently	5.52	16	5.68	16
11	Time management skills	5.48	17	5.90	9
3	With respect to the Information Systems discipline possess theoretical and practical knowledge in at least one reference discipline	5.44	18	5.27	22
25	Participate in on-going professional development	5.41	19	5.68	16
14	Ability to reflect on own strengths and weaknesses	5.38	20	5.52	19
19	Sensitivity to differences in gender, culture and customs	5.34	21	5.19	23
9	Demonstrate practical knowledge and understanding in at least one computer language	5.32	22	5.34	21
20	Possess a sense of basic curiosity about technology	5.28	23	5.38	20
12	Knowledge of how a business operates, is structured or is orientated	5.24	24	5.03	24
28	Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment	5.13	25	4.92	26
4	With respect to the Information Systems discipline possess the theoretical and practical knowledge of related disciplines.	5.01	26	4.85	28

From the mean values listed in Tables 6.1 and 6.2 it can be seen that the top 26 competencies are rated as being at least very important (mean rating of 5.00 or greater). The top five attributes are rated as being of major importance with a mean rating of 6.00 or greater.

The attributes that were ranked as being least important are listed in Table 6.3.

Table 6.3

Australian Least Important IS Attributes

Attribute No	Competency	Australian		Queensland	
		Mean	**Rank**	**Mean**	**Rank**
24	Research skills	4.91	27	4.95	25
29	Project management skills	4.78	28	4.92	26
13	Understand the profit motive of business	4.75	29	4.77	29

The three lowest ranking attributes of ***research skills, project management*** *and* ***understanding the profit motive of business*** are the attributes that are often considered to be the characteristics that distinguish between IS graduates and graduates from other Information Technology (IT) disciplines such as computer science. Anecdotal evidence and interviews with some industry representatives suggests that the most important competency that they desire in an employee is an understanding of the profit motive of business and how the business operates.

The attributes that were ranked high in the Queensland study were also ranked high in the Australian study. There is also general agreement on the relative importance of all the attributes. Some are simply identified as being more important than others.

The major findings of these studies were that each of the studies was validated by the other studies. The studies identified that the attributes of ***information retrieval, working as part of a team, self-motivation, continued learning and intellectual development, the development of critical, reflective and creative thinking, problem definition and analysis and evaluation of various solutions along with written*** and

oral communications as more important than knowledge of the Information Systems (IS) discipline.

A second finding emerged from the results of the factor analysis. The Queensland academic data indicated the following six factors that were identifiable from the data:

- **General work performance skills**
- **Individual professional competence;**
- **Business knowledge;**
- **Professional development;**
- **Project management; and,**
- **IS discipline knowledge;**

It is noted that a large number of attributes (13) were grouped generally under a heading of ***General Work Performance Skills*** and includes the attributes of interpersonal skills, oral communications and written communications, working as part of a team, working independently, self-motivation, quality of the solutions, analyse and evaluate the various solutions, retrieve evaluate and use information, ability to learn independently, programming language knowledge, problem definition and time management skills. This group of attributes with the exception of the programming language ability attribute are generally applicable to any work environment.

The ***Individual Professional Competencies*** include reflection on one's strengths and weaknesses, curiosity about technology, continuous learning and intellectual development, sensitivity to gender, cultures and customs as well as the attribute of being able to operate in diverse environments. The attribute of ethics is also included with this group of competencies. The individual professional competencies group relates to the moral and ethical attitudes that are desired in a new employee.

The ***Business Knowledge attributes*** relate to the knowledge of how a business operates and the place of business a larger view of the world. The business knowledge attributes include understanding the profit motive of business, knowledge of the operation and orientation of the business, related discipline knowledge and reference discipline knowledge.

The ***Professional Development*** group of attributes includes the attributes of professional development and research skills. These two attributes are essential for an IS person to expand their career in the IS field.

The attributes of ***Project Management Skills*** and technical competence are grouped under a heading of project management. What is important to note about this group of attributes is that time management is missing from the group. Time management is an integral part of project management. The inclusion of the attribute of technical competence with the Project Management factor is interesting, as many people would think it is more closely related to the Information Systems discipline knowledge factor.

The last, and by no means the least important group is the ***IS discipline knowledge*** factors. The attributes included with this factor include the extensive and practical knowledge of the IS discipline as well as the attribute of embracing change. What is important to note from the attributes in this factor is the absence of the programming ability attribute. The inclusion of the attribute of embracing change is significant as it is a clear statement that the IS field has as a fundamental feature the fact that change is an essential component of the discipline.

The Queensland industry data was not suitable for factor analysis in its own right. The combined Queensland data for both industry and academics identified eight underpinning competency groups of attributes. These include:

- **Business knowledge;**
- **Information use;**
- **Problem solving;**
- **Professional development;**
- **Programming skills;**
- **IS discipline knowledge;**
- **Individual competencies; and,**

- **Professional competencies**.

When the industry data is combined with the academic data, a slightly different set of underlying factors appears.

The Business Knowledge underlying factor for the combined data consists of the attributes ***time management, understanding the profit motive of business, project management skills*** and ***understanding the business operations and orientation***. What is important to note is that using the combined data the reference discipline and related discipline knowledge attributes are no longer linked to the business knowledge factor. They have been replaced by the attributes of ***time management*** and ***project management***.

The Professional Competencies factor includes the attributes of ***related discipline knowledge, sensitivity to gender, cultures and customs curiosity about technology*** and ***ethics***. Most of these were included in the factor identified by the academic factor analysis.

The Professional Development group of attributes includes the attributes of ***professional development, interpersonal skills, embracing change and continuous learning*** and ***intellectual development***. These attributes are essential for an IS person to expand their career in the IS field and indicate the need for an IS professional to be a lifelong learner.

The IS discipline knowledge factor is linked with the attributes of extensive and practical knowledge of the IS discipline, technical competence in the IS discipline as well as the attribute of reference discipline knowledge. What is important to note from the attributes in this factor is the absence of the programming ability attribute. This group of three attributes is a clear indication that employers require the new employee to have an extensive knowledge of IS but also they must be able to use the knowledge in a competent manner.

New underlying factors have emerged from the combined data. The factor identified in the academic analysis as individual professional competencies has been split into factors called individual competencies and professional competencies. The general work performance skills factor identified in the academic analysis has been replaced by the factors of information use, programming skills, and problem solving.

The new group of underlying factors called Programming Skills has evolved. The attributes included with this factor are programming language ability and working independently. These are two attributes that are often linked to programming, as programmers need to have knowledge and ability in the language they work in as well as being able to work by themselves to complete a task.

The individual competency factor includes the attributes of self-motivation, reflection on one's strengths and weaknesses and the ability to learn independently. These are attributes that relate to the individual and their individual ability.

The information use factor includes the attributes required to gather and use information in the current information age. The attributes included with this factor are research skills, retrieval evaluation and use of information and the ability to operate in diverse environments.

Last and by no means the least important factor is that of problem solving. The current business environment requires that a person be able to use problem-solving skills in the workplace. The attributes included with this factor are working as part of a team, analyse and evaluate the various solutions, problem definition, written communications skills, oral communications skills, and evaluation of the quality of the solutions to a problem. This group of attributes could also have been called teamwork, as the current work environment requires individuals to work in teams. Also both written and oral communications are essential in the modern work environment. All of the Mayer (1992) competencies were identified in the study with the exception of using mathematical ideas and techniques.

A third finding was the results of the Australian study factor analysis. Australian academics viewed the following as key competencies:

- **General work performance skills;**

- **Project management;**
- **IS discipline knowledge;**
- **Professional competence;**
- **Business knowledge;**
- **Reference discipline knowledge; and,**
- **Individual professional competence**.

As noted by the Queensland study there are a large number of attributes associated with the factor of ***General Work Performance Skills***. The associated attributes for this factor include the ability to learn independently, professional development, analyse and evaluate the various solutions, quality of solutions, self-motivation, working independently, reflecting on strengths and weaknesses, research skills, project management skills, and curiosity about technology. Of these attributes the project management attribute seems to be out of place and should be associated with the project management factor.

The ***Business Knowledge*** factor identifies the need for employees to have a general education component within their degree courses to give them knowledge of general business operations as well as knowledge of the related disciplines to IS. This is important so that the employee knows where IS fits within the larger framework of disciplines within society as well as within the business world. The attribute of reference discipline knowledge is a considered to be a separate factor.

The ***Professional Development*** factor identifies the need for continued professional development during the course of a person's career. The second associated competency of embracing change identifies the fact that the IS discipline and environment is rapidly changing and will continue to change in the future. It is therefore necessary for any employee or graduate of an IS course of study to embrace change as this is at the very core of the discipline.

The ***IS Knowledge*** factor clearly identifies that IS knowledge is an important factor in modern society. The other associated attributes include technical competence and programming language ability. These two attributes may be considered to be traditional skills required of an IS professional.

The ***Individual Professional Competency*** factor identifies the personal and professional traits that are needed in a new employee in modern society. These include the need to value the ethics involved with the IS industry, the recognition that modern society is a global society and therefore we need to be able to work and interact with different genders and accept the cultural practices of other societies we may come in contact with.

The Australian industry data was suitable for factor analysis and identified three underlying factors as follows:

- **General work performance skills;**
- **Business knowledge; and,**
- **IS discipline knowledge**.

The ***Business Knowledge*** factor identifies the need for employees to have a clear understanding of the operations of a business. Most important is the attribute of Understanding the profit motive of business. Anecdotal evidence from industry representatives suggests this attribute is considered to be the most essential of all attributes. Aligned with the above attribute is the attribute of ***quality of solutions***. This is associated with the ability of a business to make a profit as quality products and solutions are the prerequisite for a profitable business operation.

Project management and ***written communications*** are also essential in IS business operations as most work involves a significant amount of project work. Communications in the written form are essential for a employee communicating with clients in the information age when a significant amount of communications takes place via e-mail.

Of importance also is the grouping of 17 of the competencies to form one factor, ***General Work Performance Skills.*** The attributes that compose the elements of the factor, ***General Work Performance Skills*** include good ***oral communications*** skills, the ability to get the tasks of the job done and work with other people as part of a team. ***Self-motivation*** is an important attribute of an employee who is to be successful in modern society.

The splitting of the two communications competencies into different factors may infer a question as to how they are perceived in the workplace. The competency of ***technical competence*** may be misplaced as it may be more appropriately be associated with the factor of IS discipline knowledge rather than general work performance skills.

The other competencies that compose the ***General Work Performance Skills*** are competencies that would apply to any employee in any career in modern society. Specific note is made of the competencies of ***Sensitivity to gender, cultures and customs*** as this relates to the attribute of interpersonal skills and working as part of a team. In the current world environment, tolerance of different cultures and customs is an essential attribute to survive not only in the workplace, but in the broader society of the first decade of the 21st century.

Embracing change and continuous learning and intellectual development are facts of modern working life. The only certainty in the modern work environment is that it will change and continue to change as we move through the information age.

The ***IS Knowledge*** factor clearly identifies the concept that the modern IS professional not only needs to have a sound knowledge of the IS discipline knowledge, but also needs competence and knowledge of the related and reference disciplines to IS. The modern employee needs to have a sound knowledge of where the information system discipline fits within the large scheme of society and other disciplines.

Comparing the results of the factor analysis from the academics' perspective to the industry view it is noted that academics identified a factor called workplace communications as a distinct factor group required of graduates. The industry representatives identified these same component underlying attributes as belonging to the underpinning factor group called IS knowledge and competence. This may be partially explained by the industry representatives being more interested in what the employee can do in terms of the IS discipline and their competence in performing tasks.

From the Australian study combined data the following five factors were identified. These were:

- **Workplace communications;**
- **Business knowledge;**
- **IS discipline knowledge;**
- **Personal competence; and,**
- **Adaptability & professional skills**.

The **Business Knowledge** factor has the associated attributes of ***understanding the profit motive of business, knowledge of business operations and orientation, project management skills, analyse and evaluate solutions*** and ***the quality of solutions***. These attributes identify the key components required of a business to survive in the modern world.

As previously mentioned businesses do not stay in operation long if the employees do not understand the fundamental principle that a business exists to make a profit. This must be one of the key principles underlying business operations. These attributes were ranked amongst the lowest but were still identified as important. Anecdotal evidence suggests that some employers valued these attributes more highly than other employers.

The Adaptability and Professional Skills factor has the associated attributes of ***related discipline knowledge, embracing change, ethics, sensitivity to gender, cultures and customs*** and the ***ability to operate in diverse environments.*** All of these attributes relate to the concept of adaptability and are essential skills in the current world environment.

The ***IS Discipline Knowledge*** factor has the associated attributes that are commonly linked to professional competence within the IS community. These include a sound ***knowledge of the IS discipline, programming language ability, technical competence*** and ***knowledge of the reference disciplines*** upon which the IS discipline is based. The attribute of ethics in the IT environment may possibly have been associated with this factor group as it relates directly to the IS environment.

The ***Personal Competence*** factor has the associated attributes that relate to an individual's learning ability and may reflect on how far they will progress in the industry. The attributes included with this factor group include ***research skill, curiosity about technology, ability to learn independently, reflection on one's strengths and weaknesses, professional development, working independently*** and ***self-motivation.*** All of these attributes are essential for a person in the modern workforce where it is common practice to link a person's pay to their performance. Many companies implement a practice of performance planning and review (PPR) to maximise the output from their employees.

The ***Workplace Communications*** factor has the associated attributes of ***working as part of team, define problems, continuous learning and intellectual development, written communications, time management, interpersonal skills, oral communications,*** and ***retrieve, evaluate and use information.*** These attributes reflect the communications required in the modern workplace. ***Time management*** is an essential skill for an employee to enable them to be productive in a competitive environment. The two communications attributes of ***written*** and ***oral communications*** are closely linked to the attribute of ***interpersonal skills*** as at least one of the communications attributes is often the source of conflict when relationships break down.

We can conclude that the attributes were considered to be important in the work environment. Some were seen as simply more important than others. A possible explanation of the difference in ranking between the *technical* and *human* attributes may be found in the controversial motivational theory of Herzberg (Herzberg, 1968).

Herzberg developed a theory of motivation related to work situations that proposed two groups of factors, which related to job satisfaction.satisfaction. One group comprising environmental factors (hygiene) do not, by themselves, motivate satisfaction, but their absence will cause dissatisfaction. The other group are determinants of job satisfaction which are believed to result in improved performance and are termed "motivators". Thus, the technical skills/knowledge attributes will be expected to have been gained through the academic process, that is the "hygiene factors" in terms of Hertzberg's motivation theory, while the more highly rated attributes represent "motivators" because they are determinants of job satisfaction which are assumed to lead to superior performance. This meets the first objective of identifying the generic attributes required of entry level IS employees.

Another finding in support of our research hypothesis was the existence of a disparity of results between academic and industry. This may in part be to the difference in the sample populations as identified earlier. This reinforced the view that academics need to interact more closely with industry in the development and maintenance of IS course syllabi.

6.2. *Conclusions*

The mapping process used in this study allowed for the comparison of courses and other curriculum documentation. The mapping of the QUT Bachelor of Information Technology courses, the ACS Core Body of Knowledge, IS'97 and ISCC'99 are shown in figure 6.1.

The significant finding from this survey was that the attribute of working as part of a team in a productive and cooperative manner was rated as the most important. Other significant findings included the high correlation between the Queensland study and the national study in terms of the relative importance of the attributes. A second important finding is that the attribute relating to discipline knowledge was rated as relatively unimportant being ranked 13th out of 29 attributes.

Key findings from the mapping process were that all the documents displayed a similar coverage of the generic attributes. All the graphs showed a strong treatment of IS discipline knowledge. IS'97 showed the strongest coverage of written and oral communications as compared to the other curriculum documents or the courses of study examined.

This study identified a significant shortfall in the manner in which the objectives of the units of study that comprise IS courses of study at the tertiary level are written. The study found that the curriculum documents from the USA were often written with a specific number of objectives that often related to the length of the course or the number of times class was held during a week. In Australia the traditional unit has approximately 6-8 objectives. The objectives are often related to the content of the unit rather than what the student should be able to do at the end of the unit, in terms of the attributes identified by the university as being obtained by the students when they complete the course of study.

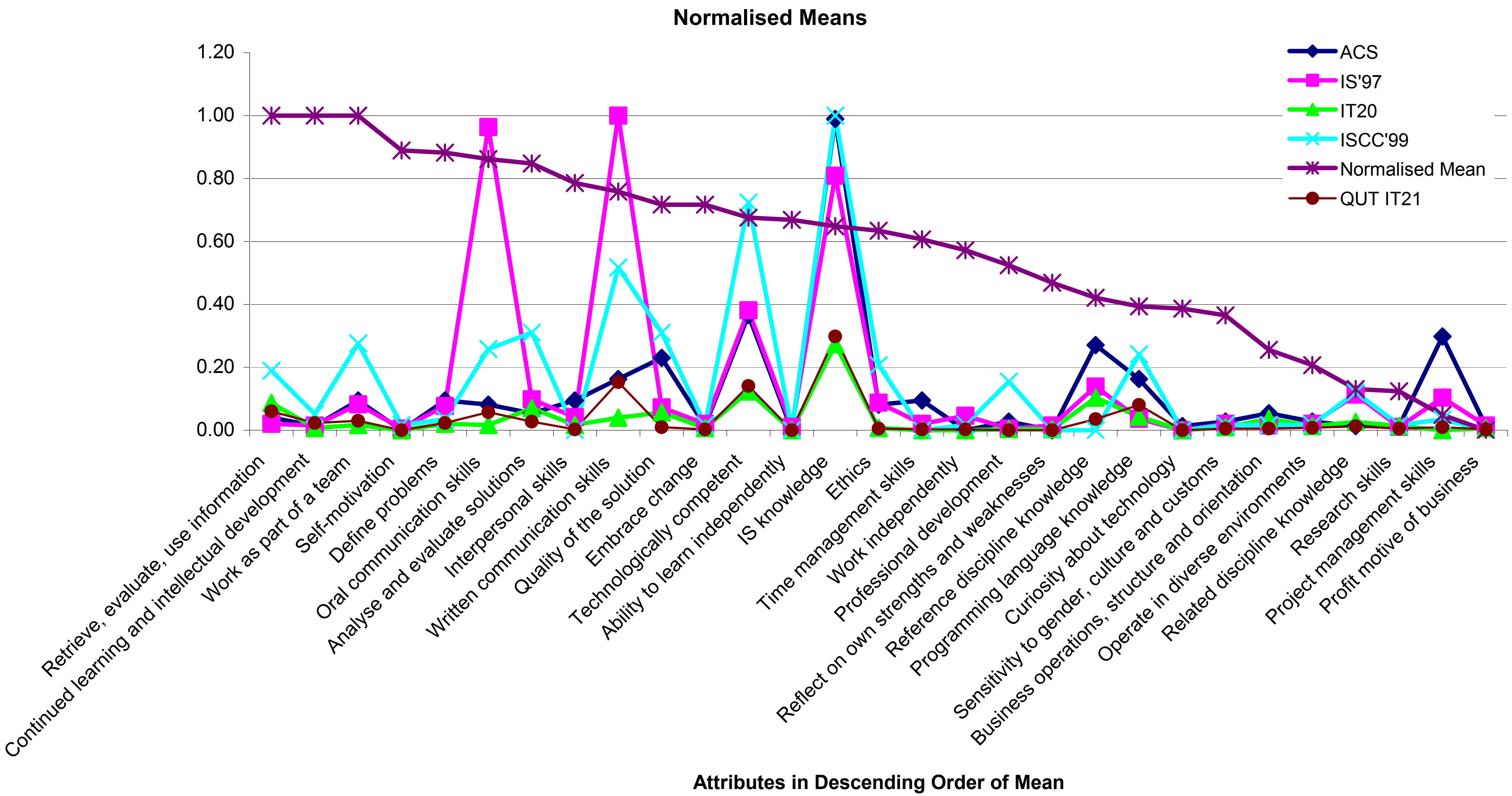

Figure 6.1

QUT's Bachelor of Information Technology (IT21): (IT20): ACS: IS'97: ISCC'99 - Normalized Data

In summary there is a consistent treatment of the attributes by all the institutions examined in this study. Comparisons were made between the major IS curriculum documents IS'97 and ISCC'99. These documents showed a similar pattern of treatment of the attributes. The content of IS was given the greatest treatment with written communications and oral communications skills also receiving significant coverage. This, as previously mentioned, may be due to the manner in which the objectives are written in the USA, where an objective is written for each hour of instruction within a course.

The ACS Core Body of Knowledge was also examined. It is the core or minimal set of knowledge an institution is required to provide to gain course accreditation from the Australian Computer Society. This, as expected, showed a treatment of the attributes to be less than that of the two major curriculum documents.

The Bachelor of Information Technology course (IT21) at QUT was examined. It showed a similar treatment of the generic attributes to the curriculum document mentioned above and the ACS Core Body of Knowledge. From the above discussion it may be concluded that the courses of study give little explicit treatment to most of the generic attributes required of graduates from the courses of study as stated in the objectives for the units. The above mapping of the curriculum objectives against the generic attributes gives an indication of the depth of treatment of each of the generic attributes within the specific units that make up the courses of study. The examination of the generic attribute coverage in the course of study at QUT meets the second research objective of analysing the offerings of the education providers.

It is important to note that the objectives are often written with the subject content in mind rather than what the student should be able to do at the end of the unit of study. The generic attributes are the qualities that students should be developing during the period of their studies at the tertiary level. The above mapping of the generic attributes meets the second and third research objectives:

- Analyse the offerings of the education providers; and,

- Develop a replicable methodology for mapping the unit objectives against the identified generic attributes.

Statistical analysis of the combined data from both the Queensland and Australian studies identified eight underlying factors. These included Team Communications, Information Use, Individual Competencies, IS Knowledge, Professionalism, Project Management, Professional Development and Diversity.

Team Communications are associated with the attributes of working as part of a team, oral communications, written communications, interpersonal skills, time management and define problems. **Information Use** is associated with the attributes of: retrieval, evaluation and use of information, and sensitivity to gender customs and cultures. **Individual Competencies** are associated with the attributes of: self-motivation, ability to learn independently, reflection on strengths and weaknesses and work independently. **IS Knowledge** is associated with the attributes of: programming language ability, IS knowledge, reference discipline knowledge and technical competence. **Professionalism** is associated with the attributes of: ethics, curiosity about technology, continuous learning and intellectual development, embracing change, and professional development. **Project Management** is associated with the attributes of: analyse and evaluate solutions, understand the profit motive of business, knowledge of business operations and its orientation, quality of solutions and project management skills. **Professional Development** is associated with the attributes of: research skills and related discipline knowledge. **Diversity** is associated with the attribute of operate in a diverse environment.

The results of the mapping of the generic attributes supports the hypothesis

- Tertiary IS courses of study do not meet IS industry needs.

Educational courses of study, as stated in their objectives, do not meet the IS industry and academic requirements in relation to generic attributes.

6.3. *Limitations of the study*

This study has identified the following limitations that future researchers need to be cognisant of in further work in this area or using the research methodology:

- This research is restricted to the university sector and the current educational unit offerings in IS courses of study in universities in the states of Queensland, New South Wales and Victoria in Australia.
- The lack of direct access to the large mailing list of the industry representative body. One of the features of the research methodology was the use of individually addressed email with the express purpose of obtaining a high response rate in the Delphi study. The response rate amongst the participants that the researcher was not able to individually address email to was lower than those who had individually addressed emails.
- The unit outlines were written by a diverse group of individuals, some of whom did not teach the units for which they were responsible for writing the unit outlines. This is a significant limitation because the writer may not have had a clear understanding of the focus, intent and depth of treatment of the knowledge to be developed in the unit.
- The currency of the unit outline. Data about the courses of study was taken from the most recently available information as supplied by the institutions offering undergraduate courses of study in Information Systems. A significant problem was encountered in the quality and variety of information provided by the institutions. Many changes were noted in the information provided from the World Wide Web (WWW) in terms of what was currently being taught as compared with the information supplied to the Australian Computer Society (ACS) when the courses were accredited, even though this was a very short time frame of less than two years;
- The generic attributes as defined in this study are developed and enhanced during the lifelong learning process that most individuals go through. The curriculum documents contain specific statements of learning objectives for a particular period. One of the difficulties in comparing the curriculum documents to the

stated learning objectives of the units of study is that we would not be comparing similar items;

- The fact that many course unit outlines are written when a course of study is first accredited. This time period is often five years or more. This is a long period of time for a course unit outline to be used;
- The emerging and constantly changing employer and IS professional desired attributes of graduates. This is a reflection of the changing nature of the IS environment. The fact that employers and IS professionals judge the quality of a university course based on what the graduates can actually do in the workplace;
- The absence of detailed demographic data from the respondents as this may indicate significant differences in the data. For example, Chief Executive Officers (CEO) may have quite a different view of the essential attributes than the Human Resource (HR) person or other individuals within an organization;
- Access to complete documentation in relation to the purpose of a course of study;
- There is a large difference between the percentage coverage of the model curriculum documents within the courses offered in the USA where they constitute approximately 30 percent of the total course content. In the Australian context the model curriculum coverage represents approximately 83 percent of the course content;
- The study used curriculum documentation and there was no validation from a student perspective of what they learnt or what generic attributes were developed in units they studied;
- The course length in the USA is generally a minimum of 4 years while in Australia the usual length of a course is 3 years; and,
- The courses of study used in this research are restricted to the tertiary sector and the current educational offerings of universities in the states of Queensland, New South Wales and Victoria, in Australia. While this may represent the views of the eastern part of the country, they may not be totally representative of the offerings for the country as a whole.
- The graduates of IS courses of study were not surveyed as this study examined course and curriculum documentation. As noted in Chapter 2 a study involving graduates of IS courses in being undertaken by Turner and Lowry (1999).

6.4. Strengths of the research

One of the most important outputs from this research has been the development of a replicable methodology for determining the extent of coverage of the generic attributes within units and courses in other disciplines. The process would be to identify the relevant curriculum documents for the discipline and the Core Body of Knowledge from the associated professional association. The generic attributes that may have a specific context within the discipline need to be validated using a similar method such as the Delphi technique. Mapping of the generic attributes would then be done and a set of similar graphs produced. This research process meets the third research objective of producing a replicable methodology for mapping the unit objectives against the generic attributes.

This study is unique in that it sought the views of both industry and academics of the required generic attribute of graduates from IS courses of study. The study then mapped the generic attributes against the unit objectives to give an indication of the extent of treatment or development during a student's course T

In an attempt to increase the response rate to the Delphi study email was used as a medium for data collection. This provided the necessary data for the identification and validation of the importance of the generic attributes in a relatively short period of time as compared to the time that a traditional Delphi study would have taken. The email medium also allowed for the easy follow up of any questions raised during the course of the questionnaires. Delphi studies may now be conducted in a relatively short time frame. This will give the researchers the ability to publish their findings more quickly than other methods of conducting studies using the Delphi method. Individually addressed email, where this was possible, enhanced the response rate and provided the researcher with added anecdotal evidence from comments made in the reply to the survey instrument.

The use of email and the accessing of email mailing lists also provided the researcher with a broader respondent population than otherwise would have been available.

The timing of the survey was done during a teaching semester to enhance the probability of contacting academics during the course of the semester. There are always a number of staff who are away on leave and thus, do not reply to the email survey. The industry representatives replied from wherever they were in the world when the survey was conducted. Specifically some respondents replied on weekends from Vienna.

6.5. *Recommendations for Curriculum Development*

The generic attributes need to be developed within the courses of study at the institutions examined in this study. Specifically the wording of objectives needs to reflect not only the content of the material to be covered but also the process through which the student gains that knowledge or competency.

The elicitation of the generic attributes is required as part of the unit outline and should clearly demonstrate to students what skills they will be developing within a particular unit. This information is then able to form part of the accreditation submission for institutions seeking accreditation from professional bodies such as the ACS.

From the above conclusion further development of the unit objectives in the institutions and the curriculum documents needs to be done to explicitly relate the content of the objectives and the courses to the generic attributes. One method of explicitly relating the content and objectives of a unit is to insert a table that cross references the objectives of the unit with the development of the generic attributes for each unit.

From the process of gathering information for this study it became clear that the writers of the unit outlines need to have professional development in the writing of the unit objectives to address the inclusion of the generic attributes.

6.6. Further research

This study examined the coverage of the generic attributes as identified in the late 1990s in the courses of study at four Australian universities and international curriculum documents. Further research needs to be conducted in the following areas as these have been identified from the work completed in this study.

The identification of generic attributes needs to be continually reviewed and a follow-up study is suggested to identify any longitudinal trends that may be evolving since this study commenced in 1998. This follow-up is needed because of significant changes in society may suggest that there are new and additional attributes that are now considered to be generic skills.

The relationship between the generic attributes identified in this study and the multi-literacies (Millard Sheets Library, 2003. -http://www.otis.edu/library/infolit.htm, Accessed 12 January, 2004) that are now the focus of educators will provide the platform for a follow-up study of the generic attributes agenda.

A further study of the generic attributes as identified by different disciplines will provide an interdisciplinary view of the important competencies that the tertiary sector needs to develop within their courses of study.

The assessment of the generic attributes as part of units within a course of study is an area for further research. A number of questions arise from the question of assessment of generic competencies or attributes.

- How do the different discipline areas assess the different generic attributes?
- What type of statement of competence should the tertiary institutions provide to the graduates on completion of their courses of study?

From this study a number of reflective question relating to the teaching and learning process. These questions may form the basis of further research and publications.

- "What is it about teaching and learning in Information Systems courses that lends itself to the development of students' generic skills?
- What can we learn about curriculum design, teaching and learning in higher education from the examination of the course and unit documentation?
- What do the views of IS employers and the professional associations tell us about the quality of the preparation for employment that students receive in this sample of Australian universities?
- How are these views different from those of stakeholders in other countries?
- How could tertiary IS courses in Australia better prepare students for subsequent employment?" [1]

The definition of a set of IS specific generic attributes for the IS industry will form the basis of a further research project. This set of IS specific generic attributes, emerging from this research, will need to be continually revised and developed as the IS industry is a dynamic industry.

[1] Examiner 1 comments from thesis examination process.

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Generic Attributes of Australian Information Systems Graduates: an Empirical Study

Supplementary Material

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Supplementary Material

Appendix A

Summary of Key Issue Studies in Information Systems

Authors	Year Conducted	Country	Number Of Rounds	Number of Respondents	Response Rate Percentage	Comments
Ball and Harris	1982	USA	1	417	29.8%	First key issue study conducted as part of a membership survey. Respondents were middle to upper management and questionnaire completion time was in the order of 30 minutes
Dickson	1983	USA	4	54	N/A	Began with open ended question No response rate reported. Used Delphi method
Hartog and Herbert	1985	USA	4	600	40%	Used a two-part survey
Brancheau and Wetherbe	1986	USA	3	90	50%	Follow up Delphi method study to Dickson's in 1983. Participants from either the first or second round received questionnaires for the third round
Parker and Idundun	1988	United Kingdom	1	100	45	Used a 4 point Likert scale. Used both questionnaire and follow up interviews
Watson	1989	Australia	3	48	24	Postal Delphi method survey. Introduced rating of the issues and the inclusion of the previous round summary data with subsequent round questionnaires
Caudle	1991	USA	1	Various	10 - 65%	Survey of key issues in the public sector. Response rates dependent on the population sector surveyed.
Niederman	1991	USA	3	104	49%	Second round questionnaires sent to entire sample population. Round three questionnaires sent to respondents of either round one or round two.
Pervan	1991	Australia	3	88	29%	Initial Delphi question was replace by the final round ranking from the previous key issue study by Watson and supplemented by the inclusion of new issues from USA studies.
Fink	1994	Australia	2	29	100%	Conducted using students as the sample population
Lu	1994	People's Republic of China	1	135	30%	A single postal survey instrument

Authors	Year Conducted	Country	Number Of Rounds	Number of Respondents	Response Rate Percentage	Comments
Morgado, Reinhard and Watson	1994	Brazil	1	69	49.3%	Single survey instrument. Used multiple additional methods such as Q-Sort[1], Interpretive Structural Modelling[2], Factor Analysis
Brancheau and Wetherbe	1996	USA	3	217	76%	Began with a list of 21 issues from the 1990 survey. Delphi method
Pervan	1996	Australia	1	490	21.4%	Single survey instrument. Used personal identification and personal addressing of the postal survey
Snoke	1996	Australia	3	107	20	Web based survey . Time taken for reply to 2 rounds was 6 months. Technology identified as a potential for rapid data collection using the Delphi method.

[1] QSORT is a method of ranking items so that the distribution fits a predefined (often normal) distribution

[2] "Interpretative Structural Modeling is a method used to create hierarchical structured models of qualitatively defined elements and relations among these elements". (Morgado, Reinhard, & Watson, 1994)

Appendix B
Pilot Study Results

1 The Pilot Study

Educators and trainers of future IS professionals must be able to identify and validate the generic attributes desired by employers of our graduates. The pilot study is significant in that it is the first study in Australia to empirically validate the attributes of the graduates from the courses we teach.

The pilot study was conducted in 1997 using the Information Systems Management Research Concentration (ISMRC) at QUT. The sample population includes both academics and representatives from industry who employ the graduates of the courses. The study was conducted using a modified three round Delphi technique and resulted in a response rate of 83 percent for the final round. The study rates a previously identified set of attributes and then ranks them according to their mean rating. A comparison of industry and academic responses is described.

B.1 Aim of the Pilot Study

This is the first Australian study that identifies and examines the generic attributes required of entry-level employees from IS tertiary programs of study. This project helps provide a focus for IS curriculum development. The results of the study will be used to develop a technique for developing a more responsive tertiary curriculum that meets the needs of the Information Systems industry. Institutions will be able to map their IS curriculum offerings against those of the Australian Computer Society (ACS) Core Body of Knowledge (Underwood, 1996) to identify strengths and weaknesses in their curriculum.

B.2 Participants

The sample population includes both academics and representatives from industry who employ the graduates of the courses. The study was conducted using a modified three round Delphi technique as suggested by Watson (1989) in his studies of key issues in information management and resulted in a response rate of 83 percent for the final round.

Eighteen participants were chosen from the Information Systems Management Research Concentration (ISMRC) at QUT. There was equal representation of academics and IS industry practitioners. A response rate of 61 percent was achieved in the first round with equal representation from both industry and academics. A response increase of 11 percent on the first round gave a second round response rate of 72 percent. Again a response increase of 11 percent on the second round gave a third round response rate of 83 percent Reminder notices were sent to only 10 percent of the academics in round three asking them to complete the questionnaire. The industry representatives did not require any prompting to complete the questionnaires. This prompting did help in increasing the response rate as well as the use of a modified Delphi technique. If the above two measures had not been used the final response rate would have been only 61 percent.

B.3 Key findings

The competencies considered essential (an average rating of 4 or more) are listed in overall rank order in Table 4.1. It should be remembered that a five point Likert scale was used in the pilot study with the following values:

1 = unimportant;
2 = of little importance;
3 = neutral;
4 = very important; and,
5 = of major importance (essential).

Table B.1

IS generic competencies

Competency	Rank	Mean	St Dev
Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.	1	4.73	0.59
Written and oral communication skills	2	4.67	0.49
With respect to the Information systems discipline possess theoretical and practical knowledge in at least one reference discipline	2	4.67	0.49
Retrieve, evaluate and use relevant information	4	4.63	0.48
With respect to the Information systems discipline possess coherent, extensive, theoretical and practical knowledge	5	4.60	0.51
Work as part of a team in a productive and cooperative manner	6	4.53	0.74
Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology	7	4.43	0.65
Define problems in a systematic way	8	4.40	0.63
With respect to the Information systems discipline be technologically competent	9	4.33	0.49
Work independently	10	4.27	0.70
Analyse, synthesise and evaluate the various solutions	10	4.27	0.70
Interpersonal skills	12	4.20	0.68
Value the ethics of the Information Technology profession	13	4.07	0.59
Consider the quality of the solution and its timeliness	13	4.07	0.70
Participate in on-going professional development	15	4.00	0.65
Ability to reflect on own strengths and weaknesses	15	4.00	0.76

Caution needs to be exercised in placing too much importance on the following interpretation due to the small sample size in this part of the total study. From the mean values listed in Table 4.1 it can be seen that the top 16 competencies are rated as being at least very important (mean rating of 4.00 or greater) with the top six being rated as essential with a mean rating of 4.50 or greater.

B.3.1 Importance of the IS discipline

An important result is that the knowledge and skills in IS are rated fifth and below knowledge of a reference disciplines as defined by Barki (Barki, Rivard, & Talbot, 1993). This suggests that the reference discipline knowledge is seen by the combined respondent group of both academics and industry as more important than the specific knowledge of the IS discipline. This is also consistent with a widely held view of generic attributes that generalist attributes are more important than the specific skills for a particular job or career.

B.3.2 Communications Skills

It is not surprising to see that written and oral communications skills are rated highly. These are essential skills in the modern working environment, which includes a large reliance on the use of email and other forms of communications.

B.3.3 Personal Attributes

The personal attribute of being able to participate in continued learning is rated number one. This personal attribute reflects the current state of the changing and evolving state of IS and information technology in a wider sense. Working as part of a team in a productive and cooperative manner is rated as essential. In current work environment, working as part of a team cooperatively and productively is at the very essence of the structure of the workplace. There do not exist many jobs or careers where a person does not need to be a participative member of a team. The ranking of these attributes, that are considered essential, is consistent with anecdotal evidence that employers value the "people" skills more highly than the traditional intellectual skills which are often defined by content knowledge.

B.3.4 Interpersonal Skills

The attributes embrace change, define problems, work independently, interpersonal skills, analyse, synthesize and evaluate the various solutions, technological competence, ethics, consider the quality of the solution, participation in ongoing professional development, and the ability to reflect on own strengths and weaknesses are all rated as very important. These attributes of define problems, work independently, interpersonal skills, analyse, synthesize and evaluate the various solutions, technological competence, and consider the quality of the solution, reflect a basic skill level required of an employee.

B.3.5 Ethics and embracing change

It is noted that the value of ethics and the attribute of reflecting on one's own strengths and weaknesses are a reflection of the personality of the individual. The attributes embrace change and participation in ongoing professional development are rated very high partially due to the societal and work environment that is changing rapidly. This rapid change requires a person to be adaptable and embrace the concept of change and learn to develop strategies to handle the effects of change on them as and individual. To remain employable requires a person to participate in professional development as a continuous process. They must keep abreast of the rapid and continuous changing technologies that are emerging within the IS field.

B.3.6 The least important attributes

Table 4.2 lists the attributes that received a mean ranking of less than four. This does not imply that they are not important, but that they are just less important to an employee in their first year on the job.

Table B.2

IS generic attributes with a mean of less than 4

Competency	Rank	Mean	St Dev
Time management skills	17	3.87	0.92
Research skills	17	3.87	0.74
Confidence about their ability to learn independently	17	3.87	0.83
Self-motivation	20	3.80	1.32
Sensitivity to differences in gender, culture and customs	20	3.80	0.77
Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment	22	3.73	0.59
Possess a sense of basic curiosity about technology	23	3.60	1.06
Knowledge of how a business operates, is structured or is orientated	24	3.53	0.83
With respect to the Information systems discipline possess the theoretical and practical knowledge of related disciplines.	25	3.30	0.65
Demonstrate practical knowledge and understanding in at least one computer language	26	3.20	1.15
Understand the profit motive of business	27	2.8	1.22

From the data in the above table it is noted that the attributes could be grouped into four clusters.

- personal skills,
- flexibility,
- knowledge of business and
- Programming knowledge.

The personal skill cluster would include the attributes of time management, research skills, self-motivation and confidence in their ability to learn independently. These are very individualized characteristics and ones that a person develops in their own style. Except for the attribute of self-motivation this entire cluster of attributes received the same mean ranking of 3.87 (out of 5).

The cluster of attributes that involves flexibility include sensitivity to gender, adapt to unfamiliar cultures and operate in a socially and culturally diverse environment, and possess a sense of basic curiosity about technology relate to the person's personality and there ability to interact with individuals from other parts of the world. The modern employee is required to work with individuals from all parts of the globe as well as often their place of employment may be in a country with a very different culture and set of social customs to that in which they were raised.

The attribute of demonstrating practical knowledge and understanding in at least one computer programming language is rated last of the attributes that received a positive ranking. The question must be asked is being able to program still a required skill in an entry-level employee. The low rating of 3.2 would suggest that an employer would not require a new employee to be able to program. This is a shift from what has traditionally been seen as an essential skill for an IS professional.

The cluster of attributes that relate to knowledge of a business is rated last. This is somewhat surprising in that IS is fundamentally about systems within a business environment. What is surprising is that the attribute of understanding the profit motive of business was not rated at all. This rating required further investigation in which it was identified at the wording of the attribute in the questionnaire was misleading and therefore participants simply did not rate it. Discussion with the industry representative respondents indicated that it should be listed as and attribute in the other parts of the study.

This section has discussed the overall results from the small pilot study. The next section will present a discussion of the industry views compared to the academic views.

B.4 Industry versus academic results

The results of the industry and academic views of the relative importance of the attributes are shown in Table 4.3.

Table B.3

Industry and academic comparison of generic attributes

Competency	Academic	Industry
Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.	2	1
Written and oral communication skills	2	2
With respect to the Information systems discipline possess theoretical and practical knowledge in at least one reference discipline.	2	2
Work as part of a team in a productive and cooperative manner	8	2
Retrieve, evaluate and use relevant information	2	5
With respect to the Information Systems discipline possess coherent, extensive, theoretical and practical knowledge	2	6
Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology	8	7
With respect to the Information systems discipline be technologically competent (the person is able to use the current technology competently)	10	8
Work independently	10	9
Research skills	23	9
Interpersonal skills	10	11
Participate in on-going professional development	17	11
Possess a sense of basic curiosity about technology	26	13
Define problems in a systematic way	1	14
Self-motivation	21	14
Analyse, synthesise and evaluate the various solutions	2	16
Value the ethics of the Information Technology profession	10	16
Consider the quality of the solution and its timeliness	10	16
Ability to reflect on own strengths and weaknesses	15	16
Confidence about their ability to learn independently	17	16
Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment	21	16
Sensitivity to differences in gender, culture and customs	17	22
Time management skills	15	23

Competency	Academic	Industry
With respect to the Information systems discipline possess the theoretical and practical knowledge of related disciplines.	25	24
Knowledge of how a business operates, is structured or is orientated	20	25
Demonstrate practical knowledge and understanding in at least one programming language	23	26
Understand the profit motive of business	27	27

Statistical analysis beyond the calculation of the mean, median, mode and standard deviation is invalid due to the small sample size. However, from the above data it should be noted that 13 of the 27 attributes listed have difference in ranking of 5 or more.

There appears to be little agreement between the academics and the industry participants as to the ranking of the most important attributes. Both industry and academics do, however, tend to agree on the least important attributes. These include ***Demonstrate practical knowledge and understanding in at least one programming language*** and ***knowledge of related disciplines***. This is surprising in that one would expect that a graduate of an IS program of study would have a sound practical and theoretical grounding in at least one programming language as programming languages form the underpinning knowledge of the IS and IT fields. One would also expect that a graduate would have some understanding of where the IS discipline fits within the larger framework of society and academic disciplines.

B.4.1 Attributes ranked higher by industry

The attributes with significantly higher ranking by industry are shown in Table 4.4. The important result from table 4.4 is the large difference between the number one ranked attribute by academics, ***Define problems in a systematic way*** and the industry view of the same attribute. Industry ranked this attribute at 14. Working as part of a team is viewed by industry as significantly more important than it is by academics.

An interesting result is the low rating given to research skills by academics who ranked it 23 out 27 attributes. This is surprising given that academic study involves a significant amount of research. The industry view may be from the perspective that industry wants to employ people who have the skills to find new information by means of researching the topic.

B.4.2 Attributes with a large difference in ranking between academics and industry

There are four of the attributes that have a difference in rating of 10 or more. This indicates a significant difference of opinion as to what is important in a new employee. These attributes rated higher by industry respondents are ***Possess a sense of basic curiosity about technology*** and ***Research skills***.

The attributes that are rated higher by academics are ***Define problems in a systematic way*** and ***Analyse, synthesise and evaluate the various solutions***. This may suggest that industry have a different view of the competencies required of new employees based on the different environments within which they work and operate.

Table B.4

Generic Attributes with significant difference in ranking by industry rank

Competency	Academic	Industry
Work as part of a team in a productive and cooperative manner	8	2
Research skills	23	9
Participate in on-going professional development	17	11
Possess a sense of basic curiosity about technology	26	13
Define problems in a systematic way	1	14
Self-motivation	21	14
Analyse, synthesise and evaluate the various solutions	2	16
Value the ethics of the Information Technology profession	10	16
Consider the quality of the solution and its timeliness	10	16
Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment	21	16
Sensitivity to differences in gender, culture and customs	17	22
Time management skills	15	23
Knowledge of how a business operates, is structured or is orientated	20	25

B.5 Overall Conclusions from the Pilot Study

The pilot study showed that the attributes of ***written and oral communications and the willingness to participate in continued learning and intellectual development*** and ***develop critical, reflective and creative thinking*** are considered more important than a specific ***knowledge of the IS discipline***. This implies that the assessment in IS units of study should contain significantly more written assignment and oral presentations.

The disparity of results between academic and industry suggests that academics need to interact more closely with industry in the development and maintenance of IS course syllabi.

This section has discussed the results of the pilot study of 18 members of the ISMRC at QUT.

Appendix C

Survey Instrument Academic Round 1

2 MGA_1A.RTF

08 March 2004

COVER LETTER,
AUSTRALIAN GENERIC ATTRIBUTES SURVEY – ACADEMIC ROUND 1

Dear Alan

I am contacting Queensland Information Systems academics listed in the 1996 Asia Pacific Directory of Information Systems Researchers, by email as part of a study by the Information Systems Management Research Concentration (ISMRC) at Queensland University of Technology to identify the generic attributes of graduates of IS programs of study

This is the first Australian study (that I know of) that examines the Generic attributes of entry level graduates of IS programs of study. Your involvement will bring about a greater awareness of the factors that influence Australian tertiary education. This project will help provide a focus for IS curriculum development. The study consists of three Delphi questionnaires that will take approximately ten minutes to complete. Your commitment is limited to the completion and return of the attached email questionnaire.

No data from the study will be published or disclosed in a way which could allow the identification of an individual respondent. Of course, your identity will be known to me from your reply. However, the maintenance of confidentiality of research data will have my highest priority. Upon request, interim results will be made available to participants in the survey.

To eliminate potential format problems, it is preferred that the questionnaire be returned by using the reply function on your email application rather than by attaching a file.

Your participation in this study is important. Please take time from your busy schedule to respond today. Although I need your RETURN BY WEDNESDAY, 15 OCTOBER, I would be delighted to receive it earlier.

Thankyou for your assistance.

Bob Snoke

Email: snoke@fit.qut.edu.au
Phone: (07) 3864 5275 School of Information Systems
Fax: (07) 3864 1969 School of Information Systems

A brief overview of the project follows.

Aim: To identify the generic attributes required of entry level employees in Information Systems.

The study involves three (3) Delphi round questionnaires to identify the competencies essential to IS entry level employees. The first questionnaire contains a list of attributes identified in the literature.

Specifically your insight into the competencies relating to tasks performed by entry level graduates will provide us with a richer understanding of the variety of tasks performed by IS personnel.

The results of the study will be used to develop a technique for developing a more responsive tertiary curriculum that meets the needs of the Information Systems industry.

This questionnaire contains a list of the generic attributes of graduates of Information Systems Bachelor degrees at Australian universities. Please rate the importance of the following attributes in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job.

There is room at the bottom of the list of attributes for you to add any you feel have not been included or to make additional comments.

Each attribute is to be rated as to whether it is important for a graduate to possess according to a seven point scale: 1, 2, 3, 4, 5, 6, 7 in order of increasing importance where
1 = extremely unimportant,
2.= unimportant
3 = of little importance,
4 = neutral,
5 = very important,
6 = of major importance.
7 = extremely important (essential).

AUSTRALIAN GENERIC ATTRIBUTES SURVEY

IS RELATED ATTRIBUTES

Please rate the importance of the following attributes in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job.

With respect to the IS discipline an IS graduate will:

1. Possess coherent, extensive, theoretical and practical knowledge

____

2. Technologically competent (the person is able to use the current technology competently)

____

3. Possess theoretical and practical knowledge in at least one reference discipline which include behavioral science, computer science, decision theory, information theory, organizational theory, management theory, language theories, systems theory, social science, management science, Artificial Intelligence, economic theory, ergonomics, political science, psychology and accounting.

____

4. Possess the theoretical and practical knowledge of related disciplines. For example, business, law, education, data communications, computer science or leisure recreation

____

5. Retrieve, evaluate and use relevant information

____

OTHER RELATED ATTRIBUTES

Please rate the importance of the following attributes in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job.

6. Define problems in a systematic way

____

7. Analyse, synthesise and evaluate the various solutions

____

8. Consider the quality of the solution and its timeliness.

____

9. Demonstrate practical knowledge and understanding in at least one computer language

____

10. Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.

____

11. Time management skills

____

12. Knowledge of how a business operates, is structured or is orientated

____

13. Understand the profit motive of business

____

14. Ability to reflect on own strengths and weaknesses

____

15. Confidence about their ability to learn independently

____

16. Self-motivation

____

17. Work independently

____

18. Value the ethics of the Information Technology profession

____

19. Sensitivity to differences in gender, culture and customs

____

20. Possess a sense of basic curiosity about technology

____

21. Work as part of a team in a productive and cooperative manner

____

22. _Written communication skills

____

23. Oral communication skills

____

24. Research skills

____

25. Participate in on-going professional development

____

26. Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology

____

27. Interpersonal skills

____

28. Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment

____

29. Others (please specify)

______

Please make any comments concerning the skills an IS graduate needs, current trends in the area or any other comments that would help to improve our program in providing you with suitable employees

Thankyou for your assistance in completing this questionnaire. Please return the completed questionnaire BY USING THE REPLY FUNCTION ON YOUR EMAIL APPLICATION to send it to:

Bob Snoke
School of Information Systems
Queensland University of Technology
GPO Box 2434 Brisbane, QLD
Australia 4001
Office: 61 7 3864-5275
Fax: 61 7 3864-1969
E-mail: snoke@fit.qut.edu.au

Appendix D

Survey Instrument Academic Round 2

3 OZGA_2A.RTF

15 July 1998

AUSTRALIAN GENERIC ATTRIBUTES SURVEY ROUND TWO

Dear John Doe

Thank you for your participation in the first round of this study. Your reply has provided valuable information on the attributes required of graduates from IS courses.

Attributes that received an average rating of 4 or less have been deleted from this round of the survey. Additional attributes have been added based on feedback from respondents in Round One. The average rating for each attribute as well as your response to round one has been included with this round.

Please rate the importance of the attributes in terms of the essential nature of the attribute in the workplace for an entry -level graduate during their first year on the job.

If upon reflection you feel you would not change your reply please hit the reply and send button now.

Thank you for your assistance in this important study.

There is room at the bottom of the list of attributes for you to add any you feel have not been included or to make additional comments.

Each attribute is to be rated as to whether it is important for a graduate to possess according to a seven point scale: 1, 2, 3, 4, 5, 6, 7 in order of increasing importance where

1 = extremely unimportant,
2.= unimportant
3 = of little importance,
4 = neutral,
5 = very important,
6 = of major importance.
7 = extremely important (essential).

Your participation in this study is important. Please take time from your busy schedule to respond today. Although I need your response RETURNED BY 7 SEPTEMBER I would be delighted to receive it earlier.

Thank you for your assistance.

Bob Snoke

Email: snoke@fit.qut.edu.au
Phone: (07) 3864 5275 School of Information Systems
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AUSTRALIAN GENERIC ATTRIBUTES SURVEY

IS RELATED ATTRIBUTES

Please rate the importance of the following attributes in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job.

With respect to the IS discipline an IS graduate will:

1. Possess coherent, extensive, theoretical and practical knowledge

______Your Rating
7______Your Rating Round 1
_5.54_Average rating Round 1

2. Technologically competent (the person is able to use the current technology competently)

______Your Rating
_7_____Your Rating Round 1
_5.54_____Average rating Round 1

3. Possess theoretical and practical knowledge in at least one reference discipline which include behavioural science, computer science, decision theory, information theory, organizational theory, management theory, language theories, systems theory, social science, management science, Artificial Intelligence, economic theory, ergonomics, political science, psychology and accounting.

______Your Rating
7______Your Rating Round 1
_5.39_____Average rating Round 1

4. Possess the theoretical and practical knowledge of related disciplines. For example, business, law, education, data communications, computer science or leisure recreation

______Your Rating
_7_____Your Rating Round 1
_4.93_____Average rating Round 1

5. Retrieve, evaluate and use relevant information

______Your Rating
__7____Your Rating Round 1
_5.94_____Average rating Round 1

OTHER RELATED ATTRIBUTES

Please rate the importance of the following attributes in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job.

6. Define problems in a systematic way

______Your Rating
___7___Your Rating Round 1
_5.86_____Average rating Round 1

7. Analyse, synthesise and evaluate the various solutions

______Your Rating
_0_____Your Rating Round 1
_5.78_____Average rating Round 1

8..Consider the quality of the solution and its timeliness.

______Your Rating
__0____Your Rating Round 1
_5.67_____Average rating Round 1

9. Demonstrate practical knowledge and understanding in at least one computer language

______Your Rating
_1_____Your Rating Round 1
__5.24____Average rating Round 1

10. Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.

______Your Rating
__7____Your Rating Round 1
_6.01_____Average rating Round 1

11. Time management skills

______Your Rating
_7_____Your Rating Round 1
_5.23_____Average rating Round 1

12. Knowledge of how a business operates, is structured or is orientated

______Your Rating
__4____Your Rating Round 1
_5.16_____Average rating Round 1

13. Understand the profit motive of business

______Your Rating
___1___Your Rating Round 1
_4.56_____Average rating Round 1

14. Ability to reflect on own strengths and weaknesses

______Your Rating
__1____Your Rating Round 1
_5.30_____Average rating Round 1

15. Confidence about their ability to learn independently

______Your Rating
_1_____Your Rating Round 1
_5.62_____Average rating Round 1

16. Self-motivation

______Your Rating
__5____Your Rating Round 1
_5.84_____Average rating Round 1

17. Work independently

______Your Rating
__1____Your Rating Round 1
__5.41____Average rating Round 1

18. Value the ethics of the Information Technology profession

______Your Rating
__6____Your Rating Round 1
__5.56____Average rating Round 1

19. Sensitivity to differences in gender, culture and customs

______Your Rating
___7___Your Rating Round 1
_5.07_____Average rating Round 1

20. Possess a sense of basic curiosity about technology

______Your Rating
__1____Your Rating Round 1
_5.16_____Average rating Round 1

21. Work as part of a team in a productive and cooperative manner

______Your Rating
_7_____Your Rating Round 1
_5.93_____Average rating Round 1

22. Written communication skills

______Your Rating
__7____Your Rating Round 1
__5.68____Average rating Round 1

23.. Oral communication skills

______Your Rating
___7___Your Rating Round 1
5.87______Average rating Round 1

24. Research skills

______Your Rating
____1__Your Rating Round 1
_4.85_____Average rating Round 1

25.. Participate in on-going professional development

______Your Rating
___1___Your Rating Round 1
_5.27_____Average rating Round 1

26. Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology

______Your Rating
_5_____Your Rating Round 1
_5.64_____Average rating Round 1

27. Interpersonal skills

______Your Rating
__7____Your Rating Round 1
_5.76_____Average rating Round 1

28. Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment

______Your Rating
___7___Your Rating Round 1
_5.02_____Average rating Round 1

29. Project Management Skills

______Your Rating
__1____Your Rating Round 1
_4.70_____Average rating Round 1

30. Others (please specify)

______

Please make any comments concerning the skills an IS graduate needs, current trends in the area or any other comments that would help to improve our program in providing you with suitable employees

Appendix E

Survey Instrument Industry Round 1

4 GA_1I.RTF

10 July 1998

COVER LETTER, **AUSTRALIAN GENERIC ATTRIBUTES SURVEY – INDUSTRY ROUND 1**

Dear Alan

I am contacting Queensland IS industry representatives by email as part of a study by the Information Systems Management Research Concentration (ISMRC) at Queensland University of Technology to identify the generic attributes of graduates of IS programs of study

This is the first Australian study (that I know of) that examines the Generic attributes of entry level graduates of IS programs of study. Your involvement will bring about a greater awareness of the factors that influence Australian tertiary education. This project will help provide a focus for IS curriculum development. The study consists of three Delphi questionnaires that will take approximately ten minutes to complete. Your commitment is limited to the completion and return of the attached email questionnaire. This survey takes only 3-4 minutes to complete.

No data from the study will be published or disclosed in a way which could allow the identification of an individual respondent. Of course, your identity will be known to me from your reply. However, the maintenance of confidentiality of research data will have my highest priority. Upon request, interim results will be made available to participants in the survey.

To eliminate potential format problems, it is preferred that the questionnaire be returned by using the reply function on your email application rather than by attaching a file.

Your participation in this study is important. Please take time from your busy schedule to respond today. Although I need your RETURN BY WEDNESDAY, 2 JULY I would be delighted to receive it earlier.

Thankyou for your assistance.

Bob Snoke

Email: snoke@fit.qut.edu.au
Phone: (07) 3864 5275 School of Information Systems
Fax: (07) 3864 1969 School of Information Systems

A brief overview of the project follows.

Aim: To identify the generic attributes required of entry level employees

The study involves three (3) Delphi round questionnaires to identify the competencies essential to IS entry level employees. The first questionnaire contains a list of attributes identified
in the literature.

Specifically your insight into the competencies relating to tasks performed by entry level graduates will provide us with a richer understanding of the variety of tasks performed by IS personnel.
The results of the study will be used to develop a technique for developing a more responsive tertiary curriculum that meets the needs of the Information Systems industry.

This questionnaire contains a list of the generic attributes of graduates of Information Systems Bachelor degrees at Australian universities. Please rate their importance in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job.

There is room at the bottom of the list of attributes
for you to add any you feel have not been included or to make additional comments.

Each attribute is to be rated as to whether it is important for a graduate to possess according to a five point scale: 1, 2, 3, 4, 5 in order of increasing importance where
1 = unimportant,
2 = of little importance,
3 = of some importance
4 = neutral,
5 = important (desired)
6 = very important,
7 = of major importance (essential).

AUSTRALIAN GENERIC ATTRIBUTES SURVEY

Attribute
With respect to the IS discipline
1. Possess coherent, extensive, theoretical and practical knowledge

______

2. Technologically competent (the person is able to use the current technology competently)

______

3. Possess theoretical and practical knowledge in at least one reference discipline which include behavioural science, computer science, decision theory, information theory, organisational theory, management theory, language theories, systems theory, social science, management science, Artificial Intelligence, economic theory, ergonomics, political science, psychology and accounting.

____

4. Possess the theoretical and practical knowledge of related disciplines. For example, business, law, education, data communications, computer science or leisure recreation

____

5. Retrieve, evaluate and use relevant information

With respect to other skills

6. Defines problems in a systematic way

____

7. Analyse, synthesise and evaluate the various solutions

____

8. Consider the quality of the solution and its timeliness.

____

9. Demonstrate practical knowledge and understanding in at least one computer language

____

10. Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.

____

11. Time management skills

____

12. Knowledge of how a business operates, is structured or is orientated

____

13. Understand the profit motive of business

____

14. Ability to refelct on own strengths and weaknesses

____

15. Confidence about their ability to learn independently

____

16. Self-motivation

____

17. Work independently

____

18. Value the ethics of the Information Technology profession

____

19. Sensitivity to differences in gender, culture and customs

____

20. Possess a sense of basic curiosity about technology

____

21. Work as part of a team in a productive and cooperative manner

____

22. Written and oral communication skills

____

23. Research skills

____

24. Participate in on-going professional development

____

25. Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology

____

26. Interpersonal skills

____

27. Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment

____

28. Others (please specify)

____

Please make any comments concerning the skills an IS student needs, current trends in the area or any other comments that would help to improve our program in providing you with suitable employees

Thankyou for your assistance in completing this questionnaire.
Please return the completed questionnaire BY USING THE REPLY FUNCTION ON YOUR EMAIL APPLICATION to send it to:

Bob Snoke
School of Information Systems
Queensland University of Technology
GPO Box 2434 Brisbane, QLD
Australia 4001
Office: 61 7 3864-5275
Fax: 61 7 3864-1969
snoke@fit.qut.edu.au

E-mail:Appendix F

Survey Instrument Industry Round 2

5 MGA_2I.RTF

10 July 1998

AUSTRALIAN GENERIC ATTRIBUTES SURVEY – INDUSTRY ROUND TWO of THREE

Dear Alan

Attributes that received an average rating of 4 or less have been deleted from this round of the survey. Additional attributes have been added when respondents to round one added them to the list. The average rating for each attribute as well as your response to round one has been included with this round.

Please indicate your views on the attributes using the following scale to rate the importance of the attributes in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job..

There is room at the bottom of the list of attributes for you to add any you feel have not been included or to make additional comments.

Each attribute is to be rated as to whether it is important for a graduate to possess according to a seven point scale: 1, 2, 3, 4, 5, 6, 7 in order of increasing importance where

1 = extremely unimportant,
2.= unimportant
3 = of little importance,
4 = neutral,
5 = very important,
6 = of major importance.
7 = extremely important (essential).

To eliminate potential format problems, it is preferred that the questionnaire be returned by using the reply function on your email application rather than by attaching a file.

Your participation in this study is important. Please take time from your busy schedule to respond today. Although I need your response RETURNED BY FRIDAY, 24 OCTOBER I would be delighted to receive it earlier.

Thank you for your assistance.

Bob Snoke

Email: snoke@fit.qut.edu.au
Phone: (07) 3864 5275 School of Information Systems
Fax: (07) 3864 1969 School of Information Systems

AUSTRALIAN GENERIC ATTRIBUTES SURVEY

IS RELATED ATTRIBUTES

Please rate the importance of the following attributes in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job.

With respect to the IS discipline an IS graduate will:

1. Possess coherent, extensive, theoretical and practical knowledge

______Your Rating
__5____Your Rating Round 1
_5.45_____Average rating Round 1

2. Technologically competent (the person is able to use the current technology competently)

______Your Rating
__2.5____Your Rating Round 1
_5.72_____Average rating Round 1

3. Possess theoretical and practical knowledge in at least one reference discipline which include behavioral science, computer science, decision theory, information theory, organizational theory, management theory, language theories, systems theory, social science, management science, Artificial Intelligence, economic theory, ergonomics, political science, psychology and accounting.

______Your Rating
__6____Your Rating Round 1
_5.06_____Average rating Round 1

4. Possess the theoretical and practical knowledge of related disciplines. For example, business, law, education, data communications, computer science or leisure recreation

______Your Rating
__6____Your Rating Round 1
_4.87_____Average rating Round 1

5. Retrieve, evaluate and use relevant information

______Your Rating

__6____Your Rating Round 1
_6.16_____Average rating Round 1

OTHER RELATED ATTRIBUTES

Please rate the importance of the following attributes in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job.

6. Define problems in a systematic way

______Your Rating
__6____Your Rating Round 1
_5.98_____Average rating Round 1

7. Analyse, synthesise and evaluate the various solutions

______Your Rating
__6____Your Rating Round 1
_5.91_____Average rating Round 1

8. Consider the quality of the solution and its timeliness.

______Your Rating
__6____Your Rating Round 1
_5.74_____Average rating Round 1

9. Demonstrate practical knowledge and understanding in at least one computer language

______Your Rating
__6____Your Rating Round 1
__5.15____Average rating Round 1

10. Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.

______Your Rating
_6_____Your Rating Round 1
_6.01_____Average rating Round 1

11. Time management skills

______Your Rating
__6____Your Rating Round 1
_5.70_____Average rating Round 1

12. Knowledge of how a business operates, is structured or is orientated

______Your Rating
_6_____Your Rating Round 1
_5.04_____Average rating Round 1

13. Understand the profit motive of business

______Your Rating
__6____Your Rating Round 1
_4.83_____Average rating Round 1

14. Ability to reflect on own strengths and weaknesses

______Your Rating
_6_____Your Rating Round 1
_5.43_____Average rating Round 1

15. Confidence about their ability to learn independently

______Your Rating
_6_____Your Rating Round 1
_5.63_____Average rating Round 1

16. Self-motivation

______Your Rating
_6_____Your Rating Round 1
_6.13_____Average rating Round 1

17. Work independently

______Your Rating
__6____Your Rating Round 1
__5.59____Average rating Round 1

18. Value the ethics of the Information Technology profession

______Your Rating
__6____Your Rating Round 1
__5.57____Average rating Round 1

19. Sensitivity to differences in gender, culture and customs

______Your Rating
_6_____Your Rating Round 1
_5.18_____Average rating Round 1

20. Possess a sense of basic curiosity about technology

______Your Rating
_6_____Your Rating Round 1
_5.33_____Average rating Round 1

21. Work as part of a team in a productive and cooperative manner

______Your Rating
_6_____Your Rating Round 1
_6.27_____Average rating Round 1

22. Written communication skills

______Your Rating
__6____Your Rating Round 1
__5.74____Average rating Round 1

23. Oral communication skills

______Your Rating
_6_____Your Rating Round 1
5.89______Average rating Round 1

24. Research skills

______Your Rating
_6_____Your Rating Round 1
_4.89_____Average rating Round 1

25. Participate in on-going professional development

______Your Rating
__6____Your Rating Round 1
_5.46_____Average rating Round 1

26. Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology

______Your Rating
_6_____Your Rating Round 1
_5.84_____Average rating Round 1

27. Interpersonal skills

______Your Rating
_6_____Your Rating Round 1
_5.80_____Average rating Round 1

28. Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment

______Your Rating
_6_____Your Rating Round 1
_4.99_____Average rating Round 1

29. Project Management Skills (added from results of round 1)

______Your Rating

30. Others (please specify)

______

Please make any comments concerning the skills an IS graduate needs, current trends in the area or any other comments that would help to improve our program in providing you with suitable employees

Thankyou for your assistance in completing this questionnaire. Please return the completed questionnaire BY USING THE REPLY FUNCTION ON YOUR EMAIL APPLICATION to send it to:

Bob Snoke
School of Information Systems
Queensland University of Technology
GPO Box 2434 Brisbane, QLD
Australia 4001
Office: 61 7 3864-5275
Fax: 61 7 3864-1969
E-mail: snoke@fit.qut.edu.au

Appendix G

Survey Instrument Academic – Non Respondent to Round 1

6 MGA_1NRA.RTF

08 March 2004

AUSTRALIAN GENERIC ATTRIBUTES SURVEY ROUND 2 of 3

Dear Alan

I am contacting Queensland Information Systems academics listed in the 1996 Asia Pacific Directory of Information Systems Researchers, by email as part of a study by the Information Systems Management Research Concentration (ISMRC) at Queensland University of Technology to identify the generic attributes of graduates of IS programs of study.

This is the first Australian study (that I know of) that examines the Generic attributes of entry level graduates of IS programs of study. Your involvement will bring about a greater awareness of the factors that influence Australian tertiary education. This project will help provide a focus for IS curriculum development. The study consists of three Delphi questionnaires that will take approximately ten minutes to complete. Your commitment is limited to the completion and return of the attached email questionnaire.

No data from the study will be published or disclosed in a way which could allow the identification of an individual respondent. Of course, your identity will be known to me from your reply. However, the maintenance of confidentiality of research data will have my highest priority. Upon request, interim results will be made available to participants in the survey.

To eliminate potential format problems, it is preferred that the questionnaire be returned by using the reply function on your email application rather than by attaching a file.

Your participation in this study is important. Please take time from your busy schedule to respond today. Although I need your response RETURN BY WEDNESDAY, 29 OCTOBER I would be delighted to receive it earlier.

Thankyou for your assistance.

Bob Snoke

Email: snoke@fit.qut.edu.au
Phone: (07) 3864 5275 School of Information Systems
Fax: (07) 3864 1969 School of Information Systems

A brief overview of the project follows.

Aim: To identify the generic attributes required of entry level employees in Information Systems

The study involves three (3) Delphi round questionnaires to identify the competencies essential to IS entry level employees. The first questionnaire contains a list of attributes identified in the literature.

Specifically your insight into the competencies relating to tasks performed by entry level graduates will provide us with a richer understanding of the variety of tasks performed by IS personnel.

The results of the study will be used to develop a technique for developing a more responsive tertiary curriculum that meets the needs of the Information Systems industry.

This questionnaire contains a list of the generic attributes of graduates of Information Systems Bachelor degrees at
Australian universities. Please rate the importance of the following attributes in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job.

There is room at the bottom of the list of attributes for you to add any you feel have not been included or to make additional comments.

Each attribute is to be rated as to whether it is important for a graduate to possess according to a seven point scale:
1, 2, 3, 4, 5, 6, 7 in order of increasing importance where

1 = extremely unimportant,
2.= unimportant
3 = of little importance,
4 = neutral,
5 = very important,
6 = of major importance.
7 = extremely important (essential).

AUSTRALIAN GENERIC ATTRIBUTES SURVEY

IS RELATED ATTRIBUTES

Please rate the importance of the following attributes in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job.

With respect to the IS discipline an IS graduate will:

1. Possess coherent, extensive, theoretical and practical knowledge

______Your Rating

_5.45_____Average rating Round 1

2. Technologically competent (the person is able to use the current technology competently)

______Your Rating

_5.72_____Average rating Round 1

3. Possess theoretical and practical knowledge in at least one reference discipline which include behavioural science, computer science, decision theory, information theory, organizational theory, management theory, language theories, systems theory, social science, management science, Artificial Intelligence, economic theory, ergonomics, political science, psychology and accounting.

______Your Rating

_5.06_____Average rating Round 1

4. Possess the theoretical and practical knowledge of related disciplines. For example, business, law, education, data communications, computer science or leisure recreation

______Your Rating

_4.87_____Average rating Round 1

5. Retrieve, evaluate and use relevant information

______Your Rating

_6.16_____Average rating Round 1

OTHER RELATED ATTRIBUTES

Please rate the importance of the following attributes in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job.

6. Define problems in a systematic way

______Your Rating

_5.98_____Average rating Round 1

7. Analyse, synthesise and evaluate the various solutions

______Your Rating

_5.91_____Average rating Round 1

8. Consider the quality of the solution and its timeliness.

______Your Rating

_5.74_____Average rating Round 1

9. Demonstrate practical knowledge and understanding in at least one computer language

______Your Rating

__5.15____Average rating Round 1

10. Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.

______Your Rating

_6.01_____Average rating Round 1

11. Time management skills

______Your Rating

_5.70_____Average rating Round 1

12. Knowledge of how a business operates, is structured or is orientated

______Your Rating

_5.04_____Average rating Round 1

13. Understand the profit motive of business

______Your Rating

_4.83_____Average rating Round 1

14. Ability to reflect on own strengths and weaknesses

______Your Rating

_5.43_____Average rating Round 1

15. Confidence about their ability to learn independently

______Your Rating

_5.63_____Average rating Round 1

16. Self-motivation

______Your Rating

_6.13_____Average rating Round 1

17. Work independently

______Your Rating

__5.59____Average rating Round 1

18. Value the ethics of the Information Technology profession

______Your Rating

__5.57____Average rating Round 1

19. Sensitivity to differences in gender, culture and customs

______Your Rating

_5.18_____Average rating Round 1

20. Possess a sense of basic curiosity about technology

______Your Rating

_5.33_____Average rating Round 1

21. Work as part of a team in a productive and cooperative manner

______Your Rating

_6.27_____Average rating Round 1

22. Written communication skills

______Your Rating

__5.74____Average rating Round 1

23. Oral communication skills

______Your Rating

5.89______Average rating Round 1

24. Research skills

______Your Rating

_4.89_____Average rating Round 1

25. Participate in on-going professional development

______Your Rating

_5.46_____Average rating Round 1

26. Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology

______Your Rating

_5.84_____Average rating Round 1

27. Interpersonal skills

______Your Rating

_5.80_____Average rating Round 1

28. Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment

______Your Rating

_4.99_____Average rating Round 1

29. Project Management Skills (added from results of round 1)

______Your Rating

30. Others (please specify)

______

Please make any comments concerning the skills an IS graduate needs, current trends in the area or any other comments that would help to improve our program in providing you with suitable employees

Thankyou for your assistance in completing this questionnaire.
Please return the completed questionnaire BY USING THE REPLY FUNCTION ON
YOUR EMAIL APPLICATION to send it to:

Bob Snoke
School of Information Systems
Queensland University of Technology
GPO Box 2434 Brisbane, QLD
Australia 4001
Office: 61 7 3864-5275
Fax: 61 7 3864-1969
E-mail: snoke@fit.qut.edu.au

Appendix H

Survey Instrument Industry – Non Respondent to Round 1

7 MGA_1NRI.RTF

10 July 1998

AUSTRALIAN GENERIC ATTRIBUTES SURVEY – ROUND 2 of 3

Dear Alan

I am contacting Australian Information Systems (IS) industry representatives by email as part of a study by the Information Systems Management Research Concentration (ISMRC) at Queensland University of Technology to identify the generic attributes of graduates of IS programs of study

This is the first Australian study (that I know of) that examines the Generic attributes of entry level graduates of IS programs of study. Your involvement will bring about a greater awareness of the factors that influence Australian tertiary education. This project will help provide a focus for IS curriculum development. The study consists of three Delphi questionnaires that will take approximately ten minutes to complete. Your commitment is limited to the completion and return of the attached email questionnaire.

No data from the study will be published or disclosed in a way which could allow the identification of an individual respondent. Of course, your identity will be known to me from your reply. However, the maintenance of confidentiality of research data will have my highest priority. Upon request, interim results will be made available to participants in the survey.

To eliminate potential format problems, it is preferred that the questionnaire be returned by using the reply function on your email application rather than by attaching a file.

Your participation in this study is important. Please take time from your busy schedule to respond today. Although I need your RETURN BY 10 September I would be delighted to receive it earlier.

Thankyou for your assistance.

Bob Snoke

Email: snoke@fit.qut.edu.au
Phone: (07) 3864 1922 School of Information Systems
Fax: (07) 3864 1969 School of Information Systems

A brief overview of the project follows.

Aim: To identify the generic attributes required of entry-level employees

The study involves three (3) Delphi round questionnaires to identify the competencies essential to IS entry-level employees. The first questionnaire contains a list of attributes identified in the literature.

Specifically your insight into the competencies relating to tasks performed by entry level graduates will provide us with a richer understanding of the variety of tasks performed by IS personnel.

The results of the study will be used to develop a technique for developing a more responsive tertiary curriculum that meets the needs of the Information Systems industry.

This questionnaire contains a list of the generic attributes of graduates of Information Systems Bachelor degrees at Australian universities. Please rate the importance of the following attributes in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job.

There is room at the bottom of the list of attributes for you to add any you feel have not been included or to make additional comments.

Each attribute is to be rated as to whether it is important for a graduate to possess according to a seven point scale: 1, 2, 3, 4, 5, 6, 7 in order of increasing importance where

1 = extremely unimportant,
2.= unimportant
3 = of little importance,
4 = neutral,
5 = very important,
6 = of major importance.
7 = extremely important (essential).

AUSTRALIAN GENERIC ATTRIBUTES SURVEY

Background Data

Please complete the following in relation to your organization
Tick (x) the appropriate item

_____ Government
_____ Non-government

Enterprise Size

_____ Small (1-19 employees)
_____ Medium (20 - 99
_____ Large (100 or more)

IS RELATED ATTRIBUTES

Please rate the importance of the following attributes in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job.

With respect to the IS discipline an IS graduate will:

1. Possess coherent, extensive, theoretical and practical knowledge

______Your Rating

_5.45_____Average rating Round 1

2. Technologically competent (the person is able to use the current technology competently)

______Your Rating

_5.72_____Average rating Round 1

3. Possess theoretical and practical knowledge in at least one reference discipline which include behavioral science, computer science, decision theory, information theory, organizational theory, management theory, language theories, systems theory, social science, management science, Artificial Intelligence, economic theory, ergonomics, political science, psychology and accounting.

______Your Rating

_5.06_____Average rating Round 1

4. Possess the theoretical and practical knowledge of related disciplines. For example, business, law, education, data communications, computer science or leisure recreation

______Your Rating

_4.87_____Average rating Round 1

5. Retrieve, evaluate and use relevant information

______Your Rating

_6.16_____Average rating Round 1

OTHER RELATED ATTRIBUTES

Please rate the importance of the following attributes in terms of the essential nature of the attribute in the workplace for an entry-level graduate during their first year on the job.

6. Define problems in a systematic way

______Your Rating

_5.98_____Average rating Round 1

7. Analyse, synthesise and evaluate the various solutions

______Your Rating

_5.91_____Average rating Round 1

8. Consider the quality of the solution and its timeliness.

______Your Rating

_5.74_____Average rating Round 1

9. Demonstrate practical knowledge and understanding in at least one computer language

______Your Rating

__5.15____Average rating Round 1

10. Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.

______Your Rating

_6.01_____Average rating Round 1

11. Time management skills

______Your Rating

_5.70_____Average rating Round 1

12. Knowledge of how a business operates, is structured or is orientated

______Your Rating

_5.04_____Average rating Round 1

13. Understand the profit motive of business

______Your Rating

_4.83_____Average rating Round 1

14. Ability to reflect on own strengths and weaknesses

______Your Rating

_5.43_____Average rating Round 1

15. Confidence about their ability to learn independently

______Your Rating

_5.63_____Average rating Round 1

16. Self-motivation

______Your Rating

_6.13_____Average rating Round 1

17. Work independently

______Your Rating

__5.59____Average rating Round 1

18. Value the ethics of the Information Technology profession

______Your Rating

__5.57____Average rating Round 1

19. Sensitivity to differences in gender, culture and customs

______Your Rating

_5.18_____Average rating Round 1

20. Possess a sense of basic curiosity about technology

______Your Rating

_5.33_____Average rating Round 1

21. Work as part of a team in a productive and cooperative manner

______Your Rating

_6.27_____Average rating Round 1

22. Written communication skills

______Your Rating

__5.74____Average rating Round 1

23. Oral communication skills

______Your Rating

5.89______Average rating Round 1

24. Research skills

______Your Rating

_4.89_____Average rating Round 1

25. Participate in on-going professional development

______Your Rating

_5.46_____Average rating Round 1

26. Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology

______Your Rating

_5.84_____Average rating Round 1

27. Interpersonal skills

______Your Rating

_5.80_____Average rating Round 1

28. Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment

______Your Rating

_4.99_____Average rating Round 1

29. Project Management Skills (added from results of round 1)

______Your Rating

30. Others (please specify)

______

Please make any comments concerning the skills an IS graduate needs, current trends in the area or any other comments that would help to improve our program in providing you with suitable employees

Thankyou for your assistance in completing this questionnaire.
Please return the completed questionnaire BY USING THE REPLY FUNCTION ON
YOUR EMAIL APPLICATION to send it to:

Bob Snoke
School of Information Systems
Queensland University of Technology
GPO Box 2434 Brisbane, QLD
Australia 4001
Office: 61 7 3864-5275
Fax: 61 7 3864-1969
E-mail: snoke@fit.qut.edu.au

Appendix I

Generic Attribute Keywords

	Attribute	Term	Related Term	Source if not Thesaurus
	With Respect to the IS discipline			
1	Possess coherent, extensive, theoretical and practical knowledge	Possess	Body Of Knowledge Comprehend Demonstrate Understanding Experience Extensive Informal Proficient Read Recognised Retention System Understand	
		Coherent	Logically Consistent	
		Practical	Analyse Analysis Behaviour Carry out Code Competence Competent Competency Conduct Create Database Design Do DBMS Develop Efficient Implement Lines Of Code Perform Planning And Control Put Into Practice Syntax Semantics Compile Execute Test	Vogler
		Knowledge	Appreciation Body Of Knowledge Experience Extensive	

	Attribute	Term	Related Term	Source if not Thesaurus
			Possess System	
		Theoretical	Association Of Ideas Design Suggest	Vogler
		Extensive	Accurate Complete Comprehensive Deep Detailed Greatness Importance Indepth Magnitude Theory Thorough	
2	Technologically competent (the person is able to use the current technology competently	Technologically	Applied Sciences Use IT Hardware Use IT Software	
		Competent	Ability Ableness Accomplish Acquire Adequate Ample Attribute Capability Capable Capacity Choose Combine Compare Competence Competency Competent Complete Compute Construct Create Do Demonstrate Efficiency Efficient Enablement Enough Excellence Experienced Expertness Identify Knack Mastery Perform Practical	

	Attribute	Term	Related Term	Source if not Thesaurus
			Prepared Proficiency Proficient Property Qualification Quality Satisfactory Skills Techniques Use	
3	Possess theoretical and practical knowledge in at least one reference discipline which include behavioural science, computer science, decision theory, information theory, organisational theory, management theory, language theories, systems theory, social sciences, management science, artificial intelligence, economic theory, ergonomics, political science, psychology and accounting.	Possess	Body Of Knowledge Comprehend Demonstrate Understanding Experience Extensive Informal Proficient Read Recognised Retention System Understand	
		Theoretical	Association Of Ideas Design Suggest	
		Practical	Analyse Analysis Behaviour Carry out Code Competence Competent Competency Conduct Create Database Design Do DBMS Develop Efficient Implement Lines Of Code Perform Planning And Control Put Into Practice Syntax Semantics Compile Execute	

	Attribute	Term	Related Term	Source if not Thesaurus
			Test	
		Knowledge	Appreciation Body Of Knowledge Experience Extensive Possess Systems	
		Reference Disciplines	Accounting Artificial Intelligence Behavioural Science Computer Science Decision Theory Economic Theory Information Theory Language Theories Management Science Management Theory Organisational Theory Political Science Psychology Social Sciences Systems Theory	BRT
4	Possess the theoretical and practical knowledge of related disciplines. For example, business, law, education data communications, computer science or leisure recreation.	Possess	Body Of Knowledge Comprehend Demonstrate Understanding Experience Extensive Informal Proficient Read Recognised Retention System Understand	
		Theoretical	Association Of Ideas Design Suggest	
		Practical	Analyse Analysis Behaviour Carry out Code Competence Competent Competency	

	Attribute	Term	Related Term	Source if not Thesaurus
			Conduct Create Database Design Do DBMS Develop Efficient Implement Lines Of Code Perform Planning And Control Put Into Practice Syntax Semantics Compile Execute Test	
		Knowledge	Appreciation Body Of Knowledge Experience Extensive Possess Systems	
		Related Disciplines	Business Computer Science Data Communications Education Law Leisure Recreation Other Disciplines That Are Not A Reference Discipline	
5	Retrieve, evaluate and use relevant information	Retrieve	Acquire Find Gather Get Manipulate data (Date) Obtain Query Receive To Search For	
		Evaluate	Appraise Assess Examine Measure Rate Value	

	Attribute	Term	Related Term	Source if not Thesaurus
		Use	Put Into Practice	
		Relevant	Related Appropriate	
		Information	Facts Knowledge News	
	With respect to other skills			
6	Defines problems in a systematic way	Defines	Be Precise Explain	
		Problems	Uncertain Thing Task	
		Systematics	Classification Ordered Planned	
		Way	Method Procedure	
7	Analyse, synthesise and evaluate the various solutions	Analyse	Appraise Assess Classify Critique Diagnose Examine Exhaustive Study Inquire Investigate	
		Synthesise	Combine Make Whole	
		Evaluate	Appraise Assess Examine Measure Rate Scope Value	
		Various	Contrasting Different Dissimilar Distinct Diverse Many Multiple Unrelated Varied	
		Solutions	Alternative Answer	

	Attribute	Term	Related Term	Source if not Thesaurus
			Conclusions Explanations Generalisations	
8	Consider the quality of the solution and its timeliness	Quality	Character Condition Essence Goodness Superiority	
		Solution	Alternative Answer Conclusions Explanations Generalisations	
		Timeliness	Opportuneness Promptness Propitiousness Punctuality	
		Consider	Attend To Intend Test Think	
9	Demonstrate practical knowledge and understanding in at least one computer language	Demonstrate	Authenticate Display	
		Practical	Analyse Analysis Behaviour Carry out Code Competence Competent Competency Conduct Create Database Design Do DBMS Develop Efficient Implement Lines Of Code Perform Planning And Control Put Into Practice Syntax Semantics Compile Execute Test	
		Knowledge	Appreciation Body Of	

	Attribute	Term	Related Term	Source if not Thesaurus
			Knowledge Experience Extensive Possess Systems	
		Understanding	Appreciation Awareness Insight Observation Perception Recognition	
		At Least One	One Or More	
		Computer Language	BASIC C++ COBOL JAVA MODULA 2 Other programming languages PASCAL RPG SQL	
10	Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking	Be Able To	Accomplish Do Perform	
		Participate	Committed Cooperate Get Involved Interest In Partake In Share	
		Continued	Advanced Endure Extend Keep Going Proceed Survive	
		Learning	Assimilation Educate Mastery Scholarship Training Understanding	
		Intellectual	Academic	
		Develop	Complete Create	

	Attribute	Term	Related Term	Source if not Thesaurus
			Evolve Grow Improve Increase Shape	
		Critical	Analyse Assess Interpret Investigate	
		Creative	Conceptional Generative Ground Breaking Innovative Original Productive	
		Thinking	Allow Believe Clarify* Concentrate Contemplation Deliberate Devise Drawing Conclusions* Evaluating* Formulating Hypothesis* Generating Ideas* Identify* Intellectualisation Introspection Mediation Philosophise Reasoning* Reconsideration	Gubbin
		Reflective	Meditate Ponder	
11	Time management skills	Time Management	Activity Management	
		Skills	Ability Attainment Cause Competence Competency Competent Excellence Expertness Knack Mastery Proficiency Talent	

	Attribute	Term	Related Term	Source if not Thesaurus
			Technical Knowledge Understanding	
12	Knowledge of how a business operates, is structured or is oriented	Business	Job	
		Knowledge	Appreciation Body Of Knowledge Experience Extensive Possess Systems	
		Operates	Act Apply Command Use	
		Structured	Composition Context Order Shape	
		Oriented	Direction Positioning	
13	Understand the profit motive of business	Understand	Appreciation Awareness Insight Observation Perception Recognition	
		Profit	Advantage Earnings Gain Remuneration Returns Revenue Takings Income	
		Motive	Encourage Incentive	
		Business	Job	
14	Ability to reflect on own strengths and weaknesses	Ability	Capability Competence	
		Reflect	Meditate Ponder	

	Attribute	Term	Related Term	Source if not Thesaurus
		Own	Self	
		Strengths	Characteristic	
		Weaknesses	Characteristics Imperfections	
15	Confidence about their ability to learn independently	Confidence	Belief Certain Hopeful	
		Ability	Capability Competence	
		Learn	Assimilation Educate Mastery Scholarship Training Understanding	
		Independently	Oneself Unaided Separately By Ones Self	
16	Self-motivation	Self	Oneself	
		Motivation	Encourage Incentive	
17	Work independently	Work	Employment Job Tasks	
		Independently	Oneself Unaided Separately By Ones Self	
18	Value the ethics of the Information technology profession	Value	Appraisal Appreciation Assessment Importance Meaning Reputation Usefulness Worth	
		Ethics	Morality Rules	
		Information Technology	Computer Science Data Communications Decision Support Systems	

	Attribute	Term	Related Term	Source if not Thesaurus
			Information Management Information Systems Multimedia	
		Profession	Job Business	
19	Sensitivity to differences in gender, culture and customs	Sensitivity	Influenced Perceptive Reactive	
		Differences	Altered Changed Discriminate Modified Varied	
		Gender	Class Sex	
		Culture	Customs	
		Customs	Common Practice Convention Etiquette Habit Protocol Tradition Unwritten Law	
20	Possess a sense of basic curiosity about technology	Possess	Body Of Knowledge Comprehend Experience Extensive Informal Proficient Read Recognised Retention System Understand	
		Sense	Influenced Perceptive Reactive	
		Basic	Characteristic Essence Fundamental Important Original	

	Attribute	Term	Related Term	Source if not Thesaurus
		Curiosity	Inquisitiveness	
		Technology	Hardware Industry Equipment Software	
21	Work as part of a team in a productive and cooperative manner	Work	Employment Job Tasks	
		Team	Corporation Group	
		Productive	Make	
		Cooperative	Helpful Participation Team Spirit	
		Manner	Behaviour Character Custom Method	
22	Written communication skills	Written	Readable	
		Communication	Contact Dialogue Dissemination Information Transmission Liaison Message	
		Skills	Ability Attainment Cause Competence Competency Competent Excellence Expertness Knack Mastery Proficiency Talent Technical Knowledge Understanding	
		Written Communication Skills	Contact Describe Dialogue Dissemination Document	

	Attribute	Term	Related Term	Source if not Thesaurus
			Explain Information Transmission Liaison List Message Outline Prepare Proficiency State Write	
23	Oral communications skills	Oral	Spoken	
		Communication	Contact Dialogue Dissemination Information Transmission Liaison Message	
		Skills	Ability Attainment Cause Competence Competency Competent Excellence Expertness Knack Mastery Proficiency Talent Technical Knowledge Understanding	
		Oral Communication Skills	Contact Describe Dialogue Dissemination Document Explain Information Transmission Liaison List Message Outline Prepare Proficiency State Write	
24	Research skills	Research	Investigation Questioning Reviewing	

	Attribute	Term	Related Term	Source if not Thesaurus
		Skills	Ability Attainment Cause Competence Competency Competent Excellence Expertness Knack Mastery Proficiency Talent Technical Knowledge Understanding	
25	Participate in on-going professional development	Participate	Commitment Interest Involved Join	
		On-Going	Continuos	
		Professional	Expert	
		Development	Create Evolve Growth Improvement Increase	
		Professional Development	Create Evolve Growth Improvement Increase	
26	Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology	Embrace	Adopt	
		Change	Affect Alteration Amendments Modification Revision Transformation	
		Obliged	Promised Required To	
		Engage	Attract Employ Join Participate	

	Attribute	Term	Related Term	Source if not Thesaurus
		Incremental	Addition Increase Steps	
		Improvement	Amelioration Amendment Betterment Enhancement Recovery	
		Rapid	Fast	
		Technology	Hardware Software	
27	Interpersonal skills	Interpersonal	Between Persons	
		Skills	Ability Attainment Cause Competence Competency Competent Excellence Expertness Knack Mastery Proficiency Talent Technical Knowledge Understanding	
28	Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment	Adapt	Adjust Change Evolve Make Do	
		Unfamiliar	Not Well Acquainted Not Well Known Strange	
		Cultures	Customs	
		Operate	Act Apply Command Use	
		Socially	Friendship Interest Group Gathering	
		Culturally	Customs	

	Attribute	Term	Related Term	Source if not Thesaurus
		Diverse	Different Mixed	
		Environment	Hardware Software Surroundings	
29	Project management skills	Skills	Ability Attainment Cause Competence Competency Competent Excellence Expertness Knack Mastery Proficiency Talent Technical Knowledge Understanding	
		Project	A coordinated effort Task	
		Management	Manage	
		Project Management Skills	Change control Control Documentation Initiate Manage Plan Quality management Report Risk management Scope	Managing IT Projects G McLEOD and D SMITH

Appendix J

List Of Words Is Used To Help Describe The Content Of The IS Course

Objective Words Or Concepts	**Source**
Analysis	(Anthony Ralston, 1983), (Davis & Olson, 1985), (Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994), (Turban, McLean, & Wetherbe, 1996), (Hirschheim, 1985a), (Hirschheim & Ed, 1987), (Sippl, 1985), (Elmasri & Navathe, 1989)
Appreciate Importance Of Benefits	(Fitzgerald & Fitzgerald, 1987), (Turban et al., 1996), (Hirschheim, 1985a), (Davis & Olson, 1985),
Business Units	(Hawryskiewycz, 1994), (Davis & Olson, 1985), (Hirschheim, 1985b)
Classify	(Turban et al., 1996),
Code / Programming	(Anthony Ralston, 1983), (Elmasri & Navathe, 1989)
Compare	(Shelly, Cashman, Adamski, & Adamski, 1991), (Fitzgerald & Fitzgerald, 1987), (Turban et al., 1996), (Elmasri & Navathe, 1989)
Comprehensive	(*The Macquarie Thesaurus*, 1991), (Fitzgerald & Fitzgerald, 1987), (Date, 1994),
Computation	(Davis & Olson, 1985),
Compiling	(Koffman, 1988)
Conduct And Interview	(Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994),
Database/DBMS	(Anthony Ralston, 1983), (Davis & Olson, 1985), (Hawryskiewycz, 1994), (Date, 1994), (Elmasri & Navathe, 1989)
Decision Making	(Anthony Ralston, 1983), (Davis & Olson, 1985), (Hawryskiewycz, 1994),

Objective Words Or Concepts	**Source**
Define	(Turban et al., 1996), (Date, 1994), (Davis & Olson, 1985),
Define A Problem	(Fitzgerald & Fitzgerald, 1987), (Davis & Olson, 1985), (Shelly et al., 1991), (Hawryskiewycz, 1994), (Turban et al., 1996),
Describe	(Shelly et al., 1991), (Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994), (Turban et al., 1996), (Cheong & Hirschheim, 1983), (Hirschheim, 1985a), (Hirschheim, 1985b)
Design	(Anthony Ralston, 1983), (Davis & Olson, 1985), (Shelly et al., 1991), (Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994), (*The Macquarie Thesaurus*, 1991), (Date, 1994), (Elmasri & Navathe, 1989)
Design Characteristics	(Eliason, 1991), (Cheong & Hirschheim, 1983), (Hirschheim, 1985a),
Detailed	(*The Macquarie Thesaurus*, 1991), (Fitzgerald & Fitzgerald, 1987), (Cheong & Hirschheim, 1983)
Develop	(Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994),
Devise	(Fitzgerald & Fitzgerald, 1987),
Discuss	(Shelly et al., 1991), (Fitzgerald & Fitzgerald, 1987), (O'Brien, 1994), (Turban et al., 1996),
Document	(Shelly et al., 1991), (Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994),
Estimate	(Shelly et al., 1991), (Fitzgerald & Fitzgerald, 1987),
Ethics	(O'Brien, 1994),
Evaluate	(Shelly et al., 1991), (Fitzgerald & Fitzgerald, 1987), (Turban et al., 1996), (Cheong & Hirschheim, 1983), (Hirschheim, 1985a),

Objective Words Or Concepts	**Source**
Explain	(Shelly et al., 1991), (Fitzgerald & Fitzgerald, 1987), (O'Brien, 1994), (Turban et al., 1996), (Date, 1994),
Gain Self-Confidence	(Fitzgerald & Fitzgerald, 1987),
Graphic Representation / Communication	(*The Macquarie Thesaurus*, 1991), (Shelly et al., 1991), (Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994),
Identify	(Fitzgerald & Fitzgerald, 1987), (O'Brien, 1994), (Turban et al., 1996),
Identify Problem Sources	(Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994), (Turban et al., 1996), (Elmasri & Navathe, 1989)
Implement	(Anthony Ralston, 1983), (Fitzgerald & Fitzgerald, 1987), (Hirschheim, 1985a),
In-Depth	(*The Macquarie Thesaurus*, 1991), (Fitzgerald & Fitzgerald, 1987),
Install	(Fitzgerald & Fitzgerald, 1987),
Interpersonal Skills/ Company Politics	(Fitzgerald & Fitzgerald, 1987), (Hirschheim, 1985b)
Limking	(Koffman, 1988)
List	(Fitzgerald & Fitzgerald, 1987), (Shelly et al., 1991),
Loading	(Koffman, 1988)
Logical	(*The Macquarie Thesaurus*, 1991), (Fitzgerald & Fitzgerald, 1987), (Date, 1994),
Modelling	(Hawryskiewycz, 1994), (Fitzgerald & Fitzgerald, 1987), (Elmasri & Navathe, 1989)
Object Oriented Design	(Hawryskiewycz, 1994),
Oral Communications / Interviews / Presentations	(Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994),

Objective Words Or Concepts	**Source**
Organise Work	(Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994),
Perform Specific Tasks	(Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994),
Planning Control	(Anthony Ralston, 1983), (Davis & Olson, 1985), (Hawryskiewycz, 1994),
Problem solving	(Koffman, 1988), (Helman & Veroff, 1988)
Algorithm Design	(Koffman, 1988), (Helman & Veroff, 1988)
Database	(Kroenke & Nilson, 1986)
Database Design	(Kroenke & Nilson, 1986)
Computer Based information management systems	(Kroenke & Nilson, 1986)
Present	(Date, 1994),
Quality	(Hawryskiewycz, 1994),
Recognise	(Turban et al., 1996), (Fitzgerald & Fitzgerald, 1987), (O'Brien, 1994),
Review	(Fitzgerald & Fitzgerald, 1987), (Turban et al., 1996),
Systems Analysis	(Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994), (Turban et al., 1996), (Elmasri & Navathe, 1989)
Technical Writing - Coding	(Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994),
Test	(Fitzgerald & Fitzgerald, 1987),
Theoretical	(Date, 1994),
Thorough	(*The Macquarie Thesaurus*, 1991), (Fitzgerald & Fitzgerald, 1987),
Understand	(Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994), (Turban et al., 1996), (Hirschheim, 1985a),
Use	(O'Brien, 1994), (Turban et al., 1996),

Objective Words Or Concepts	**Source**
Useable	(*The Macquarie Thesaurus*, 1991),
Working As An Individual	(Hawryskiewycz, 1994),
Working As Part Of A Team	(Hawryskiewycz, 1994), (Hirschheim, 1985a),
Written Reports	(Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994),
Written Communication/ Documentation	(Fitzgerald & Fitzgerald, 1987), (Hawryskiewycz, 1994), (O'Brien, 1994), (Sippl, 1985),
Behavioural Science	(Henri Barki, Rivard, & Talbot, 1988; H Barki, Rivard, & Talbot, 1993)
Computer Science	(Henri Barki et al., 1988; H Barki et al., 1993)
Decision Theory	(Henri Barki et al., 1988; H Barki et al., 1993)
Decision Science	(Henri Barki et al., 1988; H Barki et al., 1993)
Organisational Theory	(Henri Barki et al., 1988; H Barki et al., 1993)
Management Theory	(Henri Barki et al., 1988; H Barki et al., 1993)
Language Theory	(Henri Barki et al., 1988; H Barki et al., 1993)
Management Science	(Henri Barki et al., 1988; H Barki et al., 1993)
Ergonomics	(Henri Barki et al., 1988; H Barki et al., 1993)
Psychology	(Henri Barki et al., 1988; H Barki et al., 1993)
Political Science	(Henri Barki et al., 1988; H Barki et al., 1993)
Computer Systems	(Henri Barki et al., 1988; H Barki et al., 1993)
Hardware	(Henri Barki et al., 1988; H Barki et al., 1993)
Software	(Henri Barki et al., 1988; H Barki et al., 1993)
Computers	(Henri Barki et al., 1988; H Barki et al., 1993)
Data Resource Management	(Henri Barki et al., 1988; H Barki et al., 1993)
Personnel Resource Management	(Henri Barki et al., 1988; H Barki et al., 1993)
Hardware Resource Management	(Henri Barki et al., 1988; H Barki et al., 1993)
Software Resource Management	(Henri Barki et al., 1988; H Barki et al., 1993)

Objective Words Or Concepts	**Source**
IS Project Management	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Planning	(Henri Barki et al., 1988; H Barki et al., 1993)
Organising IS	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Evaluation	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Control	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Security	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Operations	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Life Cycle Activities	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Implementation	(Henri Barki et al., 1988; H Barki et al., 1993)
Organisational Use Of IS	(Henri Barki et al., 1988; H Barki et al., 1993)
Users	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Research	(Henri Barki et al., 1988; H Barki et al., 1993)
Applications Software	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Characteristics	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Development Methods And Tools	(Henri Barki et al., 1988; H Barki et al., 1993)
Individual Decision Making	(Henri Barki et al., 1988; H Barki et al., 1993)
Heuristic Decision Rules	(Henri Barki et al., 1988; H Barki et al., 1993)
Linear Decision Rules	(Henri Barki et al., 1988; H Barki et al., 1993)
Problem Solving Behaviour	(Henri Barki et al., 1988; H Barki et al., 1993)
Interactive Problem Solving	(Henri Barki et al., 1988; H Barki et al., 1993)
Knowledge Utilisation	(Henri Barki et al., 1988; H Barki et al., 1993)
Problem Diagnosis	(Henri Barki et al., 1988; H Barki et al., 1993)
Group Decision Making	(Henri Barki et al., 1988; H Barki et al., 1993)
Information Quality	(Henri Barki et al., 1988; H Barki et al., 1993)
Timeliness Of Information	(Henri Barki et al., 1988; H Barki et al., 1993)
Information Scope	(Henri Barki et al., 1988; H Barki et al., 1993)
Information Structure	(Henri Barki et al., 1988; H Barki et al., 1993)
Age Of The Information	(Henri Barki et al., 1988; H Barki et al., 1993)
Reliability Of Information	(Henri Barki et al., 1988; H Barki et al., 1993)

Objective Words Or Concepts	**Source**
Accuracy Of Information	(Henri Barki et al., 1988; H Barki et al., 1993)
Utility Of Information	(Henri Barki et al., 1988; H Barki et al., 1993)
Adequacy Of Information	(Henri Barki et al., 1988; H Barki et al., 1993)
Data Integrity	(Henri Barki et al., 1988; H Barki et al., 1993)
Quantity Of Information	(Henri Barki et al., 1988; H Barki et al., 1993)
Recency Of Information	(Henri Barki et al., 1988; H Barki et al., 1993)
Value Of Information	(Henri Barki et al., 1988; H Barki et al., 1993)
Leadership	(Henri Barki et al., 1988; H Barki et al., 1993)
Organising	(Henri Barki et al., 1988; H Barki et al., 1993)
Staffing	(Henri Barki et al., 1988; H Barki et al., 1993)
Internal Control	(Henri Barki et al., 1988; H Barki et al., 1993)
Procedures	(Henri Barki et al., 1988; H Barki et al., 1993)
Evaluation	(Henri Barki et al., 1988; H Barki et al., 1993)
Strategic Scanning	(Henri Barki et al., 1988; H Barki et al., 1993)
Forecasting	(Henri Barki et al., 1988; H Barki et al., 1993)
Budgeting	(Henri Barki et al., 1988; H Barki et al., 1993)
Priority Setting	(Henri Barki et al., 1988; H Barki et al., 1993)
Tactical Level	(Henri Barki et al., 1988; H Barki et al., 1993)
Strategic Level	(Henri Barki et al., 1988; H Barki et al., 1993)
Operational Level	(Henri Barki et al., 1988; H Barki et al., 1993)
Delphi Technique	(Henri Barki et al., 1988; H Barki et al., 1993)
Change Management	(Henri Barki et al., 1988; H Barki et al., 1993)
Office Management	(Henri Barki et al., 1988; H Barki et al., 1993)
Acquisition	(Henri Barki et al., 1988; H Barki et al., 1993)
Input/Output Models	(Henri Barki et al., 1988; H Barki et al., 1993)
Models	(Henri Barki et al., 1988; H Barki et al., 1993)
Human-Machine Systems	(Henri Barki et al., 1988; H Barki et al., 1993)
Closed/Open Systems	(Henri Barki et al., 1988; H Barki et al., 1993)
Action Research	(Henri Barki et al., 1988; H Barki et al., 1993)
Case Study	(Henri Barki et al., 1988; H Barki et al., 1993)

Objective Words Or Concepts	**Source**
Comparative Study	(Henri Barki et al., 1988; H Barki et al., 1993)
Empirical Study	(Henri Barki et al., 1988; H Barki et al., 1993)
Experimental Research	(Henri Barki et al., 1988; H Barki et al., 1993)
Exploratory Research	(Henri Barki et al., 1988; H Barki et al., 1993)
Conceptual Study	(Henri Barki et al., 1988; H Barki et al., 1993)
Field Study	(Henri Barki et al., 1988; H Barki et al., 1993)
Research Issues	(Henri Barki et al., 1988; H Barki et al., 1993)
Financial Models	(Henri Barki et al., 1988; H Barki et al., 1993)
Planning Models	(Henri Barki et al., 1988; H Barki et al., 1993)
Optimisation Models	(Henri Barki et al., 1988; H Barki et al., 1993)
Linear Programming	(Henri Barki et al., 1988; H Barki et al., 1993)
Heuristics	(Henri Barki et al., 1988; H Barki et al., 1993)
Goa; Programming	(Henri Barki et al., 1988; H Barki et al., 1993)
Mathematical Programming	(Henri Barki et al., 1988; H Barki et al., 1993)
Simulation	(Henri Barki et al., 1988; H Barki et al., 1993)
Artificial Intelligence	(Henri Barki et al., 1988; H Barki et al., 1993)
Software Copyright	(Henri Barki et al., 1988; H Barki et al., 1993)
Licensing	(Henri Barki et al., 1988; H Barki et al., 1993)
Piracy	(Henri Barki et al., 1988; H Barki et al., 1993)
Fraud	(Henri Barki et al., 1988; H Barki et al., 1993)
Changes In Work Force	(Henri Barki et al., 1988; H Barki et al., 1993)
Ethics	(Henri Barki et al., 1988; H Barki et al., 1993)
Cultural Differences	(Henri Barki et al., 1988; H Barki et al., 1993)
Social Values	(Henri Barki et al., 1988; H Barki et al., 1993)
Array Processors	(Henri Barki et al., 1988; H Barki et al., 1993)
Data Flow Architecture	(Henri Barki et al., 1988; H Barki et al., 1993)
Distributed Systems	(Henri Barki et al., 1988; H Barki et al., 1993)
Networks	(Henri Barki et al., 1988; H Barki et al., 1993)
LAN	(Henri Barki et al., 1988; H Barki et al., 1993)
WAN	(Henri Barki et al., 1988; H Barki et al., 1993)

Objective Words Or Concepts	**Source**
Value Added Networks	(Henri Barki et al., 1988; H Barki et al., 1993)
Telecommunications Technology	(Henri Barki et al., 1988; H Barki et al., 1993)
Front-End Computers	(Henri Barki et al., 1988; H Barki et al., 1993)
Back-End Computers	(Henri Barki et al., 1988; H Barki et al., 1993)
File Management Systems	(Henri Barki et al., 1988; H Barki et al., 1993)
Logic Programming	(Henri Barki et al., 1988; H Barki et al., 1993)
Relational Modelling	(Henri Barki et al., 1988; H Barki et al., 1993)
Relational Database	(Henri Barki et al., 1988; H Barki et al., 1993)
Relational Algebra	(Henri Barki et al., 1988; H Barki et al., 1993)
Data Description Languages	(Henri Barki et al., 1988; H Barki et al., 1993)
Data Definition Languages	(Henri Barki et al., 1988; H Barki et al., 1993)
Data Structures	(Henri Barki et al., 1988; H Barki et al., 1993)
Distributed Databases	(Henri Barki et al., 1988; H Barki et al., 1993)
COBOL	(Henri Barki et al., 1988; H Barki et al., 1993)
C	(Henri Barki et al., 1988; H Barki et al., 1993)
FORTRAN	(Henri Barki et al., 1988; H Barki et al., 1993)
BASIC	(Henri Barki et al., 1988; H Barki et al., 1993)
PASCAL	(Henri Barki et al., 1988; H Barki et al., 1993)
ADA	(Henri Barki et al., 1988; H Barki et al., 1993)
LISP	(Henri Barki et al., 1988; H Barki et al., 1993)
PROLOG	(Henri Barki et al., 1988; H Barki et al., 1993)
4^{th} Generation Languages	(Henri Barki et al., 1988; H Barki et al., 1993)
5^{th} Generation Languages	(Henri Barki et al., 1988; H Barki et al., 1993)
Nonprocedural Languages	(Henri Barki et al., 1988; H Barki et al., 1993)
DSS Generators	(Henri Barki et al., 1988; H Barki et al., 1993)
Modelling Languages	(Henri Barki et al., 1988; H Barki et al., 1993)
Program Generators	(Henri Barki et al., 1988; H Barki et al., 1993)
Report Generators	(Henri Barki et al., 1988; H Barki et al., 1993)
Statistical Packages	(Henri Barki et al., 1988; H Barki et al., 1993)

Objective Words Or Concepts	Source
Electronic Spreadsheets	(Henri Barki et al., 1988; H Barki et al., 1993)
Text Editing Software	(Henri Barki et al., 1988; H Barki et al., 1993)
Word Processing Software	(Henri Barki et al., 1988; H Barki et al., 1993)
Knowledge-Based Software	(Henri Barki et al., 1988; H Barki et al., 1993)
Natural Languages	(Henri Barki et al., 1988; H Barki et al., 1993)
Accounting	(Henri Barki et al., 1988; H Barki et al., 1993)
Human Resources	(Henri Barki et al., 1988; H Barki et al., 1993)
Task Ambiguity	(Henri Barki et al., 1988; H Barki et al., 1993)
Task Complexity	(Henri Barki et al., 1988; H Barki et al., 1993)
Task Uncertainty	(Henri Barki et al., 1988; H Barki et al., 1993)
Task Structure	(Henri Barki et al., 1988; H Barki et al., 1993)
Task Programmability	(Henri Barki et al., 1988; H Barki et al., 1993)
Task Interdependence	(Henri Barki et al., 1988; H Barki et al., 1993)
Managerial Task	(Henri Barki et al., 1988; H Barki et al., 1993)
Clerical Tasks	(Henri Barki et al., 1988; H Barki et al., 1993)
Database Administration	(Henri Barki et al., 1988; H Barki et al., 1993)
Human Resource Staffing	(Henri Barki et al., 1988; H Barki et al., 1993)
Software Selection	(Henri Barki et al., 1988; H Barki et al., 1993)
Hardware Contracts	(Henri Barki et al., 1988; H Barki et al., 1993)
Software Contracts	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Teams	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Project Development Policies	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Project Priorities	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Project Planning	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Project Control	(Henri Barki et al., 1988; H Barki et al., 1993)
Isproject Methods	(Henri Barki et al., 1988; H Barki et al., 1993)
Structured Planning	(Henri Barki et al., 1988; H Barki et al., 1993)
Critical Success Factors	(Henri Barki et al., 1988; H Barki et al., 1993)
Enterprise Modelling	(Henri Barki et al., 1988; H Barki et al., 1993)

Objective Words Or Concepts	**Source**
IS Planning Objectives	(Henri Barki et al., 1988; H Barki et al., 1993)
Application Selection	(Henri Barki et al., 1988; H Barki et al., 1993)
Structure Of The IS Function	(Henri Barki et al., 1988; H Barki et al., 1993)
Distributed Data Processing	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Occupations	(Henri Barki et al., 1988; H Barki et al., 1993)
DBA	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Project Manager	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Auditor	(Henri Barki et al., 1988; H Barki et al., 1993)
Computer Operator	(Henri Barki et al., 1988; H Barki et al., 1993)
Systems Designer	(Henri Barki et al., 1988; H Barki et al., 1993)
Systems Analyst	(Henri Barki et al., 1988; H Barki et al., 1993)
Cost Benefit Analysis	(Henri Barki et al., 1988; H Barki et al., 1993)
Evaluation Criteria	(Henri Barki et al., 1988; H Barki et al., 1993)
Access Control	(Henri Barki et al., 1988; H Barki et al., 1993)
Physical Security	(Henri Barki et al., 1988; H Barki et al., 1993)
Authentication	(Henri Barki et al., 1988; H Barki et al., 1993)
Authorization	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Evolution	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Technology Transfer	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Integration	(Henri Barki et al., 1988; H Barki et al., 1993)
Passwords	(Henri Barki et al., 1988; H Barki et al., 1993)
Disaster Plans	(Henri Barki et al., 1988; H Barki et al., 1993)
Outsourcing	(Henri Barki et al., 1988; H Barki et al., 1993)
Prototyping	(Henri Barki et al., 1988; H Barki et al., 1993)
Iterative Design	(Henri Barki et al., 1988; H Barki et al., 1993)
Evolution Design	(Henri Barki et al., 1988; H Barki et al., 1993)
User Development	(Henri Barki et al., 1988; H Barki et al., 1993)
User-Led Design	(Henri Barki et al., 1988; H Barki et al., 1993)
Feasibility Assessment	(Henri Barki et al., 1988; H Barki et al., 1993)
User Needs Assessment	(Henri Barki et al., 1988; H Barki et al., 1993)

Objective Words Or Concepts	Source
Information Analysis	(Henri Barki et al., 1988; H Barki et al., 1993)
Detailed Study	(Henri Barki et al., 1988; H Barki et al., 1993)
Physical Design	(Henri Barki et al., 1988; H Barki et al., 1993)
Conceptual Design	(Henri Barki et al., 1988; H Barki et al., 1993)
MIS Design	(Henri Barki et al., 1988; H Barki et al., 1993)
Process Design	(Henri Barki et al., 1988; H Barki et al., 1993)
Interface Design	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Design Issues	(Henri Barki et al., 1988; H Barki et al., 1993)
Testing	(Henri Barki et al., 1988; H Barki et al., 1993)
Conversion	(Henri Barki et al., 1988; H Barki et al., 1993)
Maintenance	(Henri Barki et al., 1988; H Barki et al., 1993)
Systems Documentation	(Henri Barki et al., 1988; H Barki et al., 1993)
Bottom-Up Design	(Henri Barki et al., 1988; H Barki et al., 1993)
Logical Design	(Henri Barki et al., 1988; H Barki et al., 1993)
Design	(Henri Barki et al., 1988; H Barki et al., 1993)
Requirement Analysis	(Henri Barki et al., 1988; H Barki et al., 1993)
IRA	(Henri Barki et al., 1988; H Barki et al., 1993)
Automated Design	(Henri Barki et al., 1988; H Barki et al., 1993)
Data Dictionary	(Henri Barki et al., 1988; H Barki et al., 1993)
Data Flow Diagrams	(Henri Barki et al., 1988; H Barki et al., 1993)
Decision Tables	(Henri Barki et al., 1988; H Barki et al., 1993)
Decision Trees	(Henri Barki et al., 1988; H Barki et al., 1993)
Entity Diagrams	(Henri Barki et al., 1988; H Barki et al., 1993)
Flowcharts	(Henri Barki et al., 1988; H Barki et al., 1993)
Functional Decomposition	(Henri Barki et al., 1988; H Barki et al., 1993)
Files	(Henri Barki et al., 1988; H Barki et al., 1993)
Work Breakdown Structure	(Henri Barki et al., 1988; H Barki et al., 1993)
Input	(Henri Barki et al., 1988; H Barki et al., 1993)
Top-Down Design	(Henri Barki et al., 1988; H Barki et al., 1993)
Output	(Henri Barki et al., 1988; H Barki et al., 1993)

Objective Words Or Concepts	**Source**
Information Retrieval	(Henri Barki et al., 1988; H Barki et al., 1993)
Electronic Mail	(Henri Barki et al., 1988; H Barki et al., 1993)
Participative Design	(Henri Barki et al., 1988; H Barki et al., 1993)
Database Requirements	(Henri Barki et al., 1988; H Barki et al., 1993)
Sequential Files	(Henri Barki et al., 1988; H Barki et al., 1993)
Strategic Intelligence	(Henri Barki et al., 1988; H Barki et al., 1993)
Exception Report	(Henri Barki et al., 1988; H Barki et al., 1993)
Knowledge Base	(Henri Barki et al., 1988; H Barki et al., 1993)
Business Charts	(Henri Barki et al., 1988; H Barki et al., 1993)
Tables	(Henri Barki et al., 1988; H Barki et al., 1993)
Icons	(Henri Barki et al., 1988; H Barki et al., 1993)
Colour	(Henri Barki et al., 1988; H Barki et al., 1993)
Menus	(Henri Barki et al., 1988; H Barki et al., 1993)
Error Messages	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Research Methodologies	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Research Framework	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Research Issues	(Henri Barki et al., 1988; H Barki et al., 1993)
IS Research Agenda	(Henri Barki et al., 1988; H Barki et al., 1993)
Future Of IS	(Henri Barki et al., 1988; H Barki et al., 1993)
Evaluation	(Bawden, 1990)

Appendix K

Textbooks Used in the Queensland University of Technology (QUT) Bachelor of Information Technology Course IT20

TEXT
Fowler GC 1990, COBOL:Structured Programming Techniques for Problem Solving
Anderson JR 1991 Cognitive Psychology and Its Implications 3rd edition freeman
Eliason Online business computer applications
Black, W., 1989, Data Networks: Concepts, theory and Practice prentice hall
Elmasri, R Navahte, SB 1989 Fundamentals of database systems, bejamin/cummings
Date, CJ, 1990An introduction to database systems 5th edition
Edmond, D & Anderson A 1989 Information modelling 4th edition, qsearch
Dunlop, C, Kling, R 1991 Computerization and Controversy: Value Conflicts and Social choices NY Academic press
Palmer RP, 1990, How to manage information: a systems approach
Bawden, D, 1990, user-oriented evaluation of information systems and services
Finkelstein C 1989, An introduction to information engineering: from strategic management to information systems
Sprague RH Information systems management in practice
Lavin MR, 1987, business information; how to find it, how to use it
Borovitis, J 1984, management of computer operations - prentice hall
Shelly & Cashman, 1990, computer concepts with microcomputer applications Arnston LJ 1989, ms/pc dos on the ibm pc - pws kent
Kroenke, DM 1986, database processing for microcomputers - sra
Koffman, EB, 1988, Problem solving and structured programming in Modula 2
Helman, P and Veroff, R 1988, Walls and Mirrors - Intermediate Problem Solving and Data Structures
Powers, MJ Cheney and Crow, 1990, Structured Systems Development
Bradley, JD, 1984, Assembly language Programming for the IBM Computer

Appendix L

List of Attributes Used in the Queensland and Australian Studies

1	With respect to the IS discipline possess coherent, extensive, theoretical and practical knowledge
2	With respect to the IS discipline be technologically competent (the person is able to use the current technology competently)
3	With respect to the IS discipline possess theoretical and practical knowledge in at least one reference discipline which include behavioral science, computer science, decision theory, information theory, organizational theory, management theory.
4	With respect to the IS discipline possess the theoretical and practical knowledge of related disciplines. For example, business, law, education, data communications, computer science or leisure recreation
5	Retrieve, evaluate and use relevant information
6	Define problems in a systematic way
7	Analyse, synthesise and evaluate the various solutions
8	Consider the quality of the solution and its timeliness
9	Demonstrate practical knowledge and understanding in at least one computer language
10	Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking.
11	Time management skills
12	Knowledge of how a business operates, is structured or is orientated
13	Understand the profit motive of business
14	Ability to reflect on own strengths and weaknesses
15	Confidence about their ability to learn independently
16	Self-motivation
17	Work independently
18	Value the ethics of the Information Technology profession
19	Sensitivity to differences in gender, culture and customs
20	Possess a sense of basic curiosity about technology
21	Work as part of a team in a productive and cooperative manner
22	Written communication skills
23	Oral communication skills
24	Research skills
25	Participate in on-going professional development
26	Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology
27	Interpersonal skills
28	Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment
29	Project Management Skills

Appendix M

Summary of Generic Attribute Coverage by Institution

	Attributes	ACS	ACS	IS'97	IS'97	Bond	Bond	IT20	IT20	IT21	IT21	RMIT	RMIT	SCU	SCU	ISCC99	ISCC99
1	IS knowledge	73	29.67%	157	19.05%	32	31.68%	82	27.33%	119	29.82%	68	31.78%	103	33.44%	58	21.97%
2	Technologically competent	27	10.98%	74	8.98%	25	24.75%	37	12.33%	56	14.04%	28	13.08%	25	8.12%	42	15.91%
3	Reference discipline knowledge	20	8.13%	27	3.28%	11	10.89%	31	10.33%	14	3.51%	16	7.48%	51	16.56%	0	0.00%
4	Related discipline knowledge	1	0.41%	22	2.67%	0	0.00%	8	2.67%	5	1.25%	0	0.00%	48	15.58%	7	2.65%
5	Retrieve, evaluate, use information	3	1.22%	4	0.49%	2	1.98%	26	8.67%	24	6.02%	9	4.21%	0	0.00%	11	4.17%
6	Define problems	7	2.85%	15	1.82%	1	0.99%	6	2.00%	9	2.26%	12	5.61%	1	0.32%	2	0.76%
7	Analyse and evaluate solutions	4	1.63%	19	2.31%	1	0.99%	21	7.00%	11	2.76%	9	4.21%	7	2.27%	18	6.82%
8	Quality of the solution	17	6.91%	14	1.70%	1	0.99%	17	5.67%	4	1.00%	15	7.01%	4	1.30%	18	6.82%
9	Programming language knowledge	12	4.88%	7	0.85%	5	4.95%	13	4.33%	32	8.02%	6	2.80%	15	4.87%	14	5.30%
10	Continued learning and intellectual development	1	0.41%	3	0.36%	1	0.99%	2	0.67%	9	2.26%	3	1.40%	3	0.97%	3	1.14%
11	Time management skills	7	2.85%	4	0.49%	0	0.00%	0	0.00%	1	0.25%	0	0.00%	0	0.00%	0	0.00%

	Attributes	ACS	ACS	IS'97	IS'97	Bond	Bond	IT20	IT20	IT21	IT21	RMIT	RMIT	SCU	SCU	ISCC99	ISCC99
12	Business operations, structured and orientation	4	1.63%	3	0.36%	2	1.98%	11	3.67%	2	0.50%	4	1.87%	5	1.62%	1	0.38%
13	Profit motive of business	1	0.41%	3	0.36%	0	0.00%	2	0.67%	1	0.25%	0	0.00%	1	0.32%	0	0.00%
14	Reflect on own strengths and weaknesses	0	0.00%	3	0.36%	0	0.00%	1	0.33%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
15	Ability to learn independently	0	0.00%	2	0.24%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
16	Self-motivation	0	0.00%	1	0.12%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	1	0.38%
17	Work independently	0	0.00%	9	1.09%	0	0.00%	0	0.00%	1	0.25%	0	0.00%	1	0.32%	1	0.38%
18	Ethics	6	2.44%	17	2.06%	2	1.98%	2	0.67%	2	0.50%	2	0.93%	1	0.32%	12	4.55%
19	Sensitivity to gender, culture and customs	2	0.81%	4	0.49%	2	1.98%	3	1.00%	2	0.50%	1	0.47%	2	0.65%	1	0.38%
20	Curiosity about technology	1	0.41%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	2	0.93%	0	0.00%	0	0.00%
21	Work as part of a team	7	2.85%	16	1.94%	1	0.99%	5	1.67%	12	3.01%	11	5.14%	7	2.27%	16	6.06%
22	Written communication skills	12	4.88%	194	23.54%	9	8.91%	12	4.00%	61	15.29%	10	4.67%	20	6.49%	30	11.36%
23	Oral communication skills	6	2.44%	187	22.69%	4	3.96%	5	1.67%	23	5.76%	7	3.27%	6	1.95%	15	5.68%
24	Research skills	1	0.41%	2	0.24%	0	0.00%	4	1.33%	2	0.50%	0	0.00%	0	0.00%	1	0.38%
25	Professional development	2	0.81%	1	0.12%	0	0.00%	1	0.33%	0	0.00%	0	0.00%	0	0.00%	9	3.41%

	Attributes	ACS	ACS	IS'97	IS'97	Bond	Bond	IT20	IT20	IT21	IT21	RMIT	RMIT	SCU	SCU	ISCC99	ISCC99
26	Embrace change	1	0.41%	4	0.49%	0	0.00%	2	0.67%	1	0.25%	2	0.93%	1	0.32%	1	0.38%
27	Interpersonal skills	7	2.85%	8	0.97%	0	0.00%	5	1.67%	1	0.25%	3	1.40%	2	0.65%	0	0.00%
28	Operate in diverse environments	2	0.81%	4	0.49%	1	0.99%	4	1.33%	3	0.75%	1	0.47%	2	0.65%	1	0.38%
29	Project management skills	22	8.94%	20	2.43%	1	0.99%	0	0.00%	4	1.00%	5	2.34%	3	0.97%	2	0.76%
	Totals	246		824		101		300		399		214		308		264	

Appendix N

Coverage of the Generic Attributes from Southern Cross University, Bond University and Royal Melbourne Institute of Technology

N.1 Southern Cross University

The mapping of the generic attributes against the BIT offered at Southern Cross University (SCU) is shown in Figure N.1 - Figure N.3. The course of study examined at SCU was written with 308 objectives. This is a similar number for the IT20 course of study at QUT written at a similar time in the early to mid 1990's. This course of study has the largest number of objectives for its course of all the business school IS courses of study.

From the graphs in Figures N.1 – N.3 it should be noted that the course of study at SCU gives a strong treatment to the attribute of ***IS knowledge*** with 33 percent of the objectives relating to this attribute. Significant in the data displayed on the graph is the representation of the attributes of ***reference discipline knowledge*** and ***related disciplines knowledge.*** These attributes received coverage by the objectives of 17 percent and 16 percent respectively. This indicates a strong orientation of the course of study towards the business environment. It also indicates that the course of study requires a student to identify where the IS discipline sits within the broader framework of education. This meets the expectation that an IS course of study in a business school will have a strong business orientation. Also from this it should be noted that the student receives a general education by the inclusion of subjects in the degree course that are not discipline specific to the major being studied.

From the data shown in Figure N.2 it should be noted that only six of the attributes receive coverage of more than 10 objectives. In addition to the three attributes mentioned above the attributes to receive coverage greater than 10 times include:

- Technical competence;
- Written communications skills; and,
- Programming language knowledge.

Significant is the number of attributes that received only minimal treatment. These are listed below:

- Define problems in a systematic way;
- Consider the quality of the solution and its timeliness;
- Be able to participate in continued learning and intellectual development and develop critical, reflective and creative thinking;
- Understand the profit motive of business;
- Work independently;
- Value the ethics of the Information Technology profession;
- Sensitivity to differences in gender, culture and customs;
- Embrace change and be obliged to engage in incremental improvement to keep up with the rapid change in technology;
- Interpersonal skills;
- Adapt to unfamiliar cultures and operate in a socially and culturally diverse environment; and,
- Project management skills.

From the above list of attributes that receive only minimalist coverage it is surprising to see the inclusion of ***define problems in a systematic way*** as most academics would expect students who successfully complete an undergraduate degree to be able to define problems. At some point during the course of study students would be expected to define a problem and then produce a solution.

The list of minimalist coverage of the attributes includes many of the attributes considered important to get along with other people in the workplace. These include the attributes of ***interpersonal skills*** and ***sensitivity to gender, culture and customs*** as well as being able to ***operate in a diverse environment***.

Significant is the relatively large number of attributes that receive no coverage within the course of study objectives. These are listed below:

- Retrieve, evaluate and use relevant information;

- Time management skills;
- Ability to reflect on own strengths and weaknesses;
- Confidence about their ability to learn independently;
- Self-motivation;
- Possess a sense of basic curiosity about technology;
- Research skills; and,
- Participate in on-going professional development.

One of the most interesting results from the above list is the lack of coverage of the attribute of research skills. Most academics would expect that all students develop research skills during the course of the studies. This exclusion may be an oversight on the part of the unit objective writers rather than an intentional omission from the course of study.

From the data presented in Figure N.3 it should be noted that four of the attributes including IS discipline knowledge, technical competence, reference discipline knowledge and related discipline knowledge account for 74 percent of the generic attribute coverage within the course of study at SCU. The remaining 25 attributes receive only 26 percent coverage in total, which averages out to one percent per attribute.

The implication from the data in Figure N.3 is that the writers of the unit objectives need to be more explicit in how they express the competencies that students will develop or learn within a specific unit.

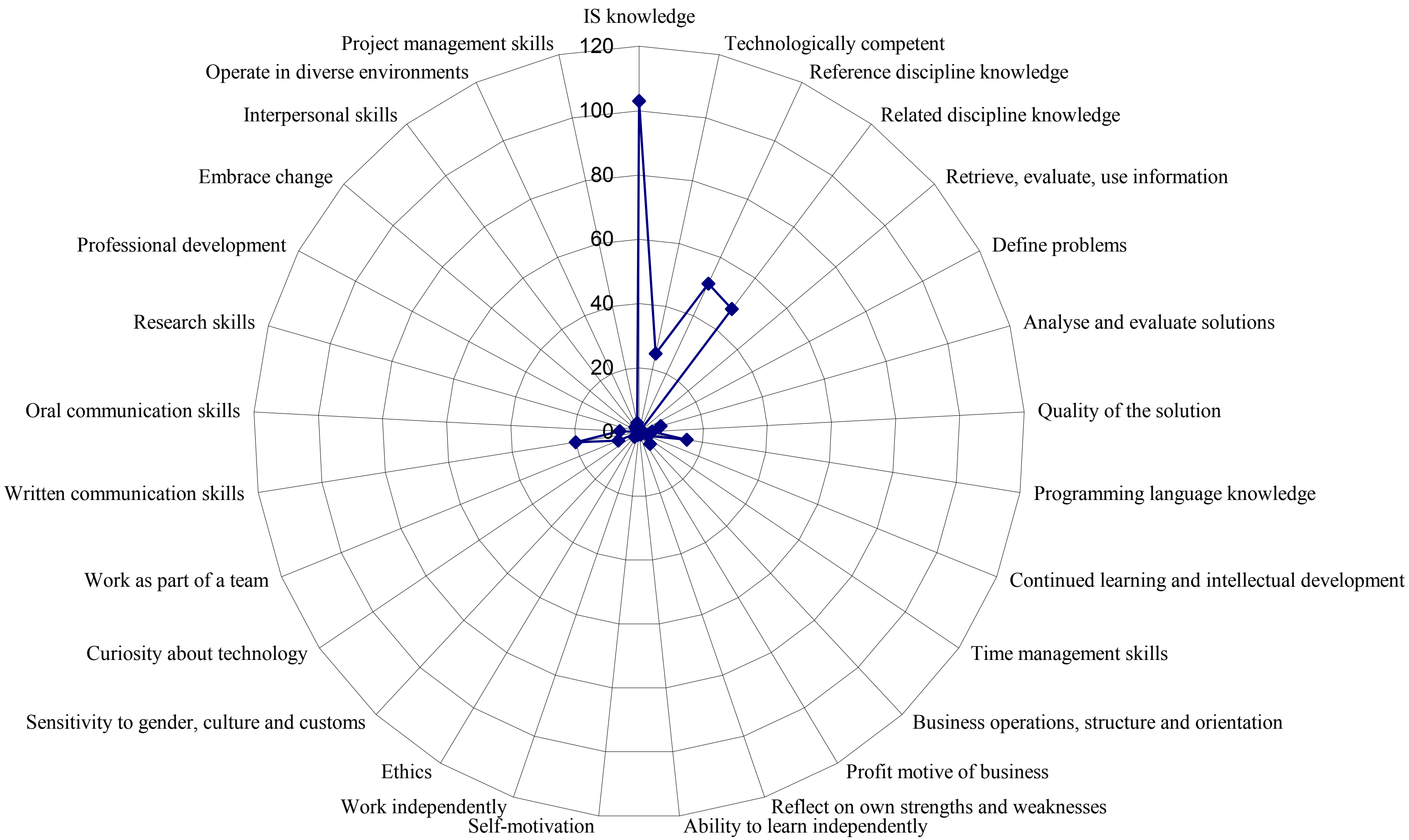


Figure N.1
Southern Cross University's Bachelor of Information Technology – Raw Data

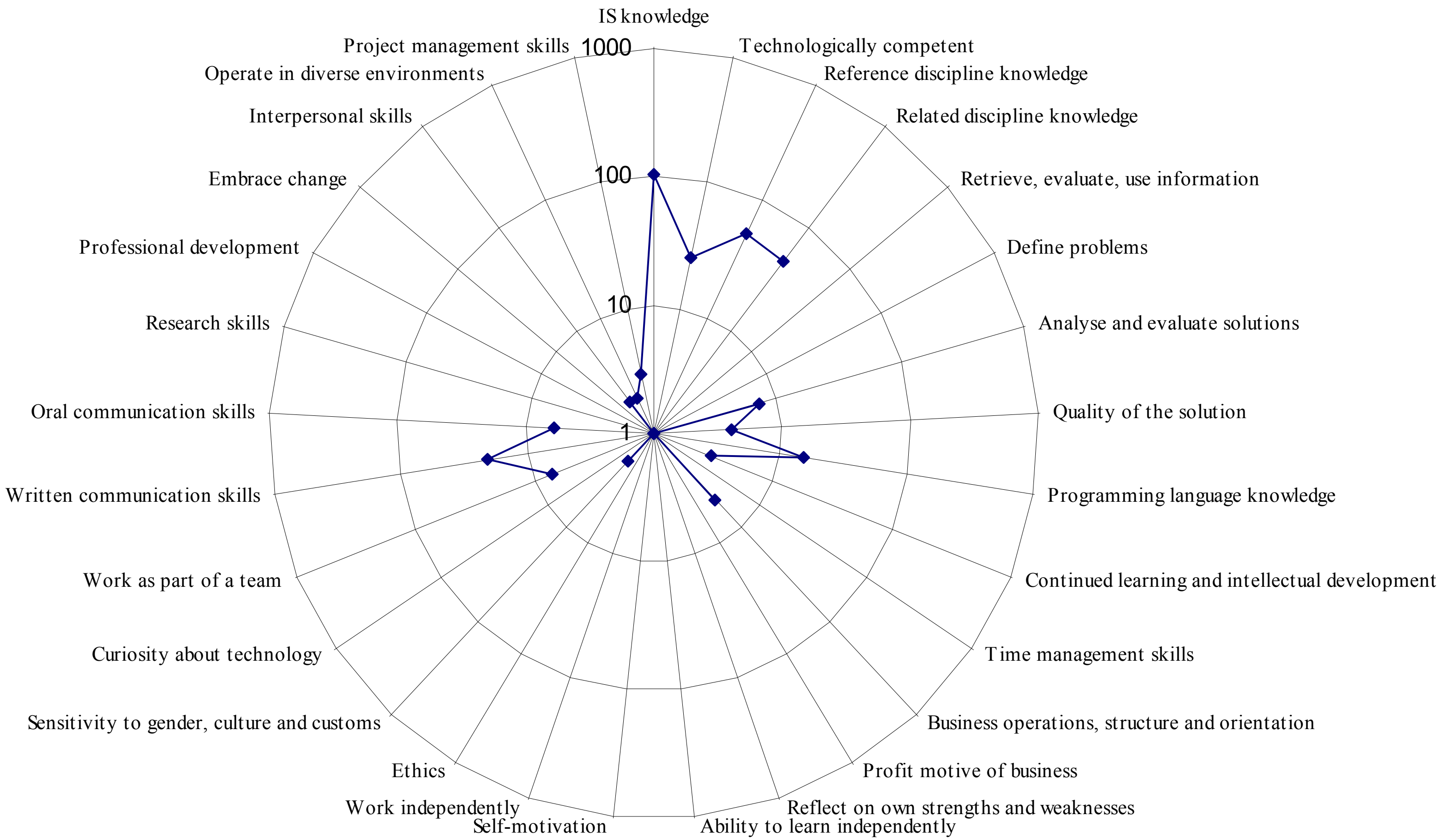


Figure N.2
Southern Cross University's Bachelor of Information Technology – Logarithmic Scale

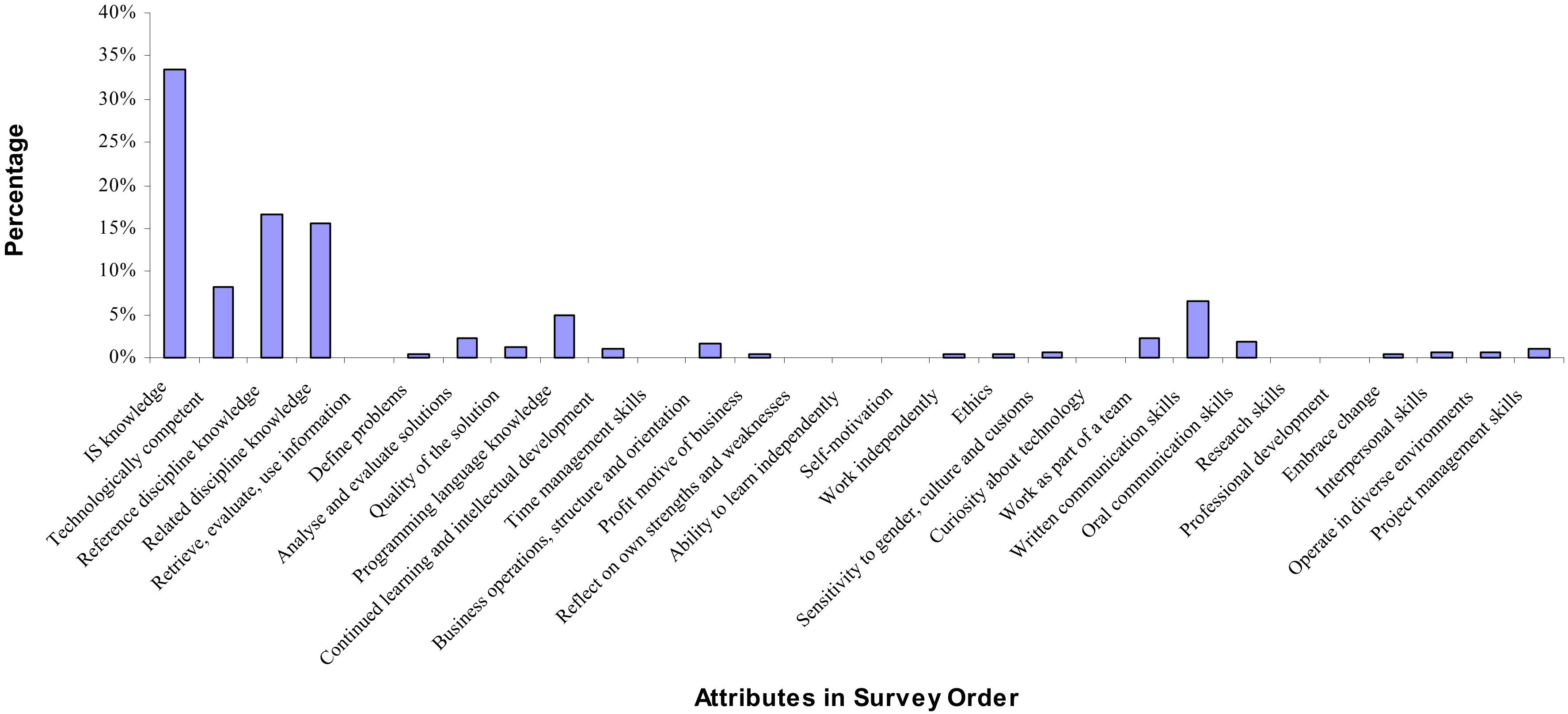


Figure N.3

Southern Cross University's Bachelor of Information Technology –Column Graph

A comparison of the SCU course of study with the ACS Core Body of Knowledge, IS’97 and ISCC’99 is shown in Figure N.4. As can be seen from the graph the general pattern of the coverage of the generic attributes is similar to the ACS Core Body of Knowledge, IS’97 and ISCC’99. It should be noted from the graph that the majority of the objectives fall above the minimum ACS Core Body of Knowledge level and below the maximum ideal level of the curriculum documents IS'97 and ISCC'99.

There are only three objectives that give coverage greater than 15 percent. These are IS knowledge, reference discipline knowledge and related discipline knowledge. The only other attribute to rank above five percent is ***written communications skills*** (6 percent).

All the other attributes receive only minimal coverage within the SCU course of study. The implication of this minimalist treatment is that the course unit objective writers need to be more explicit in stating the learning outcomes of the unit in terms of the generic attributes that the graduates are expected to possess at the end of their experience in the course of study.

A normalized version of the graph in Figure N.4 is shown in Figure N.5. This graph clearly demonstrates that educational courses as stated in their unit objectives do not meet the IS industry needs as identified in the generic attributes of entry-level employees.

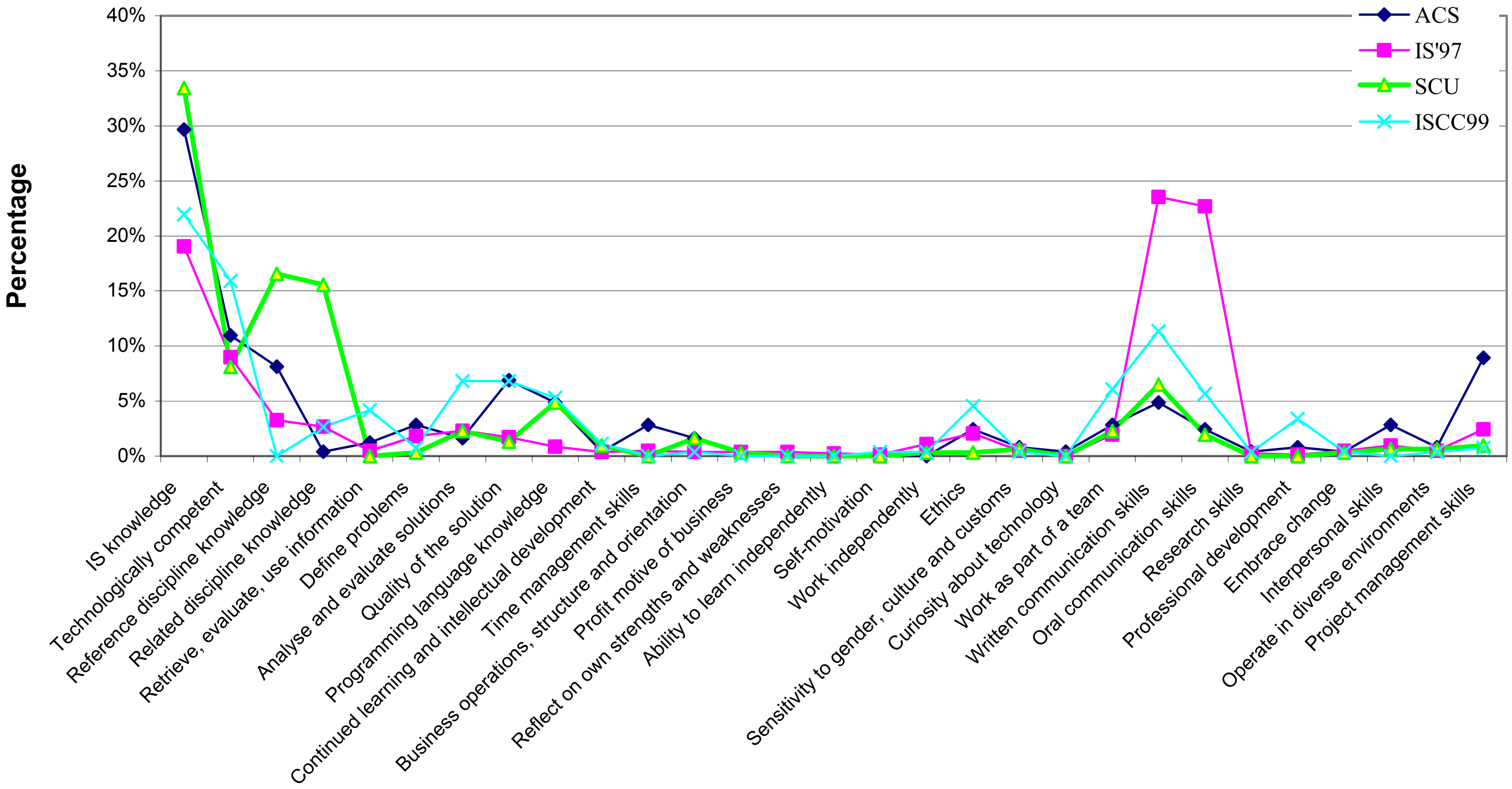


Figure N.4

Southern Cross University: ACS Core Body of Knowledge: IS’97: ISCC’99

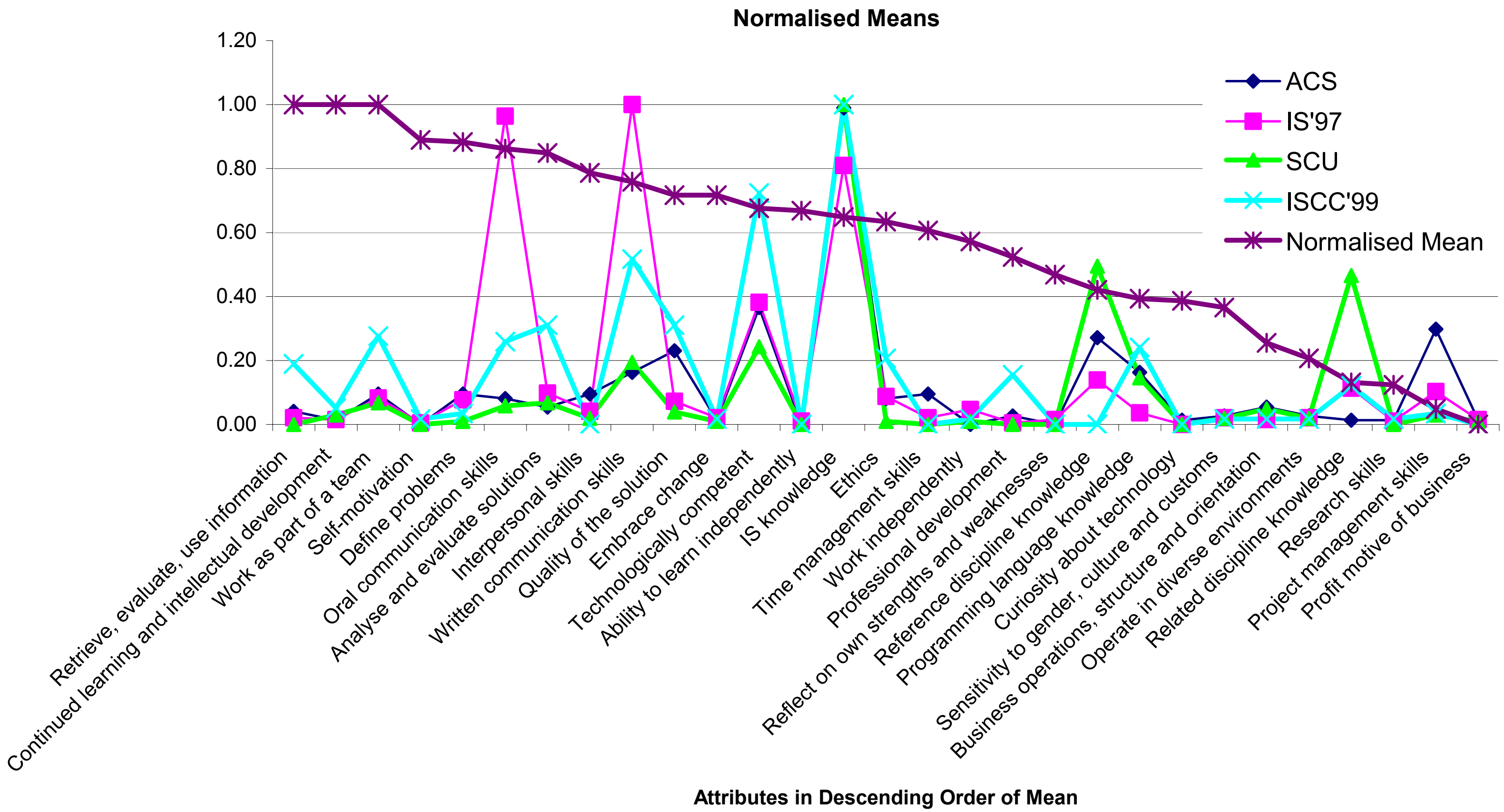


Figure N.5

Southern Cross University: ACS Core Body of Knowledge: IS'97: ISCC'99 – Normalized Data

N.2 Bachelor of Information Technology - Bond University

The data showing the treatment of the generic attributes at Bond University is shown in Figures N.6 through Figure N.8. The course of study at Bond University is slightly different to the other business school courses of study examined in this study in that it is designed to be completed over a period of two calendar years with classes being offered 48 weeks of the year. The curriculum documents examined contained only 101 generic attribute objectives for the course of study. This is significantly lower than the number of objectives in most of the other courses of study at universities in Australia. Therefore, care must be taken in interpreting the data.

The data presented in Figures N.6 and N.7 gives a clear picture that the focus of the course of study at Bond University is very limited. The treatment of the content of IS as relates to the attribute ***with respect to the IS discipline possess coherent, extensive, theoretical and practical knowledge*** is 32 percent. Only five other attributes receive a treatment of greater than four percent are:

- Technical competence 25 percent;
- Reference discipline knowledge - 11 percent;
- Programming language knowledge -5 percent;
- Written communication skills - 9 percent; and,
- Oral communications skills- 4 percent.

The treatment of ***written communications skills*** is consistent with that of other IS courses of study in that it is given a higher degree of importance in terms of the number of objectives that relate to written communications than some of the more general attributes. An important finding is the relatively high ranking of technical competence. At Bond university it is the second highest ranked attribute.

Significant also is the number of attributes that did not receive any coverage. These are:

- Time management skills;
- Profit motive of business;
- Reflect on own strengths and weaknesses;

- Ability to learn independently;
- Self-motivation;
- Work independently;
- Curiosity about technology;
- Research skills;
- Professional development;
- Embrace change; and,
- Interpersonal skills.

The coverage of the attributes as delivered in the course of study at Bond university is compared to the major curriculum models and the ACS Core Body of Knowledge in Figure N.9. It should be noted that Bond University's treatment of the IS content attribute is higher than the maximum in the idealistic curriculum models and the ACS Core Body of Knowledge. The coverage of the attribute of ***technical competence*** is significantly higher than the curriculum documents and the reference discipline knowledge attribute is slightly higher than the curriculum documents.

In general the other attributes fall into the expected pattern of being above the ACS Core Body of Knowledge and below the IS'97 and ISCC'99 coverage of the attributes.

From the data shown in Figure N.8 it should be noted that three of the attributes account for 76 percent of the coverage by the objectives of the course of study. These are IS discipline knowledge, technical competence and reference discipline knowledge. The only other attribute to receive a significant coverage is written communications skills at nine percent.

A normalized version of the graph in Figure N.9 is shown in Figure N.10. This graph clearly demonstrates that educational courses as stated in their unit objectives do not meet the IS industry needs as identified in the generic attributes of entry-level employees.

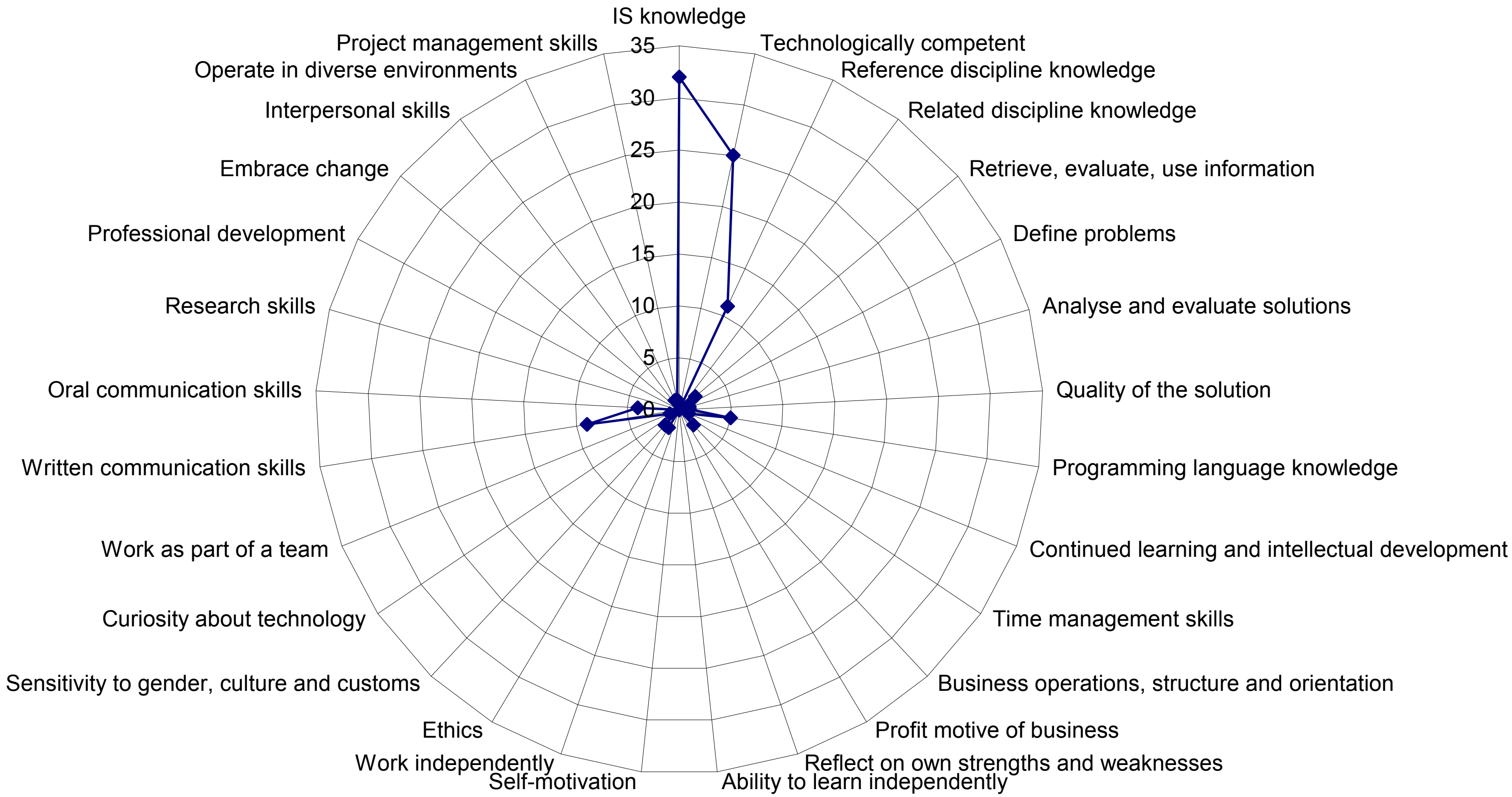


Figure N.6

Bond University Bachelor of Information Technology – Raw Data

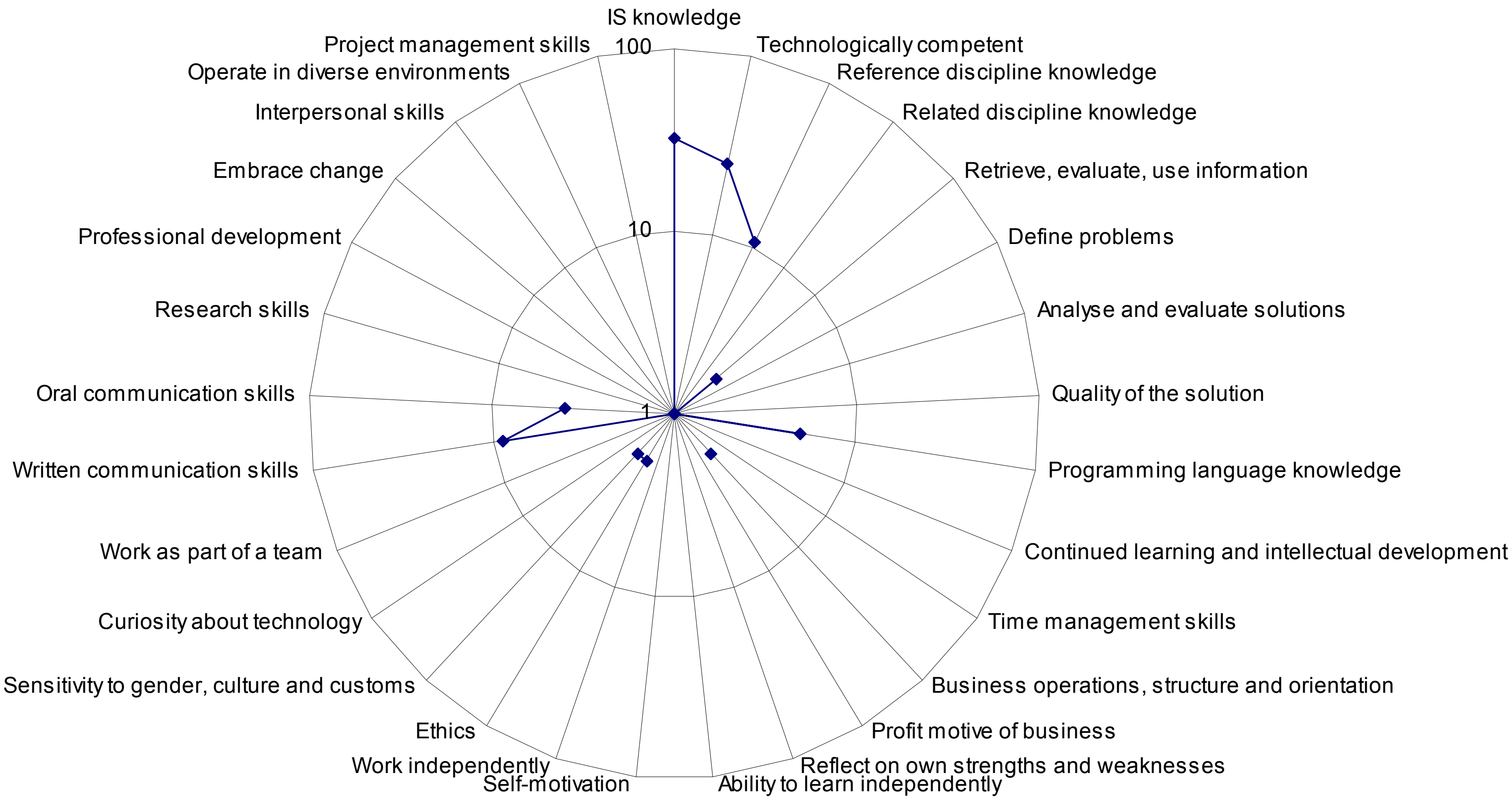


Figure N.7

Bond University Bachelor of Information Technology – Logarithmic Scale

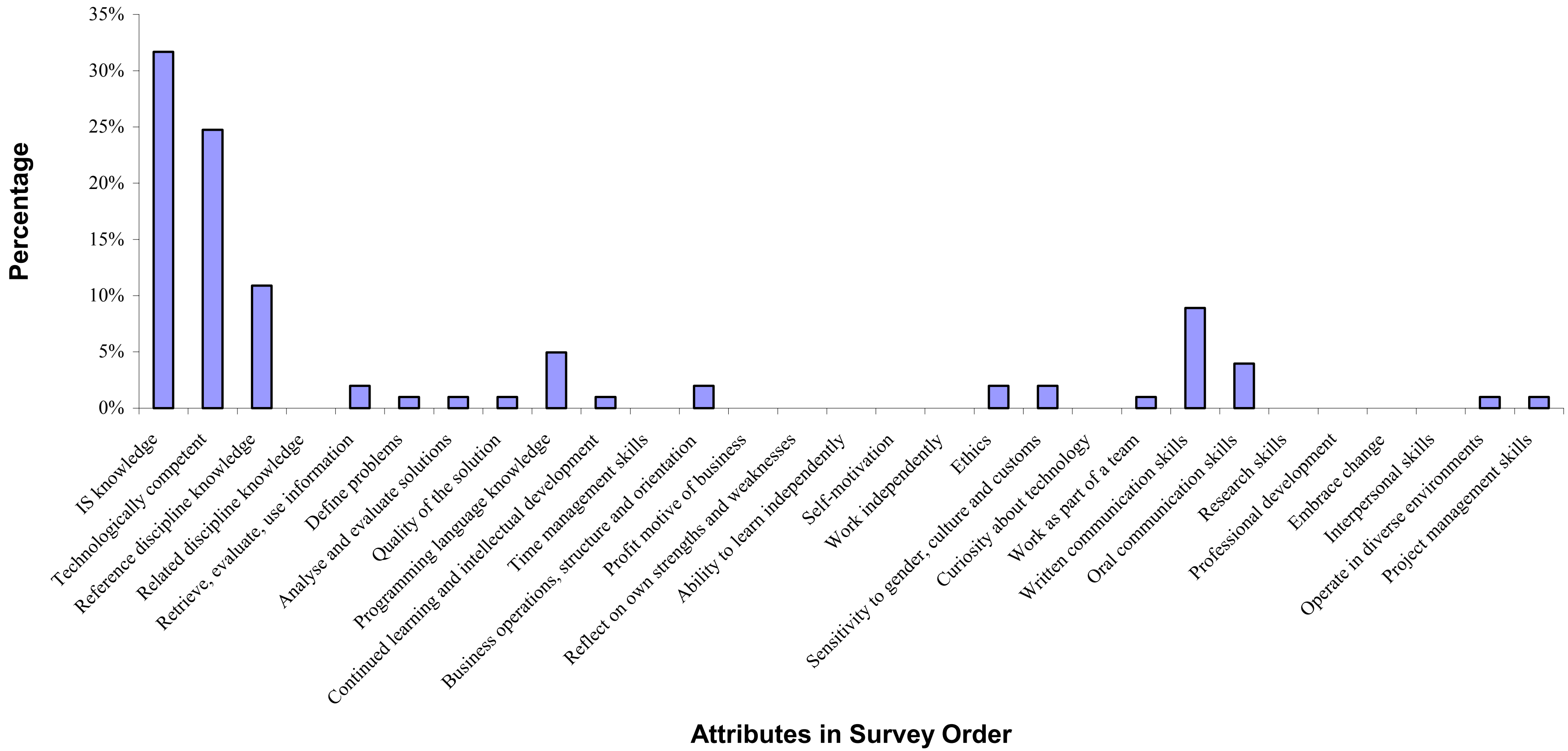


Figure N.8
Bond University Bachelor of Information Technology - Column Graph

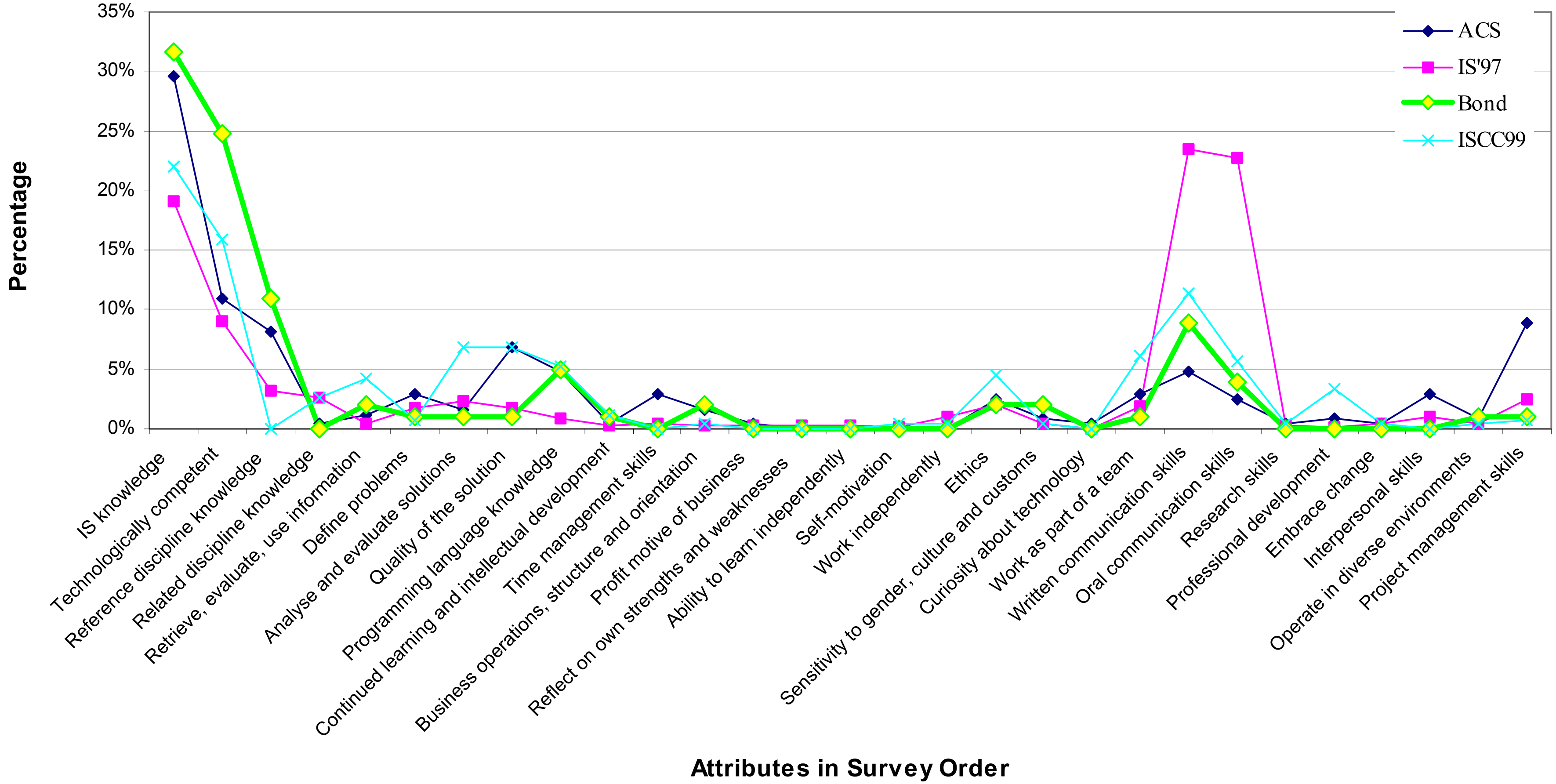


Figure N.9

Bond University Bachelor of Information Technology: ACS Core Body of Knowledge: IS'97: ISCC'99

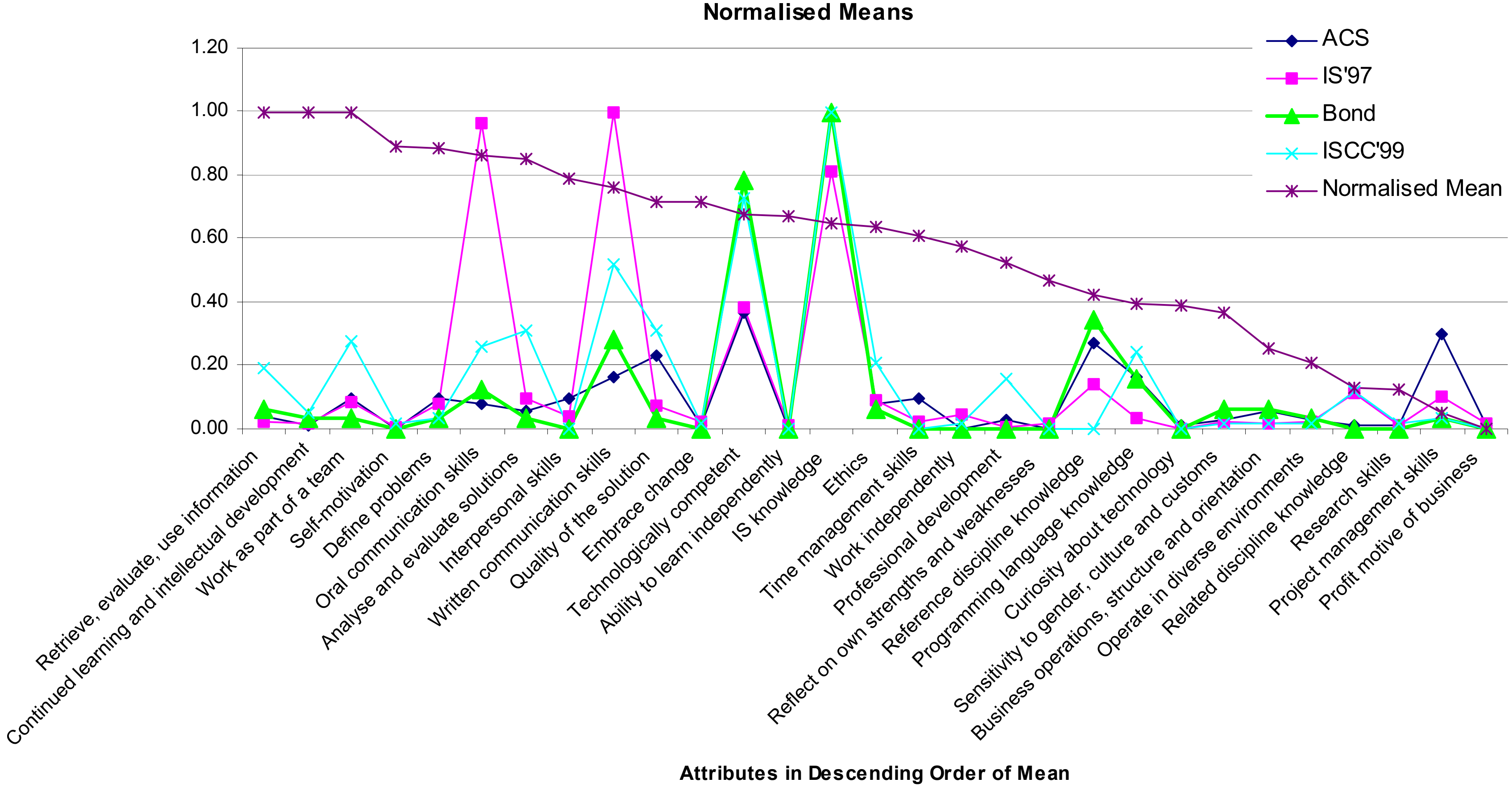


Figure N.10

Normalised Data

Bond University Bachelor of Information Technology: ACS Core Body of Knowledge: IS’97: ISCC’99

N.3 Bachelor of Information technology - Royal Melbourne Institute of Technology (RMIT)

The data for the coverage of the attributes at RMIT is displayed in the graphs in Figures N.11 through N.14. The IS course of study at RMIT has 214 objectives within the units offered in the degree course. As with the other courses of study the attribute of IS discipline knowledge receives the greatest treatment.

The attribute of technical competence receives second most treatment to the other attributes. The attributes that are mentioned more than ten times in the objectives are reference discipline knowledge, define problems, quality of the solution, working as part of team and written communications.

The attributes that receive only minimal treatment at RMIT are:

- Interpersonal skills;
- Oral communications;
- Embracing change;
- Continued learning and intellectual development;
- Business operations, structured and orientation;
- Ethics;
- Sensitivity to gender, culture and customs;
- Curiosity about technology;
- Embrace change;
- Interpersonal skills;
- Operate in diverse environments; and,
- Project management skills.

The attributes of retrieve evaluate and use information and programming language knowledge receive only slightly above the minimal level of the abovementioned attributes.

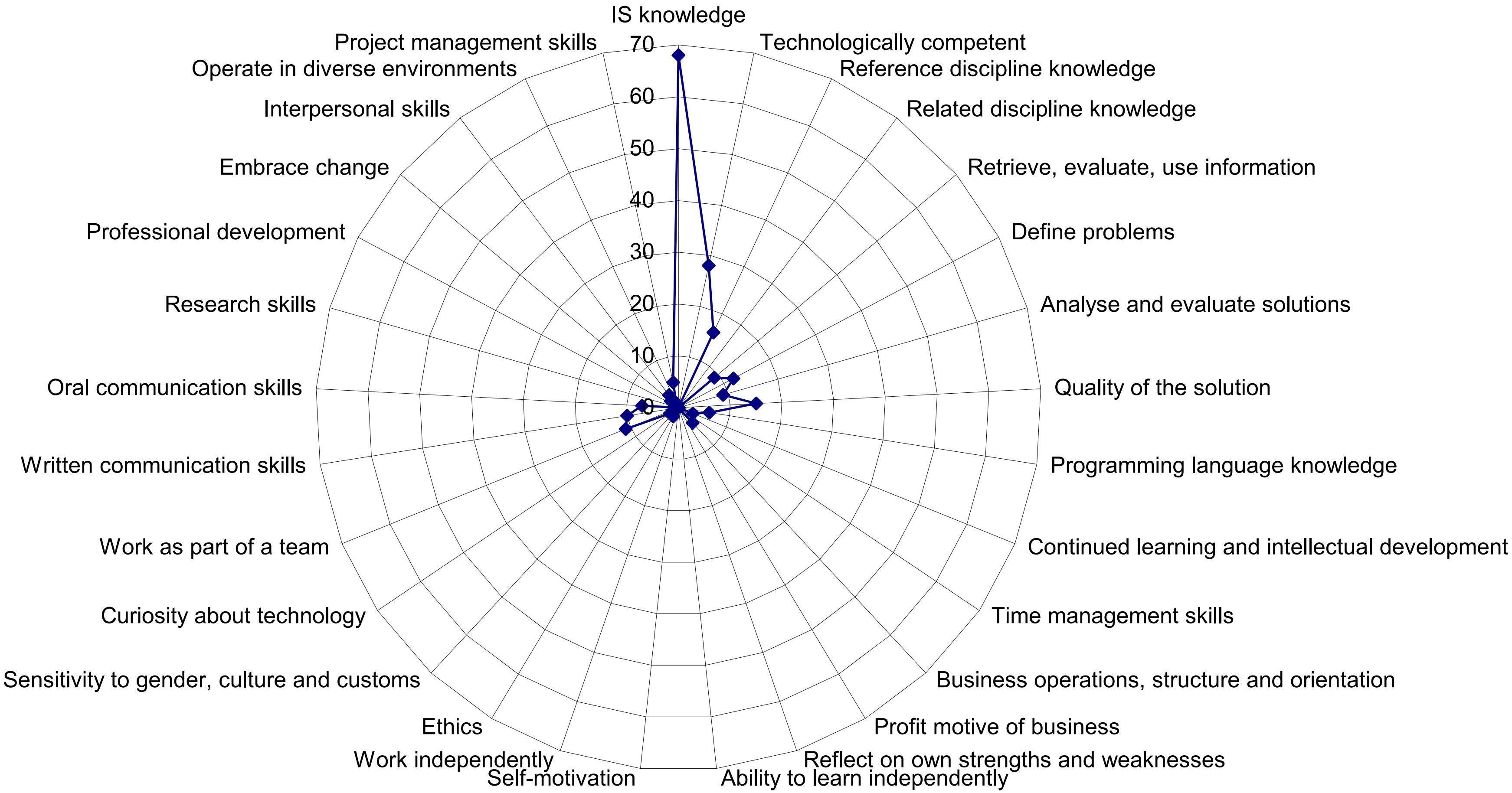


Figure N.11

Royal Melbourne Institute of Technology (RMIT) - Raw Data

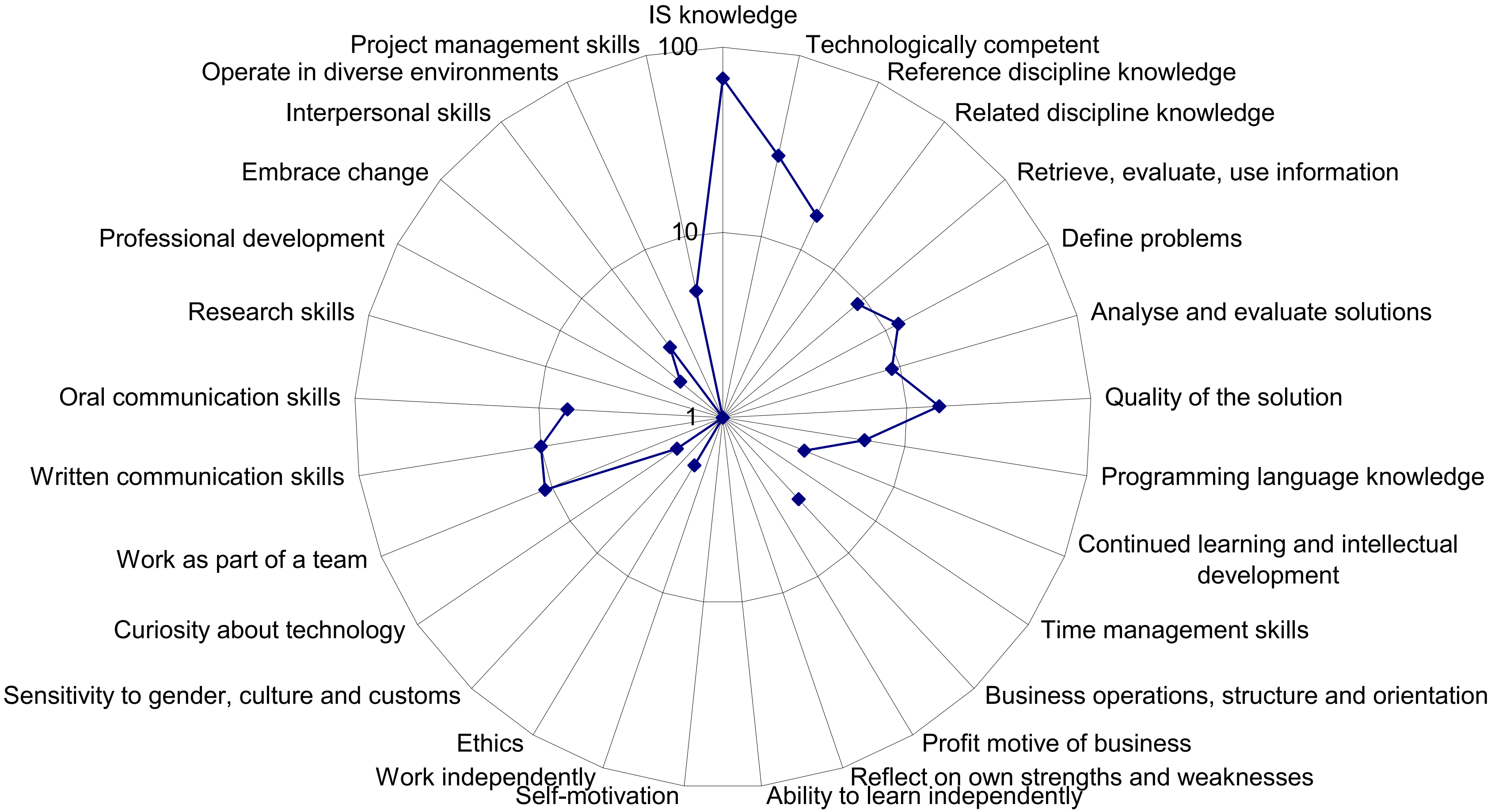


Figure N.12

Royal Melbourne Institute of Technology (RMIT) - Logarithmic Scale

Attributes that receive no mention in the objectives of the units that form the course of study at RMIT are:

- Related discipline knowledge;
- Time management skills;
- Profit motive of business;
- Reflect on own strengths and weaknesses;
- Ability to learn independently;
- Self-motivation;
- Work independently;
- Research skills; and,
- Professional development.

One possible explanation of the large number of attributes that receive no treatment may be the perception by the unit writers that they do not need to specify in detail the attributes to be developed within the unit. It is also surprising to see the omission of research skills and the ability to learn independently from the course of study. It is a general expectation that the student in a tertiary course of study will have to develop research skills and be independent in their learning.

From the graph in Figure N.13 it should be noted that three of the attributes (IS discipline knowledge, technical competence and reference discipline knowledge) account for 52 percent of the objectives. Other attributes that stand out as receiving some treatment include ***retrieve evaluate and use information, define problems, analyse and evaluate solutions, quality of the solution, written communications skills*** and ***oral communications skills***.

The comparison of the RMIT IS course of study with the ACS Core Body of Knowledge, IS'97 and ISCC'99 is shown in Figure N.14. From the data shown in the graph the RMIT course of study follows a very similar pattern to the other curriculum documents in terms of their coverage of the generic attributes.

Only two attributes stand out as receiving significantly different coverage than the ACS Core Body of Knowledge or the curriculum documents. ***Define problems*** which receives more coverage than in any of the three other documents displayed. The other attribute to show a marked difference is ***project management*** which receives the same coverage as IS’97 but significantly less than the ACS Core Body of Knowledge.

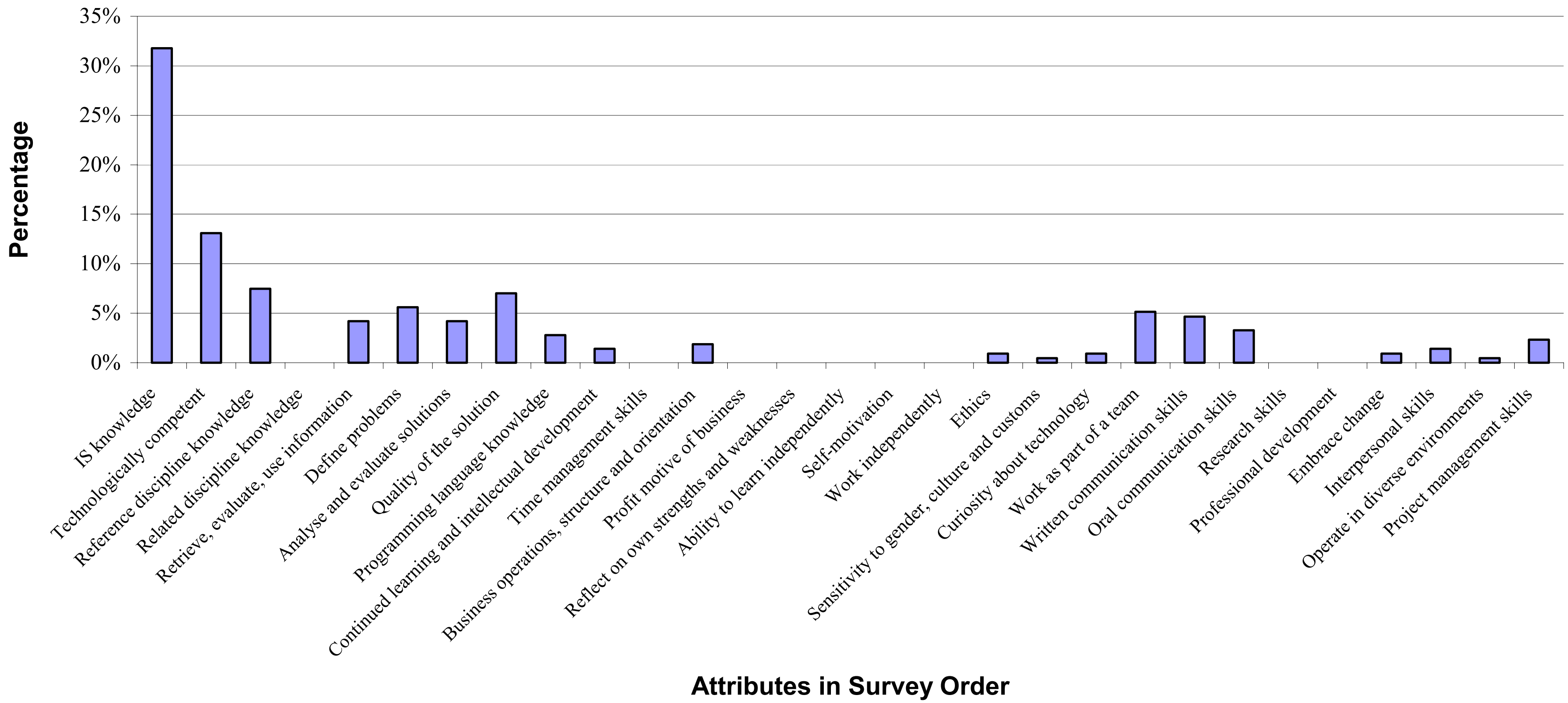
In contrast to the course of study at Bond University there are a number of attributes that receive a good deal of coverage. These attributes include ***working as part of a team, defining problems, written communications skills, quality of the solution, technical competence***, and ***reference discipline knowledge***. It is interesting to note the importance placed on teamwork being ranked above written communications skills. RMIT is the only institution to place a very high emphasis on the treatment of teamwork in the objectives of the units within the course of study.

When the coverage of the attributes at RMIT is compared with the curriculum documents and the ACS Core Body of Knowledge it is noted that as with the other courses of study the content of IS is given a higher treatment than the curriculum documents and the ACS Core Body of Knowledge. Most of the other attributes show a similar treatment to the other institutions examined in this study in that they fall above the ACS Core Body of Knowledge and below the IS'97 and ISCC'99 model curriculum documents. Exceptions to this are the attributes of ***related discipline knowledge, ethics, written communications skills, research skills,*** and ***professional development.*** These attributes all fall below the minimum treatment recommended by the ACS. RMIT rated the following attributes higher than either the curriculum models or the ACS core body of knowledge:

- Define problems; and,
- Business operations, structure and orientation.

Project management is covered in a similar depth to that recommended by the IS’97 model curricula but significantly lower than that recommended by the ACS.

A normalized version of the graph in Figure N.14 is shown in Figure N.15. This graph clearly demonstrates that educational courses as stated in their unit objectives do not meet the IS industry needs as identified in the generic attributes of entry-level employees.



N.23

Figure N.13

Royal Melbourne Institute of Technology (RMIT) - Column Graph

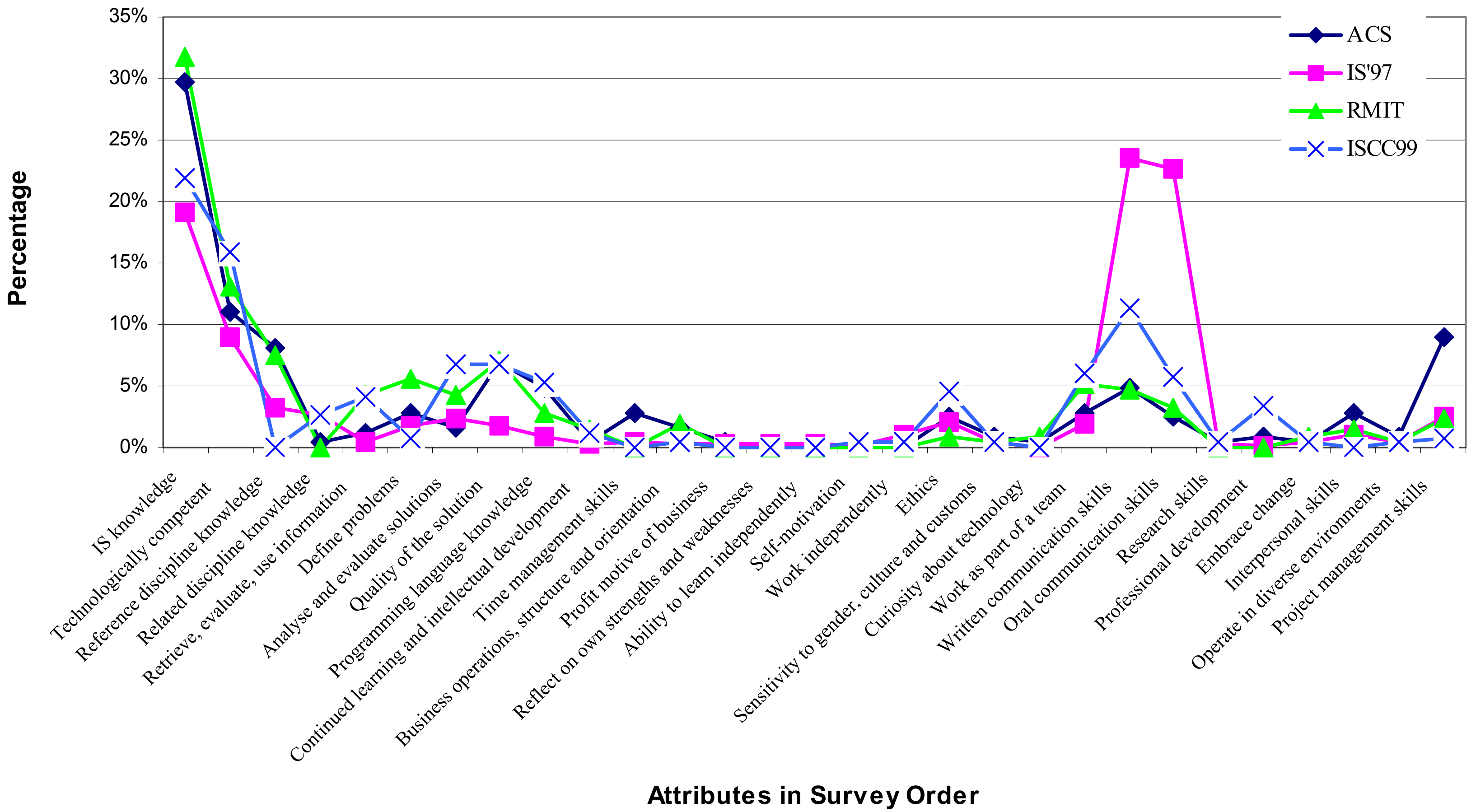


Figure N.14

Royal Melbourne Institute of Technology (RMIT): ACS Core Body of Knowledge: IS’97: ISCC’99

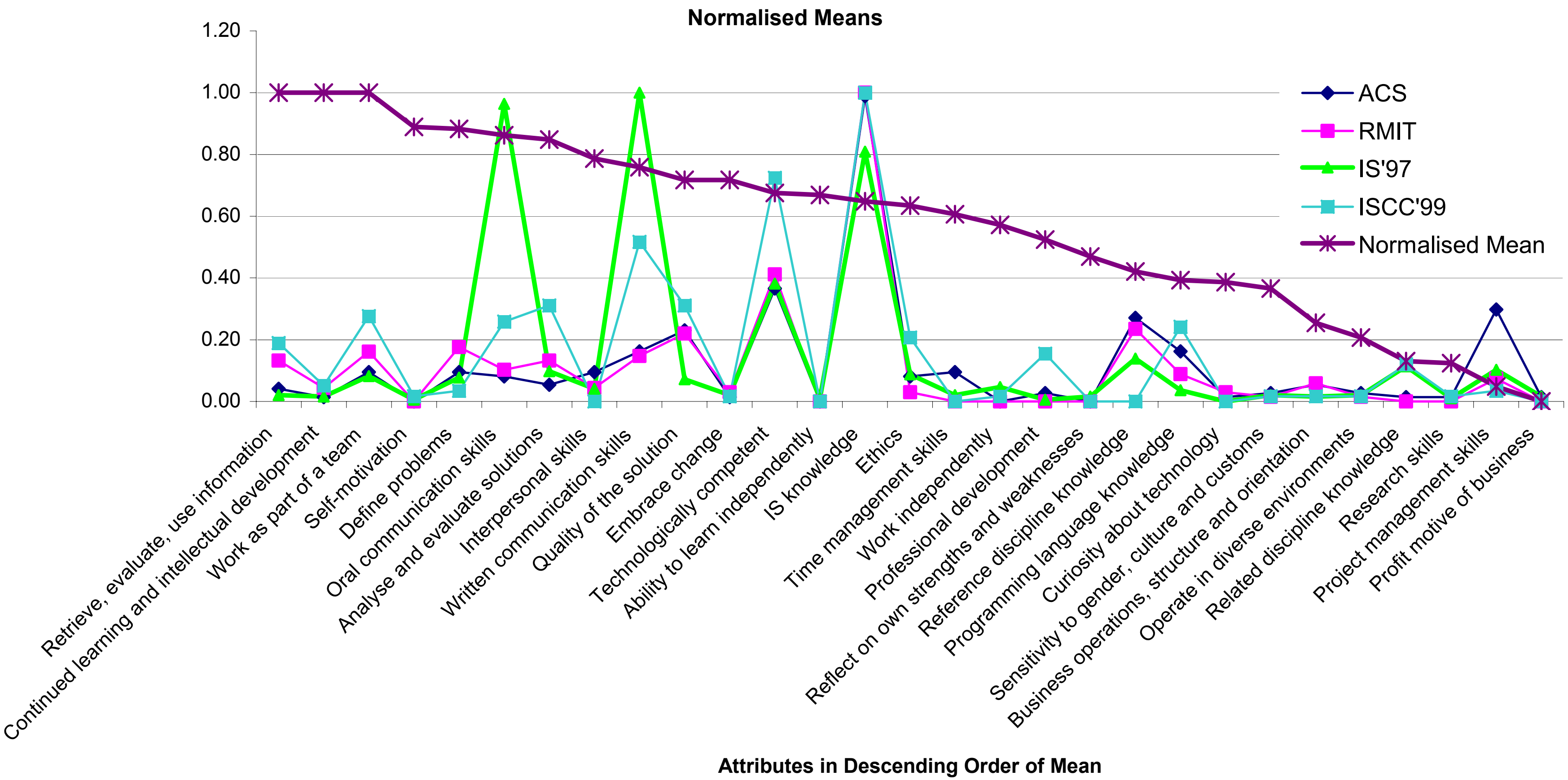


Figure N.15

Royal Melbourne Institute of Technology (RMIT): ACS Core Body of Knowledge: IS’97: ISCC’99Normalized Data

A comparison graph of the three business schools IS courses of study and QUT's IT21 course of study is shown in Figure N.16. All of the courses of study follow a similar pattern in their treatment of the generic attributes.

There is a general pattern of high treatment of the content of the IS discipline with a smaller peak at the attribute of written communications skills. Most the other attributes are treated with the similar small percentage across all four courses of study.

The only university to show a significant difference in the treatment of the attributes is SCU which places less emphasis on technical competence than either RMIT, QUT or Bond university. SCU also places significantly more emphasis on the reference and related disciplines than the other universities used in this study.

RMIT places a higher emphasis on the attributes of ***define problems, analyse and evaluate solutions*** and ***the quality of a solution*** than SCU, QUT and Bond university. RMIT places only slightly more emphasis on the attribute of ***project management*** than the other universities in this study.

Bond University places significantly higher emphasis on the technical competence of a person than the other universities. QUT places the most emphasis on ***written communications skills*** of the four institutions examined by more than six percent. It should also be noted that all four institutions gave a large number of the attributes little or no coverage within their courses of study.

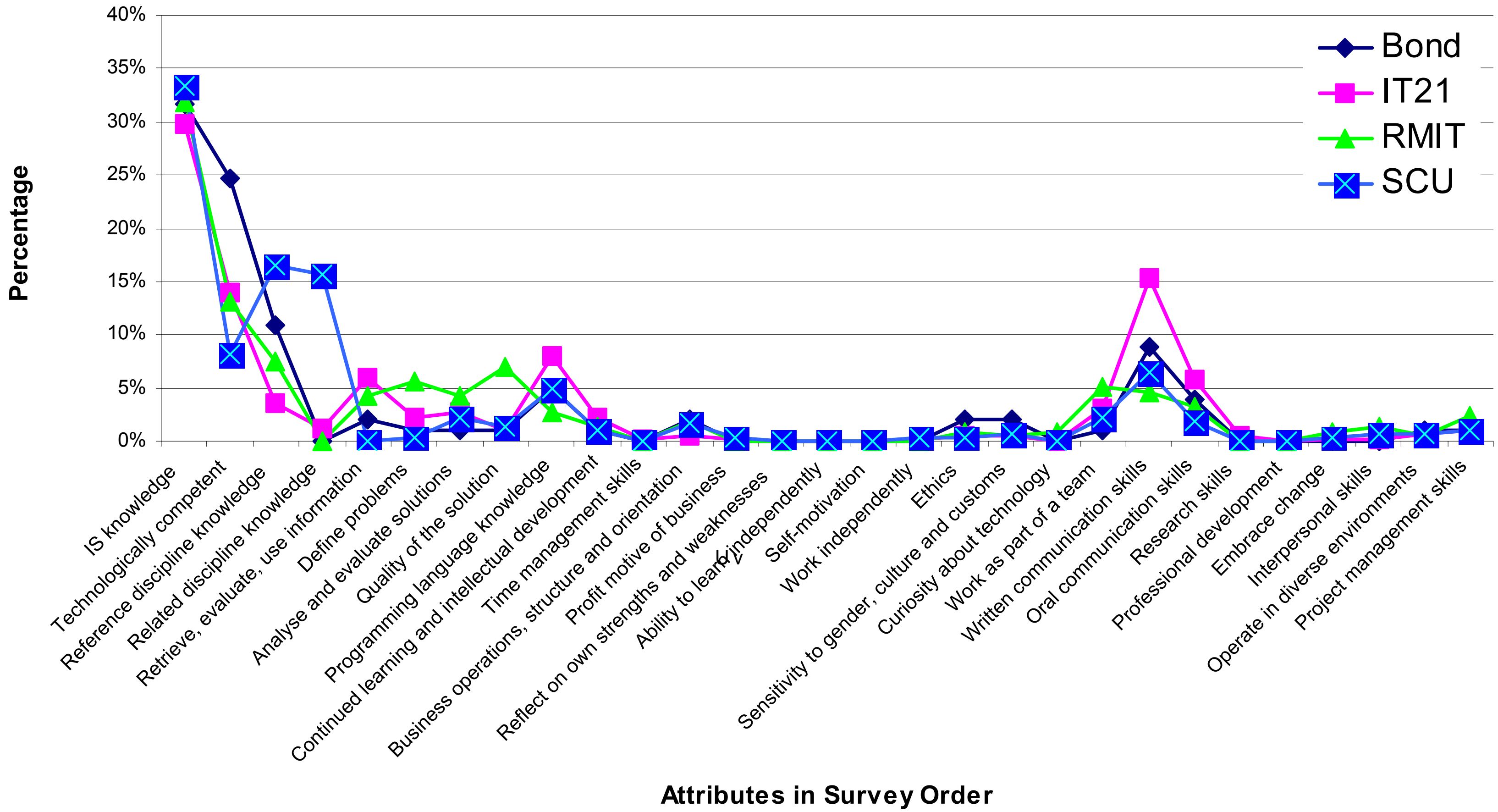


Figure N.16

Bond University: Southern Cross University: Royal Melbourne Institute of Technology: QUT's IT21

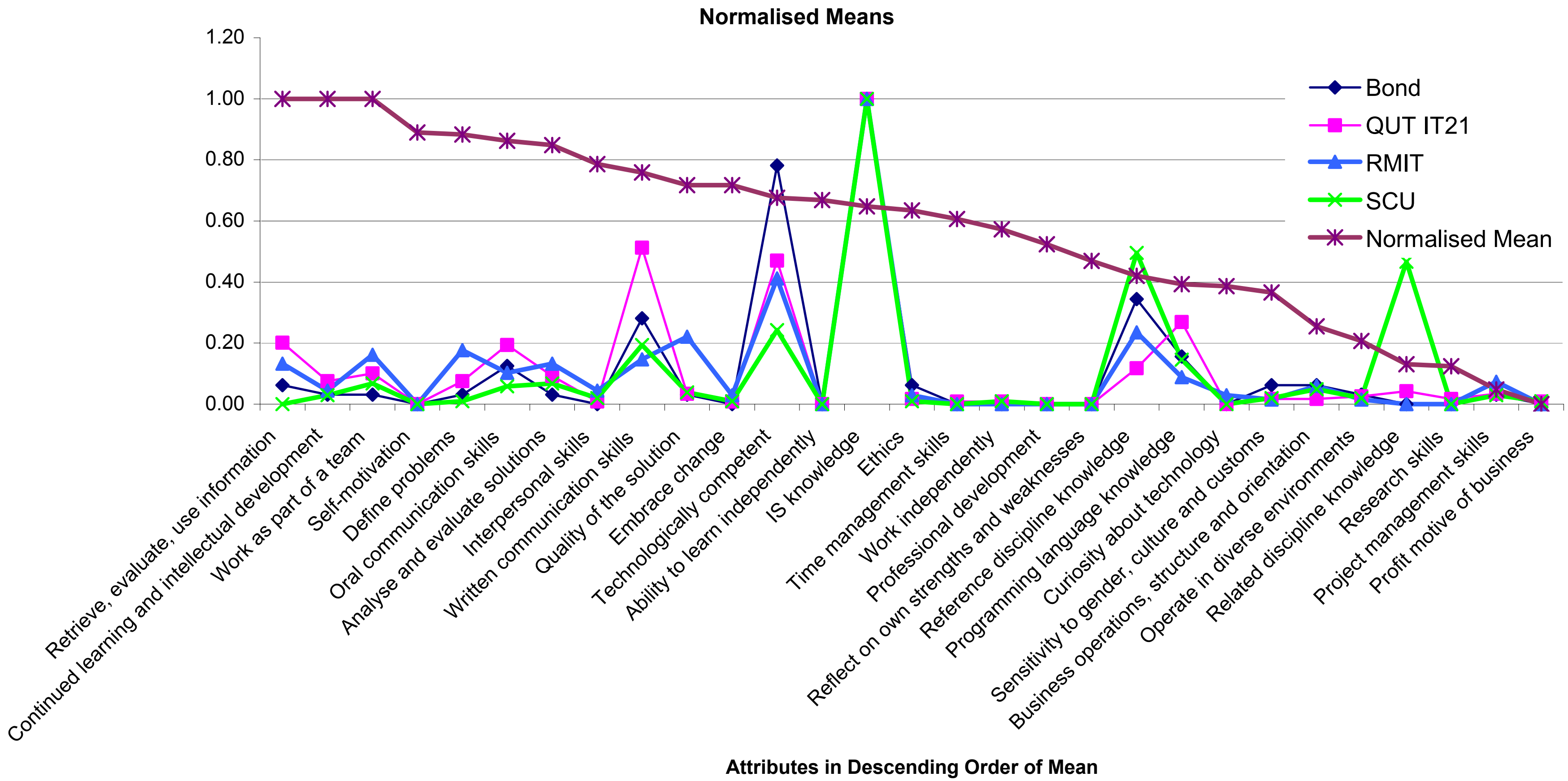


Figure N.17

Normalised Data

Bond University: Southern Cross University: Royal Melbourne Institute of Technology: QUT's IT21