IS SKILLS FOR IT PROFESSIONALS IN MALAYSIA

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Abstract

This study was undertaken to compile data about the IS skills for the IT professionals in Malaysia and also to describe what type of skills that the IT professionals in Malaysia should have for their career advancement. This study discusses about the important skills for certain specific post and the changes that must be done in Computer Science and IT curriculum so that IT graduates would be able to acquire appropriate skills needed by industry. The study used a survey research method and a set of questionnaire was administered to 150 IT professionals in Klang Valley. The findings revealed that well rounded IT professional should have a combination of Analysis and Design Skills, Business Skills and Interpersonal Skills. Most of the respondents acquired these skills through their working experience since most of university and college curricular does not provide them with these skills. Overall the skill levels of IT professionals on each skill depends on their position, knowledge they acquired while studying in universities and colleges and also through their working experience. Since, there is no proper tool to evaluate the IS skills among the employees in IT field, a proper system was therefore needed to evaluate the IS skills among IT professional. In this way employees can be aware of their skill level and take further action to improve it. In order to do that, Information System Skills Assessment System (ISSAS) was developed.

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Chapter 1: Introduction

1.1 Background

Rapid changes in information and communication technologies and its application cause the skills and knowledge required by IT professionals to change correspondingly (Virgo, 1992) and lead to new roles for IT professionals (United Communications Group, 1998). Information System (IS) skills mean a set of techniques, methods and basic knowledge that shape the work of IT professionals.

In an era when information technology (IT) is an integral part of society, many organizations are finding it difficult to hire adequate numbers of information technology personnel. Computer systems have permeated virtually every facet of organizations, creating a demand for individuals with IS skills at every level. The situation is complicated by the fact that finding personnel with the appropriate skills mix is even more problematic. As we move into the new millennium IT roles are shifting at an increasingly rapid pace. Technical skills alone are not sufficient for success in the IT profession, soft skills like communication, problem solving and teamwork are increasingly important. Recognizing that no curriculum can provide all training needed by every employee in every position, the issue then would be to identify which specific sets of knowledge, skills and abilities are most important to IT organizations.

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What skills must IT professional possess to successfully contribute to their organization's performance? This question unites both the professionals who practice IT in organization and the academics who study and teach IT. Even these two groups often disagree on what these skills should be (Trauth et al., 1993).

In early 1990's IS skills possessed by IT professionals were very limited. They just had to know how to use Microsoft PowerPoint to do the presentation and use simple programming language. At that time, Java was only known as a brand of coffee, C was a passing grade and web master has eight legs. During that era most IT professionals were focusing on the technical skills rather than managerial skills (Bailey et al., 2000).

But today, the IT field has completely changed. Experts in Java Computing and C programming command a premium in the labour market and an army of human web masters keep the information updated on the rapidly expanding World Wide Web. Presentation is created using Multimedia Software such as Macromedia Director or Macromedia Flash, which includes beautiful graphics, audio, video and interesting animation. The IT professionals nowadays are not only focusing on the technical skills but also the managerial skills such as business skills and interpersonal skills. They are also able to communicate with people from all walks of life.

For some time now university and college courses in IT field have been strongly criticized by the industry for concentrating on conceptual learning while failing to provide their graduates with experience and grounding in IS skills. Furthermore, in the

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area of IS, training had focused on technical skills rather than managerial skills. In fact most practical skills are often learnt 'on the job' after the formal academic courses have been completed and the students entered the workplace. Unfortunately, this process is unreliable and often the skills that are acquired are very specific and there is some evidence that learning gained in this way is not conceptual learning and that it does generalize (Morrison and Branter, 1992). A further problem with this approach is that it may lead to inappropriate learning and to the adoption of inefficient or ineffective strategies.

The IT curriculum offered by local academic institutions in Malaysia were criticized by industrial experts for their narrow focus and for teaching obsolete technologies and irrelevant or obsolete computer programming language. They were not aligned with the industry needs and were incapable of producing qualified and employable IT professionals (Chow, 2004).

IT professional with solid business backgrounds will be able to cater better to user's needs and to develop a more effective relationship suitable to the needs of management (Bailey et al., 2000). This suggests that IT professional of the new millennium should possess a combination of interpersonal, technical and business skills that will allow them to analyze problems, integrate applications and implement new business processes built around information technology.

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1.2 Problem Statement

With the rapid advancement of information technology (IT), the domain of IS skills required by IT professionals in Malaysia are getting larger and larger. The skillful professionals will have high demand in the industry. The question now is what are the skills that IT professionals should have for their job career advancement and also to successfully contribute to their organization's performance?

University and college courses in IT field are often criticized by industry for failing to provide their students with the skills which are required for the challenging working environment. They are concentrating more on conceptual learning while failing to provide skillful and knowledgeable graduates (SIM, 1998). When this scenario happens, how do these IT professionals get the skills required for the industry?

Technology is changing at an exponential pace. Globalization, distributed work environment and increased competition, complicate the challenges faced by modern organization in the process of recruiting IT professionals. At the same time, academic institutions have traditionally found it difficult to respond quickly to the changes (Sibley, 1998). Although there are many unemployed IT graduates currently, however there is a shortage of IT professionals with the right IS skills. Therefore how will the IT industry overcome these problems?

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The labour market for IT workers is expanding and shifting rapidly. It had been driven by the unrelenting advancement and diffusion of IT. New skills are constantly in demand and the IT industry is evolving in new directions. As a result, IT professionals who are able to constantly update and keep abreast with technological advances will be the 'stars' in the IT industry.

This dissertation will investigate the type of IS skills possessed by IT professionals in Malaysia currently, where they have acquired these skills and how do the curriculum in universities and colleges help them to meet the requirements of the industry.

1.3 Research Objectives

Even though there are a lot of vacancies in IT industries, but IT graduates have difficulties in finding a job. A survey on jobless revealed the profile of the unemployed graduate: from a public university majoring in business studies or information technology (New Straits Times, 2005). Based on this fact, the need to study the types of IS Skills required by Malaysian IT community has become the major objective of this research. Therefore, this research mainly focuses on fulfilling the following objectives:

1. To identify current IS skills which are perceived to be important for IT professionals in Malaysia to possess.
2. Investigate how IT professionals acquire the IS skills required by the industry
3. Investigate the subjects and courses in universities and colleges that provide the IT professionals with these required skills

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4. To develop a framework or model for assessing the level of IS skills among IT professionals
5. Implement the model into a web based system and test the system

Findings in these areas will be used to develop a system, which is an assessment system, Information System Skills Assessment System (ISSAS). This system will assess and evaluate IS skills level among IT professionals. ISSAS can be used by IT companies to assess their employees' IS skills level by individually or by department. Skills assessment report generated by this system can be used by employers to find out ways to improve the skills level of their employees. Basically this system is a tool for employers to keep track the skills level of their IT employees.

1.4 Research Questions

This research proposes to answers questions regarding the IS skills for IT professionals in Malaysia. The research questions are identified below:

1. What are the IS skills that IT professional in Malaysia have currently?
2. What are the IS skills needed for certain specific post?
3. How IT professionals obtain required IS skills for the industry?
4. What are the important IS skills in IT industry in five years' time?
5. What are the subjects that they learn in universities and colleges that provide them with these required skills?

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6. How universities and colleges can adjust their programmes in order to provide competitive and thinking IT professionals?

1.5 Research Assumptions

This research is carried out based on the following assumptions:

1. The respondents are familiar with the terms and acronyms used in defining the IS skills in the questionnaire form.
2. The respondents are willing and are able to provide factual and accurate information on the questionnaire provided.
3. The IT professionals are recruited by the organization based on the IS skills which have been identified in this questionnaire.

The limitations of this research are identified as follows:

1. All the respondents chosen for this survey are working in the Klang valley because it is a place with a high number of IT professionals and most of the well-established organizations are located in this place.
2. Most of the respondents are from IT based companies in the private sector.
3. Not all the IS skills have been listed, and the important and related skills for the current Malaysia's IT industry are listed in the questionnaire form which are obtained through interview with IT professionals and reference to IS skills

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list which had been presented in 1995 PRIISM Conference and discussion with lecturers.

1.6 Significance of Research

The IT industry is one of the fastest growing industries globally. Well round IT professionals should have combination of interpersonal, business and technical skills. This research will provide information and data on required IS skills by industries. This useful information can be used by universities and colleges to redesign their curriculum in order to meet the challenging and fast developing IT industries. Data collected from this research will also help IT professionals to be aware of the changes in the IT field and help them be competitive and keep up with the ever changing technology.

Furthermore, the system being developed can be used as a framework or model for assessing the level of IS skills among IT professionals in Malaysia.

1.7 Expected Research Outcomes

This research will provide valuable information for universities and colleges to adjust their curriculum so that they could produce competitive and thinking IT professionals who meet the fact-changing technology. The findings on the important IS skills in 5 years time will help universities and colleges to include the related subjects in their programme which can provide their students with these skills.

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The analysis of the survey data will reveal the types and levels of IS skills among IT professional in Malaysia. The universities and colleges can use this as a reference tool to develop their curriculum and programmes.

The findings will also contribute to the human resources department in the companies to look for suitable IS skills when recruiting IT professionals. IT professionals on the other hand can make themselves ready with these skills before entering the challenging job market.

Since, there is no IS skills assessment system available, ISSAS which was developed in this research can be used as a guidance and reference by software developers to develop more sophisticated IS skills assessment system in the future. This system can be used widely in IT industry to assess skills level of their employees.

1.8 Organisation of Thesis

This research is organized into five chapters. Chapter one presents an introduction and background of the study which is IS skills for IT professionals in Malaysia. In addition it looks into the problem statement, research objectives, research questions, research scope, research methodology and design and expected future outcomes. Chapter two presents a review of the literature related to the study. In chapter three, the research methodology that is used in the collection and analysis of the data has been explained in detail. Then it reports the results of the questionnaire and analysis of data. The data from the

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respondents were numerically coded and analyzed using Statistical Packages for Social Science (SPSS) version 11.5 for Windows. The data were also presented in visual formats to provide more insight to the data analysis. Chapter four explained about the development of IS Skills Assessment Program (ISSAS) in detail. It also looks on system overview, system development tools, system design and testing. Chapter five concludes this study by discussing the major findings and implications for both IT professionals and academic institutions. This chapter ends with some recommendations and suggestions for future research in this field.

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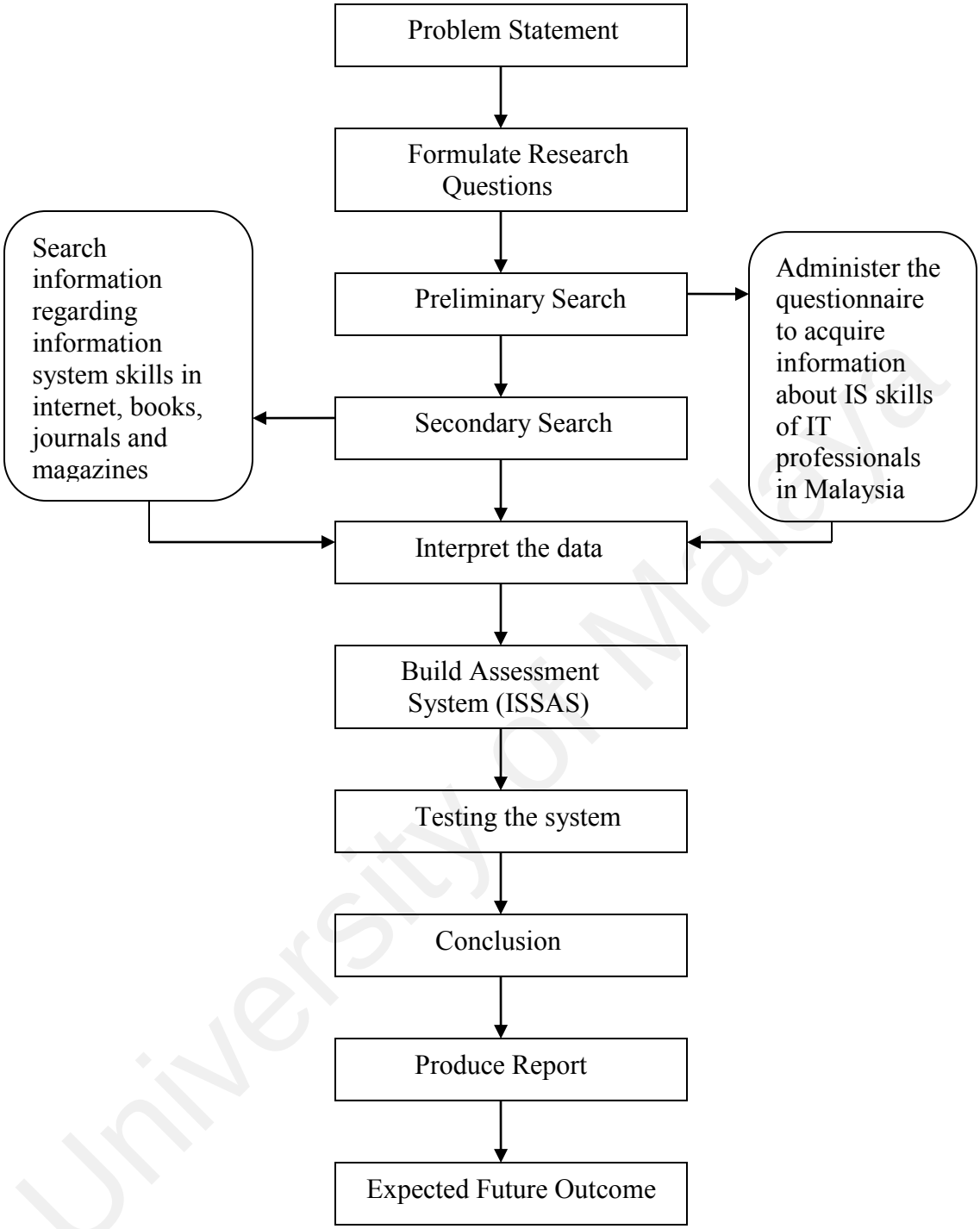

Figure 1.0 Structure of the Research Program conducted for this Thesis

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Chapter 2: Literature Review

2.0 Introduction

This chapter presents the review which guides the study and discusses specific findings that provide the researchers with insights when formulating the research problem, methodology and design. Literature on IS skills for IT professionals in Malaysia is rather scarce. Thus search for the relevant literature was extended to include studies on IT professionals in general. The search for relevant articles was done by using keywords such as IS skills, IT professionals, IT community, IT workforce, IT skills, managing IT professionals and various combination of these.

The literature on the topic was obtained by searching the University of Malaya Library's (UML) online public access catalogues (OPAC), ACM Digital Libraries, Library of Information Science Abstracts (LISA) and Dissertation Abstracts Online (DAO). Relevant articles were also obtained from citations of individual articles in the internet.

In the following section, the review is divided into certain parts such as definition what is IS skills, desired IT professionals skills, problem in preparing IT professionals with required skill, alignment between IT curriculum in Malaysia and other countries and overview on other researches on this topic .

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2.1 Definition of IS skill

One way to understand the essence and nature of IS, is to analyze some of definitions attributed to this phrase. The term "information systems" can be interpreted differently by different groups. For example, Falkenberg describe three potential interpretations of the term IS; a technical system, a social system and a conceptual system. This represents a challenge in arriving at a precise definition (Falkenberg et al, 1998).

A very basic definition of the term IS is based in the meaning of terms 'information' and 'systems'. According to Laudon, information has been defined as 'meaningful processed data' where 'meaningful' implies relevance to a consumer (user) of information and 'data' implies raw symbols or facts. A system is a collection of interrelated components that work together for a common purpose. Hence, an information system is a collection of interrelated components (hardware, software, procedures, people, databases) that work together to collect (or retrieve), process, store and distribute information to support decision-making and control an organization (Laudon, 1994).

Although IT and IS have been used equivalently, especially by practitioners, we consider IT to be a subset of IS (Friedman, 1994). In an attempt to incorporate the diversity of the IS phenomenon, while limiting the scope of the field, Ein-Dor and Segev define IS as any computerized system with a user or operator interface provided the computer is not physically embedded (Segev, 1993).

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In the curriculum development context, Davis and Gorgone (1997) delineates the scope of the IS field as follows: Information Systems, as an academic field, encompasses two broad areas:

a) Acquisition, deployment and management of information technology resources and services (the information systems function) and
b) Development and evolution of infrastructure and systems for use in organization processes (system development).

Similarly, Cushing (1990) defined the IS discipline as the study of the interaction of IS developers and IS users in the processes of development and use of IS within organizations. "Contrasting disciplines that are closely allied because of the use of technology as one key component", Avgerou and Cornford argue that while computer science is about how computers work (as hardware and software), and software engineering is about building technical systems (ensembles of hardware and software) that meet given specifications, information system is about understanding what is or might be done with these technical systems, and the effects they have in the human, organizational or social world (Avgerou and Conford, 1995) .

However, although IT is the key enabling technology of the information system discipline, its focus is on the structure and management of large information entities, with document lists and librarians being key agents (Ingwersen, 1996). Based on Lucas, IS is the study of the effective use of information and potential impact of software systems and enabling information technologies on the human, organizational and social world (Lucas,

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1990). According to Lucas the impact of IS on the organizations are effective management and use of IT in organizations.

Another way to understand the nature and scope of IS is to consider the impact of reference disciplines. Some authors have argued that IS at a minimum has a support base of three foundational fields such as computer science, management science and organizational science (Benbasat and Weber, 1996). Others have also identified economics and cognitive science as additional foundational disciplines from which IS research has continued to borrow (Swanson and Ramiler, 1993).

An obvious problem in the IS fields is the rapid development of technology and its applications. This contributes to frequent shifts in focus as results of new areas of deployment, for example, electronic commerce and knowledge management. In fact, it could be argued that this is one example where reference disciplines such as marketing and organizational science have been directly impacted by the conceptual development in the IS field especially in the areas of e-commerce, knowledge management and data ware-housing and mining.

In this research, IS skills means combination of business, analysis, technical and interpersonal skills which should be possessed by IT professional in order to compete and be competitive in IT industries.

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2.2 Desired IT Professionals Skills

According to industry experts, acquiring and maintaining the right skills for IT professional is one of critical issues in IT industries nowadays. Different categories of IT jobs required different kind of skills. JobStreet.com chief executive officer Mark Chang said there was a disparity between the skills requirements now and those of 10 years ago for the same jobs. He also added that, even though the job category is not so different from what it was 10 years ago, the skills requirements are much higher now (Chow, 2004).

Based on IS manager interviews at large firms, survey conducted by Levinson in 1998 notes that communication skills, business skills and change agent skills becoming critical levers for IT industry (Levinson, 1998). The studies on the required general skills that an IT industry needs emphasize the increasing importance of 'soft skills' and business related skills (Bailey, 2000).

According to Gramignoli, there is a list of desired competencies for IT executives in the following 7 areas; systematic vision of the firm, long-term vision, communication ability, leadership, integration between IT management and firm strategy, evaluation of both organization and economical impact and technical knowledge (Gramignoli et. al, 1999). Skills studies on IT project manager, system analyst and even web-based system personnel find the increasing importance of business and communication skills. For example, the survey carried out by Zeltman suggest that system designers and

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programmers find communication skills, understanding business unit support and ability to interpret source code to be more effective skills (Zeltman et. al, 1992).

Majority of studies support the view that IT industry requires equally or even more business, analysis and interpersonal skills than just technical skills regardless of the position and specific duties. The answer to the question on desired IT professionals' skills requires mix of business, analysis, interpersonal and technical skills for nearly all position.

Based on this and interviews with IT experts, in my research the skills categories are divided into main nine groups such as analysis and design skills, programming skills, interpersonal skills, environment or platform skills, business skills, application knowledge, computer language knowledge, database knowledge and multimedia knowledge. Each category consist few sub-skills to give more view on specific skills needs and required for certain job category in IT industry.

2.3 Problems in preparing IT Professionals with the Required Skills

Educating undergraduate students to be capable IT professionals poses several significant problems. Firstly, there is the question of what knowledge should be taught in a subject where new areas of interest can appear, flourish and then largely disappear within a few years. Secondly, there is the question of how the subject should be taught to try to ensure

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that the students not only acquire knowledge which enables them to pass their University examinations but can put that knowledge into practical use in their subsequent careers.

The problems encountered in preparing students for the wide range of software, hardware, concepts and approaches in industry are universal in IT education because of the rapidly changing nature of the subject. This makes it difficult for lecturers to teach the subject in a conventional way if the aim is to prepare students for a career involving IT. The need for IT related skills is increasingly being seen as important and that this too poses problems for conventional teaching approaches.

Having a good knowledge of a subject, and being able to impart that knowledge, are considered important aspects of being a good teacher. It is, therefore, taken for granted that there is a body of knowledge that needs to be learned, with the learning being assessed in some way. This is particularly true at the university level where most of the assessment process is devoted to testing knowledge and understanding.

Thus, IT educators tend to focus on the knowledge that needs to be acquired by students and published syllabuses tend to concentrate on the units of knowledge to be taught. Furthermore, the definition of a profession is usually related to the knowledge that members are expected to have before they can be accepted as adequately qualified. This is certainly true in the well established professions such as medicine, law and accountancy which all demand the achievement of an acceptable academic standard, demonstrated by passing examinations, as part of their acceptance criteria. Closer to IT, software engineers have been discussing what is needed to make their discipline into a

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profession for some years (Thompson and Edwards, 2001), and are attempting to identify the underlying 'Body of Knowledge' required (SWEBOK, 2001).

However, IT differs from conventional subjects in its rapidly changing nature. Firstly, there is the continuously changing technology. Many topics seen as important little more than a decade ago have become irrelevant because of the changes in hardware and software. For example, sophisticated algorithms to manage memory and disc storage space were routinely taught to computer science undergraduates when computers offered 640K bytes of memory and 100Mbytes of disc. Now it is usually much cheaper to buy additional Megabytes of memory and Gigabytes of disc than to employ a programmer to write code to improve memory management.

Secondly there are the changes in the terminology. New jargon words and phrases are created, come into widespread use, but then disappear. What is worse, new phrases are regularly coined for the same underlying concept (e.g. Management Information System, Executive Information System, Decision Support System). These changes frequently drive student expectations of what should be taught, reflecting the latest fashion in the IT industry. For example, student demand for the programming language they are first taught has moved from FORTRAN to Pascal and from C to C++ and now to Java (Cowling, 2001). By comparison with other disciplines this is really very unusual.

The problem facing the conventional lecture based approach is further complicated by the increasing recognition that the acquisition of skills is also an important component of IT

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education. As an example, the UK Quality Assurance Agency (QAA) published guidelines to be used to assess university computing courses. These contain three skill sections summarized below (Computing, 1999):

- Computing related cognitive abilities: the abilities to apply computing knowledge when identifying, modeling, designing, building and evaluating systems and to reflect on experiences and on the professional, moral and ethical issues involved.

- Computing related practical abilities: the abilities to specify, design, construct and evaluate computer-based systems, assess alternatives, evaluate risks and use appropriate tools.

- Transferable skills: the abilities to retrieve and use information, work in a team and develop personal learning capabilities.

Based on this problem, university ICT courses should be adjusted from time to time so they are inline with the evolution of technology. More practical training should be implemented in ICT courses at universities level although they are not the vocational institution to give more experience for IT graduates to face challenging working environment.

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2.4 IT Education In Malaysia: The Present Scenario

Currently, there are eleven public institutions of higher learning in Malaysia which offer computer science programs at the certificate, diploma, degree and postgraduate levels. Formal education in Computer Science in the country started in 1969 when a three-year diploma course was offered by the Mara Institute of Technology (ITM) which is currently known as Mara University of Technology (UiTM). The first bachelor's program in Computer Science was started by University of Science Malaysia (USM), followed by the National University of Malaysia (UKM), University of Technology Malaysia (UTM), University Putra Malaysia (UPM) and University of Malaya (UM) (Kamsah, 1994).

There are about 500 private colleges in Malaysia, with at least 36 of them offer various information technology programs and courses. These institutions offer both local diploma programs and various twinning degree program with established universities in the United Kingdom, United States and Australia. For example, Sunway University College offers diploma in Information Technology and a twinning degree program with the Victoria University, Australia and University of Portsmouth, United Kingdom in Computer Science and Information Systems. The Asia Pacific Institute of Information Technology (APIIT) offers local diploma courses in Computing and Information Technology and a Bachelor of Science Computing twinning degree program with Staffordshire University from United Kingdom.

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Most of the computer science curriculum in Malaysians' higher learning institutions focused on subjects related to multimedia, networking and software engineering. Table 1 shows the undergraduates programmes in some of public institutions of higher learning in Malaysia.

Table 1: Undergraduates Programmes in Public Institutions of Higher Learning

University	**Programmes**
University of Malaya	**Bachelor of Computer Science** Computer Networking & System Software Engineering Management Information & System Artificial Intelligence **Bachelor of Information Technology** Information Science Multimedia Management
Universiti Kebangsaan Malaysia	**BSc in Information Technology** Computer Science Science and System Management Information Science Multimedia Study Industrial Computing
Universiti Putra Malaysia	**Bachelor in Computer Science** Computer System Software Engineering Network Multimedia
Universiti Teknologi Malaysia	**Bachelor of Computer Science** Computer Networks and Security Software Engineering Industrial Computing Graphics and Multimedia Software BioInformatics
Universiti Sains Malaysia	**Bachelor of Computer Science** Computing & Software Engineering Information Engineering Computer Systems and Technology
Universiti Utara Malaysia	**Bachelor of Information Technology** **Bachelor of Multimedia**
Universiti Sabah Malaysia	**Bachelor of Computer Science** Network & System Management Software Engineering
Universiti Malaysia Sarawak	**Bachelor of Computer Science** Computational Science

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	Information System Multimedia Computing Network Computing Software Engineering

In order to provide students with industrial experiences, most of public institutions of higher learning in Malaysia make industrial training as a part of their computer science curriculum. It is compulsory for students to attend this training at least for three months.

2.5 Alignment between IT curriculum and industry: Current Scenario in Malaysia

According to director of DP Search, Rosemary Chisholm the ever changing technology has made it necessary for professionals in information technology industry to take their own initiative to acquire more skills. According to her, their efforts will make them highly sought-after in the competitive IT industry as their skills are relevant to the markets needs (Hamisah, 2001). Chisholm also said the slump in the IT industry has made it inevitable for IT professional to upgrade and widen their skills to face the stiff competition.

Over the years, as the IT graduates enter the job market, the question remains, are they indeed suitably prepared for the job market? According to Malaysian Employers Federation president Md Jafar Abdul Carrim although plenty of jobs are available for IT graduates but many cannot fit into the positions because they lack the skills that their prospective employers are looking for (Geoffrey, 2005). Why these happen?

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The existing education system continues to emphasise on academic ability. The universities and private colleges set up have not been able to match industry skills requirements (Chow, 2004). According to Lt. Col. Husin Jazri, CISSP, Director of NISER, IT dependent organizations in Malaysia need highly-qualified information security professionals to secure their IT environments but the country is facing a lack of university curriculum that would be able to produce competent and certified information security professionals. These scenarios show that current universities and colleges' curriculum in Malaysia need to be revised in order to provide more competitive graduates for IT industry.

Since IT industry now is very competitive and as employers are on selective and strategic hiring, IT graduates should upgrade their knowledge and skills especially fresh graduates (Hamisah, 2001). Chisholm said since universities curriculum are inadequate to meet the fact-changing technology.

The Human Resources Ministry notes that local ICT graduates have not yet achieved the meaningful level of skill sets to tackle high-end ICT jobs such as computer chip designer or three-dimensional (3-D) animator. Its Minister Datuk Wira Dr Fong Chan Onn says there is currently a strong demand for ICT specialists in the high-end ICT job market segment such as Web designers. He, however, notes that given the current shortage of suitable qualified local ICT graduates for such jobs, the country has turned to acquiring thousands of foreign ICT expertise (Foo, 2004).

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According to JobStreet.com, the top ICT skills required by employers include Java, Visual Basic, C++ Language, J2EE, MS SQL Server, SQL, ASP, as well as Unix and Linux. Meanwhile, industry observers believe that there is still demand for specific professional ICT skills such as software programming, database and e-commerce, software engineering and project management, systems administration, networking and telecommunications, creative multimedia and security (Foo, 2004). But according Human Resources Minister Datuk Wira Dr Fong Chan Onn what some ICT graduates learn in the university is not really what the industry requires. Fong added government is trying to solve the problem through retraining programmes for ICT graduates (Rozana, 2004).

According to Dr Nor Adnan Yahya, head of the IT programme at MUST, we're currently hiring foreign graduates to overcome shortage for jobs developing saleable systems using languages like C++ and Assembler. He said the main problem for this situation is the "mismatch" between employers' requirements and the quality of IT graduates that our higher learning institutions are producing (Charles, 2004).

2.6 Alignment between IT curriculum and industry: Current Scenario in Singapore

Singapore offers immense scope for IT professionals since they are facing a shortage of skilled manpower. Professionals conversant in ERP applications like SAP are in great demand. According to Mr Alex Siow Co-Chairman, Board of Governors,National IT Skills Certification Board, IT professionals should be responsible to maintain and

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improve their professional competence. He strongly encourage every IT professional in Singapore to seek IT certification since the skills sets provided by higher learning institution is not in depth. (Alex, 2000).

According to Jobstreet's Thiru there's still a lot of demand for skilled IT professionals in Singapore but most of fresh graduates was unable to meet employers requirements since the skills that they obtain in higher learning institution was inadequate to meet the fact-changing technology (Fran, 2003). The top IS skills that IT professionals in Singapore should arm themselves with is Java, MS SQL Server, J2EE, MS Exchange, SAP and C++ programming. But these skills were not taught in depth in higher learning institution (Fran, 2003).

According to Rosmary Chisholm, Kapient (S) Pte Ltd chief executive officer, slump in the IT industry has made it inevitable for IT professionals to upgrade and widen their skills to face the stiff competition. She added that self-training is a norm where IT professionals in countries like Singapore undergo training courses to upgrade their skills since higher learning institution just provide basic skills (Hamisah, 2001). Based on Chisholm statement, we can say the ICT curriculum in Singaporean higher learning institution was unable to cater the rapid evolution and fact-changing technologies in IT fields.

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2.7 Other Research

There are a number of previous studies been carried out regarding this topic. In this section, review of past three studies will be discussed. One of the famous studies related to this topic is entitled "Information System Skills: Achieving Alignment between the Curriculum and the Needs of the IS Professionals In The Future" (Eugenia et al., 1995).

This study examines what are important skills in 1993 and in 1998 and the perceived emphasis of IS curriculum. The respondents for this study are students from the Department of Computing at the Hong Kong Polytechnic University who graduated in 1988 to 1993.

Since the respondents for this study are limited to IT professionals who graduate from one educational institution, the data from this study cannot be used to assess the computer science curriculum in overall. To get a clear view on how the computer science curriculum match industry needs, IT professionals who graduate from various educational institutions should be included. In my study the respondents are IT professionals from various educational institutions and various organizations. This will give clearer views on IS skill needs that ought to be acquired by IT professionals in Malaysia. It also helps me to evaluate the current computer science curriculum and determine if it is able to provide skillful IT professionals for the future IT industry. Some suggestions and ideas will be given, so that the universities can modify or adjust their curriculum in order to supply skillful professionals for the needs of the industry.

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As the IS field is evolving very fast, more new technologies and ideas have been discovered. More new skills have been identified. Since the previous study was conducted in 1993, the skills, which they provided in their skill list, are limited. Only fifty-four skills, which are grouped into seven categories, are tested. In my study a lot of new skills have been added (112 skills) which are grouped into nine categories. This skill list was compiled after interviewing the IT experts from industry, academicians from higher learning institutions and also IT professionals who worked in IT sector for certain years. They had suggested a lot of new skills should be added to skill list to make it more complete and accurate. A complete skill list was prepared after taking their ideas into consideration and also by referring a lot of computer journals and newspapers on the latest skills which prefer by IT professionals. Therefore, the study which I conduct will give more accurate results about the IS skills acquired and needs by IT professionals nowadays especially in Malaysia.

Another study, which is related to this topic, is entitled "Corporate IT Skill Need: A Case Study of BigCo" (Steve et al., 1999). The respondents for this study are BigCo's Corporate IT (CIT) staffs which consisted of 150 professionals and 20 administrative support staff.

Since this research just focused on IT professionals in one organization, it does not give overall view on the skills that IT professional should have and also the skills they need in the future. In my research, the respondents will be the IT professionals from various companies and various industry sectors. This will give a clear view on what are the skills

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that IT professionals should have and the skills required by IT industry in future. This will also help the universities and colleges to adjust and modify their curriculum in order to produce suitable and skillful graduates for the challenging and fast developing IT industry.

Other than that, just a few skills were included in the skill list for this survey. Mainly they were based on the needs of their organization. In my research a lot of new skills were included in skill list and they were divided into more categories to get more accurate data regarding this research. The skills on the latest technologies, platform and latest computer programming languages were included in the skill list in my survey to give more options for respondents to assess their skill level based on their current needs and also in the future.

One of the latest researches in this field is entitled "Preparing the Information Technology Workforce for the New Millennium" (Bailey et al., 200). For this research data was collected through web-research, site interviews and focus groups as well as a web-based survey.

In overall this research provides the clear view on the skills that IT professionals should have and need for the new millennium. The methodology that they used to collect data for this study was very efficient and effective. It is because data from multiple sources is higher in quality than data from single sources (Yin, Batemen & Moore, 1983) and multiple data collection methodology is common in theory-building and foundational research (Eisenhardt, 1989). Based on these concepts, the skill list in my questionnaire

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was compiled through various methods such as reference in journals and also interview with IT experts from industries and also academics.

However this research does not collect data about the important IS skills for IT professionals in future. In my research, the perception of respondents about the important IS skills for IT industry in future were also tested. They have to rank the skills in order of importance in five years' time. This will give clear view for IT professionals to prepare themselves with these skills so they are able to overcome the challenging and fast developing IT industries.

List of IS skills in my research is divided into nine main categories with 112 sub-skills were obtain through interview with IT professionals, reference to IS skills list which presented in 1995 PRIISM Conference (Eugenia et al., 1995) and discussion with lecturers. Table 2 shows the list of IS skills in my research:

Table 2: List of IS Skills

Skill Category	**Sub-skills**
Analysis and Design Skills	• Ability to do an adequate feasibility study • Ability to do a cost/ benefit analysis of alternative system design • Ability to do a cost/ benefit analysis of alternative packages or tools • Ability to create a formal conceptual design for an application • Ability to perform semantic data modeling • Ability to use CASE development tools • Ability to perform object-oriented analysis and design for application using UML • Ability to use formal information requirements determination methods
Programming Skills	• Ability to apply structured program design • Ability to design program data structure • Ability to create effective documentation for application

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	• Ability to design and use algorithms • Ability to prototype applications • Ability to design security, privacy and auditing controls for applications • Knowledge of systems development quality assurance procedures • Knowledge of a specific systems development methodology • Ability to develop web sites
Interpersonal Skills	• Ability to work with others to accomplish some goals • Ability to write clearly and effectively • Ability to work alone to accomplish some goals • Ability to listen to others • Ability to give effective presentation • Ability to respond appropriately to another's emotions • Ability to persuade others • Ability to train others
Environment/ Platform Skills	• Ability to build systems in a mainframe environment • Ability to build systems in a PC environment • Ability to build applications in multiple environment/ platform • Ability to build systems in a minicomputer environment • Ability to build applications in a UNIX environment • Ability to build applications in a LINUX environment • Ability to build applications in a Windows environment • Ability to build applications in NT environment • Ability to build applications for the SNA environment • Ability to build applications for SAA environment • Ability to build applications in a Novell environment • Knowledge on 3G Technologies • Knowledge on Mobile Communications • Knowledge on VOIP • Knowledge on Cisco Routers • Knowledge on Internet/ Intranet systems and protocols • Knowledge on LAN • Knowledge on WAN • Knowledge on WLAN • Knowledge on VLAN • Knowledge on Virtual Private Network (VPN) • Knowledge on web security • Knowledge on network security • Knowledge on Public Key Infrastructure • Knowledge on Intrusion Detection System • Knowledge on Visual InterDev • Knowledge on Cold Fusion • Knowledge on Web Sphere • Knowledge on Notes & Domino • Knowledge on DNS • Knowledge on TCP/IP • Knowledge on HTTP • Knowledge on E-mail • Knowledge on Proxy • Knowledge on Firewalls

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Business Skills	• Have an understanding of a specific business function • Ability to create a formal conceptual design for an application • Ability to do project planning and control • Ability to foresee problems that would results from introduction of new technology • Have and understanding of industry structure and behavior • Ability to use techniques for identifying application that will provide competitive advantages • Ability to use MIS planning methods • Knowledge of the laws and ethical issues associated with computing • Knowledge on E-commerce • Knowledge in Business Process Reengineering (BPR)
Application knowledge	• Ability to design relational databases • Ability to design distributed applications • Ability to design collaborative work application • Ability to create effective Decision Support System • Ability to design hierarchical or network databases • Ability to perform analysis and design for expert systems • Knowledge in Enterprise Reengineering and Restructuring (ERR) software • Knowledge in Enterprise Resources Planning (ERP) software • Knowledge on Software Management Configuration
Computer Language Knowledge	• Ability to program in COBOL • Ability to build application using 4th generation language • Ability to use operating system Job Control Languages • Ability to program in C • Ability to program using an object-oriented language • Ability to program using an Artificial Intelligence Language • Ability to program in ADA • Ability to program in Java/J2EE • Ability to program in Visual Basic • Ability to program in HTML • Ability to program in DHTML • Ability to program in ASP • Ability to program in PHP • Ability to program in C++ • Ability to program in Delphi • Ability to program in Perl • Ability to program in MySQL
Database Knowledge	• Ability to build application using SQL Server 2000 • Ability to build application using Oracle 91 • Ability to build application using DB2 • Ability to build application using Informix • Ability to build application using Sybase • Ability to build application using MS Access
Multimedia Knowledge	• Ability to use Macromedia Director • Ability to use Macromedia Flash • Ability to use Dreamweaver • Ability to use Adobe Photoshop

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	• Ability to use GIF Animator • Ability to build animation using VRML • Knowledge on Scriptwriting • Knowledge on Production Design • Ability to use 3D Studio Max • Knowledge on storyboarding

2.8 Summary

This chapter serves as a literature review to the research. It looks on the definition of IS and desired skills for IT professionals was explained. The problems in preparing IT professionals with required skills were explained in detail. Moreover the current scenarios between IT industry and curriculum in Malaysia and other countries have been illustrated in details. Finally, review on the similar previous research has been discussed in detail. Since there are no systems or tools available to assess IS skills level among IT professionals, in my research, Information Skills Assessment System (ISSAS) was developed as a prototype system to analysis and evaluate IS skills level among IT professionals. Development of this system has been explained in detail in chapter 4 (System Development).

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Chapter 3: Research Methodology and Survey

3.0 Introduction

The main objective of this research is to collect information on the important IS skills among IT professionals in Malaysia and important skills needed for certain position. Furthermore, the survey attempts to find out how they acquired the needed IS skills to be dynamic and skillful employees for industry. Feedback and data collected from this survey can be used in determining the importance of IS skills in IT markets nowadays and the findings could be used to evaluate the curriculum in universities and colleges in order to provide the skillful employees that the industry truly needs. The IT professionals have been chosen as a data provider because they are the people who know well the skills they have and the skills they need for their career advancement. This section explains about the population that is selected for the research, development of survey instruments, pilot test, data collection and data analysis.

Respondents' knowledge in a total of 112 skills which are grouped into nine categories (compiled based on reference in journals, newspapers and interviews with IT experts from industry and academic fields), the important skills needed in future and the way they are acquired is ranked by the respondents in this study. Charts and tables are used to display results. First, background information and characteristics on the respondents are described. Findings related to the research study question were then presented. In overall

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analysis, the relevant information obtained from personal communication and visits are noted and integrated.

3.1 The Survey

Sample Population

The sample selected need to be representative of the population. The population of the given research is defined as a set of characteristics of a universe being studied. The researcher has to ensure that the population consists of those entities which actually posses the information sought by the survey.

The population of this research is the IT professionals who work in established and well known companies and firms in Malaysia. Since most of these companies are situated within the Klang Valley, the selection of population focused on IT professionals in this area. This was based on the findings that more than 50% of well established and big companies in Malaysia are located in Kuala Lumpur and Selangor especially in Klang Valley. Therefore IT professionals from other states are not taking part in this study.

IT professionals in general had received various level of education. However for this study, the respondents should have at least a Professional Certificate in the IT field. This is to evaluate how the education that they had received has been helping them to meet the industry requirements as well as their career advancement. A total of 150 questionnaires

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were distributed to IT professionals and the target was to collect at least 100 completed questionnaires.

Survey Instruments

The data collection instrument is a questionnaire designed to find out the IS skills among IT professionals in Malaysia. Various IS skills required by IT industry were studied. To encourage a higher response rate, the basic and familiar terms were used in the construction of questionnaire. First, a brief introduction stating the purpose of the study was provided and the respondents were assured that their responses would be kept confidential. Second, care was taken to ensure that the questionnaire was not unnecessarily lengthy yet capable of soliciting enough information for the study. Third, fixed response questions were used instead of open-ended questions. The respondents were only required to tick or write the appropriate responses. Nevertheless, space was provided at appropriate places for respondents to write down alternative answers other than those, which had been specified. Fourth, some attention was given to the layout and format of the questionnaire to make it presentable.

The questionnaire was made up of three sections comprising eight pages. Section A consists of ten questions pertaining to general particulars of the respondents such as gender, position, organization's name, organization type, organization sector, organization size and years of IT experience. Other than that, it also focuses on

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respondent's academic qualifications such as their highest qualification obtained, major and name of universities and colleges that they studied.

Section B contains a total of 112 skills. This skill list was compiled based on current Malaysia's IT industry which were obtain through interview with IT professionals and reference to IS skills list which presented in 1995 PRIISM Conference (Eugenia et al., 1995) and discussion with lecturers. They are grouped into nine categories such as analysis and design skills (8 skills), programming skills (9 skills), interpersonal skills (8skills), environment or platform skills (35 skills), business skills (10 skills), application knowledge (9 skills), computer language knowledge (17 skills), database knowledge (6 skills) and multimedia knowledge (10 skills). The respondents were asked to rate themselves in these skills. The scale 1 (very poor) to 5 (very good) was provided for them to rate their experience and knowledge on the respective skills. The skills were presented in tables so those respondents could indicate their ratings.

Section C contains seven items and it focused on the importance of IS skills to the respondents and how they acquire it and the importance of these skills in five years time. Item 1 requires the respondents to rate the skills in order of importance for themselves and their position. A nine point Likert Scale ranging from 1 (less important) to 9 (more important) was provided. The respondents have to rate the importance of the nine main skills categories such as analysis and design skills, programming skills, interpersonal skills, environment or platform skill, business skills, application knowledge, computer language knowledge, database knowledge and multimedia knowledge. Item 2 requires the

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respondents to indicate how well the universities or colleges that they graduate from provide them with the skills that they rank in item 1. The frequency was indicated as very good, good, moderate, poor and very poor.

To collect information on what courses that the respondents learned in universities or colleges and which provided them with these skills, item 3 was used. This is an open-ended question. Respondents have to list down the respective courses. Since there are many ways to acquire the IS skills, item 4 was used to identify the ways IT professionals acquired their skills. A few choices such as vendor training, short courses, conference or seminars and working organization were given for the respondents to indicate the ways. Space was provided for the respondents to write down alternative answers other than those, which had been specified.

To get the opinion of respondents regarding the curriculum of universities and colleges in producing preferred IT professionals for industry item 5 was used. The respondents have to choose either they agree or not (strongly agree, agree, slightly agree, slightly disagree, disagree and strongly disagree) with the opinion. Item 6 collects the respondents' opinion that the universities and colleges have expertise to train their students with the required IS skills. Once again the respondents have to indicate either they agree or not.

As the Information and Communication Technology (ICT) world is evolving very fast, the respondents have to rank the importance of the main nine categories of IS skills (analysis and design skills, programming skills, interpersonal skills, environment or

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platform skill, business skills, application knowledge, computer language knowledge, database knowledge and multimedia knowledge) in order of importance in five years time. A nine point Likert Scale was used (1 for less important to 9 for more important). For this purpose item 7 was developed. Space was provided for the respondents to indicate any alternative skills other than those, which had been specified.

Pilot Test

A pilot test was conducted to ascertain the clarity of the instrument. The questionnaire was distributed to 10 IT professionals of various companies in Klang Valley. The IT professionals who were chosen in the pilot test were excluded from the actual research and they are not apart of study to ensure valid and reliable responses from the population.

In the pilot test the questionnaire was administered and completed on the same day. Then, separate informal interviews with these personnel were held. Their comments were encouraging as they pointed out unclear items and making comments and criticism regarding the questionnaire length, format and clarity of ideas. Based on the responses, certain items considered ambiguous and inappropriate were revised and eliminated for the final version. On the whole, the respondents encountered no difficulty in answering the questionnaire.

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Data Collection

The aim of this study was to gather quantitative data that would lead to deep analysis. Hence, the data was collected through the distribution of questionnaire among IT professionals from various companies.

Prior to collecting data, a cover letter was obtained from the Dean of Faculty of Computer Science and Information Technology (FSKTM). Copies of the questionnaire were sent for this purpose. The cover letter was attached together with the questionnaire to inform respondents about the purpose and objective of the study. The data collection process commenced in August 2003.

An appointment was made with the HR managers of various companies. The questionnaire was distributed to them and short explanation was given. A one week time period was given, so that they could distribute the questionnaire to the IT professionals in their company. After one week, another visit will be done to collect the completed questionnaire. Beside these, questionnaire was administered to some IT professionals involved in the Master's programme in FSKTM and this was collected on the same day.

Analysis of Data

The data from the respondents were analysed using the Statistical Package for Social Science (SPSS) version 11.5 for Windows. Questionnaires that were found to have less

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than 25% of the questions not responded were discarded. Out of the 150 questionnaires distributed, 125 questionnaires were collected. There were 100 usable questionnaires after discarding 25 incomplete questionnaires.

Programmes were run to obtain frequencies, percentages, mean and standard deviations for demographic variables and responses. Mean of data indicate the central value of a set data which is used to make generalizations of the findings meanwhile standard deviations are used to determine distribution and differences between each pair of data within the set of data. Cross tabulation procedure was used to generate contingency tables to study the IS skills of IT professionals with demographic variables in the study. This test provides useful data on the research to meet the research objectives. Only statistically significant values are reported and discussed in this study.

3.2 Data Analysis

Section A: Demographic Data

Gender

The first question in section A was constructed to identify the gender of respondents involved in the study. The distribution of respondents by gender is shown in Table 3. The responses showed that out of 100 respondents, 58 respondents (58.0%) were males and 42 respondents (42.0%) were females. It shows that, IT field in Malaysia was conquered

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by male professionals. However, the roles of female professionals in this field were also quiet important since there is not a big difference in percentage of involvement.

Cross tabulation of the respondents' gender by qualification is also shown in Table 3. The data indicated that out of 58 male respondents, 6 respondents (10.3%) were diploma holders, 50 respondents (86.2%) were degree holders, and 2 respondents (3.4%) were master holders. On the other hand, out of 42 female respondents, 5 respondents (11.9%) were diploma holders, 36 respondents (85.7%) were degree holders and 1 respondent (2.4%) was a master holder. The data shows that most of the IT professionals in Malaysia have degree as qualification to enter the job market. This shows that the education awareness among Malaysian has been increased and most of them trying to pursue higher education for better life and gain more knowledge.

Table 3: Respondents' gender by qualification (N=100)

Respondents' Gender	**Qualification**						**Total**
	Diploma		**Degree**		**Master**		
	N	**%**	**N**	**%**	**N**	**%**	
Male	6	10.3	50	86.2	2	3.4	58
Female	5	11.9	36	85.7	1	2.4	42
Actual Reponses	11	11.0	86	86.0	3	3.0	100

Position

Question two of section A was designed to generate data on the position of the respondents. Table 4 shows the distribution of respondents by position. Out of 100 respondents, 19 respondents (19.0%) were programmers, 23 respondents (23.0%) were

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system engineers, 25 (25.0%) respondents were software engineers, 18 respondents (18.0%) were lecturers, 3 respondents (3.0%) were managers, 5 respondents (5.0%) were assistant managers and 7 respondents (7.0%) were in other categories. Based on advertisements posted on JobStreet.com the top IT jobs in Malaysia is software engineers (Foo, 2004). This survey also shows the same scenario where most of respondents work as software engineers. According to Quantrum Alliance Sdn Bhd's technical director Ralph K. Tee, IT professionals in Malaysia choose to be software engineers, because software engineering fields was very demanding in job market and offers high pay (Angelina, 2004). The interviews with some IT professionals also give the same answers.

A cross tabulation of respondents' position by their gender is also shown in Table 4. The table indicates that, out 19 programmers, 9 respondents (47.4%) were males and 10 respondents (52.6%) were females. Out of 23 system engineers, 17 respondents (73.9%) were males and 6 respondents were (26.1%) females. Out of 25 software engineers, 15 respondents (60.0%) were males and the rest (40.0%) were females. Furthermore, out of 18 lecturers, 6 respondents (33.3%) were male and 12 respondents (66.7%) were females. Out of 3 managers, 2 respondents (66.7%) were males and 1 respondent (33.3%) was female. Out of 5 assistant managers, 3 respondents (60.0%) were males and 2 respondents (40.0%) were females. Out of 7 respondents from other job categories, 6 of them (85.7%) were males and 1 respondent (14.3%) was female. This shows that, position, as system engineers were monopolized by male professionals' meanwhile position as lecturers were monopolized by female professionals. According to female

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respondents, they choose to become lecturer because the pay is better, there is less job stress and the working hours are shorter.

Table 4: Respondents' position by gender (N=100)

Position	Gender				Total
	Male		Female		
	N	%	N	%	
Programmer	9	47.4	10	52.6	19
System Engineer	17	73.9	6	26.1	23
Software Engineer	15	60.0	10	40.0	25
Lecturer	6	33.3	12	66.7	18
Manager	2	66.7	1	33.3	3
Assistant Manager	3	60.0	2	40.0	5
Others	6	85.7	1	14.3	7
Actual Responses	58	58.0	42	42.0	100

Organizational Type

Question four section A was designed to identify the type of respondents' working organization. The distribution of respondents working organization type is shown in Table 5. The responses showed that, out of 100 valid respondents, 70 respondents (70.0%) were working in private companies and firms and the rest of the 30 respondents were working in government agencies. Today's trend shows that, most IT professionals preferred to work in private sector rather than the government sector. According to respondents, private sectors offer competitive salary and expose to latest ICT technologies.

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Cross tabulation of the respondents' working organization type by gender also shown in Table 5. The data indicated that out of 70 respondents in private sector, 40 respondents (57.1%) were males and 30 respondents (42.9%) were females. Out of 30 respondents in government sector, 18 respondents (60.0%) were males and 12 respondents (40.0%) were females. Distribution of male and female professionals in private sector was almost the same. Based on respondents the better pay, opportunity to learn new technologies and future career advancement are reasons why they prefer working in private sector.

Table 5: Respondents' working organization type by gender (N=100)

Organizational Type	Gender				Total
	Male		Female		
	N	%	N	%	
Private Sector	40	57.1	30	42.9	70
Government Sector	18	60.0	12	40.0	30
Actual Responses	58	58.0	42	42.0	100

Organizational sector

Question five in section A was designed to identify the working organization sector of respondents involved in the study. The distribution of respondents' working organization sector is shown in Table 6. The responses showed that out of 100 valid respondents, 39 respondents (39.0%) were working in software and telecommunication sector, 17 respondents (17.0%) were working in finance and banking sector, 8 respondents (8.0%) were working in manufacturing sector, 26 respondents (26.0%) were working in consulting and education sector, 2 respondents (2.0%) were working in construction sector, 8 respondents (8.0%) were working in research and development sector. More IT

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professionals were working in software and telecommunication sector since this sector has become one of the important sector in development of ICT industry in Malaysia.

Cross tabulation of the respondents' working organization sector by gender also shown in Table 6. The data indicated that out of 39 respondents in software and telecommunication sector, 25 respondents (64.1%) were males and 14 respondents (35.9%) were females. Out of 17 respondents in finance and banking sector, 8 respondents (47.1%) were males and 9 respondents (52.9%) were females. In the manufacturing sector, 5 respondents (62.5%) were males and 3 respondents (37.5%) were females. From the 26 respondents in consulting and education sector, 12 respondents (46.2%) were males and 14 respondents (53.8%) were females. According to female respondents, they prefer consulting fields because there is less job stress and they do not have to do much coding. Out of 2 respondents in the construction sector, all of them (100.0%) were males. Then, out of 8 respondents in research and development sector (RND), 6 respondents (75.0%) were males and 2 respondents (25.0%) were females. The distribution of male and female professionals in finance and banking sector was almost the same. According to respondents banking sector become their preference because of competitive pay.

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Table 6: Respondents' working organization sector by gender (N=100)

Organizational Sector	Gender				Total
	Male		Female		
	N	%	N	%	
Software and Telecommunication	25	64.1	14	35.9	39
Finance and Banking	8	47.1	9	52.9	17
Manufacturing	5	62.5	3	37.5	8
Consulting and Education	12	46.2	14	53.8	26
Construction	2	100.0	-	-	2
Research and Development	6	75.0	2	25.0	8
Actual Responses	58	58.0	42	42.0	100

Organization Size

Question six of section A was designed to generate data on the working organization size of the respondents. Figure 3.2(a) shows the distribution of respondents by position. Out of 100 respondents, 12 respondents (12.0%) were working in organizations having less than 50 employees, 14 respondents (14.0%) were working in organizations having between 51 to 100 employees, 13 (13.0%) respondents were working in organizations having between 101 to 200 employees, 28 respondents (28.0%) were working in organizations having between 201 to 500 employees, 21 respondents (21.0%) were working in organizations having between 501 to 1000 and 12 respondents (12.0%) were working in organizations having more than 1000 employees. According to respondents, they prefer to work in organizations which have more than 200 employees because these

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organizations have strong financial background and they feel that their jobs are more secured.

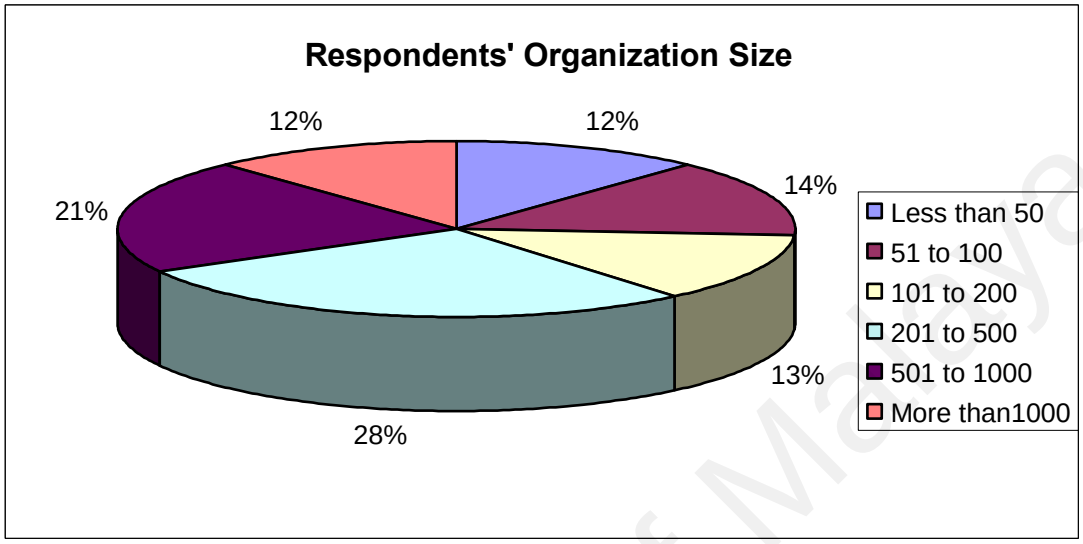

Figure 3.2 (a): Respondents' Organization Size

IT Experience

Question seven section A was designed to identify IT experience of respondents involved in the study. The distribution of respondents' IT experience is shown in Table 7. The responses showed that, out of 100 valid respondents, 14 respondents (14.0%) had 1 to 2 years experience, 36 respondents (36.0%) had 3 to 4 years experience, 23 respondents (23.0%) had 5 to 6 years experience, 14 respondents (14.0%) had 7 to 8 years experience, 8 respondents (8.0%) had 9 to 10 years experience and 5 respondents (5.0%) had more than 10 years experience. Around 50% of respondents were new to IT industry where they had less than four years of experience. According to them, IT was still the new field in our country and it become popular among Malaysian recently.

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Cross tabulation of the respondents' IT experience by gender also shown in Table 7. The distribution of male and female professionals in terms of IT experience in the first two categories, 1 to 2 years of experience and 3 to 4 years of experience, were almost the same. According to experts from industry, there is equal job opportunity for male and female graduates in IT fields. Normally they are employed based on their skills and knowledge and there is no discrimination between genders in IT fields in Malaysia. Meanwhile, out of 23 respondents with 5 to 6 years IT experience, 15 respondents (65.2%) were males and 8 respondents (34.8%) were females. In the next category, 10 respondents (71.4%) were males and 4 respondents (28.5%) were females. From 8 respondents with 9 to 10 years IT experience, 6 respondents (75.0%) were males and 2 respondents (25.0%) were females. Then, out of 5 respondents with more than 10 years IT experience, 4 of them (80.0%) were males and 1 of them (20.0%) was a female. Male respondents have more year experiences in IT fields compared to female respondents. Based on interviews with IT experts from industry, male graduates choose to enter job market earlier than female graduates. Female graduates are normally choose to further their education to higher level before enter job market and they also expect for jobs with good pay and less stress.

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Table 7: Respondents' IT Experience by gender (N=100)

Respondents' IT Experience (years)	Gender				Total
	Male		Female		
	N	%	N	%	
1 to 2	6	42.9	8	57.1	14
3 to 4	17	47.2	19	52.8	36
5 to 6	15	65.2	8	34.8	23
7 to 8	10	71.4	4	28.6	14
9 to 10	6	75.0	2	25.0	8
More than 10	4	80.0	1	20.0	5
Actual Responses	58	58.0	42	42.0	100

Academic Qualification

The first question in section B was constructed to identify the highest qualification obtained by respondents involved in the study. The distribution of respondents by qualification is shown in Figure 3.2(b). The responses showed that out of 100 respondents, 11 respondents (11.0%) were diploma holders, 86 respondents (86.0%) were degree holders and 3 respondents (3.0%) were master holders. Most of the IT professionals in Malaysia have good academic qualification with at least a degree. The awareness of importance of education among Malaysian, encourage young generation to pursue their studies to higher level before enter the industry world. Most of respondents say degree is a stepping stone for them to get first job with competitive salary.

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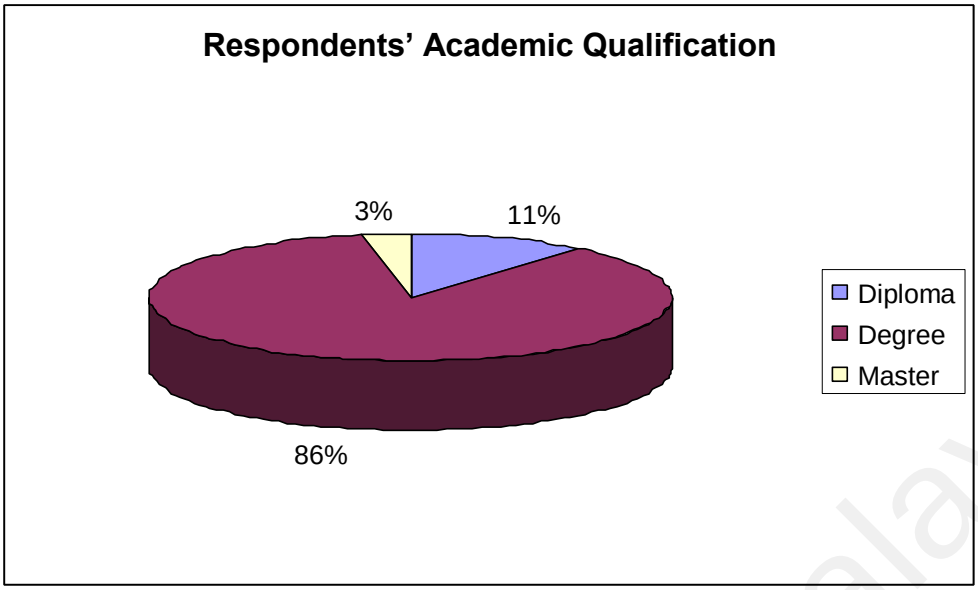

Figure 3.2(b): Respondents' Academic Qualification

Degree Specialization

Question two in section B was designed to identify degree specialization of respondents involved in the study. The distribution of respondents' degree specialization is shown in Table 8. The responses showed that, out of 100 valid respondents, 8 respondents (8.0%) had degree in Business Studies, 75 respondents (75.0%) had degree in Computer Science and IT, 12 respondents (12.0%) had degree in Electric and Electronics and 5 respondents (5.0%) had degree in other fields such as Mass Communication, CAD and CAM Engineering. Since IT sector has a bright future, most of the respondents were majoring in Computer Science and IT field. Respondents say that degree in Computer Science or IT fields are most suitable for IT industry since what they learn in their courses such as programming languages, networking principles and multimedia concepts will be implemented in their working environment.

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Cross tabulation of the respondents' degree specialization by gender also shown in Table 8. The data indicated that out of 8 respondents with degree in Business Studies, 5 respondents (62.5%) were males and 3 respondents (37.5%) were females. Out of 75 respondents with degree in Computer Science and IT, 39 respondents (52.0%) were males, 36 respondents (48.0%) were females. Meanwhile, out of 12 respondents with degree in Electric and Electronics, 9 of them (75.0%) were males and the rest of them (25.0%) were females. In the next category, all the respondents (100.0%) were males. Since IT industry has a good prospective, most of Malaysian young generation has choose to pursue their studies in Computer Science and IT field. According to Quantrum Alliance Sdn Bhd's technical director Ralph K. Tee, those who wish to work in IT industry should ensure that they have the right IT education such as a major in computer science or equivalent (Angelina, 2004).

Table 8: Respondents' specialization by gender (N=100)

Respondents' Majoring	**Gender**				**Total**
	Male		**Female**		
	N	**%**	**N**	**%**	
Business Studies	5	62.5	3	37.5	8
Computer Science & IT	39	52.0	36	48.0	76
Electric &Electronic	9	75.0	3	25.0	12
Others	5	100.0	-	-	5
Actual Responses	58	58.0	42	42.0	100

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Graduating Institution

Question three in section B was designed to identify the graduating institution of respondents involved in the study. The distribution of respondents' graduating institution is shown in Table 9. The responses showed that, out of 100 valid respondents, 87 respondents (87.0%) graduated from local institutions and 13 respondents (13.0%) graduated from foreign institutions. Since the quality of education in Malaysia was increasing and recognized, most IT professionals chose local universities and colleges to pursue their higher studies.

Cross tabulation of the respondents' graduating institution by gender also shown in Table 9. The data indicated that out of 87 respondents from local institutions, 49 respondents (56.3%) were males, 38 respondents (43.7%) were females. Out of 13 respondents from foreign institution 9 respondents (69.2%) were males and 4 respondents (30.8%) were females. Distribution of male and female professionals in both local and foreign institutions was almost the same. Based on interviews with IT professionals, most of them say high quality of education which recognized globally and proper facilities in local institution encourage them to pursue their studies in local higher learning institution.

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Table 9: Respondents' Graduating Institution by gender (N=100)

Respondents' Graduating Institution	Gender				Total
	Male		Female		
	N	%	N	%	
Local Institution	49	56.3	38	43.7	87
Foreign Institution	9	69.2	4	30.8	13
Actual Reponses	58	58.0	42	42.0	100

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Section B: Skills Level

Analysis and Design Skills

The first question in section C was constructed to identify the skills level of respondents in analysis and design skills. The scale 1 (very poor) to 5 (very good) was provided for them to rate their experience and knowledge on the respective skills. The distribution of respondents and their mean in each of the skills is shown in Table 10.

Table 10: Distribution of respondents in analysis and design skills (N=100)

Skills	**Number of Respondents**					**Mean**	**Standard Deviation**
	1	**2**	**3**	**4**	**5**		
Ability to do an adequate feasibility study	15	10	38	25	12	3.09	1.19
Ability to do a cost/ benefit analysis of alternative system design	10	12	35	33	10	3.21	1.10
Ability to do a cost/ benefit analysis of alternative packages or tools	15	25	40	10	10	2.75	1.14
Ability to create a formal conceptual design for an application	8	10	17	42	23	3.62	1.17
Ability to perform semantic data Modeling	5	15	51	16	13	3.17	1.00
Ability to use CASE development tools	10	10	58	14	8	2.86	1.33
Ability to perform object-oriented analysis and design for application using UML	3	12	18	32	35	3.84	1.12
Ability to use formal information requirements determination methods	6	8	51	22	13	3.28	0.99
	Overall Mean					3.22	

Based on survey's results most of the sub-skills in this category show mean more than 3.00. The overall mean for this category is 3.22 which fall above the moderate level based on five point Likert Scale. This shows that, IT professionals nowadays have a good knowledge in Analysis and Design Skills. According to respondents, most of the knowledge in these skills was acquired through working experience. Based on interviews

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with software engineers, they have good knowledge in *'ability to perform object-oriented analysis and design for application using UML'*. According to them, this skill is considered as one of the most important skills for their career development. Since most of respondents were software engineers, this sub-skill shows a higher mean which is 3.84.

'Ability to use CASE development tools' shows mean of 2.86 where 58 respondents ranked that they were moderate in this skill. 15 respondents ranked that they were very poor in *'ability to do a cost/ benefit analysis of alternative packages or tools'* with a mean of 2.75. This data shows that, IT professionals in Malaysia were poor in these skills. According to respondents since they didn't have a proper expose to these skills, their knowledge are limited in both of the skills. Even some of them suggested that incorporate training will help them to increase their expertise in both of the skills which is quite useful for their career.

Programming Skills

The second question in section C was constructed to identify the skills level of respondents in programming skills. The distribution of respondents and their mean in each of the skills is shown in Table 11.

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Table 11: Distribution of respondents in programming skills (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Ability to apply structured program design	4	18	39	27	12	3.25	1.01
Ability to design program data structure	6	12	40	36	6	3.24	0.95
Ability to create effective documentation for application	2	10	31	49	8	3.51	0.85
Ability to design and use algorithms	6	14	39	33	8	3.23	0.99
Ability to prototype applications	8	14	35	33	10	3.23	1.07
Ability to design security, privacy and auditing controls for applications	10	24	43	21	2	2.81	0.95
Knowledge of systems development quality assurance procedures	10	22	37	27	4	2.93	1.02
Knowledge of a specific systems development methodology	4	18	45	29	4	3.11	0.88
Ability to develop web sites	8	6	41	25	20	3.43	1.11
	Overall Mean					3.19	

Overall mean for this category is 3.19 which is also above moderate level based on five point Likert scale. From the survey results, 49 respondents ranked that they have a good knowledge in *'ability to create effective documentation for application'*. Based on interviews IT professionals say their expertise in this skill increase as their experience in IT industry increase. The data also shows IT professionals have ranked that they have good knowledge in *'ability to develop web sites'*. When interviewed, IT experts from industry, feels rapid evolution in World Wide Web (WWW), caused IT professionals' knowledge in this skill increase recently. This is followed by *'ability to apply structured program design'*.

Based on survey results, *'ability to design security, privacy and auditing controls for applications'* have the lowest mean compared to other skills in this category. 24 respondents ranked that they were poor meanwhile 43 respondents ranked that they were moderate in this skill. Based on interviews that carried out, IT professionals feel their

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expertise in this skill low because the knowledge that they acquired in universities or colleges on this skill was too limited.

Interpersonal Skills

The third question in section C was constructed to identify the skills level of respondents in the interpersonal skills. The distribution of respondents and their mean in each of the skills is shown in Table 12.

Table 12: Distribution of respondents in the interpersonal skills (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Ability to work with others to accomplish some goals	-	2	17	59	22	4.01	0.69
Ability to write clearly and effectively	-	4	18	60	18	3.92	0.72
Ability to work alone to accomplish some goals	-	2	18	51	29	4.07	0.74
Ability to listen to others	-	-	21	57	22	4.01	0.66
Ability to give effective presentation	2	2	35	49	12	3.67	0.79
Ability to respond appropriately to another's emotions	2	4	22	55	17	3.81	0.83
Ability to persuade others	2	6	41	39	12	3.53	0.85
Ability to train others	2	4	19	57	18	3.85	0.83
	Overall Mean					3.86	

Based on the survey results, the respondents ranked that they have good knowledge in most of the sub-skills and the overall mean of 3.85 indicates that IT professionals' skill level in Interpersonal Skills was good. IT professionals believe that this skill is very important for their career advancement. The data shows that many IT professionals have *'ability to work alone to accomplish some goals'*. According to them, they develop this skill since IT fields require them to be independent and they only need minimum

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supervision in their work. The next two top skills among IT professionals in this category are *'ability to work with others to accomplish some goals'* and *'ability to listen to others'*.

49 respondents ranked that they were good in *'ability to give effective presentation'* meanwhile 39 respondents ranked that they were good in *'ability to persuade others'*. According to the respondents they need to develop these skills since they have to deal with clients and provide the system support to their customers. They found these skills are very important in IT industry.

Environment or Platform Skills

The fourth question in section C was constructed to identify the skills level of respondents in environment or platform skills. The distribution of respondents and their mean in each of the skills is shown in Table 13.

Table 13: Distribution of respondents in environment or platform skills (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Ability to build systems in a mainframe environment	-	2	17	59	22	4.01	0.69
Ability to build systems in a PC environment	-	4	18	60	18	3.92	0.72
Ability to build applications in multiple environment/ platform	-	2	18	51	29	4.07	0.74
Ability to build systems in a minicomputer environment	-	-	21	57	22	4.01	0.66
Ability to build applications in a UNIX environment	2	2	35	49	12	3.67	0.79
Ability to build applications in a LINUX environment	2	4	22	55	17	3.81	0.83
Ability to build applications in a Windows environment	2	4	20	39	35	4.01	0.94
Ability to build applications in NT environment	3	7	20	45	25	3.82	0.98

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Ability to build applications for the SNA environment	15	34	29	14	8	2.66	1.13
Ability to build applications for SAA environment	17	32	41	6	4	2.48	0.97
Ability to build applications in a Novell environment	13	20	35	18	14	3.00	1.21
Knowledge on 3G Technologies	8	38	35	9	10	2.75	1.06
Knowledge on Mobile Communications	9	17	34	18	22	3.27	1.23
Knowledge on VOIP	20	28	32	11	9	2.61	1.18
Knowledge on Cisco Routers	10	2	47	30	11	3.30	1.03
Knowledge on Internet/ Intranet systems and protocols	3	5	43	36	13	3.51	0.89
Knowledge on LAN	-	2	22	40	36	4.10	0.81
Knowledge on WAN	-	5	26	47	22	3.86	0.81
Knowledge on WLAN	3	13	40	28	16	3.41	1.00
Knowledge on VLAN	8	7	43	25	17	3.36	1.09
Knowledge on Virtual Private Network (VPN)	9	12	34	28	17	3.32	1.16
Knowledge on web security	8	10	28	32	22	3.50	1.17
Knowledge on network security	12	12	36	27	13	3.17	1.17
Knowledge on Public Key Infrastructure	12	16	40	23	9	3.01	1.11
Knowledge on Intrusion Detection System	23	22	35	14	6	2.58	1.16
Knowledge on Visual InterDev	20	21	38	9	12	2.72	1.23
Knowledge on Cold Fusion	15	25	33	10	17	2.89	1.27
Knowledge on Web Sphere	13	17	49	11	10	2.88	1.09
Knowledge on Notes & Domino	10	20	40	13	17	2.97	1.42
Knowledge on DNS	9	19	51	8	13	2.97	1.07
Knowledge on TCP/IP	-	5	28	34	33	3.95	0.90
Knowledge on HTTP	3	3	10	37	47	4.22	0.95
Knowledge on E-mail	-	-	15	35	50	4.35	0.73
Knowledge on Proxy	7	3	47	28	15	3.41	1.01
Knowledge on Firewalls	6	10	28	39	17	3.51	1.07
	Overall Mean					3.40	

Based on survey results, IT professionals' skill level in Environment or Platform sub-skills is not consistent. They ranked that they were good in certain skills and their knowledge was quite low in some of the sub-skills. In overall their knowledge in this skill category was above the moderate level based on five point Likert Scale with mean of 3.40. Most of respondents ranked that they have a good knowledge in *'knowledge on E-mail'* with a mean of 4.35. According to them e-mail is fastest and cheapest communication tools in IT field. This is followed by *'knowledge on HTTP'* and

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'knowledge on LAN', where according to respondents are basic skills for IT professionals who involved in networking field.

According to Quantrum Alliance Sdn Bhd's technical director Ralph K. Tee the programmers should know how to use Microsoft Windows XP and Red Hat Linux platform as well as open sources platform to be a successful software programmers (Angelina, 2004). In line with Tee's statement, the survey results also show respondents ranked that they have good knowledge in *'ability to build applications in a Windows environment'*, *'ability to build applications in NT environment'* and *'ability to build applications in LINUX environment'*.

According to the survey data respondents skill level was low in certain skills such as *'knowledge on VOIP'*, *'knowledge on Intrusion Detection System'* and *'ability to build application for SAA environment'*. Based on the interviews with respondents, they say that their knowledge was low in newly discovered technologies since they didn't have a proper training and expose to those skills.

Fast evolution and rapid changes in ICT field, result in new technologies to be discovered from time to time. Therefore IT professionals should be updated with this scenarios and increase their expertise in these new technologies to overcome the challenging IT world.

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Business Skills

The fifth question in section C was constructed to identify the skills level of respondents in business skills. The distribution of respondents and their mean in each of the skills is shown in Table 14.

Table 14: Distribution of respondents in business skills (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Have an understanding of a specific business function	6	11	18	34	31	3.73	1.18
Ability to create a formal conceptual design for an application	8	9	45	23	15	3.28	1.08
Ability to do project planning and control	9	13	35	20	23	3.35	1.22
Ability to foresee problems that would results from introduction of new technology	11	22	44	14	9	2.88	1.07
Have an understanding of industry structure and behavior	10	6	30	24	30	3.58	1.25
Ability to use techniques for identifying application that will provide competitive advantages	12	13	38	22	15	3.15	1.19
Ability to use MIS planning methods	5	10	30	32	23	3.58	1.10
Knowledge of the laws and ethical issues associated with computing	20	21	31	16	12	2.79	1.27
Knowledge on E-commerce	9	15	28	16	32	3.47	1.31
Knowledge in Business Process Reengineering (BPR)	12	15	38	16	19	3.15	1.24
	Overall Mean					3.30	

The survey shows that, in overall respondents knowledge in Business Skills was above moderate level with the mean of 3.30 (based on five point Likert Scale). Most of the respondents ranked that they have a good knowledge in 'have *an understanding of a specific business function'*. When interviewed, IT experts from industry say knowledge in business skills is very important for IT professionals since IT has a close relation with business and development of IT industry depends on development of business field.

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Based on that principle, respondents also have good knowledge in '*have an understanding of industry structure and behavior'* and *'ability to use MIS planning.*

Since online business becomes a new trend in modern life, the skill levels in *'knowledge on E-commerce'* among IT professionals were quite good with a mean of 3.47. The survey also shows that, respondents have low knowledge in *'Knowledge of the laws and ethical issues associated with computing'*. Overall, the skill levels in this category show that Business Skills are very important for the development of IT industry nowadays.

Application Skills

The sixth question in section C was constructed to identify the skills level of respondents in application skills. The distribution of respondents and their mean in each of the skills is shown in Table 15.

Table 15: Distribution of respondents in application skills (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Ability to design relational databases	13	23	35	17	12	2.92	1.18
Ability to design distributed applications	10	20	43	14	13	3.00	1.12
Ability to design collaborative work application	12	24	39	16	9	2.86	1.10
Ability to create effective Decision Support System	15	18	35	14	18	3.02	1.28
Ability to design hierarchical or network databases	21	25	31	15	8	2.64	1.20
Ability to perform analysis and design for expert systems	19	19	30	22	10	2.85	1.24
Knowledge in Enterprise Reengineering and Restructuring (ERR) software	19	16	37	17	11	2.85	1.23
Knowledge in Enterprise Resources Planning (ERP) software	17	15	33	24	11	2.97	1.23

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Knowledge on Software Management Configuration	10	18	30	19	23	3.27	1.27
	Overall Mean					2.93	

Respondents' skill level in Application Knowledge was slightly below than the moderate level and the survey shows that overall mean is 2.93. Based on data collected, respondents' expertise in '*knowledge on Software Management Configuration'* was better compared to other skills since most of the respondents were software engineers. This is followed by respondents' expertise level in '*ability to create effective Decision Support System'* and *'ability to design distributed applications'*.

From the interview conducted, IT professionals feel that, they should increase their expertise level in Application Knowledge since knowledge in this category is going to be important for their profession in the future. According to them good knowledge in application skill will help them in their career advancement and also increase their domain knowledge in IT fields.

Computer Language Knowledge

The seventh question in section C was constructed to identify the skills level of respondents in computer language knowledge. The distribution of respondents and their mean in each of the skills is shown in Table 16.

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Table 16: Distribution of respondents in computer language knowledge (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Ability to program in COBOL	18	19	34	17	12	2.86	1.24
Ability to build application using 4th generation language	10	21	32	16	21	3.17	1.26
Ability to use operating system Job Control Languages	27	28	33	5	7	2.37	1.14
Ability to program in C	3	4	20	44	29	3.92	0.96
Ability to program using an object-oriented language	6	7	37	28	22	3.53	1.09
Ability to program using an Artificial Intelligence Language	27	30	26	8	9	2.42	1.22
Ability to program in ADA	22	34	27	10	7	2.46	1.14
Ability to program in Java/J2EE	12	22	45	12	9	2.84	1.07
Ability to program in Visual Basic	4	5	44	30	17	3.51	0.96
Ability to program in HTML	10	11	41	22	16	3.23	1.15
Ability to program in DHTML	13	14	43	17	13	3.03	1.16
Ability to program in ASP	12	18	39	18	13	3.02	1.17
Ability to program in PHP	11	24	45	11	9	2.83	1.06
Ability to program in C++	1	3	18	27	51	4.24	0.92
Ability to program in Delphi	17	15	32	19	17	3.04	1.30
Ability to program in Perl	13	19	38	22	8	2.93	1.12
Ability to program in MySQL	10	20	30	23	17	3.17	1.22
	Overall Mean					3.09	

Computer language knowledge is essential skills for most of IT jobs such as programmers. Good knowledge in computer languages will help IT professionals to become a successful person in their career. The data shows, 51 respondents ranked that they were very good in *'ability to program in C++'*. This is followed by *'ability to program in C'* where 44 respondents ranked that they were good in this skill. Respondents' skill level in '*ability to program using an object-oriented language'* was also quite good. From observation on computer languages offered in Computer Science curriculum in local higher learning institution, it shows that these languages were mainly taught nowadays and many local graduates have good expose in these languages.

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Based on data collected, respondents' knowledge level in *'ability to program in Visual Basic'* was quite good. The evolution and rapid development of World Wide Web (WWW) caused the skill levels of IT professionals in *'ability to program in HTML'* to be high. This is followed by *'ability to build application using 4th generation language'* and *'ability to program in MySQL'* with the mean of 3.17.

According to the respondents, their knowledge level in certain computer languages are low since they don't have much exposure to those languages in their studies and also working fields. Respondents ranked *'ability to program in ADA'*, *'ability to use operating system Job Control Languages'* and *'ability to program using an Artificial Intelligence Language'* under this category. However, based on respondents' response, in overall their knowledge in computer language knowledge was above moderate level with mean of 3.09.

Although the skill levels of IT professionals were good in certain languages, but this trend will be changed in the future. Languages such as Visual Basic, Java, J2EE, ASP, and PHP are going to be popular among IT professionals since these languages have a high demand in the IT market. IT professionals should increase their expertise level in these languages in order to be successful in their career.

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Database Knowledge

The eighth question in section C was constructed to identify the skills level of respondents in database knowledge. The distribution of respondents and their mean in each of the skills is shown in Table 17.

Table 17: Distribution of respondents in database knowledge (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Ability to build application using SQL Server 2000	12	4	39	28	17	3.34	1.17
Ability to build application using Oracle 91	12	14	43	19	12	3.05	1.13
Ability to build application using DB2	10	13	40	20	17	3.21	1.17
Ability to build application using Informix	11	10	40	29	10	3.17	1.10
Ability to build application using Sybase	8	19	40	22	11	3.09	1.08
Ability to build application using MS Access	-	2	10	35	53	4.39	0.75
	Overall Mean					3.38	

The data indicates overall knowledge of respondents in Database Knowledge was quite good with mean of 3.38 which is above moderate level based on five point Likert scale. The survey shows 53 respondents ranked that they were very good in *'ability to build application using MS Access'* with a mean of 4.39. This is followed by *'ability to build application using SQL Server 2000'* where 28 respondents ranked that they were good in this skill. According to respondents SQL server is one of the famous database tools to develop application nowadays.

Since oracle was used widely in IT industry, the data show that respondents knowledge in *'ability to build application using Oracle 91'* above the moderate level with mean of 3.05. From the analysis conducted, most of IT professions need the knowledge in

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databases, the expertise level of respondents in this category was quite good. They have to maintain this scenario to be successful in their professions.

Multimedia Knowledge

The ninth question in section C was constructed to identify the skills level of respondents in multimedia knowledge. The distribution of respondents and their mean in each of the skills is shown in Table 18.

Table 18: Distribution of respondents in multimedia knowledge (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Ability to use Macromedia Director	17	29	14	20	20	2.97	1.40
Ability to use Macromedia Flash	15	19	34	15	17	3.00	1.27
Ability to use Dreamweaver	17	18	29	17	19	3.03	1.34
Ability to use Adobe Photoshop	4	6	26	34	30	3.80	1.06
Ability to use GIF Animator	15	10	42	16	17	3.10	1.24
Ability to build animation using VRML	22	23	45	5	5	2.48	1.04
Knowledge on Scriptwriting	20	25	29	19	7	2.68	1.19
Knowledge on Production Design	40	38	17	3	2	1.89	0.93
Ability to use 3D Studio Max	14	15	36	18	17	3.09	1.25
Knowledge on storyboarding	17	18	34	22	9	2.88	1.19
	Overall Mean					2.89	

IT professionals' skill levels in Multimedia Knowledge were not consistent. They were good in certain sub-skills and their knowledge in some of the sub-skills was very low. The survey shows the overall mean for this skill was below the moderate level. Since the respondents for this study were not involved directly in Multimedia fields, their expertise in this skill was low. However, the data shows most of the respondents have good knowledge in *'ability to use Adobe Photoshop'*. This is followed by *'ability to use GIF*

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Animator' and *'ability to use 3D Studio Max'* . According to respondents these skills were useful for them to build interactive user interface for their applications.

According to respondents, their knowledge in certain Multimedia skills such as *'ability to build animation using VRML'* and *'knowledge on Production Design'* quite low because these skills are not important for their job scope. Since multimedia is a new field in IT world, the IT professionals' expertise and knowledge in this field was quite low and ought to be increased in the future.

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Section C: Others

Respondents' Current Important Skills

The first question in section D was constructed to identify the skills in order of importance to respondents. A nine point Likert Scale ranging from 1 (less important) to 9 (most important) were provided for them to rate the skills in order of importance. The distribution of respondents and their mean in each of the skills was shown in Table 19. The value of mean indicates the importance of the skills where higher value indicates that the skill was more important and lesser value indicates that the skill was less important.

Table 19: Distribution of respondents' in current important skills (N=100)

Skills	Number of respondents									Mean	Standard Deviation
	1	2	3	4	5	6	7	8	9		
Analysis and Design Skills	-	-	-	3	12	22	20	28	15	7.03	1.34
Programming Skills	-	-	1	9	6	18	31	21	14	6.88	1.46
Interpersonal Skills	-	7	12	21	20	12	7	12	9	5.32	2.03
Environment/ Platform Skills	7	9	17	14	8	4	12	16	13	5.25	2.59
Business Skills	25	17	13	5	9	11	4	6	10	3.95	2.72
Application Knowledge	14	18	26	16	13	2	1	3	7	3.63	2.05
Computer Language Knowledge	-	-	3	2	25	21	15	13	21	6.66	1.65
Database Knowledge	21	20	15	12	7	6	7	1	11	3.81	2.58
Multimedia Knowledge	33	29	13	18	-	4	3	-	-	2.47	1.53

Based on the survey, respondents ranked Analysis and Design Skills as the most important skills for their career currently with the mean of 7.03. According to them, knowledge in this skill will help them to overcome challenges and also to analysis the problem within their job scope effectively. Since most of respondents in this study were

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programmers and software engineers, they ranked Programming Skills and Computer Language Knowledge as important skills for their career currently. These skills ranked as second and third important skills in order of importance with the mean of 6.88 and 6.66 respectively. Interpersonal Skills ranked as the forth important skill for their career currently by respondents. From the interview conducted, respondents say this skill is necessary where IT professionals required communicating with their clients to do requirement studies and trainings.

Most of the system engineers choose Environment or Platform Skills as important skills to their current working environment with a mean of 5.25. According to them, this skill is necessary because their job scope needs them to have a good knowledge on networking side. Database Knowledge was ranked as seventh important skill by respondent for their working environment currently. Based on interviews with IT experts from industry, Database Knowledge is essential skill for IT jobs like programmer and software engineers where their job scope requires them to maintain their applications' database. Respondents have ranked Multimedia Knowledge as the least importance skill for their career currently. Since most of respondents for this survey were software engineers, programmers and system engineers, they feel this skill is not directly link to their job scope. According to them multimedia knowledge is important for those who work as graphic designer, 3D animator and web designer.

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Respondents' Opinion on how well the universities or colleges are providing the IS Skills

The second question in section D was constructed to identify how well the universities or colleges that respondents graduate from, provide them with the skills that they rank in first question in section D. The frequency indicating as very good, good, moderate, poor and very poor was used. The distribution of respondents' opinion was shown in Table 20. The responses showed that, most of respondents ranked that universities and colleges are moderate in providing IS skills for their students. Respondents opinion were proved true because according to Human Resources Minister Datuk Wira Dr Fong Chan Onn, what some ICT graduates learn in the university is not really what the industry requires. Fong said the Government is trying to solve the problem through retraining programmes (Rozana, 2004).

Based on interviews carried out, respondents feels the current universities and colleges curriculum on Computer Science should be revised and more emphasizes should be given to new technologies and demanding programming language in ICT market. The current skill sets provided by computer science curriculum fails to meet industry requirements. Their opinion was supported by JobStreet.com's vice president of Malaysia operation, Suresh Thiru's opinion. He believes that one of the main issues of the current ICT graduate unemployment problems is the differences between the graduates' actual skill sets and that of those required by the job market (Foo, 2004).

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Cross tabulation of the respondents' opinion on how well the universities or colleges that respondents graduate from, provide them with the IS skills by qualification also shown in Table 18. The data indicated that out of 10 respondents who choose 'very good' as an answer, 2 respondents (20.0%) were diploma holders and 8 respondents (80.0%) were degree holders. Out of 18 respondents who choose 'good' as an answer, 7 respondents (38.9%) were diploma holders, 10 respondents (55.6%) were degree holders and 1 respondent (5.5%) was a master holder. Meanwhile, from 45 respondents who chose 'moderate' as an answer, 2 respondents (4.5%) were diploma holders, 42 respondents (93.3%) were degree holders and 1 respondent (2.2%) was a master holder. Out of 20 respondents whose answer was 'poor', all of them (100.0%) were degree holders. From 7 respondents whose answer was 'very poor', 6 of them (85.7%) were degree holders and 1 (14.3%) of them was a master holder.

Technology is rapidly changing and it is important that Computer Science curriculum is relevant to employer needs (Lee et al., 2002). Based on this argument, diploma, degree and master programmes should be revised from time to time so it was up to date with evolving technologies which is demanded by employers and necessary upgrade must be done in order to provide more knowledge and improve skill sets of their graduates.

Table 20: Respondents' opinion by qualification (N=100)

Respondents' Opinion	**Qualification**						**Total**
	Diploma		**Degree**		**Master**		
	N	**%**	**N**	**%**	**N**	**%**	
Very good	2	20.0	8	80.0	-	-	10
Good	7	38.9	10	55.6	1	5.5	18

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Moderate	2	4.5	42	93.3	1	2.2	45
Poor	-	-	20	100.0	-	-	20
Very Poor	-	-	6	85.7	1	14.3	7
Actual Responses	11	11.0	86	86.0	3	3.0	100

Where respondents acquire IS Skills other than universities and colleges

Question four section D was designed to generate data, where respondents acquire IS skills besides universities and colleges. In this question, respondents may choose more than one choice. Figure 3.2(c) shows the distribution of respondents' choices. Since IT professionals are told to upgrade their skills level from time to time (Hamisah, 2001), they have taken various steps to increase their knowledge and improve their skill set so it was in line with the ever-changing technology in IT field. IT industry nowadays is very competitive as employers are on selective and strategic hiring, therefore IT professionals should always be in a learning environment to face stiff competition. The data shows that most of the IT professionals are capable of learning new knowledge or skills by their own through research, online tutorials in internet and also by attending conference, seminars and trainings.

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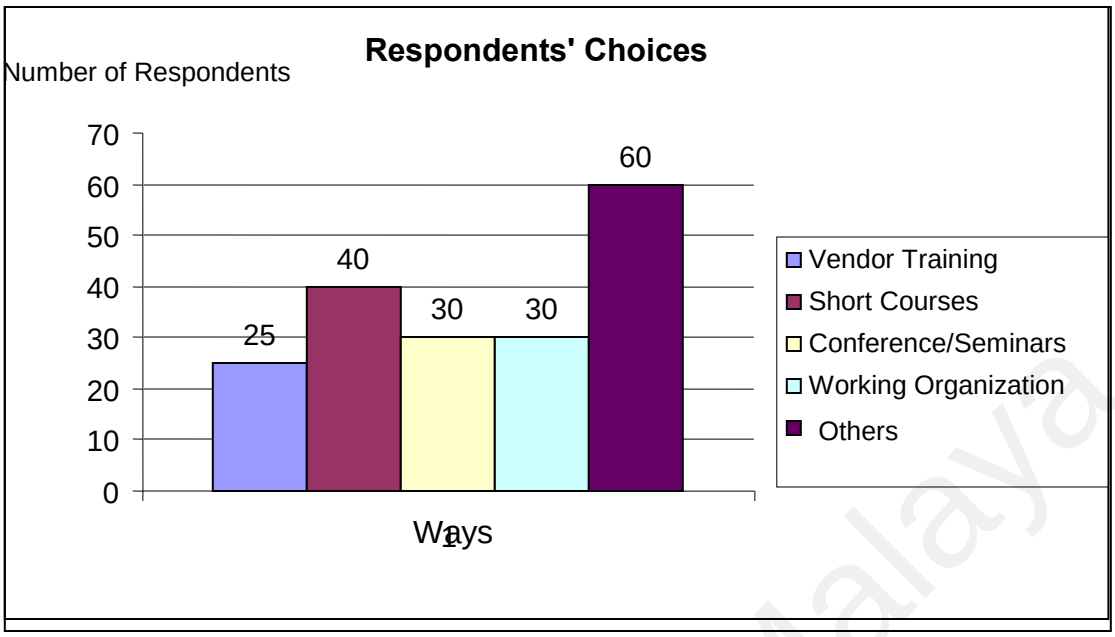

Figure 3.2(c): Respondents' Choices

Respondents' Opinion on how well the universities or colleges prepare the preferred graduates for industry

The fifth question in section D was constructed to identify how well the current curriculum in universities or colleges prepare and train the preferred graduates for industry. The frequency indicating as strongly agree, agree, slightly agree, slightly disagree, disagree and strongly disagree was used. The distribution of respondents' opinion was shown in Table 21. The responses showed that, nearly 50% of respondents disagree that universities and colleges are able to produce preferred graduates for industry. According to respondents, most of them acquire a lot of skills once they enter their job world. From analysis that carried out on Computer Science curriculum in local universities and interviews with academicians, the curriculum was unable to meet the

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fast-changing technology and IT graduates should be wiling to change and open to learning environment. They also should be able to build their expertise level based on basic skills which provided by their higher learning institution.

Cross tabulation of the respondents' opinion on how well the current curriculum in universities or colleges produces preferred graduates for industry by qualification also shown in Table 21. The data indicated that out of 10 respondents who strongly agree, 5 respondents (50.0%) were diploma holders, while the other 5 respondents (50.0%) were degree holders. Out of 25 respondents who agree, 5 respondents (20.0%) were diploma holders and 20 respondents (80.0%) were degree holders. Meanwhile, from 21 respondents who slightly agree, 1 respondent (4.8%) was a diploma holder, 19 respondents (90.4%) were degree holders and 1 respondent (4.8%) was a master holder. Out of 30 respondents who slightly disagree, 29 respondents (96.7%) were degree holders and 1 respondent (3.3%) was a master holder. From 9 respondents who disagree, 8 of them (88.9%) were degree holders and 1 (11.1%) of them was a master holder. Finally, out of 5 respondents who strongly disagree, all of them (100.0%) were degree holders.

The current situation where fresh graduates find difficulties to get suitable jobs in IT field caused them to disagree that university and colleges are capable to produce preferred graduates for industry. The issues like mismatch between the graduates' skills and those needed by job market also contribute to this scenario. The retraining programmes which conducted by Human Resources Ministry for ICT graduates also makes most of degree

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holders feel that skills provided by higher learning institution do not match employers need.

Table 21: Respondents' opinion by qualification (N=100)

Respondents' Opinion	Qualification						Total
	Diploma		Degree		Master		
	N	%	N	%	N	%	
Strongly Agree	5	50.0	5	50.0	-	-	10
Agree	5	20.0	20	80.0	-	-	25
Slightly Agree	1	4.8	19	90.4	1	4.8	21
Slightly Disagree	-	-	29	96.7	1	3.3	30
Disagree	-	-	8	88.9	1	11.1	9
Strongly Disagree	-	-	5	100.0	-	-	5
Actual Responses	11	11.0	86	86.0	3	3.0	100

Respondents' Opinion on how well the universities or colleges expertise train their students with IS skills

Question six in section D was designed to generate data, on respondents' opinion whether universities and colleges have enough expertise to train their students with required IS skills. The frequency indicating as strongly agree, agree, slightly agree, slightly disagree, disagree and strongly disagree was used. The distribution of respondents' opinion was shown in table 22. The responses showed that, 70% of respondents agree that expertise in universities and colleges were capable to train their students with IS skills. As we know, minimum qualification to be lecturer in higher learning institution nowadays should be master degree holders. In terms of academic qualification, these experts do not face any problems. Some of them even proved to have good knowledge in their fields. The major

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issue is, some of higher learning institution face shortage of experts to teach latest technologies.

Cross tabulation of the respondents' opinion whether universities and colleges have enough expertise to train their students with required IS skills by qualification also shown in Table 22. The data indicated that out of 20 respondents who strongly agree, 5 respondents (25.0%) were diploma holders and 15 respondents (75.0%) were degree holders. Out of 30 respondents who agree, 6 respondents (20.0%) were diploma holders and 24 respondents (80.0%) were degree holders. Meanwhile, out of 20 respondents who slightly agree, all of them (100.0%) were degree holders. In the next category, 15 respondents (88.2%) were degree holders and 2 respondents (11.8%) were master holders. From 10 respondents who disagree, all of them (100.0%) were degree holders. Then, out of 3 respondents who strongly disagree, 2 of them (66.7%) were degree holders and 1 of them (33.3%) was a master holder.

The survey clearly shows that, the problem in preparing the IT graduate for industry is not the shortage of expertise that the universities and colleges face but the subjects that been taught in their courses. More subjects related to latest technologies should be included in computer science curriculum in order to provide IT graduates the basic knowledge about these technologies before entering the job market.

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Table 22: Respondents' opinion by qualification (N=100)

Respondents' Opinion	Qualification						Total
	Diploma		Degree		Master		
	N	%	N	%	N	%	
Strongly Agree	5	25.0	15	75.0	-	-	20
Agree	6	20.0	24	80.0	-	-	30
Slightly Agree	-	-	20	100.0	-	-	20
Slightly Disagree	-	-	15	88.2	2	11.8	17
Disagree	-	-	10	100.0	-	-	10
Strongly Disagree	-	-	2	66.7	1	33.3	3
Actual Responses	11	11.0	86	86.0	3	3.0	100

Respondents' Important Skills in Future

The seventh question in section D was constructed to identify the skills in order of importance to respondents in future (5 years time). A nine point Likert Scale ranging from 1 (less important) to 9 (more important) were provided for them to rate the skills in order of importance. The distribution of respondents and their mean in each of the skills was shown in table 23. The value of mean indicates the importance of the skills where higher value indicates that the skill was more important and lesser value indicates that the skill was less important.

Table 23: Distribution of respondents' in current important skills (N=100)

Skills	Number of respondents									Mean	Standard Deviation
	1	2	3	4	5	6	7	8	9		
Analysis and Design Skills	-	-	-	-	4	25	22	31	18	7.34	1.15
Programming Skills	-	-	-	8	8	18	35	19	12	6.85	1.37
Interpersonal Skills	-	5	9	17	21	13	9	15	11	5.70	2.02
Environment/ Platform Skills	8	10	20	14	11	7	8	12	10	4.83	2.48
Business Skills	23	12	15	4	7	12	6	8	13	4.38	2.86

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Application Knowledge	13	17	24	17	11	3	2	4	9	3.87	2.32
Computer Language Knowledge	5	7	5	10	20	15	12	10	16	5.72	2.30
Database Knowledge	21	22	3	23	10	7	6	1	7	3.71	2.35
Multimedia Knowledge	30	27	24	7	8	-	-	-	4	2.60	2.01

Based on the survey, most of the respondents ranked Analysis and Design Skills will be the most important skills for their challenging career in the future with the mean of 7.34. This skill is essential for IT professional to analyze the complex problem within their job scope. Since most of respondents are programmers and software engineers and they expect themselves with to be promoted to the senior level in a five years time, there will be a decrease in importance of Programming Skills in the future.

Meanwhile the importance of Interpersonal Skills and Business Skills will be increased because career advancement requires respondents to communicate effectively in order to gather requirements and also involved in consulting role. It is understandable that Application Knowledge and Multimedia Skills would gain more importance in future as career advancement also requires respondents to have good domain knowledge in certain areas and ability to give powerful and attractive presentation. However there are skills which will decrease in importance in the future, they are the Environment or Platform Skills, Computer Language Knowledge and Database Knowledge.

From the data collected we can suggest that IT professionals in future should possess combination of interpersonal, business and technical skills which will allow them to analyze problems, integrate application and implement new business process.

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3.3 Summary

From the survey conducted, most of respondents involved in this study are male and working as software engineers. Based on survey's data, most of IT professionals in Malaysia have obtained at least a degree before start their profession. Mainly most of them are majoring in Computer Science and IT studies and involved in Software and Telecommunications industries. The survey also shows most of respondents involved in this survey have more than 3 years working experience in IT industries and working in an organization with more than 200 employees.

The survey shows that, most of respondents have good Interpersonal Skills since the overall mean in this category is higher compared to other categories. The second highest rated skill is Environment and Platform Skills followed by Database Knowledge. But when the respondents were asked to rate the important skills for their working environment currently, most of them choose Analysis and Design Skills as the most important skill, followed by Programming Skills and Computer Language Knowledge. Based on these results, it clearly shows that the skills possess by most of IT professionals does not match the industry requirements. Therefore, a major change should be done in current Computer Science and IT curriculum in order to provide preferred graduates for IT industry in the future.

The finding also shows most of respondents feel universities and colleges are moderate in providing IS skills for their students. 46% of respondents disagree that the universities

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and colleges have provided preferred graduates for the industries. The respondents also rated, most of them acquire IS skills by their own through attending seminars, online tutorials and on job-training.

The findings also shows that, for the future (5 years time) Analysis and Design skills is rated as most important skills to IT professionals followed by Programming skills and Computer Language Knowledge. The survey results also show the importance of Interpersonal skills and Business Skills has been increase among IT professionals in the future.

To support the findings from the survey IS skills assessment tool has been developed. Since there is no existing IS skills assessment tool in the market, ISSAS (Information System Skills Assessment System) which was developed as a part of this research will be a prototype system and reference to develop more sophisticated and effective skills' assessment tool in the future. Development of ISSAS was explained in detail in the following mention chapter.

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Chapter 4: System Design and Development

4.0 Introduction

The rapid growth in IT industry has resulted in the skills requirement for IT professionals to change from time to time. There are several IS skills that IT professional should possess in order to be highly in demand in the IT job market. From the survey and analysis which have been done it shows that, a well rounded IT professional should have a combination of technical skills, business skills and interpersonal skills as shown in Table 19 of Chapter 3.

Therefore a proper system is needed to evaluate the IS skills among IT professional so that they can be aware of their skills level and take further action to improve it. In order to do that, an Information System Skills Assessment System (ISSAS) was developed. This chapter has discussed about the development of ISSAS. The chapters are divided into 11 sections inclusive of:

- System Overview
- System Objective
- System Scope

As for the development of the system, it is divided as follows:

- System Methodology
- Software and hardware consideration
- System Design

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- Database Design
- Interface Design
- System Development
- System Testing
- System Limitation

4.1 System Overview

Information System Skills Assessment System (ISSAS) was developed as a tool to evaluate the IS skills level among IT professionals in the organization. Since, there is no proper tool and guide to evaluate the IS skills among the employees in IT field, ISSAS was developed. It is believed that, ISSAS can be used as a guidance by organization to evaluate the skills level so that IT professionals will know their skills level and can take further action to improve their knowledge in certain skills especially the skills that they need in their career. ISSAS also can be a basis to develop more sophisticated and effective skills' assessment tool for IT industry in future.

ISSAS is a web based assessment system, which was developed using Java and Java Script and the database was developed using SQL Server 2000 and it runs on Jakarta-tomcat 3.2.3 as its web-server. In ISSAS, a total of 112 sub-skills, are provided and they are categorized into nine groups. IT professionals have to rank their expertise level in each skill based on a scale provided. A five point Likert scale, 1 (very poor) to 5(very good) was provided for this purpose.

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ISSAS has been designed in such a way to enable users to access the system by registering for the first time if they are new to the system. After successful registration, if the users are under employees' category the system enables them to participate in the skill assessment. Once they complete the assessment, a skills assessment report will be generated by the system together with the graph and useful comment.

In this assessment system, the users under managers' category are able to view the overall assessment report of employees in their department. The system also allows them to view the individual assessment report of each employee in their department. They also have feasibility to view the skills level of their employee in each sub-skill. ISSAS allows the managers to do search on their employees' skills level. Meanwhile the administrator of ISSAS would be in charge of managing the whole system and manage the members who register in the system.

4.2 System Objectives

The objective of ISSAS is to act as an assessment tool for employers to evaluate the IS skills level among IT professionals in their organizations. Moreover, it is the aim that skills assessment report generated by ISASS is used by employers to analyse and provide related training for their employees in order to increase their effectiveness at their work. ISSAS also aims to take a closer look at the current IS skills in IT industry by providing a list of IS skills for assessment to allow IT professionals to rate them in the demanding skills in IT fields nowadays. This assessment will help the IT professionals to be more

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aware on current scenarios in IT industry and take drastic steps to improve their knowledge and to be more competitive in IT market.

4.3 System Scope

IS Skills Assessment System (ISSAS) is designed for IT professionals to evaluate their skills level in IS skills. This system contains a total of 112 IS sub-skills, which are grouped into 9 main categories to be ranked by the user of the system, employees. Other than that, managers of each department will use this system to view the overall assessment report of their employees and also by individual. This assessment system has a few modules namely:

i) registration module

In this module, the users of system, employee and department managers need to register them in order to use this system. For registration purpose they need to provide their personal information such as their name, position, employee id, department id and other relevant information. The registration process only will be successful if users provide all the required information. All the required fields in the registration form were marked with asterisks (*).

ii) employee module

In this module, employees need to rank their skills level in each category based on the five point Likert Scale. Once, they complete ranking their skills level in each category. The mean for each skill category will be calculated and skills

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assessment report will be generated together with the graph and useful comments which clearly describes their skills level.

iii) manager module

In this module, the manager can view the overall assessment report of employees in their department. The system will generate the overall assessment report of employees together with graph to give a clear view. Managers also have feasibility to view their employees' assessment report individually. This module also allows manager to do search on employee record based on their skill level in each category.

iv) administrator module

Administrator will be in charge of the whole system and has authority to manage the users of system where the administrator is able to delete and update the employee's record. Administrator also has authority to edit skills' list where they can update the list with latest skills and remove the obsolete one. This module also allows administrator to edit the comment provided in assessment report in order to provide more valuable comment for employee.

4.4 System Development Methodology

The strategy used to develop this project is based on the waterfall model with prototyping as shown in Figure 4.4. It is used because ISSAS will be developed under the

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environment that needs to be separated into different process phases, which cascade into several phases such as requirement analysis, system design, program design, coding, unit and integration testing, system testing, acceptance testing, operation and maintenance.

The prototyping is incorporated into the waterfall model because ISSAS is a system that makes it vital to test out the functionality of its module before the development process gets into the implementation stage. The usage of prototype will also allow potential users to test out the ISSAS and any necessary modification can be made before it is implemented. Another reason for using the waterfall model with prototyping approach was that, it offered a means of making the development process visible compared to other models.

Throughout this model, the ISSAS interface is built and tested as a prototype, so that user would understand what the ISSAS system would be like. Major kinks in the requirements are addressed and fixed well before the requirements are officially validated during system testing. Prototyping is useful for validation and verification. Validation ensures that ISSAS has implemented all of the requirements, so that each system function can be tracked back to a particular requirement in the specification while verification ensures that each function works correctly.

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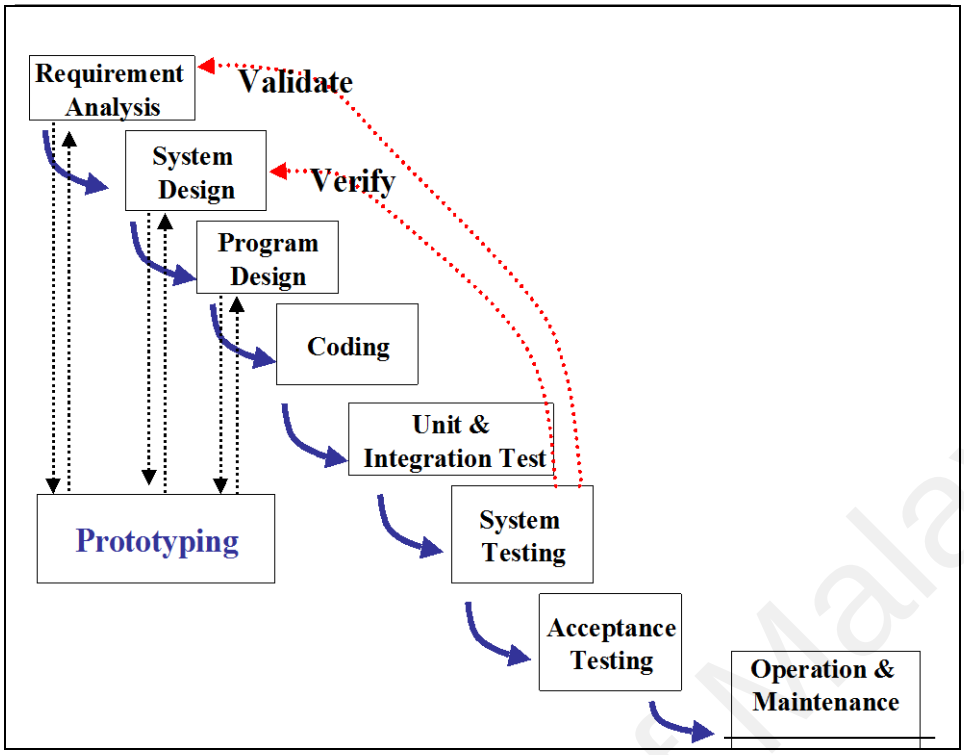

Figure 4.4: Waterfall Model with Prototyping

4.5 System Development Tool

The following section discusses the hardware, software or programming language, web server and database tools used to develop ISSAS.

4.5.1 Hardware

The following hardware was chosen for the development of the ISSAS:

- DELL Computer Corporation OptiPlex GX110 (Desktop)
- DELL Compatible Computer – 256MB RAM, Intel Pentium III 733MHz Processor
- 50x speed WDC WD204BB 0.7.0 CD-ROM Driver

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- SVGA 800 x 600 pixels 15-inch color DELL monitor
- Input Devices such as keyboard and mouse
- Standard floppy disk drive, printer

4.5.2 Software and Programming language

Java

Java Programming language is a high-level language that can be characterized by all the following words: simple, object-oriented, distributed, multithreaded, dynamic, portable and high performance. Based on these characteristics, ISSAS was coded in Java. In the java programming language, all source code is first written in plain text files ending with the *.java* extension. Those source files are then compiled into *.class* files by the java compiler. The Java launcher tool then runs our application with an instance of the Java Virtual Machine which is available on different operating system. Java coupled with database connectivity package like JDBC is a good language for things like database front ends and other lightweight applications. Java also has features like deployment technologies which provide standard mechanisms, such as Java Web Start and Java Plug-In for deploying our applications to end users.

JavaScript

JavaScript has been used to develop the system as the coding enables interaction between the web pages. The flexibility and robustness of JavaScript was used to validate form

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information, before sending the information to a database. This is useful to be certain that visitors fill in all required form fields (boxes of information). In ISSAS, JavaScript was also used for drop-down menus, mouse-over effects and much more. Furthermore, both Microsoft's Internet Explorer and Netscape Navigator support JavaScript (Deitel & Deitel, 2000).

Macromedia Dreamweaver MX

Dreamweaver is the industry-leading web development tool which enables users to efficiently design, develop and maintain standards-based websites and applications. ISSAS's user interfaces were developed using Dreamweaver to have more professionals' looks and to be more attractive as a skills assessment tool. The unified Cascading Style Sheet (CSS) panel provides a powerful and easy way to understand cascade of styles applied to content as well as quick access to making changes without having to navigate a lot of code through trial and error.

Jakarta-tomcat 3.2.3

Tomcat functions as a servlet container developed under the Jakarta Project at the Apache Software foundation. Tomcat implements the servlet and the JavaServer Pages (JSP) specifications. It's considered to be a web server. ISSAS which was develop by using Java and JavaScript were running on Jakarta-tomcat 3.2.3 as it's' web-server. A web server is a program that, using the client/server model and the World Wide Web's

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Hypertext Transfer Protocol (HTTP), serves the files that form web pages to web users (whose computers contain HTTP clients that forward their requests). Every web server has an IP address and possibly a domain name. Any computer can be turned into a web server by installing server software and connecting the machine to the internet.

4.5.3 Database Technology

OLE DB

OLE DB was used as the database technology for ISSAS. The OLE DB protocol is a Microsoft standard for Universal Data Access: the ability to use one protocol to access both SQL and non-SQL based data sources and seamlessly integrate them into a single application. It is fast and easy to use OLE DB as it acts as a middleware on the client or server across a wide variety of applications.

4.5.4 Database Access Libraries

Active Data Objects (ADO)

ADO (Active Data Objects) is a set of objects for utilizing OLE DB data. Active Data Objects are used to get at different data sources, in particular databases, but in general any sort of data which an OLE DB provider has been written too. The objects defined within ADO Object Model can be graphically stated as in the figure shown below.

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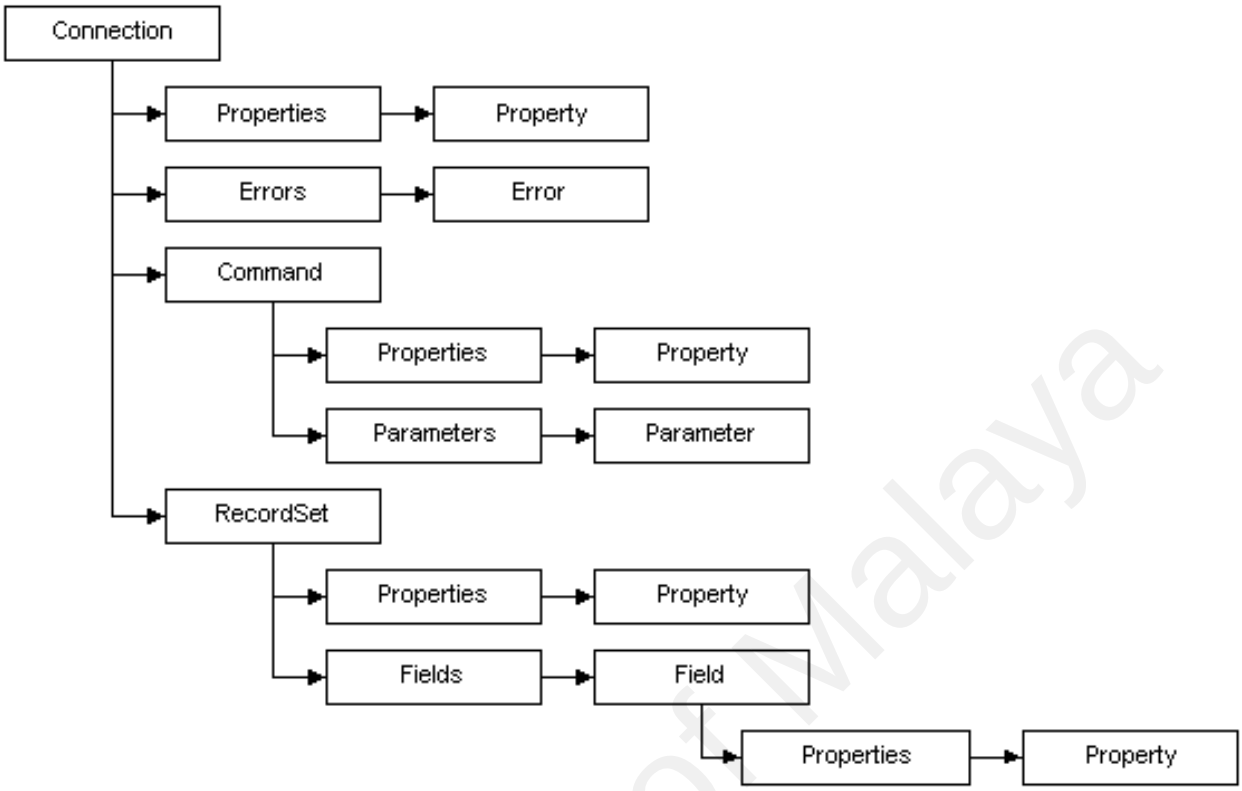

Figure 4.5: ADO Object Model

There are 4 primary objects in the ADO programming environment:

- **Connection** is used to establish and manage connections to a database. In ISSAS the connection to the database was done through ADO.
- **RecordSet** manages a collection of records. It contains navigational methods to move to a particular record. The Recordset was used in ISSAS to post the data into the database as well as retrieve, delete, update and modify the data as required by the user.

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- **Fields** is a collection of fields associated with a record in a RecordSet. The values within the Field objects within the Fields collection change as different navigational methods are used to move around the RecordSet.

- **Command** is an object used to access stored procedures or parameterized SQL statements. Commands were used in ISSAS for fixed parameters when there is a request to access the database to avoid repetition of codes and duplication.

The above-mentioned objects have been deployed in ISSAS development to access the database access library.

4.5.5 Database Management System (DBMS)

SQL Server 2000

Microsoft SQL Server is a relational database management and analysis system for e-commerce, line-of-business, and data warehousing solutions. Benchmarked for scalability, speed, and performance, SQL Server 2000 is a fully enterprise-class database product, providing core support for Extensible Markup Language (XML) and Internet queries; performance and availability features to partition load and ensure uptime and advanced management and tuning functionality to automate routine tasks and lower total cost of ownership.

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The features of SQL Server 2000 enable:

- **Easy-to-Use Business Intelligence (BI) Tools**

  Through rich data analysis and data mining capabilities that integrate with familiar applications such as Microsoft Office, SQL Server 2000 enables you to provide all of your employees with critical, timely business information tailored to their specific information needs. Every copy of SQL Server 2000 ships with a suite of BI services.

- **Self-Tuning and Management Capabilities**

  Revolutionary self-tuning and dynamic self-configuring features optimize database performance, while management tools automate standard activities. Graphical tools and wizards simplify setup, database design, and performance monitoring, allowing database administrators to focus on meeting strategic business needs.

- **Data Management Applications and Services**

  SQL Server 2000 provides a powerful and comprehensive data management platform. Every software license includes extensive management and development tools, a powerful extraction, transformation, and loading (ETL) tool, business intelligence and analysis services, and new capabilities such as Notification Services. The result is the best overall business value available.

4.6 System Design

IS Skills Assessment System (ISSAS) was designed to help the employees to evaluate their skills level. This system has four main modules namely registration module,

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employee module, manager module and administrator module as shown in Figure 4.6(a). The overall function of the system and how it works is illustrated in a flowchart in Figure 4.6(b).

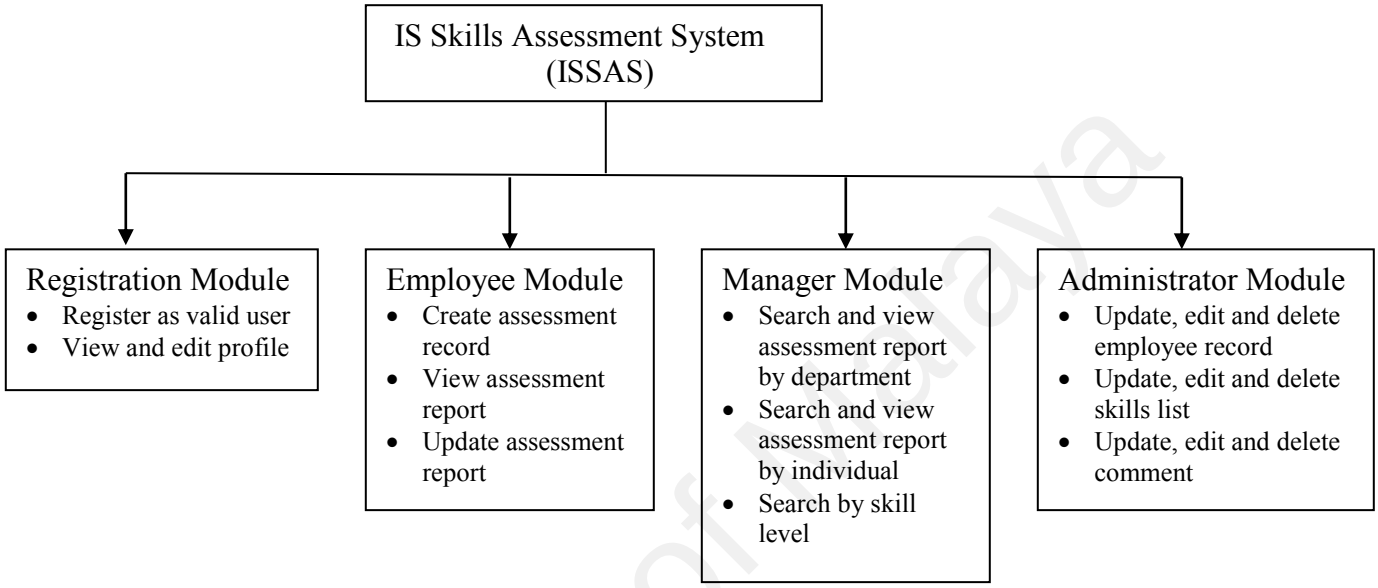

Figure 4.6 (a): Modules in ISSAS

Registration Module

The first time users of ISSAS which includes both employees and managers have to register themselves using the registration form which is provided in the system. They have to key in their personal information such as their name, employee id, department id, password and other relevant information in the provided columns and then hit the register button. The required field such as employee id and password should be filled in order to complete the registration process successfully. All the required field in registration form are marked with asterisks (*) symbol. If these fields are blank, error message "Required

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fields should not be blank" will be displayed when user hits the register button. Once the registration is completed successfully, message "Your registration is successful" will be displayed. Users have to remember their password in order to assess the system and also to view and update their profile in the future.

Employee Module

Once the registration process is completed successfully, new employees will create their skills assessment record in this module. To create the assessment record employees have to access the system by using their employee id and password and then click on login button. New employees will create their record by ranking the skills provided based on a given scale. There are a total of 112 sub-skills which are categorized in nine main groups such as Analysis and Design Skills, Programming Skills, Interpersonal Skills, Environment/Platform Skills, Business Skills, Application Knowledge, Computer Language Knowledge, Database Knowledge and Multimedia Knowledge. The mean for each main group will be calculated and kept in the database with employee ID, department id and password. Then the system will generate the employees' skills assessment report. Together with this report, graph and comment will be generated based on their mean to give clear view on their skills level.

For existing employees, they have to login into the system by keying in their employee id and password and then click on login button. Their record will be searched in the database and the skill assessment report together with the graph and comment will be

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displayed. If the employee's record is not in database, the message "Record does not exist" will be displayed. Employees also can view their skills level in each of the sub skills by clicking on the main category. The employees also able to edit and update their skill assessment report.

Manager Module

In this module, registered managers have to key in their employee id and password and then click on login button to access to the system. If their record was not found in database the message 'login failure' will be displayed. Once login, the list of employee in their department will be displayed together with the graph which shows the overall skills level of all the employees in their department. Managers can click on their employees' name to view their assessment report individually. Managers also are able to view the skills level of their employees in each of sub-skills by clicking on the main category.

Other than that this module also allows managers to search their employee record based on their skill level in each category. For this purpose, managers have to click on search link and new windows will pop-up. They have to choose the skill category and skill level and then click on search button. Then list for the search results will be displayed.

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Administrator Module

In this module, administrator has to login into the system by using valid employee id and password. Currently, there is only one administrator and administrator would be in charge of managing the whole system and members who register in the system. This module allows administrator to delete the employees' record. To do this, administrator has to click on delete link and list of employees in the system will be displayed. Then administrator has to click on the delete button beside the employee's name to delete the respective record. Delete confirmation message will be displayed, once administrator clicks on OK button, the record will be permanently removed from database. Administrator also able to update or edit the employees record by clicking on manage employee link.

Administrator is also able to edit and update the skills in each category by clicking on manage skill link. Administrator can add the new skill to the list or delete the existing skills from the list. Finally the administrator also able to edit comment for the skill level.

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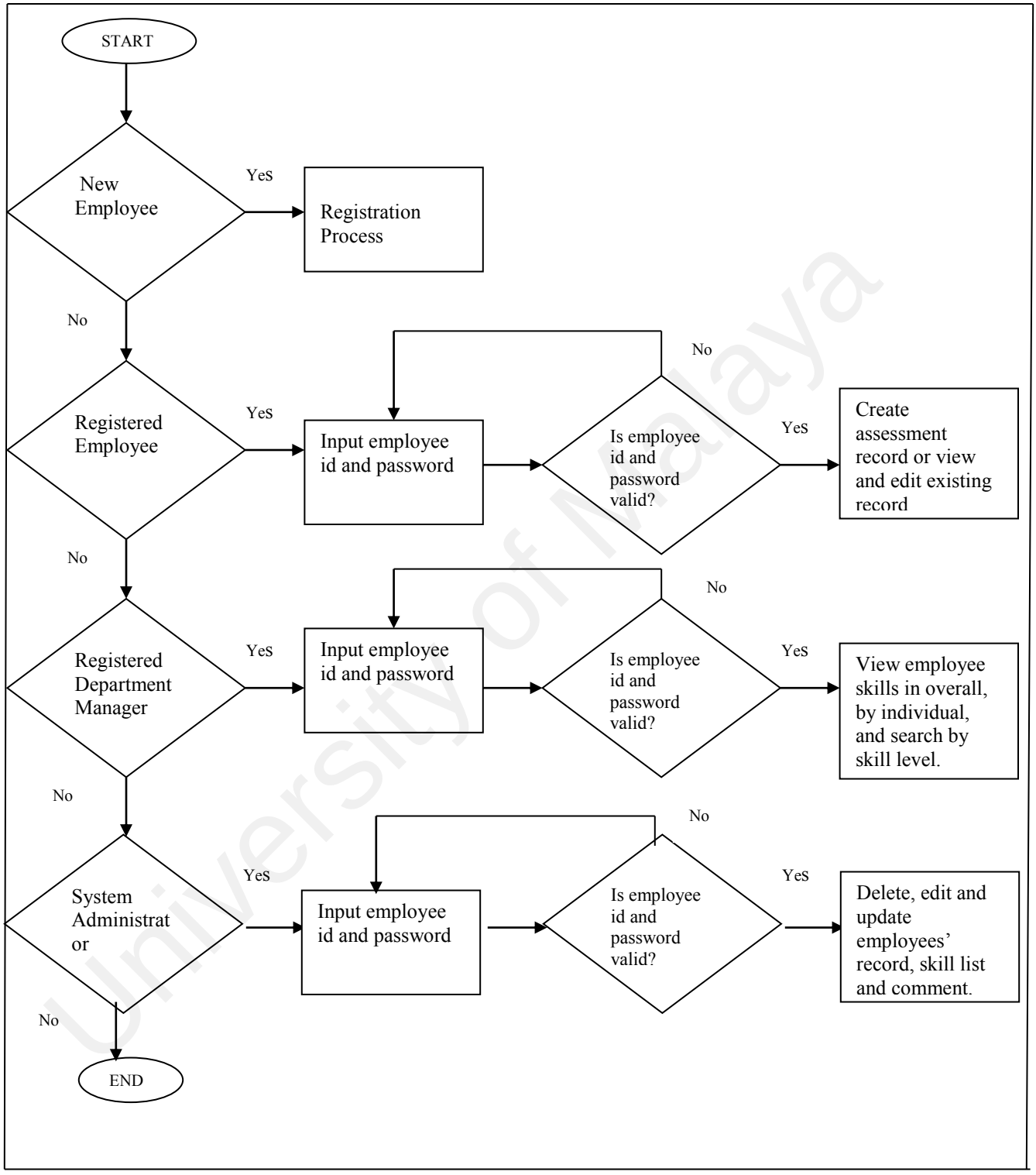

Figure 4.6 (b): Flowchart of ISSAS

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4.7 Database Design

ISSAS used SQL Server 2000 as its backend database to store all the data from the web. SQL Server 2000 is a relational database, which is being used robustly by many small and medium sized industries. The tables created and its functions are described in Table 24.

Table 24: Tables in ISSAS

Table Name	Description
AnalysisandDesign	Stores employee id and employee skill level in each sub skill for Analysis and Design category. The primary key is emp_id.
ApplicationKnowledge	Stores employee id and employee skill level in each sub skill for Application Knowledge category. The primary key is emp_id.
BusinessSkill	Stores employee id and employee skill level in each sub skill for Business Skill category. The primary key is emp_id.
ComputerLanguage	Stores employee id and employee skill level in each sub skill for Computer Language category. The primary key is emp_id.
DatabaseKnowledge	Stores employee id and employee skill level in each sub skill for Database Knowledge category. The primary key is emp_id.
EnviromentOrPlatform	Stores employee id and employee skill level in each sub skill for Environment and Platform Knowledge category. The primary key is emp_id.
InterpersonalSkill	Stores employee id and employee skill level in each sub skill for Interpersonal Skill category. The primary key is emp_id.
Min	Stores employee id and mean of each category. The primary key is emp_id.
MultimediaKnowledge	Stores employee id and employee skill level in each sub skill for Multimedia Knowledge category. The primary key is emp_id.
ProgrammingSkill	Stores employee id and employee skill level in each sub skill for Programming Skill category. The primary key is emp_id.
Employee	Stores employee id and employees personal details together with the password which they used for login purpose. The primary key is emp_id.
Comment	Stores comment for the skills level

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4.8 User Interface Design

The term 'User Interface' refers to the method and devices that are used to accommodate interaction between machines and the human beings who use them (users). User interfaces can take on many forms but always accomplish two fundamental tasks; communicating information from the machine to the user and communicating information from the user to the machine (Brown, 1995).

The devices that are used to implement user interface on modern computers are video screens, keyboard and pointing devices such a mice and trackballs. User interface entered the modern era when innovative designers at the Xerox Palo Alto Research Center broke away from the character-based interface paradigm and invented the Graphic User Interface (GUI) (Brown, 1995).

Screen Design

Design requires a balance of reason and intuition, an impetus to act and an ability to reflect on actions taken. Screen design is the intentional arrangement of elements to communicate an idea, thought or theme by planning for the manipulation of the physical form of the message (Tiranasar, 1998). The following figures show the screen design of the ISSAS.

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Figure 4.8(a) shows the Login Screen of ISSAS. The users have to key in their employee id and password to login into the system. New users can register themselves by clicking on the word 'Click Here' which is below the phrase 'New employee please register first'. Only registered users can login into the system. The brief description about the system also display in this screen.

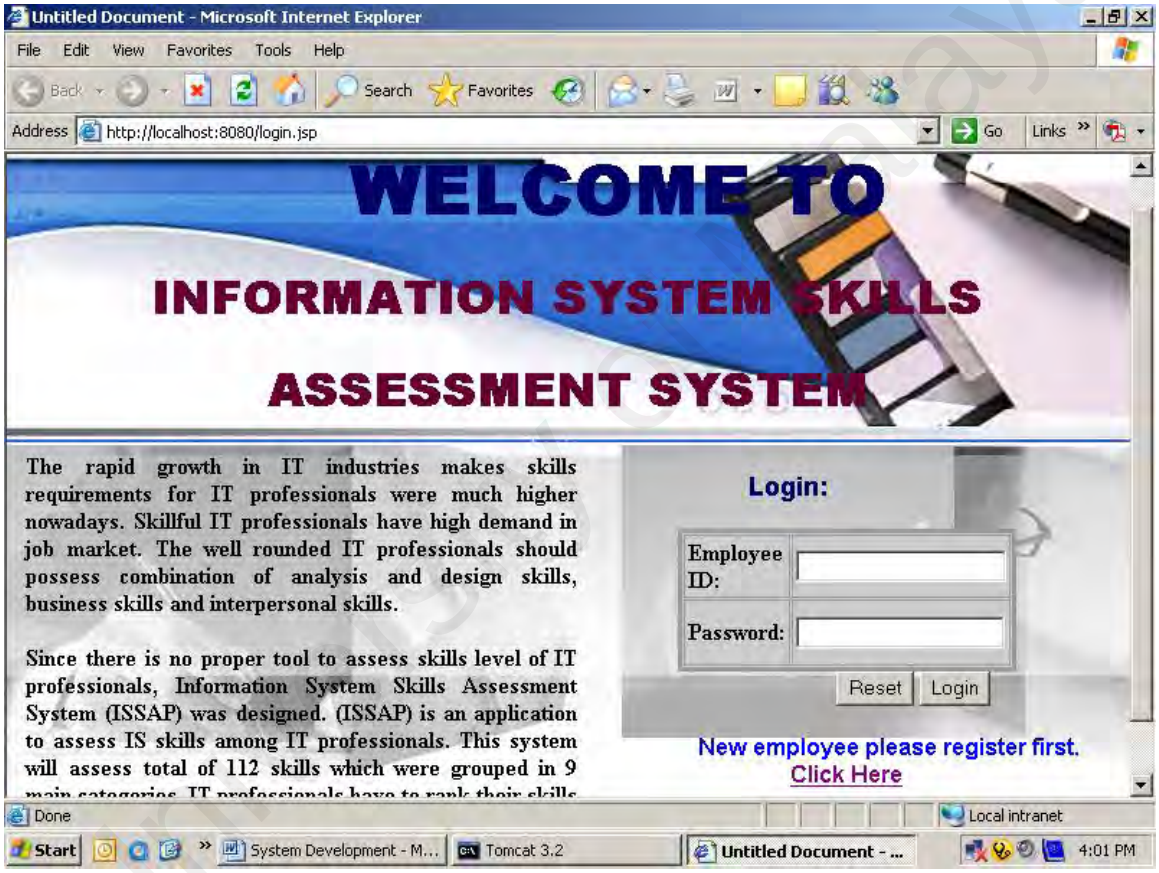

Figure 4.8(a): Login Screen

Figure 4.8(b) and figure 4.8(c) shows the Registration Screen where users need to key their personal details to register as valid user of the system. The fields with * are required fields and users need to key valid data in these fields to complete their registration process successfully. After key in all the required information in the respective fields, the user needs to hit the register button to complete the registration process.

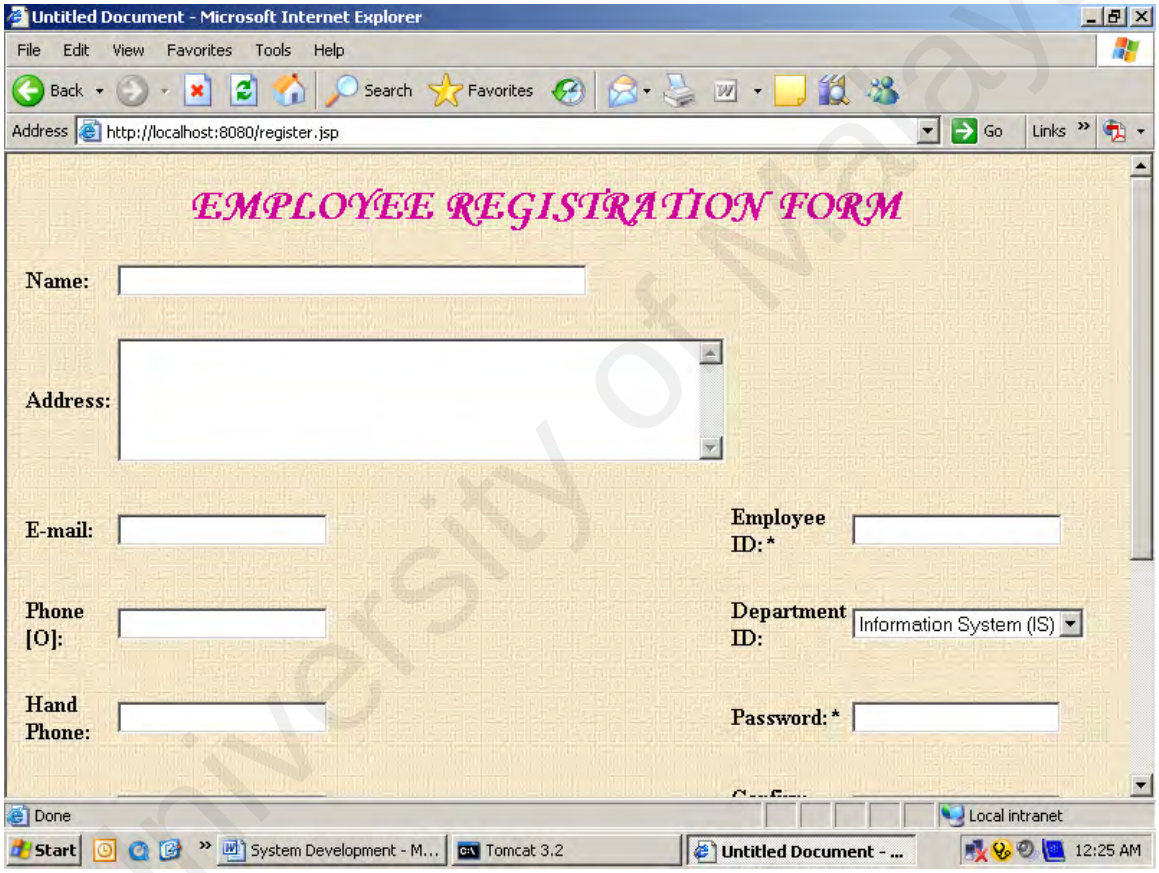

Figure 4.8(b): Registration Screen

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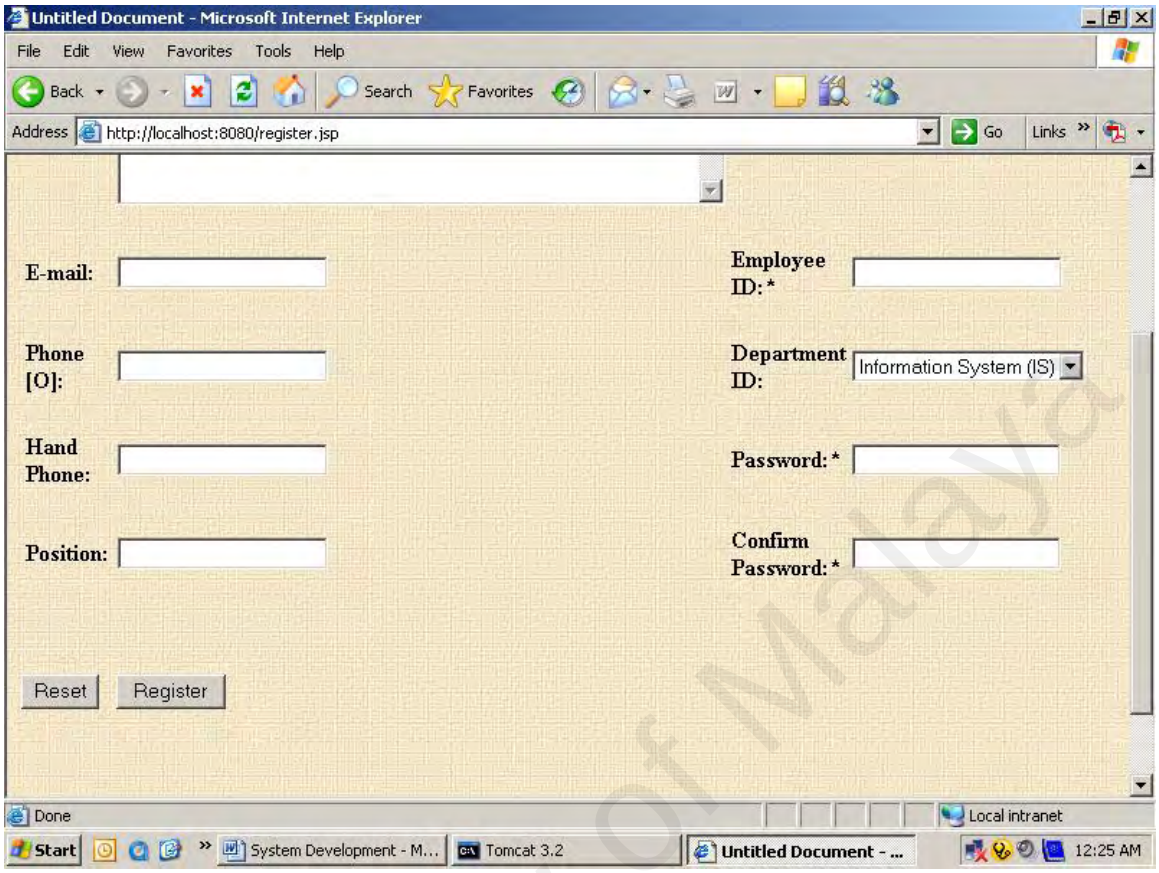

Figure 4.8(c): Registration Screen

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Figure 4.8(d) shows the Skill Screen where nine similar screens were designed for employees to rank their knowledge on a total of 112 IS skills which were categorized in 9 main categories. A five point Likert Scale was provide for employees to rank themselves. Then, the mean for each category will be calculated and kept in database.

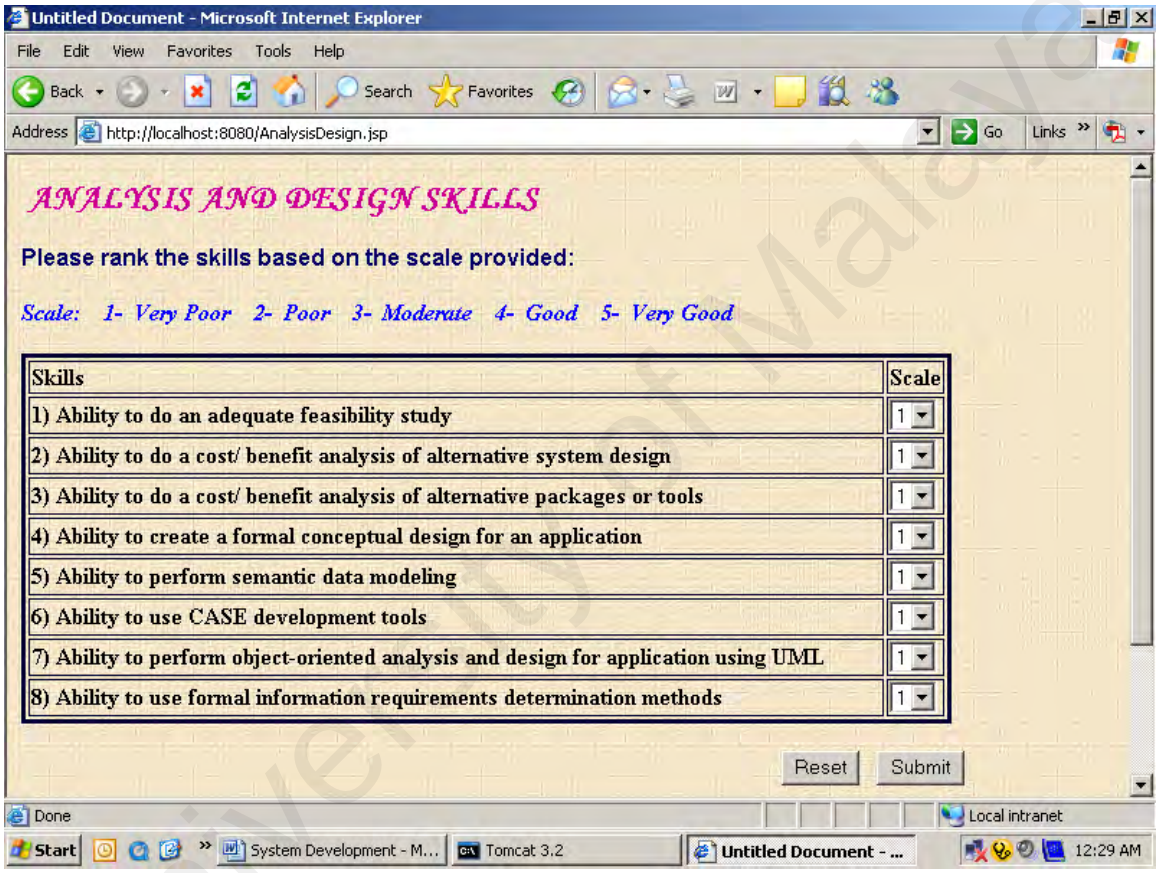

Figure 4.8(d): Skill Screen

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Figure 4.8(e) and Figure 4.8(f) show the Employee's Skill Assessment Report Screen. The mean in each skill category will be displayed and a respective graph will be shown to give clear view on employee's expertise level in each category. Employees have to click on the main category to view their skills' level in each sub-skill.

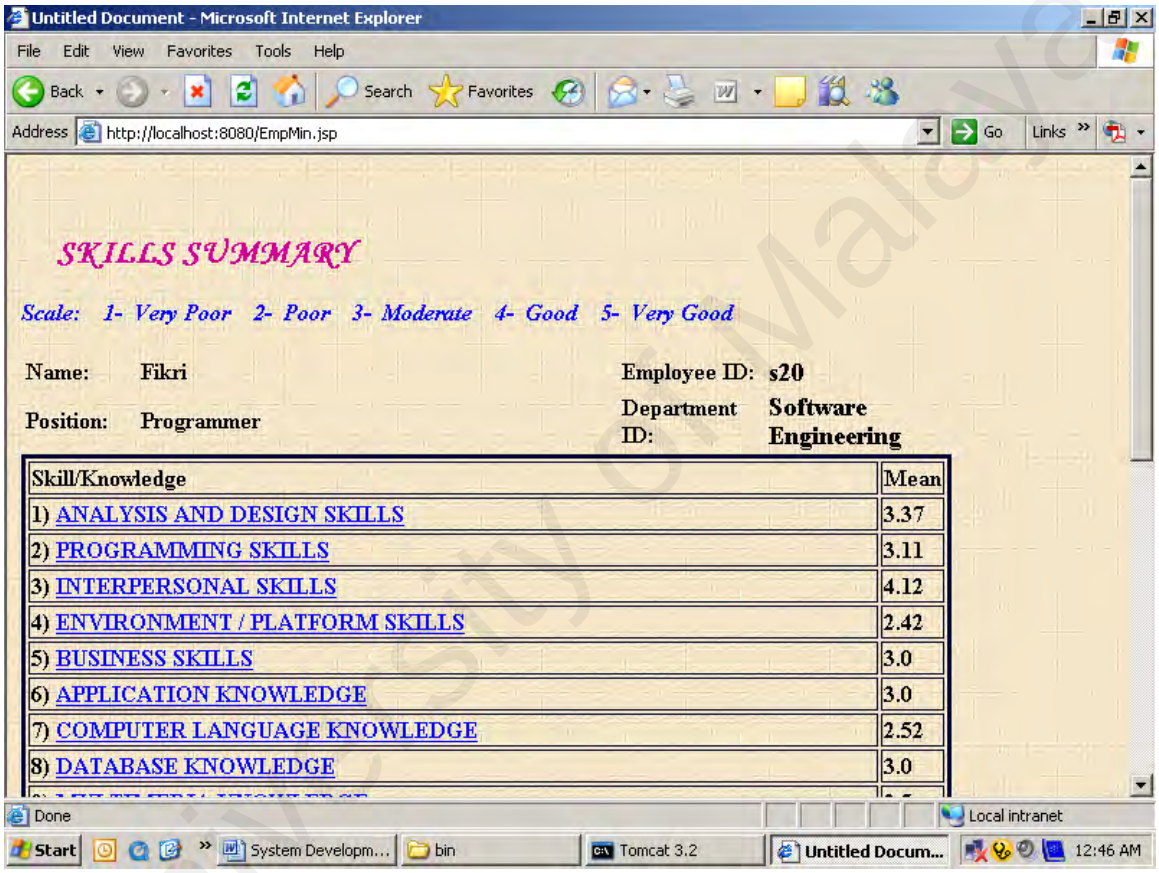

Figure 4.8(e): Employee's Skill Assessment Report Screen

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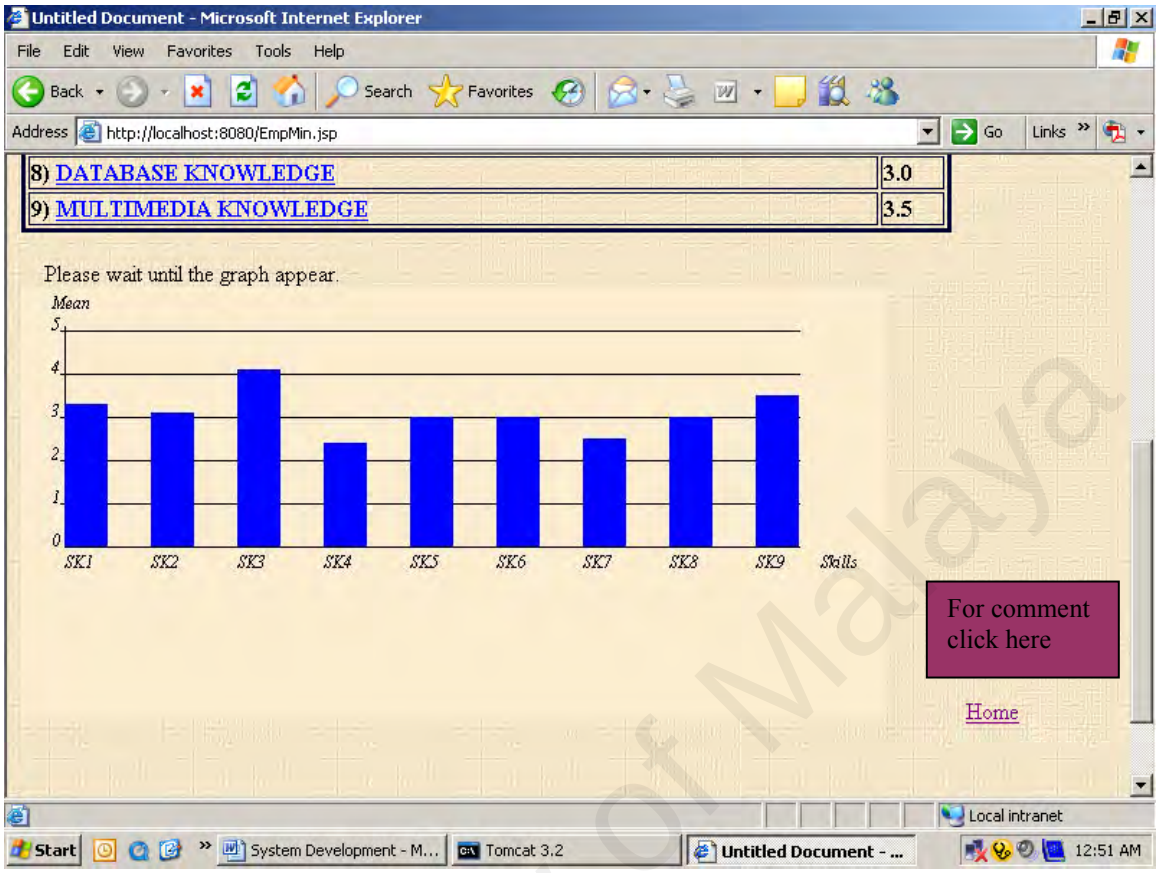

Figure 4.8(f): Employee's Skill Assessment Report Screen

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Figure 4.8(g) and figure 4.8(h) shows the Employees Skills by Department Screen. Only the manager of each department has access to this screen. Other employees did not have permission to access this screen. In this screen, all the employees in that particular department will be display together with the overall skills assessment report of all employees in that department in form of graph. Managers have to click on employees' name to view skills assessment report of each employee individually.

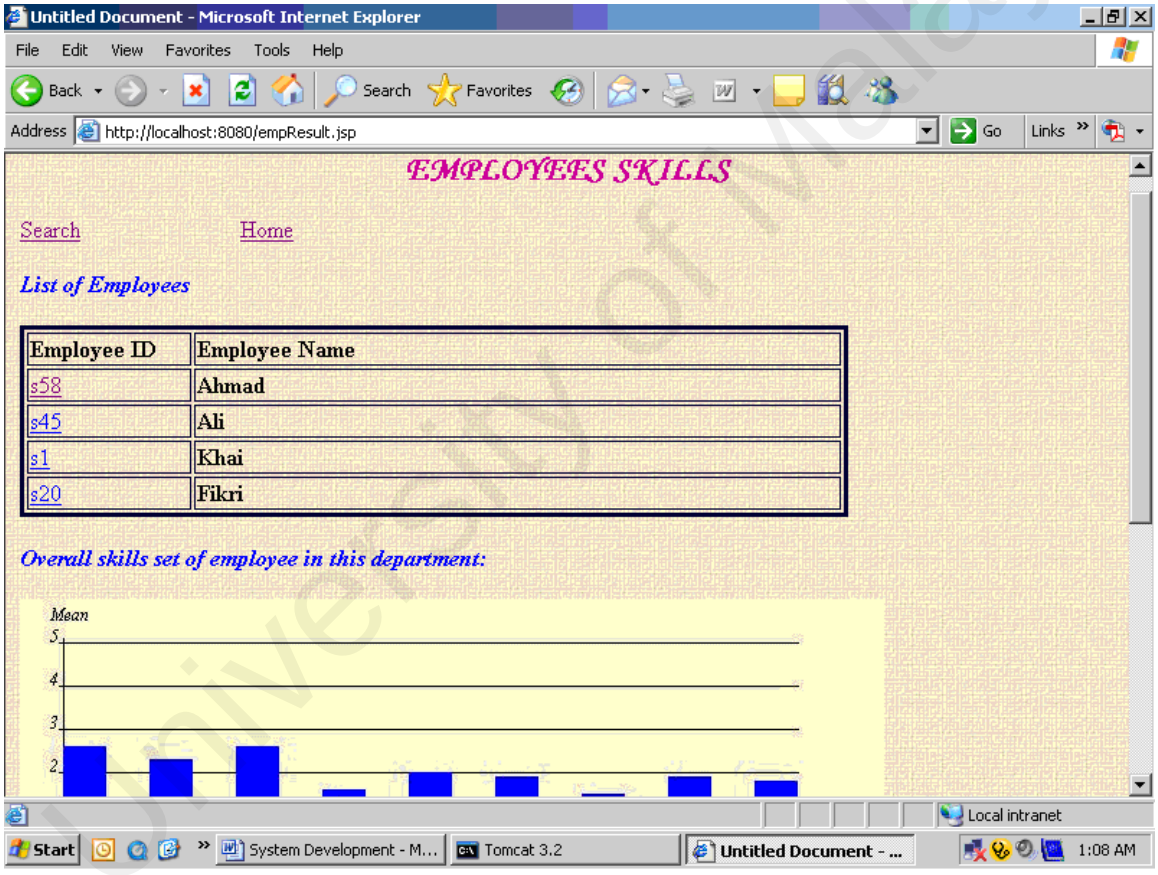

Figure 4.8(g): Employees Skills by Department Screen

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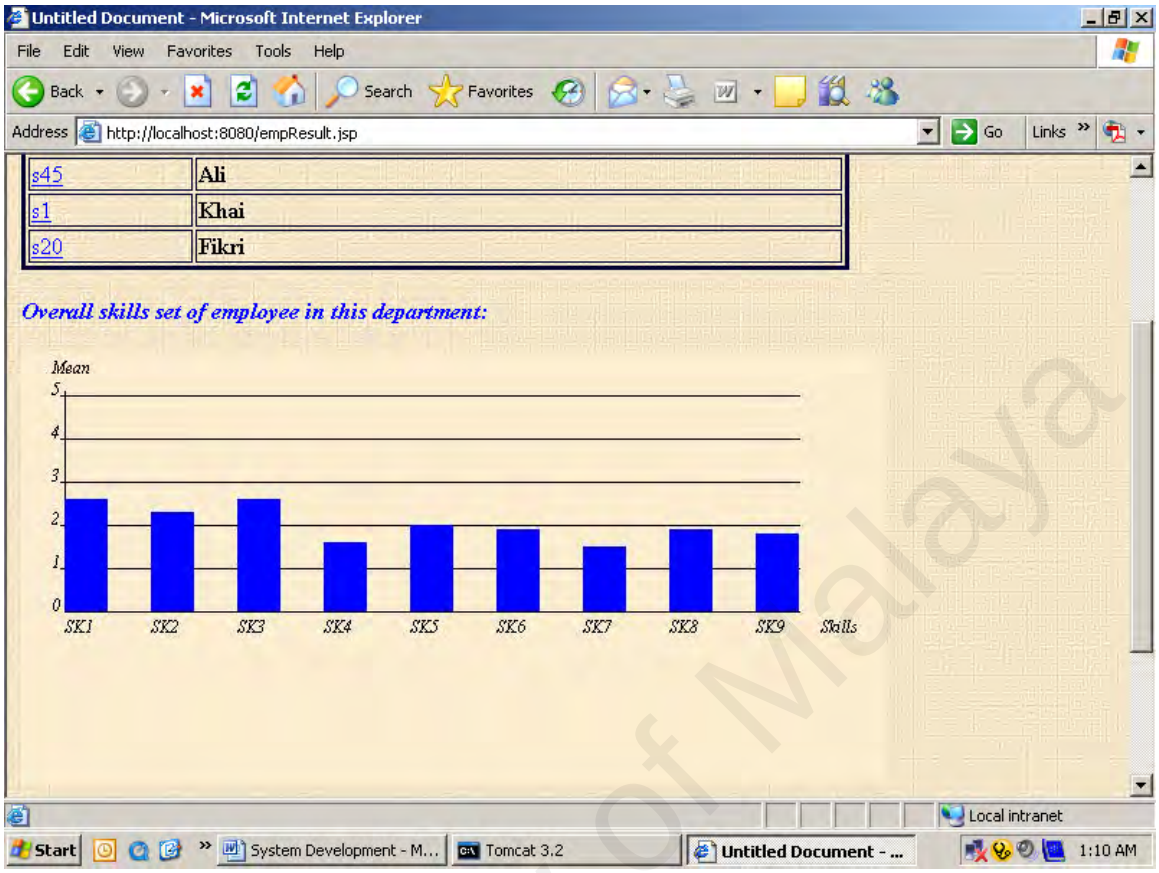

Figure 4.8(h):Employees Skills by Department Screen

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Figure 4.8(i) shows Search Screen. In this screen the manager has to choose the skill category and skill level and click on search button to search the record that they wanted. The search result will be displayed.

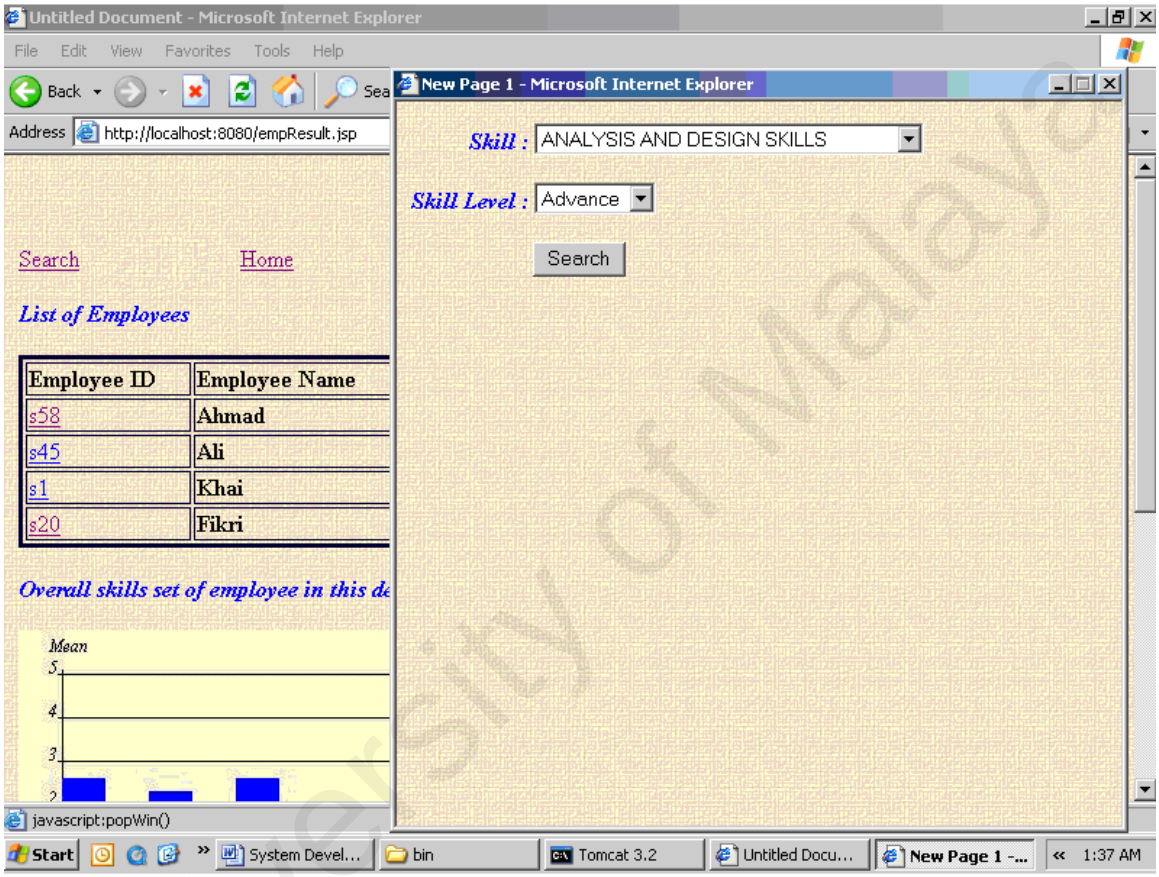

Figure 4.8(i): Search Screen

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Figure 4.8 (j) shows the Search Result Screen. In this screen the search result will be displayed.

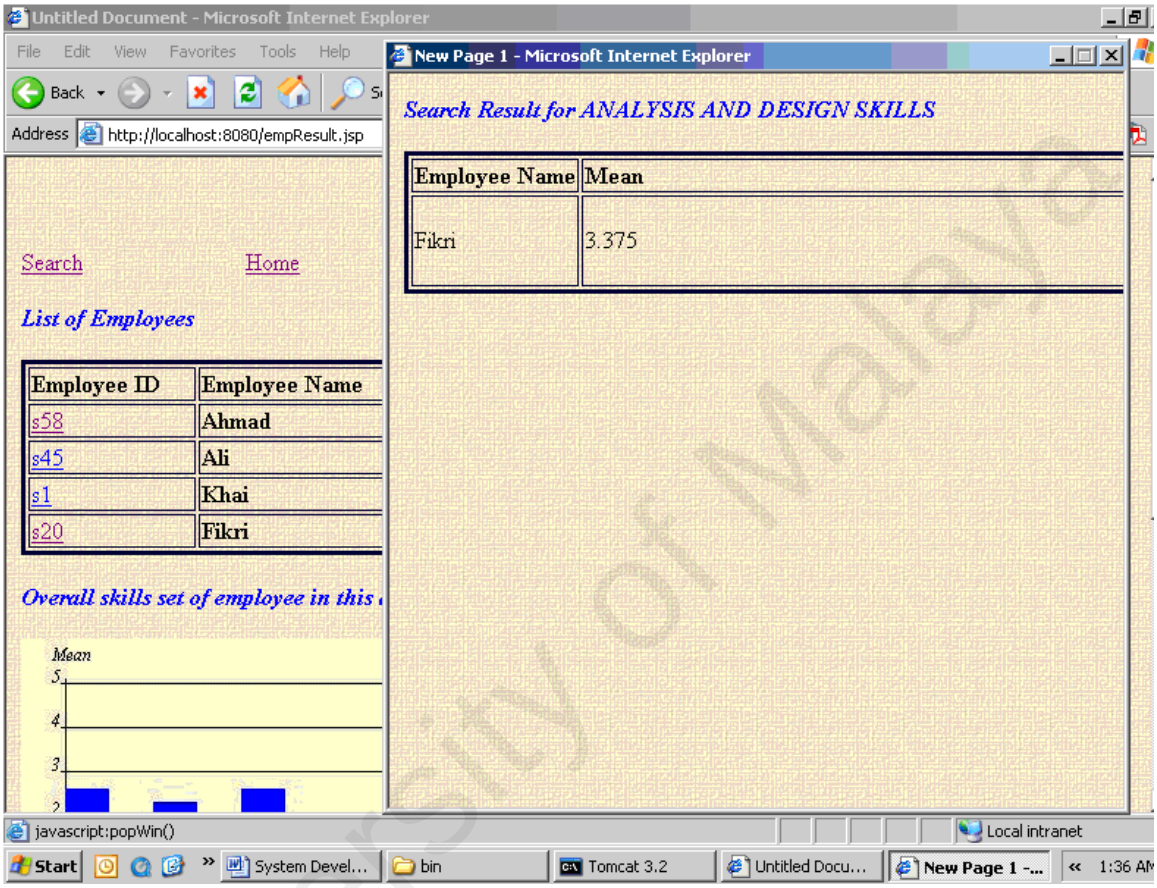

Figure 4.8(j): Search Result Screen

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Figure 4.8(k) shows the Administrator Screen. In this screen, administrator has three options where administrator can delete the employee record (Delete Record button), edit or update employee record (Manage Employee button) and edit or update skill list (Manage Skill button).

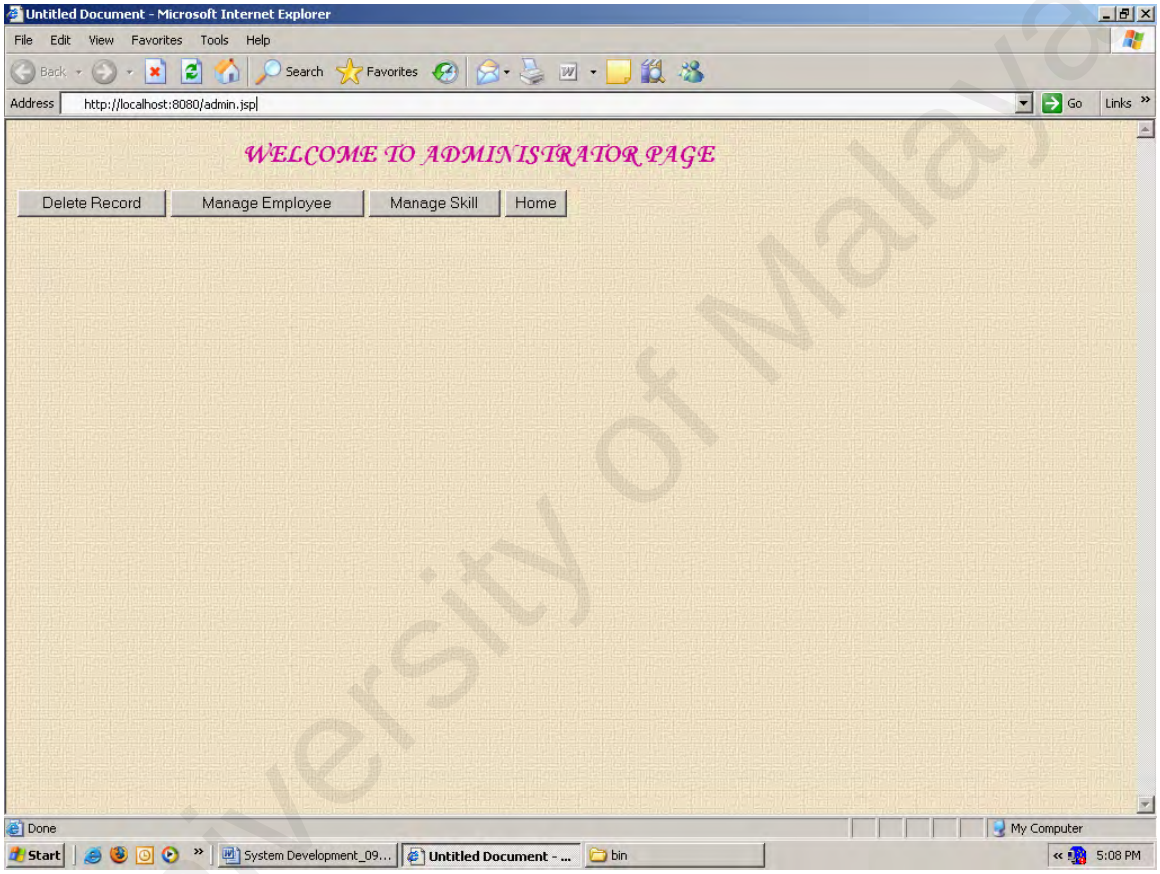

Figure 4.8(k): Administrator Screen

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Figure 4.8(l) shows the Employee Delete Screen. In this screen, administrator can delete the unwanted employees' skill assessment report by clicking on delete button. Delete confirmation message will be displayed before the respective employees record is permanently removed from the database.

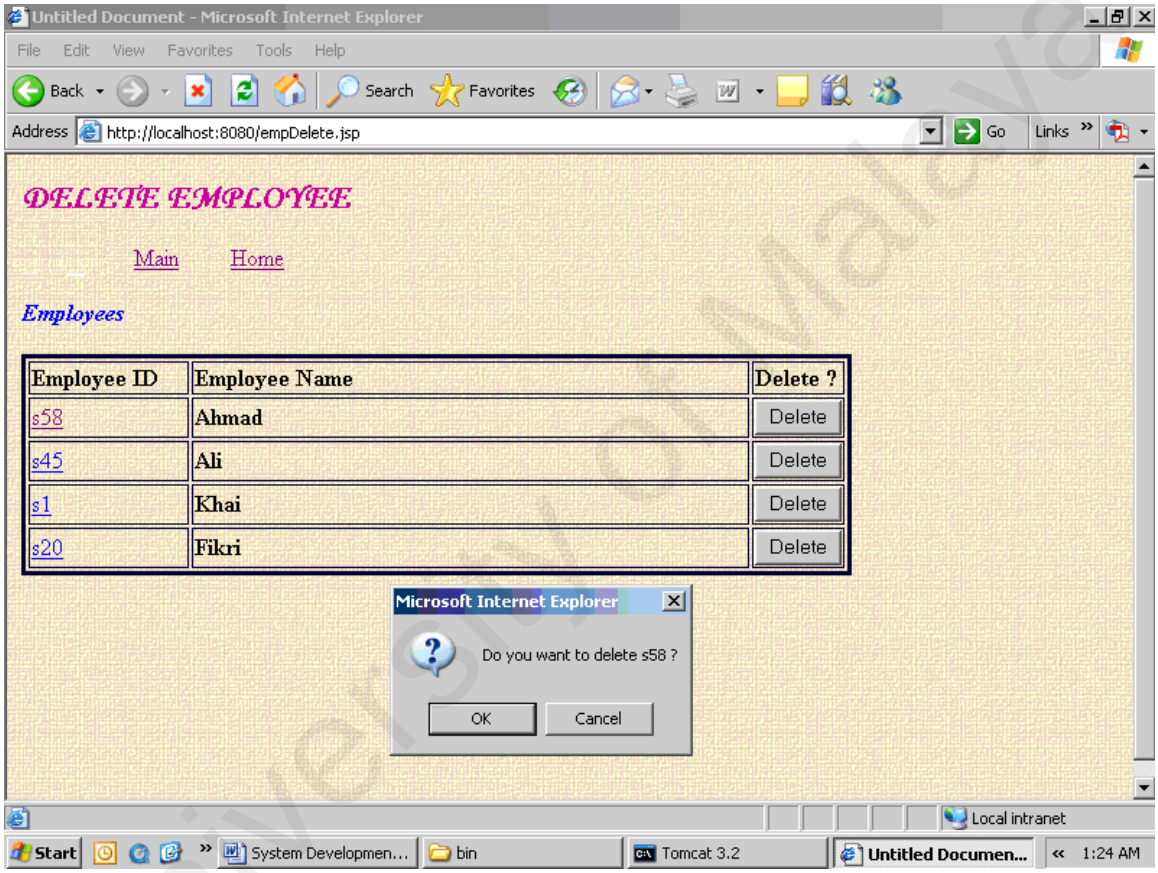

Figure 4.8(l): Employee Delete Screen

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4.9 System Development

ISSAS system was developed as a result of the survey conducted about IS skills for IT professionals in Malaysia. Therefore, the system requirements and contents were gathered from methods inclusive of:

Survey

150 questionnaire forms were distributed to IT professionals in various organizations. Based on the 150 questionnaires distributed, about 100 questionnaires were chosen as the rest were incomplete. The results of the survey were displayed and discussed in more detail in Chapter 3 of this thesis. The skills list in the survey was used to design the skills list in ISSAS.

Interviews and Literature Review

Interviews were conducted in random even though questionnaires were distributed as to have a clear view about the skill level of IT professionals. Some of the survey questions were used in the interview. Some of the skills in the questionnaire as well as ISSAS skills list are also based on the data gathered in the literature review which has been discussed in Chapter 2 of this thesis.

Besides that, the DFD (data flow diagram) has been developed with the gathered information, which is followed by the database table creation, and the user interface

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creation for each module designed for the system. The prototype module was adapted in creating the system design and development.

After the interface was designed for each module, coding was done based on the design. The access to the system was divided in two modules, which is the administrator access and user access. Administrator has access to all the modules and also can view some functionality in each module but a normal user is limited to certain transactions only. The normal user does not have access to any module or transactions that involve user management or updating any information. The purpose of this access control is to enable the administration of the site by one user and there's no violation in terms of accessibility as well as data input. The existing modules in the system are the registration module, employee module, manager module, and administrator module.

Finally, testing was carried out to ensure the system functionality is as per designed and there's no error existing when there is submission of data or when a data is being processed. The flow of the system development steps are shown in Figure 4. 9.

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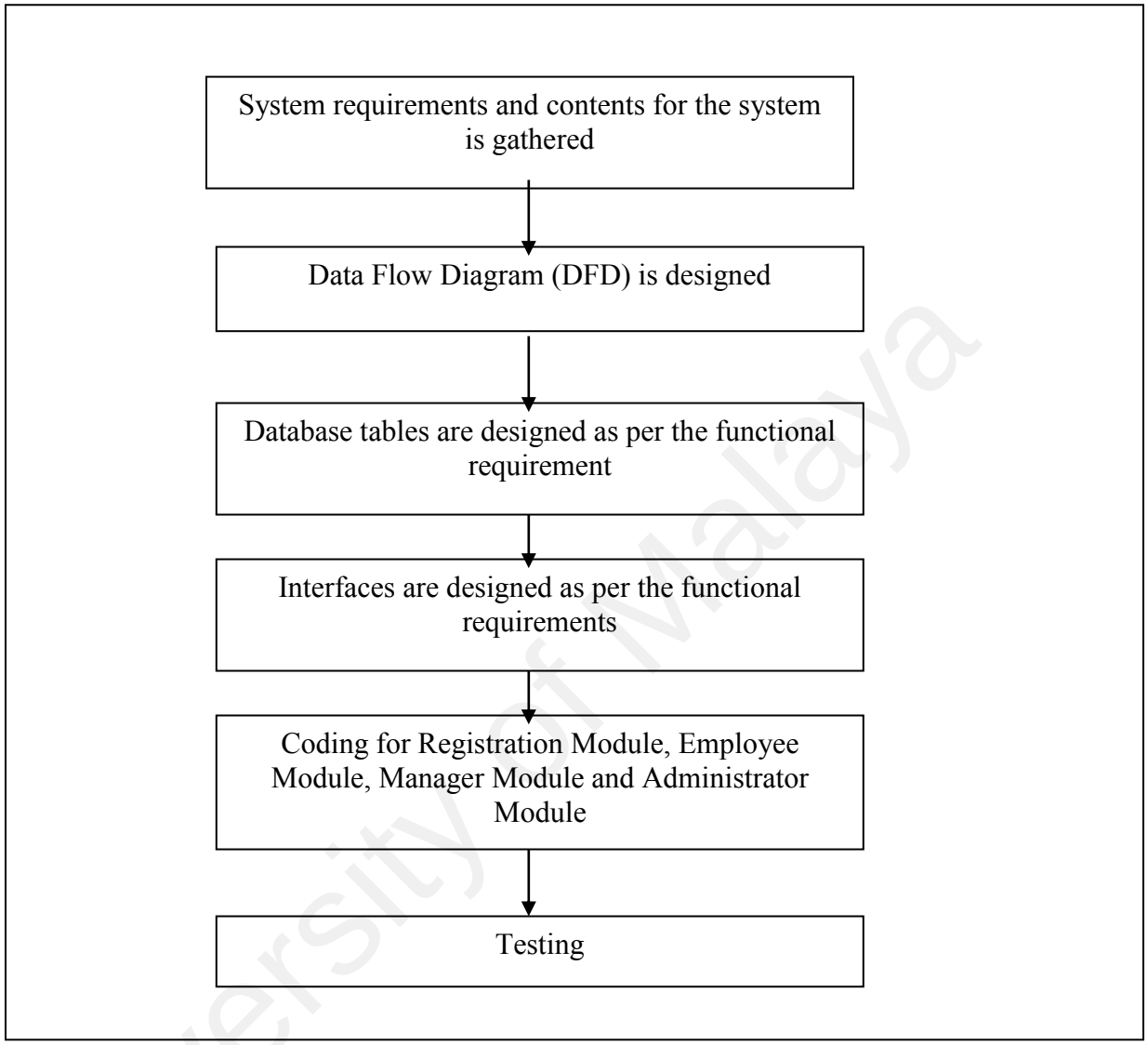

Figure 4.20: System Development Process

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4.10 Testing

Testing is the process of exercising a product to identify differences between expected and actual behavior. Typically, testing comprise bottom up, unit test, integration test and finally system test. Ideally testing should be done by real users bashing on prototype long enough to get thoroughly acquainted with it, with careful monitoring and follow –up of the results (Howe, 1993). The descriptions of the various type of testing undertaken for ISSAS are as follows.

4.10.1 Unit Testing

Unit testing is a set of executable code that exercises the production code, with the intent of checking it for correctness (Weirich, 2000). During the development of the ISSAS, unit testing is done extensively and repeated during programme coding on all the modules that were developed.

After completing the source codes of each module, the codes were examined by reading through it, spotting the algorithm, data and syntax faults. The codes were compiled and the remaining syntax faults were eliminated. Unit testing was conducted to challenge the system's strengths and to ensure it will operate as intended.

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4.10.2 Integration Testing

Integration testing is a logical extension of unit testing. In its simplest form, two units that have already been tested are combined into a component and the interface between them is tested. The purpose of integration testing is to ensure that every module in the ISSAS is able to interact among each other when the data flows from one module to another. Therefore, it is to ensure that there is an end-to-end flow in ISSAS.

Integration testing was done in all the modules as to ensure that functionalities are limited to the type of user login. If a normal user (employees and department managers) logs in to ISSAS, then the user would not be able to access certain functionalities that can be viewed by the administrator, which has been embedded in some of the modules.

4.10.3 System Testing

System test is conducted on the whole integrated system as one single unit. Its activities include testing of system performance, strength, security, usability, data integrity, efficiency, sensitivities, error handling and recovery. In system testing, the ISSAS is tested to verify its functionality and design in order to meet all the objectives. There are 2 steps in testing the ISSAS, which are function testing and performance testing.

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a) Function testing

During function testing, the system functionality was taken into account. Each function is associated with the system components that accomplish its function. Testing compares the system's actual performance with its requirements. Function testing is performed in a carefully controlled situation. ISSAS employs several guidelines for function testing:

i) high probability in detecting a fault

ii) know the expected action and output

iii) test both valid and invalid input types

iv) include stopping criteria

b) Performance Testing

While the functional testing addresses the functional requirements, performance testing addresses the non-functional requirements. System performance is measured against the performance objectives set by the potential users. As for the ISSAS, performance testing examines the usability, reliability, robustness and response time of the system where all desirable information should be available at any point of time.

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4.10.4 End User Testing

End user testing was performed to access the effectiveness, efficiency, user-friendliness, functionalities, and specifications and to ensure that the system meets the needs as well as the expectations and objectives. Five users were invited to use and test the system. After the testing was performed the user filled up an evaluation form. A copy of the evaluation form by user is attached in Appendix D. The feedback from the users who performed the end user testing has been displayed in Table 25:

Table 25: Summary of the End User Testing

Criteria that was tested	**Feedback**
User interface design	The users found that the user interface design of ISSAS is attractive and has a professional look. Therefore, it can be concluded that the users are quite satisfied with the interface design.
Colour chosen for the user interface design	The respondents were satisfied with the chosen colour for the interface design.
Response time and processing time	The respondents agree that the system is fast when a data has been sent for processing the display of the results is done in a very fast manner.
User friendliness	All the respondents agreed that the system is user friendly and easy to use without the help feature.
Text style and fonts used in the system	All the respondents agree that the texts in the system are easy to read and the font chosen is suitable for the system structure and layout.
Error-free system	During the usage of the system, the respondents agreed that the system is error-free and the processing as fast.
Relevancy of the skills	All the respondents agree that the skills that have been uploaded on the system are relevant to current IT industries.
Contents of the system	The respondents feel that the contents of the system are quite simple and easy to understand.
Positive aspects of the system	The respondents feel that the system is user-friendly and it is easy to understand and access all the modules available.
Negative aspects of the system	The respondents feel that the system should be more colorful and contains more images to attract more people to complete the assessment process.
Comments and suggestions to improve the system	More graphics and animation should be added to make the system more attractive and chat module should be develop for employee to exchange their idea and expertise on IS skills

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Based on the end user testing results, the system has met the objectivity as an assessment tool for employers to assess their employees IS skills level. Assessment report generated by the system will help the IT professionals to upgrade their skills level to be more competitive in the IT world. Even though the modules were limited, users were satisfied with the module as it enables them to view the assessment report together with the graph and useful comment that indicates their skills level.

Due to time constraint, all the valuable suggestions will be part of the future system enhancement as well. As a conclusion, the ISSAS is said to be satisfactory and it is hoped to be a valuable assessment tool for IT professionals.

4.11 Limitation

Like any other system, ISSAS also has several limitations. These limitations can be addressed in the future development and system enhancement. The limitations of ISSAS are:

i. No forum module

   ISSAS does not have forum module where employees (IT professionals) can discuss and exchange ideas about various topic which will help them to upgrade their skills level.

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ii. Did not incorporate with a chat engine

ISSAS does not incorporate a chat engine in any of the existing module, which limits the communication between users who are accessing the system at a particular time.

4.12 Future System Enhancement

Due to the time constraint and lack of knowledge, ISSAS has several limitations, which could be avoided in the future system enhancement. The following suggestions are areas to be considered for future development:

i. ISSAS should have more graphic and animation

In the future IS Skills Assessment System (ISSAS)'s interface should have more graphic and animation. This will make the system appear more interesting and not too static.

ii. Forum module

The future system should have the forum module to give opportunity for IT professional to exchange their ideas and thought related to IS fields in order to improve their expertise and upgrade their skills level.

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iii. Incorporate with a chat engine

In the future, ISSAS should be incorporate with a chat engine to allow users to exchange ideas about IS skills online. This will increase the efficiency among IT professionals.

4.13 Conclusion

Since there is no proper tool to evaluate IS skills among IT professionals, ISSAS was developed. ISSAS can be used as a tool to evaluate IS skills among IT professionals. This tool can help to achieve research objectives such as help to identify IT professionals knowledge in IS skills and also to identify which skills are famous among IT professionals in certain department. For this purpose, ISSAS can generate skills' assessment report for each employee and also for each department.

A systematic and efficient assessment system has been developed to assess the level of IS skills among IT professionals. During the whole implementation period of the system, a number of valuable knowledge was gained such as programming knowledge and data manipulation.

Apart from that, the testing and evaluation phase has provided a great deal of experience. It has enabled one to learn and tackle any problem that could arise during unit testing, integration testing and system testing. Comments and suggestions during this phase has been considered and accepted with open arms.

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Although ISSAS has several limitations, it is hoped that this system will be able to facilitate the targeted group user. Knowledge gained from this system development provided valuable lessons and experience.

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Chapter 3: Research Methodology and Survey

3.0 Introduction

The main objective of this research is to collect information on the important IS skills among IT professionals in Malaysia and important skills needed for certain position. Furthermore, the survey attempts to find out how they acquired the needed IS skills to be dynamic and skillful employees for industry. Feedback and data collected from this survey can be used in determining the importance of IS skills in IT markets nowadays and the findings could be used to evaluate the curriculum in universities and colleges in order to provide the skillful employees that the industry truly needs. The IT professionals have been chosen as a data provider because they are the people who know well the skills they have and the skills they need for their career advancement. This section explains about the population that is selected for the research, development of survey instruments, pilot test, data collection and data analysis.

Respondents' knowledge in a total of 112 skills which are grouped into nine categories (compiled based on reference in journals, newspapers and interviews with IT experts from industry and academic fields), the important skills needed in future and the way they are acquired is ranked by the respondents in this study. Charts and tables are used to display results. First, background information and characteristics on the respondents are described. Findings related to the research study question were then presented. In overall

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analysis, the relevant information obtained from personal communication and visits are noted and integrated.

3.1 The Survey

Sample Population

The sample selected need to be representative of the population. The population of the given research is defined as a set of characteristics of a universe being studied. The researcher has to ensure that the population consists of those entities which actually posses the information sought by the survey.

The population of this research is the IT professionals who work in established and well known companies and firms in Malaysia. Since most of these companies are situated within the Klang Valley, the selection of population focused on IT professionals in this area. This was based on the findings that more than 50% of well established and big companies in Malaysia are located in Kuala Lumpur and Selangor especially in Klang Valley. Therefore IT professionals from other states are not taking part in this study.

IT professionals in general had received various level of education. However for this study, the respondents should have at least a Professional Certificate in the IT field. This is to evaluate how the education that they had received has been helping them to meet the industry requirements as well as their career advancement. A total of 150 questionnaires

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were distributed to IT professionals and the target was to collect at least 100 completed questionnaires.

Survey Instruments

The data collection instrument is a questionnaire designed to find out the IS skills among IT professionals in Malaysia. Various IS skills required by IT industry were studied. To encourage a higher response rate, the basic and familiar terms were used in the construction of questionnaire. First, a brief introduction stating the purpose of the study was provided and the respondents were assured that their responses would be kept confidential. Second, care was taken to ensure that the questionnaire was not unnecessarily lengthy yet capable of soliciting enough information for the study. Third, fixed response questions were used instead of open-ended questions. The respondents were only required to tick or write the appropriate responses. Nevertheless, space was provided at appropriate places for respondents to write down alternative answers other than those, which had been specified. Fourth, some attention was given to the layout and format of the questionnaire to make it presentable.

The questionnaire was made up of three sections comprising eight pages. Section A consists of ten questions pertaining to general particulars of the respondents such as gender, position, organization's name, organization type, organization sector, organization size and years of IT experience. Other than that, it also focuses on

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respondent's academic qualifications such as their highest qualification obtained, major and name of universities and colleges that they studied.

Section B contains a total of 112 skills. This skill list was compiled based on current Malaysia's IT industry which were obtain through interview with IT professionals and reference to IS skills list which presented in 1995 PRIISM Conference (Eugenia et al., 1995) and discussion with lecturers. They are grouped into nine categories such as analysis and design skills (8 skills), programming skills (9 skills), interpersonal skills (8skills), environment or platform skills (35 skills), business skills (10 skills), application knowledge (9 skills), computer language knowledge (17 skills), database knowledge (6 skills) and multimedia knowledge (10 skills). The respondents were asked to rate themselves in these skills. The scale 1 (very poor) to 5 (very good) was provided for them to rate their experience and knowledge on the respective skills. The skills were presented in tables so those respondents could indicate their ratings.

Section C contains seven items and it focused on the importance of IS skills to the respondents and how they acquire it and the importance of these skills in five years time. Item 1 requires the respondents to rate the skills in order of importance for themselves and their position. A nine point Likert Scale ranging from 1 (less important) to 9 (more important) was provided. The respondents have to rate the importance of the nine main skills categories such as analysis and design skills, programming skills, interpersonal skills, environment or platform skill, business skills, application knowledge, computer language knowledge, database knowledge and multimedia knowledge. Item 2 requires the

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respondents to indicate how well the universities or colleges that they graduate from provide them with the skills that they rank in item 1. The frequency was indicated as very good, good, moderate, poor and very poor.

To collect information on what courses that the respondents learned in universities or colleges and which provided them with these skills, item 3 was used. This is an open-ended question. Respondents have to list down the respective courses. Since there are many ways to acquire the IS skills, item 4 was used to identify the ways IT professionals acquired their skills. A few choices such as vendor training, short courses, conference or seminars and working organization were given for the respondents to indicate the ways. Space was provided for the respondents to write down alternative answers other than those, which had been specified.

To get the opinion of respondents regarding the curriculum of universities and colleges in producing preferred IT professionals for industry item 5 was used. The respondents have to choose either they agree or not (strongly agree, agree, slightly agree, slightly disagree, disagree and strongly disagree) with the opinion. Item 6 collects the respondents' opinion that the universities and colleges have expertise to train their students with the required IS skills. Once again the respondents have to indicate either they agree or not.

As the Information and Communication Technology (ICT) world is evolving very fast, the respondents have to rank the importance of the main nine categories of IS skills (analysis and design skills, programming skills, interpersonal skills, environment or

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platform skill, business skills, application knowledge, computer language knowledge, database knowledge and multimedia knowledge) in order of importance in five years time. A nine point Likert Scale was used (1 for less important to 9 for more important). For this purpose item 7 was developed. Space was provided for the respondents to indicate any alternative skills other than those, which had been specified.

Pilot Test

A pilot test was conducted to ascertain the clarity of the instrument. The questionnaire was distributed to 10 IT professionals of various companies in Klang Valley. The IT professionals who were chosen in the pilot test were excluded from the actual research and they are not apart of study to ensure valid and reliable responses from the population.

In the pilot test the questionnaire was administered and completed on the same day. Then, separate informal interviews with these personnel were held. Their comments were encouraging as they pointed out unclear items and making comments and criticism regarding the questionnaire length, format and clarity of ideas. Based on the responses, certain items considered ambiguous and inappropriate were revised and eliminated for the final version. On the whole, the respondents encountered no difficulty in answering the questionnaire.

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Data Collection

The aim of this study was to gather quantitative data that would lead to deep analysis. Hence, the data was collected through the distribution of questionnaire among IT professionals from various companies.

Prior to collecting data, a cover letter was obtained from the Dean of Faculty of Computer Science and Information Technology (FSKTM). Copies of the questionnaire were sent for this purpose. The cover letter was attached together with the questionnaire to inform respondents about the purpose and objective of the study. The data collection process commenced in August 2003.

An appointment was made with the HR managers of various companies. The questionnaire was distributed to them and short explanation was given. A one week time period was given, so that they could distribute the questionnaire to the IT professionals in their company. After one week, another visit will be done to collect the completed questionnaire. Beside these, questionnaire was administered to some IT professionals involved in the Master's programme in FSKTM and this was collected on the same day.

Analysis of Data

The data from the respondents were analysed using the Statistical Package for Social Science (SPSS) version 11.5 for Windows. Questionnaires that were found to have less

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than 25% of the questions not responded were discarded. Out of the 150 questionnaires distributed, 125 questionnaires were collected. There were 100 usable questionnaires after discarding 25 incomplete questionnaires.

Programmes were run to obtain frequencies, percentages, mean and standard deviations for demographic variables and responses. Mean of data indicate the central value of a set data which is used to make generalizations of the findings meanwhile standard deviations are used to determine distribution and differences between each pair of data within the set of data. Cross tabulation procedure was used to generate contingency tables to study the IS skills of IT professionals with demographic variables in the study. This test provides useful data on the research to meet the research objectives. Only statistically significant values are reported and discussed in this study.

3.2 Data Analysis

Section A: Demographic Data

Gender

The first question in section A was constructed to identify the gender of respondents involved in the study. The distribution of respondents by gender is shown in Table 3. The responses showed that out of 100 respondents, 58 respondents (58.0%) were males and 42 respondents (42.0%) were females. It shows that, IT field in Malaysia was conquered

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by male professionals. However, the roles of female professionals in this field were also quiet important since there is not a big difference in percentage of involvement.

Cross tabulation of the respondents' gender by qualification is also shown in Table 3. The data indicated that out of 58 male respondents, 6 respondents (10.3%) were diploma holders, 50 respondents (86.2%) were degree holders, and 2 respondents (3.4%) were master holders. On the other hand, out of 42 female respondents, 5 respondents (11.9%) were diploma holders, 36 respondents (85.7%) were degree holders and 1 respondent (2.4%) was a master holder. The data shows that most of the IT professionals in Malaysia have degree as qualification to enter the job market. This shows that the education awareness among Malaysian has been increased and most of them trying to pursue higher education for better life and gain more knowledge.

Table 3: Respondents' gender by qualification (N=100)

Respondents' Gender	**Qualification**						**Total**
	Diploma		**Degree**		**Master**		
	N	**%**	**N**	**%**	**N**	**%**	
Male	6	10.3	50	86.2	2	3.4	58
Female	5	11.9	36	85.7	1	2.4	42
Actual Reponses	11	11.0	86	86.0	3	3.0	100

Position

Question two of section A was designed to generate data on the position of the respondents. Table 4 shows the distribution of respondents by position. Out of 100 respondents, 19 respondents (19.0%) were programmers, 23 respondents (23.0%) were

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system engineers, 25 (25.0%) respondents were software engineers, 18 respondents (18.0%) were lecturers, 3 respondents (3.0%) were managers, 5 respondents (5.0%) were assistant managers and 7 respondents (7.0%) were in other categories. Based on advertisements posted on JobStreet.com the top IT jobs in Malaysia is software engineers (Foo, 2004). This survey also shows the same scenario where most of respondents work as software engineers. According to Quantrum Alliance Sdn Bhd's technical director Ralph K. Tee, IT professionals in Malaysia choose to be software engineers, because software engineering fields was very demanding in job market and offers high pay (Angelina, 2004). The interviews with some IT professionals also give the same answers.

A cross tabulation of respondents' position by their gender is also shown in Table 4. The table indicates that, out 19 programmers, 9 respondents (47.4%) were males and 10 respondents (52.6%) were females. Out of 23 system engineers, 17 respondents (73.9%) were males and 6 respondents were (26.1%) females. Out of 25 software engineers, 15 respondents (60.0%) were males and the rest (40.0%) were females. Furthermore, out of 18 lecturers, 6 respondents (33.3%) were male and 12 respondents (66.7%) were females. Out of 3 managers, 2 respondents (66.7%) were males and 1 respondent (33.3%) was female. Out of 5 assistant managers, 3 respondents (60.0%) were males and 2 respondents (40.0%) were females. Out of 7 respondents from other job categories, 6 of them (85.7%) were males and 1 respondent (14.3%) was female. This shows that, position, as system engineers were monopolized by male professionals' meanwhile position as lecturers were monopolized by female professionals. According to female

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respondents, they choose to become lecturer because the pay is better, there is less job stress and the working hours are shorter.

Table 4: Respondents' position by gender (N=100)

Position	Gender				Total
	Male		Female		
	N	%	N	%	
Programmer	9	47.4	10	52.6	19
System Engineer	17	73.9	6	26.1	23
Software Engineer	15	60.0	10	40.0	25
Lecturer	6	33.3	12	66.7	18
Manager	2	66.7	1	33.3	3
Assistant Manager	3	60.0	2	40.0	5
Others	6	85.7	1	14.3	7
Actual Responses	58	58.0	42	42.0	100

Organizational Type

Question four section A was designed to identify the type of respondents' working organization. The distribution of respondents working organization type is shown in Table 5. The responses showed that, out of 100 valid respondents, 70 respondents (70.0%) were working in private companies and firms and the rest of the 30 respondents were working in government agencies. Today's trend shows that, most IT professionals preferred to work in private sector rather than the government sector. According to respondents, private sectors offer competitive salary and expose to latest ICT technologies.

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Cross tabulation of the respondents' working organization type by gender also shown in Table 5. The data indicated that out of 70 respondents in private sector, 40 respondents (57.1%) were males and 30 respondents (42.9%) were females. Out of 30 respondents in government sector, 18 respondents (60.0%) were males and 12 respondents (40.0%) were females. Distribution of male and female professionals in private sector was almost the same. Based on respondents the better pay, opportunity to learn new technologies and future career advancement are reasons why they prefer working in private sector.

Table 5: Respondents' working organization type by gender (N=100)

Organizational Type	Gender				Total
	Male		Female		
	N	%	N	%	
Private Sector	40	57.1	30	42.9	70
Government Sector	18	60.0	12	40.0	30
Actual Responses	58	58.0	42	42.0	100

Organizational sector

Question five in section A was designed to identify the working organization sector of respondents involved in the study. The distribution of respondents' working organization sector is shown in Table 6. The responses showed that out of 100 valid respondents, 39 respondents (39.0%) were working in software and telecommunication sector, 17 respondents (17.0%) were working in finance and banking sector, 8 respondents (8.0%) were working in manufacturing sector, 26 respondents (26.0%) were working in consulting and education sector, 2 respondents (2.0%) were working in construction sector, 8 respondents (8.0%) were working in research and development sector. More IT

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professionals were working in software and telecommunication sector since this sector has become one of the important sector in development of ICT industry in Malaysia.

Cross tabulation of the respondents' working organization sector by gender also shown in Table 6. The data indicated that out of 39 respondents in software and telecommunication sector, 25 respondents (64.1%) were males and 14 respondents (35.9%) were females. Out of 17 respondents in finance and banking sector, 8 respondents (47.1%) were males and 9 respondents (52.9%) were females. In the manufacturing sector, 5 respondents (62.5%) were males and 3 respondents (37.5%) were females. From the 26 respondents in consulting and education sector, 12 respondents (46.2%) were males and 14 respondents (53.8%) were females. According to female respondents, they prefer consulting fields because there is less job stress and they do not have to do much coding. Out of 2 respondents in the construction sector, all of them (100.0%) were males. Then, out of 8 respondents in research and development sector (RND), 6 respondents (75.0%) were males and 2 respondents (25.0%) were females. The distribution of male and female professionals in finance and banking sector was almost the same. According to respondents banking sector become their preference because of competitive pay.

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Table 6: Respondents' working organization sector by gender (N=100)

Organizational Sector	Gender				Total
	Male		Female		
	N	%	N	%	
Software and Telecommunication	25	64.1	14	35.9	39
Finance and Banking	8	47.1	9	52.9	17
Manufacturing	5	62.5	3	37.5	8
Consulting and Education	12	46.2	14	53.8	26
Construction	2	100.0	-	-	2
Research and Development	6	75.0	2	25.0	8
Actual Responses	58	58.0	42	42.0	100

Organization Size

Question six of section A was designed to generate data on the working organization size of the respondents. Figure 3.2(a) shows the distribution of respondents by position. Out of 100 respondents, 12 respondents (12.0%) were working in organizations having less than 50 employees, 14 respondents (14.0%) were working in organizations having between 51 to 100 employees, 13 (13.0%) respondents were working in organizations having between 101 to 200 employees, 28 respondents (28.0%) were working in organizations having between 201 to 500 employees, 21 respondents (21.0%) were working in organizations having between 501 to 1000 and 12 respondents (12.0%) were working in organizations having more than 1000 employees. According to respondents, they prefer to work in organizations which have more than 200 employees because these

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organizations have strong financial background and they feel that their jobs are more secured.

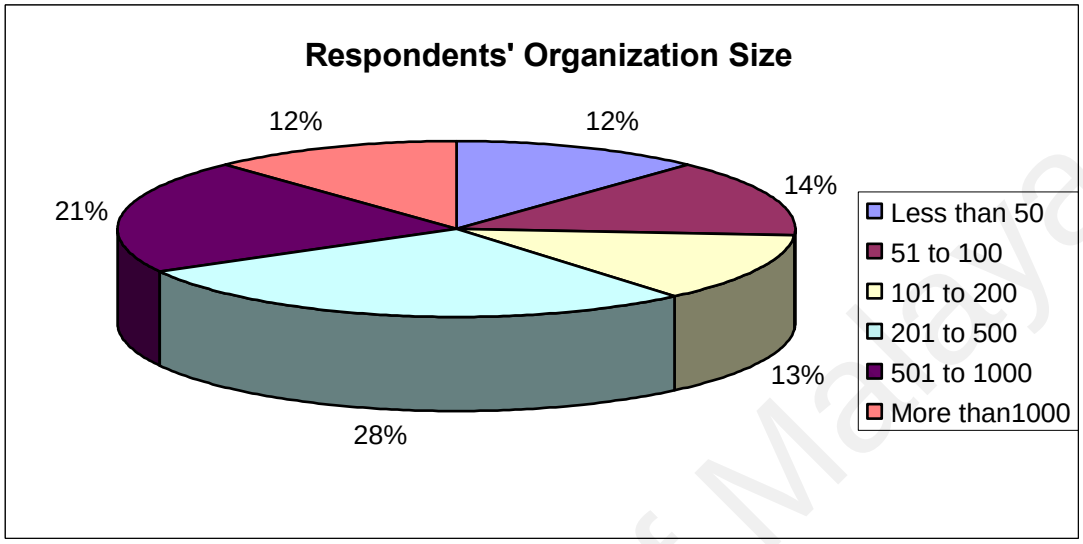

Figure 3.2 (a): Respondents' Organization Size

IT Experience

Question seven section A was designed to identify IT experience of respondents involved in the study. The distribution of respondents' IT experience is shown in Table 7. The responses showed that, out of 100 valid respondents, 14 respondents (14.0%) had 1 to 2 years experience, 36 respondents (36.0%) had 3 to 4 years experience, 23 respondents (23.0%) had 5 to 6 years experience, 14 respondents (14.0%) had 7 to 8 years experience, 8 respondents (8.0%) had 9 to 10 years experience and 5 respondents (5.0%) had more than 10 years experience. Around 50% of respondents were new to IT industry where they had less than four years of experience. According to them, IT was still the new field in our country and it become popular among Malaysian recently.

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Cross tabulation of the respondents' IT experience by gender also shown in Table 7. The distribution of male and female professionals in terms of IT experience in the first two categories, 1 to 2 years of experience and 3 to 4 years of experience, were almost the same. According to experts from industry, there is equal job opportunity for male and female graduates in IT fields. Normally they are employed based on their skills and knowledge and there is no discrimination between genders in IT fields in Malaysia. Meanwhile, out of 23 respondents with 5 to 6 years IT experience, 15 respondents (65.2%) were males and 8 respondents (34.8%) were females. In the next category, 10 respondents (71.4%) were males and 4 respondents (28.5%) were females. From 8 respondents with 9 to 10 years IT experience, 6 respondents (75.0%) were males and 2 respondents (25.0%) were females. Then, out of 5 respondents with more than 10 years IT experience, 4 of them (80.0%) were males and 1 of them (20.0%) was a female. Male respondents have more year experiences in IT fields compared to female respondents. Based on interviews with IT experts from industry, male graduates choose to enter job market earlier than female graduates. Female graduates are normally choose to further their education to higher level before enter job market and they also expect for jobs with good pay and less stress.

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Table 7: Respondents' IT Experience by gender (N=100)

Respondents' IT Experience (years)	Gender				Total
	Male		Female		
	N	%	N	%	
1 to 2	6	42.9	8	57.1	14
3 to 4	17	47.2	19	52.8	36
5 to 6	15	65.2	8	34.8	23
7 to 8	10	71.4	4	28.6	14
9 to 10	6	75.0	2	25.0	8
More than 10	4	80.0	1	20.0	5
Actual Responses	58	58.0	42	42.0	100

Academic Qualification

The first question in section B was constructed to identify the highest qualification obtained by respondents involved in the study. The distribution of respondents by qualification is shown in Figure 3.2(b). The responses showed that out of 100 respondents, 11 respondents (11.0%) were diploma holders, 86 respondents (86.0%) were degree holders and 3 respondents (3.0%) were master holders. Most of the IT professionals in Malaysia have good academic qualification with at least a degree. The awareness of importance of education among Malaysian, encourage young generation to pursue their studies to higher level before enter the industry world. Most of respondents say degree is a stepping stone for them to get first job with competitive salary.

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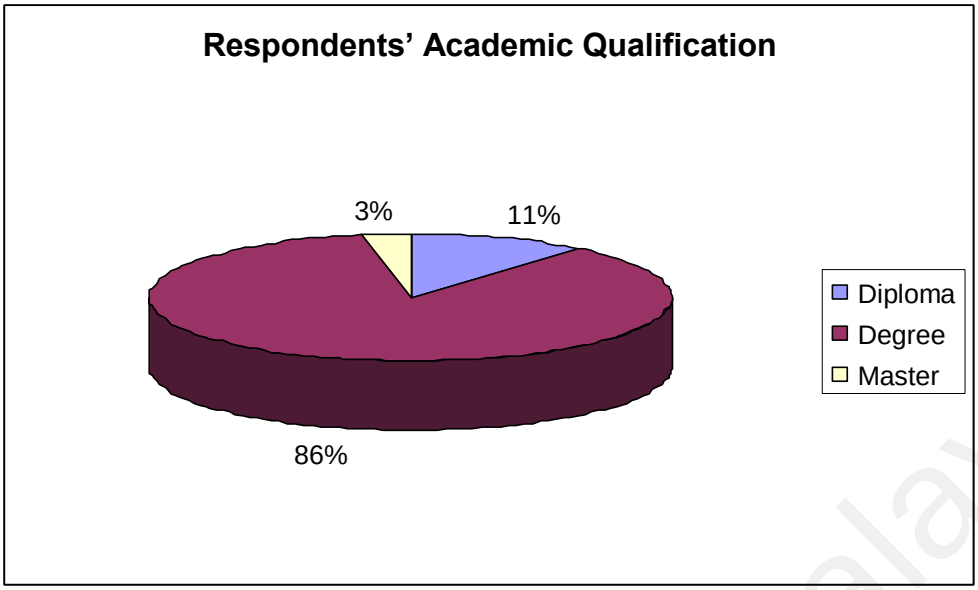

Figure 3.2(b): Respondents' Academic Qualification

Degree Specialization

Question two in section B was designed to identify degree specialization of respondents involved in the study. The distribution of respondents' degree specialization is shown in Table 8. The responses showed that, out of 100 valid respondents, 8 respondents (8.0%) had degree in Business Studies, 75 respondents (75.0%) had degree in Computer Science and IT, 12 respondents (12.0%) had degree in Electric and Electronics and 5 respondents (5.0%) had degree in other fields such as Mass Communication, CAD and CAM Engineering. Since IT sector has a bright future, most of the respondents were majoring in Computer Science and IT field. Respondents say that degree in Computer Science or IT fields are most suitable for IT industry since what they learn in their courses such as programming languages, networking principles and multimedia concepts will be implemented in their working environment.

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Cross tabulation of the respondents' degree specialization by gender also shown in Table 8. The data indicated that out of 8 respondents with degree in Business Studies, 5 respondents (62.5%) were males and 3 respondents (37.5%) were females. Out of 75 respondents with degree in Computer Science and IT, 39 respondents (52.0%) were males, 36 respondents (48.0%) were females. Meanwhile, out of 12 respondents with degree in Electric and Electronics, 9 of them (75.0%) were males and the rest of them (25.0%) were females. In the next category, all the respondents (100.0%) were males. Since IT industry has a good prospective, most of Malaysian young generation has choose to pursue their studies in Computer Science and IT field. According to Quantrum Alliance Sdn Bhd's technical director Ralph K. Tee, those who wish to work in IT industry should ensure that they have the right IT education such as a major in computer science or equivalent (Angelina, 2004).

Table 8: Respondents' specialization by gender (N=100)

Respondents' Majoring	**Gender**				**Total**
	Male		**Female**		
	N	**%**	**N**	**%**	
Business Studies	5	62.5	3	37.5	8
Computer Science & IT	39	52.0	36	48.0	76
Electric &Electronic	9	75.0	3	25.0	12
Others	5	100.0	-	-	5
Actual Responses	58	58.0	42	42.0	100

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Graduating Institution

Question three in section B was designed to identify the graduating institution of respondents involved in the study. The distribution of respondents' graduating institution is shown in Table 9. The responses showed that, out of 100 valid respondents, 87 respondents (87.0%) graduated from local institutions and 13 respondents (13.0%) graduated from foreign institutions. Since the quality of education in Malaysia was increasing and recognized, most IT professionals chose local universities and colleges to pursue their higher studies.

Cross tabulation of the respondents' graduating institution by gender also shown in Table 9. The data indicated that out of 87 respondents from local institutions, 49 respondents (56.3%) were males, 38 respondents (43.7%) were females. Out of 13 respondents from foreign institution 9 respondents (69.2%) were males and 4 respondents (30.8%) were females. Distribution of male and female professionals in both local and foreign institutions was almost the same. Based on interviews with IT professionals, most of them say high quality of education which recognized globally and proper facilities in local institution encourage them to pursue their studies in local higher learning institution.

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Table 9: Respondents' Graduating Institution by gender (N=100)

Respondents' Graduating Institution	Gender				Total
	Male		Female		
	N	%	N	%	
Local Institution	49	56.3	38	43.7	87
Foreign Institution	9	69.2	4	30.8	13
Actual Reponses	58	58.0	42	42.0	100

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Section B: Skills Level

Analysis and Design Skills

The first question in section C was constructed to identify the skills level of respondents in analysis and design skills. The scale 1 (very poor) to 5 (very good) was provided for them to rate their experience and knowledge on the respective skills. The distribution of respondents and their mean in each of the skills is shown in Table 10.

Table 10: Distribution of respondents in analysis and design skills (N=100)

Skills	**Number of Respondents**					**Mean**	**Standard Deviation**
	1	**2**	**3**	**4**	**5**		
Ability to do an adequate feasibility study	15	10	38	25	12	3.09	1.19
Ability to do a cost/ benefit analysis of alternative system design	10	12	35	33	10	3.21	1.10
Ability to do a cost/ benefit analysis of alternative packages or tools	15	25	40	10	10	2.75	1.14
Ability to create a formal conceptual design for an application	8	10	17	42	23	3.62	1.17
Ability to perform semantic data Modeling	5	15	51	16	13	3.17	1.00
Ability to use CASE development tools	10	10	58	14	8	2.86	1.33
Ability to perform object-oriented analysis and design for application using UML	3	12	18	32	35	3.84	1.12
Ability to use formal information requirements determination methods	6	8	51	22	13	3.28	0.99
	Overall Mean					3.22	

Based on survey's results most of the sub-skills in this category show mean more than 3.00. The overall mean for this category is 3.22 which fall above the moderate level based on five point Likert Scale. This shows that, IT professionals nowadays have a good knowledge in Analysis and Design Skills. According to respondents, most of the knowledge in these skills was acquired through working experience. Based on interviews

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with software engineers, they have good knowledge in *'ability to perform object-oriented analysis and design for application using UML'*. According to them, this skill is considered as one of the most important skills for their career development. Since most of respondents were software engineers, this sub-skill shows a higher mean which is 3.84.

'Ability to use CASE development tools' shows mean of 2.86 where 58 respondents ranked that they were moderate in this skill. 15 respondents ranked that they were very poor in *'ability to do a cost/ benefit analysis of alternative packages or tools'* with a mean of 2.75. This data shows that, IT professionals in Malaysia were poor in these skills. According to respondents since they didn't have a proper expose to these skills, their knowledge are limited in both of the skills. Even some of them suggested that incorporate training will help them to increase their expertise in both of the skills which is quite useful for their career.

Programming Skills

The second question in section C was constructed to identify the skills level of respondents in programming skills. The distribution of respondents and their mean in each of the skills is shown in Table 11.

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Table 11: Distribution of respondents in programming skills (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Ability to apply structured program design	4	18	39	27	12	3.25	1.01
Ability to design program data structure	6	12	40	36	6	3.24	0.95
Ability to create effective documentation for application	2	10	31	49	8	3.51	0.85
Ability to design and use algorithms	6	14	39	33	8	3.23	0.99
Ability to prototype applications	8	14	35	33	10	3.23	1.07
Ability to design security, privacy and auditing controls for applications	10	24	43	21	2	2.81	0.95
Knowledge of systems development quality assurance procedures	10	22	37	27	4	2.93	1.02
Knowledge of a specific systems development methodology	4	18	45	29	4	3.11	0.88
Ability to develop web sites	8	6	41	25	20	3.43	1.11
	Overall Mean					3.19	

Overall mean for this category is 3.19 which is also above moderate level based on five point Likert scale. From the survey results, 49 respondents ranked that they have a good knowledge in *'ability to create effective documentation for application'*. Based on interviews IT professionals say their expertise in this skill increase as their experience in IT industry increase. The data also shows IT professionals have ranked that they have good knowledge in *'ability to develop web sites'*. When interviewed, IT experts from industry, feels rapid evolution in World Wide Web (WWW), caused IT professionals' knowledge in this skill increase recently. This is followed by *'ability to apply structured program design'*.

Based on survey results, *'ability to design security, privacy and auditing controls for applications'* have the lowest mean compared to other skills in this category. 24 respondents ranked that they were poor meanwhile 43 respondents ranked that they were moderate in this skill. Based on interviews that carried out, IT professionals feel their

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expertise in this skill low because the knowledge that they acquired in universities or colleges on this skill was too limited.

Interpersonal Skills

The third question in section C was constructed to identify the skills level of respondents in the interpersonal skills. The distribution of respondents and their mean in each of the skills is shown in Table 12.

Table 12: Distribution of respondents in the interpersonal skills (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Ability to work with others to accomplish some goals	-	2	17	59	22	4.01	0.69
Ability to write clearly and effectively	-	4	18	60	18	3.92	0.72
Ability to work alone to accomplish some goals	-	2	18	51	29	4.07	0.74
Ability to listen to others	-	-	21	57	22	4.01	0.66
Ability to give effective presentation	2	2	35	49	12	3.67	0.79
Ability to respond appropriately to another's emotions	2	4	22	55	17	3.81	0.83
Ability to persuade others	2	6	41	39	12	3.53	0.85
Ability to train others	2	4	19	57	18	3.85	0.83
	Overall Mean					3.86	

Based on the survey results, the respondents ranked that they have good knowledge in most of the sub-skills and the overall mean of 3.85 indicates that IT professionals' skill level in Interpersonal Skills was good. IT professionals believe that this skill is very important for their career advancement. The data shows that many IT professionals have *'ability to work alone to accomplish some goals'*. According to them, they develop this skill since IT fields require them to be independent and they only need minimum

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supervision in their work. The next two top skills among IT professionals in this category are *'ability to work with others to accomplish some goals'* and *'ability to listen to others'*.

49 respondents ranked that they were good in *'ability to give effective presentation'* meanwhile 39 respondents ranked that they were good in *'ability to persuade others'*. According to the respondents they need to develop these skills since they have to deal with clients and provide the system support to their customers. They found these skills are very important in IT industry.

Environment or Platform Skills

The fourth question in section C was constructed to identify the skills level of respondents in environment or platform skills. The distribution of respondents and their mean in each of the skills is shown in Table 13.

Table 13: Distribution of respondents in environment or platform skills (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Ability to build systems in a mainframe environment	-	2	17	59	22	4.01	0.69
Ability to build systems in a PC environment	-	4	18	60	18	3.92	0.72
Ability to build applications in multiple environment/ platform	-	2	18	51	29	4.07	0.74
Ability to build systems in a minicomputer environment	-	-	21	57	22	4.01	0.66
Ability to build applications in a UNIX environment	2	2	35	49	12	3.67	0.79
Ability to build applications in a LINUX environment	2	4	22	55	17	3.81	0.83
Ability to build applications in a Windows environment	2	4	20	39	35	4.01	0.94
Ability to build applications in NT environment	3	7	20	45	25	3.82	0.98

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Ability to build applications for the SNA environment	15	34	29	14	8	2.66	1.13
Ability to build applications for SAA environment	17	32	41	6	4	2.48	0.97
Ability to build applications in a Novell environment	13	20	35	18	14	3.00	1.21
Knowledge on 3G Technologies	8	38	35	9	10	2.75	1.06
Knowledge on Mobile Communications	9	17	34	18	22	3.27	1.23
Knowledge on VOIP	20	28	32	11	9	2.61	1.18
Knowledge on Cisco Routers	10	2	47	30	11	3.30	1.03
Knowledge on Internet/ Intranet systems and protocols	3	5	43	36	13	3.51	0.89
Knowledge on LAN	-	2	22	40	36	4.10	0.81
Knowledge on WAN	-	5	26	47	22	3.86	0.81
Knowledge on WLAN	3	13	40	28	16	3.41	1.00
Knowledge on VLAN	8	7	43	25	17	3.36	1.09
Knowledge on Virtual Private Network (VPN)	9	12	34	28	17	3.32	1.16
Knowledge on web security	8	10	28	32	22	3.50	1.17
Knowledge on network security	12	12	36	27	13	3.17	1.17
Knowledge on Public Key Infrastructure	12	16	40	23	9	3.01	1.11
Knowledge on Intrusion Detection System	23	22	35	14	6	2.58	1.16
Knowledge on Visual InterDev	20	21	38	9	12	2.72	1.23
Knowledge on Cold Fusion	15	25	33	10	17	2.89	1.27
Knowledge on Web Sphere	13	17	49	11	10	2.88	1.09
Knowledge on Notes & Domino	10	20	40	13	17	2.97	1.42
Knowledge on DNS	9	19	51	8	13	2.97	1.07
Knowledge on TCP/IP	-	5	28	34	33	3.95	0.90
Knowledge on HTTP	3	3	10	37	47	4.22	0.95
Knowledge on E-mail	-	-	15	35	50	4.35	0.73
Knowledge on Proxy	7	3	47	28	15	3.41	1.01
Knowledge on Firewalls	6	10	28	39	17	3.51	1.07
	Overall Mean					3.40	

Based on survey results, IT professionals' skill level in Environment or Platform sub-skills is not consistent. They ranked that they were good in certain skills and their knowledge was quite low in some of the sub-skills. In overall their knowledge in this skill category was above the moderate level based on five point Likert Scale with mean of 3.40. Most of respondents ranked that they have a good knowledge in *'knowledge on E-mail'* with a mean of 4.35. According to them e-mail is fastest and cheapest communication tools in IT field. This is followed by *'knowledge on HTTP'* and

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'knowledge on LAN', where according to respondents are basic skills for IT professionals who involved in networking field.

According to Quantrum Alliance Sdn Bhd's technical director Ralph K. Tee the programmers should know how to use Microsoft Windows XP and Red Hat Linux platform as well as open sources platform to be a successful software programmers (Angelina, 2004). In line with Tee's statement, the survey results also show respondents ranked that they have good knowledge in *'ability to build applications in a Windows environment'*, *'ability to build applications in NT environment'* and *'ability to build applications in LINUX environment'*.

According to the survey data respondents skill level was low in certain skills such as *'knowledge on VOIP'*, *'knowledge on Intrusion Detection System'* and *'ability to build application for SAA environment'*. Based on the interviews with respondents, they say that their knowledge was low in newly discovered technologies since they didn't have a proper training and expose to those skills.

Fast evolution and rapid changes in ICT field, result in new technologies to be discovered from time to time. Therefore IT professionals should be updated with this scenarios and increase their expertise in these new technologies to overcome the challenging IT world.

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Business Skills

The fifth question in section C was constructed to identify the skills level of respondents in business skills. The distribution of respondents and their mean in each of the skills is shown in Table 14.

Table 14: Distribution of respondents in business skills (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Have an understanding of a specific business function	6	11	18	34	31	3.73	1.18
Ability to create a formal conceptual design for an application	8	9	45	23	15	3.28	1.08
Ability to do project planning and control	9	13	35	20	23	3.35	1.22
Ability to foresee problems that would results from introduction of new technology	11	22	44	14	9	2.88	1.07
Have an understanding of industry structure and behavior	10	6	30	24	30	3.58	1.25
Ability to use techniques for identifying application that will provide competitive advantages	12	13	38	22	15	3.15	1.19
Ability to use MIS planning methods	5	10	30	32	23	3.58	1.10
Knowledge of the laws and ethical issues associated with computing	20	21	31	16	12	2.79	1.27
Knowledge on E-commerce	9	15	28	16	32	3.47	1.31
Knowledge in Business Process Reengineering (BPR)	12	15	38	16	19	3.15	1.24
	Overall Mean					3.30	

The survey shows that, in overall respondents knowledge in Business Skills was above moderate level with the mean of 3.30 (based on five point Likert Scale). Most of the respondents ranked that they have a good knowledge in 'have *an understanding of a specific business function'*. When interviewed, IT experts from industry say knowledge in business skills is very important for IT professionals since IT has a close relation with business and development of IT industry depends on development of business field.

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Based on that principle, respondents also have good knowledge in '*have an understanding of industry structure and behavior'* and *'ability to use MIS planning.*

Since online business becomes a new trend in modern life, the skill levels in *'knowledge on E-commerce'* among IT professionals were quite good with a mean of 3.47. The survey also shows that, respondents have low knowledge in *'Knowledge of the laws and ethical issues associated with computing'*. Overall, the skill levels in this category show that Business Skills are very important for the development of IT industry nowadays.

Application Skills

The sixth question in section C was constructed to identify the skills level of respondents in application skills. The distribution of respondents and their mean in each of the skills is shown in Table 15.

Table 15: Distribution of respondents in application skills (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Ability to design relational databases	13	23	35	17	12	2.92	1.18
Ability to design distributed applications	10	20	43	14	13	3.00	1.12
Ability to design collaborative work application	12	24	39	16	9	2.86	1.10
Ability to create effective Decision Support System	15	18	35	14	18	3.02	1.28
Ability to design hierarchical or network databases	21	25	31	15	8	2.64	1.20
Ability to perform analysis and design for expert systems	19	19	30	22	10	2.85	1.24
Knowledge in Enterprise Reengineering and Restructuring (ERR) software	19	16	37	17	11	2.85	1.23
Knowledge in Enterprise Resources Planning (ERP) software	17	15	33	24	11	2.97	1.23

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Knowledge on Software Management Configuration	10	18	30	19	23	3.27	1.27
	Overall Mean					2.93	

Respondents' skill level in Application Knowledge was slightly below than the moderate level and the survey shows that overall mean is 2.93. Based on data collected, respondents' expertise in '*knowledge on Software Management Configuration'* was better compared to other skills since most of the respondents were software engineers. This is followed by respondents' expertise level in '*ability to create effective Decision Support System'* and *'ability to design distributed applications'*.

From the interview conducted, IT professionals feel that, they should increase their expertise level in Application Knowledge since knowledge in this category is going to be important for their profession in the future. According to them good knowledge in application skill will help them in their career advancement and also increase their domain knowledge in IT fields.

Computer Language Knowledge

The seventh question in section C was constructed to identify the skills level of respondents in computer language knowledge. The distribution of respondents and their mean in each of the skills is shown in Table 16.

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Table 16: Distribution of respondents in computer language knowledge (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Ability to program in COBOL	18	19	34	17	12	2.86	1.24
Ability to build application using 4th generation language	10	21	32	16	21	3.17	1.26
Ability to use operating system Job Control Languages	27	28	33	5	7	2.37	1.14
Ability to program in C	3	4	20	44	29	3.92	0.96
Ability to program using an object-oriented language	6	7	37	28	22	3.53	1.09
Ability to program using an Artificial Intelligence Language	27	30	26	8	9	2.42	1.22
Ability to program in ADA	22	34	27	10	7	2.46	1.14
Ability to program in Java/J2EE	12	22	45	12	9	2.84	1.07
Ability to program in Visual Basic	4	5	44	30	17	3.51	0.96
Ability to program in HTML	10	11	41	22	16	3.23	1.15
Ability to program in DHTML	13	14	43	17	13	3.03	1.16
Ability to program in ASP	12	18	39	18	13	3.02	1.17
Ability to program in PHP	11	24	45	11	9	2.83	1.06
Ability to program in C++	1	3	18	27	51	4.24	0.92
Ability to program in Delphi	17	15	32	19	17	3.04	1.30
Ability to program in Perl	13	19	38	22	8	2.93	1.12
Ability to program in MySQL	10	20	30	23	17	3.17	1.22
	Overall Mean					3.09	

Computer language knowledge is essential skills for most of IT jobs such as programmers. Good knowledge in computer languages will help IT professionals to become a successful person in their career. The data shows, 51 respondents ranked that they were very good in *'ability to program in C++'*. This is followed by *'ability to program in C'* where 44 respondents ranked that they were good in this skill. Respondents' skill level in '*ability to program using an object-oriented language'* was also quite good. From observation on computer languages offered in Computer Science curriculum in local higher learning institution, it shows that these languages were mainly taught nowadays and many local graduates have good expose in these languages.

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Based on data collected, respondents' knowledge level in *'ability to program in Visual Basic'* was quite good. The evolution and rapid development of World Wide Web (WWW) caused the skill levels of IT professionals in *'ability to program in HTML'* to be high. This is followed by *'ability to build application using 4th generation language'* and *'ability to program in MySQL'* with the mean of 3.17.

According to the respondents, their knowledge level in certain computer languages are low since they don't have much exposure to those languages in their studies and also working fields. Respondents ranked *'ability to program in ADA'*, *'ability to use operating system Job Control Languages'* and *'ability to program using an Artificial Intelligence Language'* under this category. However, based on respondents' response, in overall their knowledge in computer language knowledge was above moderate level with mean of 3.09.

Although the skill levels of IT professionals were good in certain languages, but this trend will be changed in the future. Languages such as Visual Basic, Java, J2EE, ASP, and PHP are going to be popular among IT professionals since these languages have a high demand in the IT market. IT professionals should increase their expertise level in these languages in order to be successful in their career.

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Database Knowledge

The eighth question in section C was constructed to identify the skills level of respondents in database knowledge. The distribution of respondents and their mean in each of the skills is shown in Table 17.

Table 17: Distribution of respondents in database knowledge (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Ability to build application using SQL Server 2000	12	4	39	28	17	3.34	1.17
Ability to build application using Oracle 91	12	14	43	19	12	3.05	1.13
Ability to build application using DB2	10	13	40	20	17	3.21	1.17
Ability to build application using Informix	11	10	40	29	10	3.17	1.10
Ability to build application using Sybase	8	19	40	22	11	3.09	1.08
Ability to build application using MS Access	-	2	10	35	53	4.39	0.75
	Overall Mean					3.38	

The data indicates overall knowledge of respondents in Database Knowledge was quite good with mean of 3.38 which is above moderate level based on five point Likert scale. The survey shows 53 respondents ranked that they were very good in *'ability to build application using MS Access'* with a mean of 4.39. This is followed by *'ability to build application using SQL Server 2000'* where 28 respondents ranked that they were good in this skill. According to respondents SQL server is one of the famous database tools to develop application nowadays.

Since oracle was used widely in IT industry, the data show that respondents knowledge in *'ability to build application using Oracle 91'* above the moderate level with mean of 3.05. From the analysis conducted, most of IT professions need the knowledge in

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databases, the expertise level of respondents in this category was quite good. They have to maintain this scenario to be successful in their professions.

Multimedia Knowledge

The ninth question in section C was constructed to identify the skills level of respondents in multimedia knowledge. The distribution of respondents and their mean in each of the skills is shown in Table 18.

Table 18: Distribution of respondents in multimedia knowledge (N=100)

Skills	Number of Respondents					Mean	Standard Deviation
	1	2	3	4	5		
Ability to use Macromedia Director	17	29	14	20	20	2.97	1.40
Ability to use Macromedia Flash	15	19	34	15	17	3.00	1.27
Ability to use Dreamweaver	17	18	29	17	19	3.03	1.34
Ability to use Adobe Photoshop	4	6	26	34	30	3.80	1.06
Ability to use GIF Animator	15	10	42	16	17	3.10	1.24
Ability to build animation using VRML	22	23	45	5	5	2.48	1.04
Knowledge on Scriptwriting	20	25	29	19	7	2.68	1.19
Knowledge on Production Design	40	38	17	3	2	1.89	0.93
Ability to use 3D Studio Max	14	15	36	18	17	3.09	1.25
Knowledge on storyboarding	17	18	34	22	9	2.88	1.19
	Overall Mean					2.89	

IT professionals' skill levels in Multimedia Knowledge were not consistent. They were good in certain sub-skills and their knowledge in some of the sub-skills was very low. The survey shows the overall mean for this skill was below the moderate level. Since the respondents for this study were not involved directly in Multimedia fields, their expertise in this skill was low. However, the data shows most of the respondents have good knowledge in *'ability to use Adobe Photoshop'*. This is followed by *'ability to use GIF*

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Animator' and *'ability to use 3D Studio Max'* . According to respondents these skills were useful for them to build interactive user interface for their applications.

According to respondents, their knowledge in certain Multimedia skills such as *'ability to build animation using VRML'* and *'knowledge on Production Design'* quite low because these skills are not important for their job scope. Since multimedia is a new field in IT world, the IT professionals' expertise and knowledge in this field was quite low and ought to be increased in the future.

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Section C: Others

Respondents' Current Important Skills

The first question in section D was constructed to identify the skills in order of importance to respondents. A nine point Likert Scale ranging from 1 (less important) to 9 (most important) were provided for them to rate the skills in order of importance. The distribution of respondents and their mean in each of the skills was shown in Table 19. The value of mean indicates the importance of the skills where higher value indicates that the skill was more important and lesser value indicates that the skill was less important.

Table 19: Distribution of respondents' in current important skills (N=100)

Skills	Number of respondents									Mean	Standard Deviation
	1	2	3	4	5	6	7	8	9		
Analysis and Design Skills	-	-	-	3	12	22	20	28	15	7.03	1.34
Programming Skills	-	-	1	9	6	18	31	21	14	6.88	1.46
Interpersonal Skills	-	7	12	21	20	12	7	12	9	5.32	2.03
Environment/ Platform Skills	7	9	17	14	8	4	12	16	13	5.25	2.59
Business Skills	25	17	13	5	9	11	4	6	10	3.95	2.72
Application Knowledge	14	18	26	16	13	2	1	3	7	3.63	2.05
Computer Language Knowledge	-	-	3	2	25	21	15	13	21	6.66	1.65
Database Knowledge	21	20	15	12	7	6	7	1	11	3.81	2.58
Multimedia Knowledge	33	29	13	18	-	4	3	-	-	2.47	1.53

Based on the survey, respondents ranked Analysis and Design Skills as the most important skills for their career currently with the mean of 7.03. According to them, knowledge in this skill will help them to overcome challenges and also to analysis the problem within their job scope effectively. Since most of respondents in this study were

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programmers and software engineers, they ranked Programming Skills and Computer Language Knowledge as important skills for their career currently. These skills ranked as second and third important skills in order of importance with the mean of 6.88 and 6.66 respectively. Interpersonal Skills ranked as the forth important skill for their career currently by respondents. From the interview conducted, respondents say this skill is necessary where IT professionals required communicating with their clients to do requirement studies and trainings.

Most of the system engineers choose Environment or Platform Skills as important skills to their current working environment with a mean of 5.25. According to them, this skill is necessary because their job scope needs them to have a good knowledge on networking side. Database Knowledge was ranked as seventh important skill by respondent for their working environment currently. Based on interviews with IT experts from industry, Database Knowledge is essential skill for IT jobs like programmer and software engineers where their job scope requires them to maintain their applications' database. Respondents have ranked Multimedia Knowledge as the least importance skill for their career currently. Since most of respondents for this survey were software engineers, programmers and system engineers, they feel this skill is not directly link to their job scope. According to them multimedia knowledge is important for those who work as graphic designer, 3D animator and web designer.

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Respondents' Opinion on how well the universities or colleges are providing the IS Skills

The second question in section D was constructed to identify how well the universities or colleges that respondents graduate from, provide them with the skills that they rank in first question in section D. The frequency indicating as very good, good, moderate, poor and very poor was used. The distribution of respondents' opinion was shown in Table 20. The responses showed that, most of respondents ranked that universities and colleges are moderate in providing IS skills for their students. Respondents opinion were proved true because according to Human Resources Minister Datuk Wira Dr Fong Chan Onn, what some ICT graduates learn in the university is not really what the industry requires. Fong said the Government is trying to solve the problem through retraining programmes (Rozana, 2004).

Based on interviews carried out, respondents feels the current universities and colleges curriculum on Computer Science should be revised and more emphasizes should be given to new technologies and demanding programming language in ICT market. The current skill sets provided by computer science curriculum fails to meet industry requirements. Their opinion was supported by JobStreet.com's vice president of Malaysia operation, Suresh Thiru's opinion. He believes that one of the main issues of the current ICT graduate unemployment problems is the differences between the graduates' actual skill sets and that of those required by the job market (Foo, 2004).

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Cross tabulation of the respondents' opinion on how well the universities or colleges that respondents graduate from, provide them with the IS skills by qualification also shown in Table 18. The data indicated that out of 10 respondents who choose 'very good' as an answer, 2 respondents (20.0%) were diploma holders and 8 respondents (80.0%) were degree holders. Out of 18 respondents who choose 'good' as an answer, 7 respondents (38.9%) were diploma holders, 10 respondents (55.6%) were degree holders and 1 respondent (5.5%) was a master holder. Meanwhile, from 45 respondents who chose 'moderate' as an answer, 2 respondents (4.5%) were diploma holders, 42 respondents (93.3%) were degree holders and 1 respondent (2.2%) was a master holder. Out of 20 respondents whose answer was 'poor', all of them (100.0%) were degree holders. From 7 respondents whose answer was 'very poor', 6 of them (85.7%) were degree holders and 1 (14.3%) of them was a master holder.

Technology is rapidly changing and it is important that Computer Science curriculum is relevant to employer needs (Lee et al., 2002). Based on this argument, diploma, degree and master programmes should be revised from time to time so it was up to date with evolving technologies which is demanded by employers and necessary upgrade must be done in order to provide more knowledge and improve skill sets of their graduates.

Table 20: Respondents' opinion by qualification (N=100)

Respondents' Opinion	**Qualification**						**Total**
	Diploma		**Degree**		**Master**		
	N	**%**	**N**	**%**	**N**	**%**	
Very good	2	20.0	8	80.0	-	-	10
Good	7	38.9	10	55.6	1	5.5	18

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Moderate	2	4.5	42	93.3	1	2.2	45
Poor	-	-	20	100.0	-	-	20
Very Poor	-	-	6	85.7	1	14.3	7
Actual Responses	11	11.0	86	86.0	3	3.0	100

Where respondents acquire IS Skills other than universities and colleges

Question four section D was designed to generate data, where respondents acquire IS skills besides universities and colleges. In this question, respondents may choose more than one choice. Figure 3.2(c) shows the distribution of respondents' choices. Since IT professionals are told to upgrade their skills level from time to time (Hamisah, 2001), they have taken various steps to increase their knowledge and improve their skill set so it was in line with the ever-changing technology in IT field. IT industry nowadays is very competitive as employers are on selective and strategic hiring, therefore IT professionals should always be in a learning environment to face stiff competition. The data shows that most of the IT professionals are capable of learning new knowledge or skills by their own through research, online tutorials in internet and also by attending conference, seminars and trainings.

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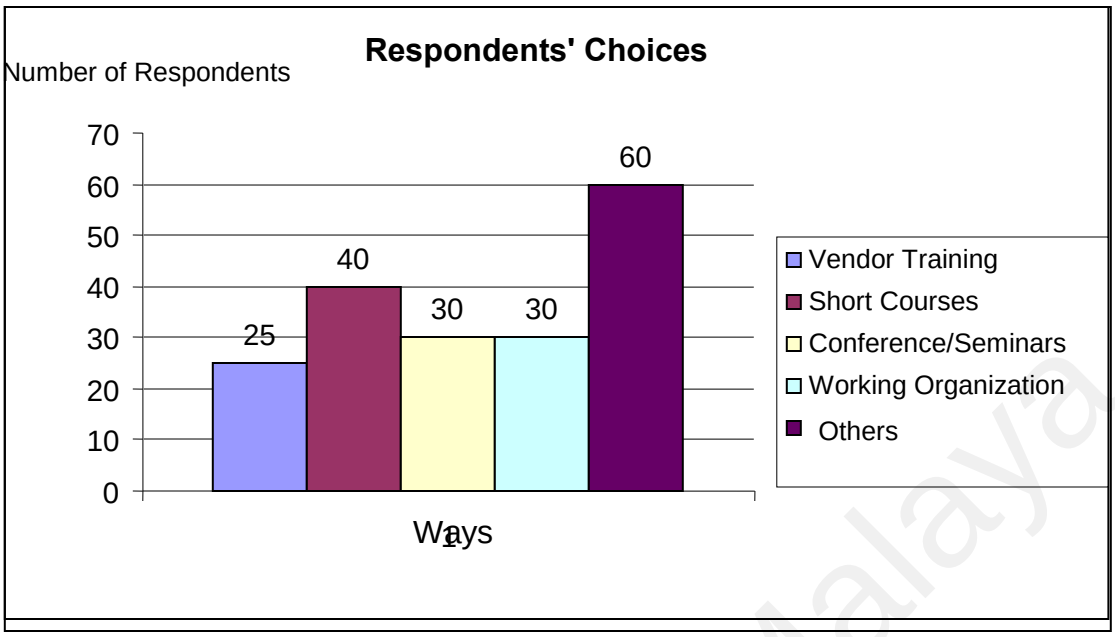

Figure 3.2(c): Respondents' Choices

Respondents' Opinion on how well the universities or colleges prepare the preferred graduates for industry

The fifth question in section D was constructed to identify how well the current curriculum in universities or colleges prepare and train the preferred graduates for industry. The frequency indicating as strongly agree, agree, slightly agree, slightly disagree, disagree and strongly disagree was used. The distribution of respondents' opinion was shown in Table 21. The responses showed that, nearly 50% of respondents disagree that universities and colleges are able to produce preferred graduates for industry. According to respondents, most of them acquire a lot of skills once they enter their job world. From analysis that carried out on Computer Science curriculum in local universities and interviews with academicians, the curriculum was unable to meet the

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fast-changing technology and IT graduates should be wiling to change and open to learning environment. They also should be able to build their expertise level based on basic skills which provided by their higher learning institution.

Cross tabulation of the respondents' opinion on how well the current curriculum in universities or colleges produces preferred graduates for industry by qualification also shown in Table 21. The data indicated that out of 10 respondents who strongly agree, 5 respondents (50.0%) were diploma holders, while the other 5 respondents (50.0%) were degree holders. Out of 25 respondents who agree, 5 respondents (20.0%) were diploma holders and 20 respondents (80.0%) were degree holders. Meanwhile, from 21 respondents who slightly agree, 1 respondent (4.8%) was a diploma holder, 19 respondents (90.4%) were degree holders and 1 respondent (4.8%) was a master holder. Out of 30 respondents who slightly disagree, 29 respondents (96.7%) were degree holders and 1 respondent (3.3%) was a master holder. From 9 respondents who disagree, 8 of them (88.9%) were degree holders and 1 (11.1%) of them was a master holder. Finally, out of 5 respondents who strongly disagree, all of them (100.0%) were degree holders.

The current situation where fresh graduates find difficulties to get suitable jobs in IT field caused them to disagree that university and colleges are capable to produce preferred graduates for industry. The issues like mismatch between the graduates' skills and those needed by job market also contribute to this scenario. The retraining programmes which conducted by Human Resources Ministry for ICT graduates also makes most of degree

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holders feel that skills provided by higher learning institution do not match employers need.

Table 21: Respondents' opinion by qualification (N=100)

Respondents' Opinion	Qualification						Total
	Diploma		Degree		Master		
	N	%	N	%	N	%	
Strongly Agree	5	50.0	5	50.0	-	-	10
Agree	5	20.0	20	80.0	-	-	25
Slightly Agree	1	4.8	19	90.4	1	4.8	21
Slightly Disagree	-	-	29	96.7	1	3.3	30
Disagree	-	-	8	88.9	1	11.1	9
Strongly Disagree	-	-	5	100.0	-	-	5
Actual Responses	11	11.0	86	86.0	3	3.0	100

Respondents' Opinion on how well the universities or colleges expertise train their students with IS skills

Question six in section D was designed to generate data, on respondents' opinion whether universities and colleges have enough expertise to train their students with required IS skills. The frequency indicating as strongly agree, agree, slightly agree, slightly disagree, disagree and strongly disagree was used. The distribution of respondents' opinion was shown in table 22. The responses showed that, 70% of respondents agree that expertise in universities and colleges were capable to train their students with IS skills. As we know, minimum qualification to be lecturer in higher learning institution nowadays should be master degree holders. In terms of academic qualification, these experts do not face any problems. Some of them even proved to have good knowledge in their fields. The major

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issue is, some of higher learning institution face shortage of experts to teach latest technologies.

Cross tabulation of the respondents' opinion whether universities and colleges have enough expertise to train their students with required IS skills by qualification also shown in Table 22. The data indicated that out of 20 respondents who strongly agree, 5 respondents (25.0%) were diploma holders and 15 respondents (75.0%) were degree holders. Out of 30 respondents who agree, 6 respondents (20.0%) were diploma holders and 24 respondents (80.0%) were degree holders. Meanwhile, out of 20 respondents who slightly agree, all of them (100.0%) were degree holders. In the next category, 15 respondents (88.2%) were degree holders and 2 respondents (11.8%) were master holders. From 10 respondents who disagree, all of them (100.0%) were degree holders. Then, out of 3 respondents who strongly disagree, 2 of them (66.7%) were degree holders and 1 of them (33.3%) was a master holder.

The survey clearly shows that, the problem in preparing the IT graduate for industry is not the shortage of expertise that the universities and colleges face but the subjects that been taught in their courses. More subjects related to latest technologies should be included in computer science curriculum in order to provide IT graduates the basic knowledge about these technologies before entering the job market.

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Table 22: Respondents' opinion by qualification (N=100)

Respondents' Opinion	Qualification						Total
	Diploma		Degree		Master		
	N	%	N	%	N	%	
Strongly Agree	5	25.0	15	75.0	-	-	20
Agree	6	20.0	24	80.0	-	-	30
Slightly Agree	-	-	20	100.0	-	-	20
Slightly Disagree	-	-	15	88.2	2	11.8	17
Disagree	-	-	10	100.0	-	-	10
Strongly Disagree	-	-	2	66.7	1	33.3	3
Actual Responses	11	11.0	86	86.0	3	3.0	100

Respondents' Important Skills in Future

The seventh question in section D was constructed to identify the skills in order of importance to respondents in future (5 years time). A nine point Likert Scale ranging from 1 (less important) to 9 (more important) were provided for them to rate the skills in order of importance. The distribution of respondents and their mean in each of the skills was shown in table 23. The value of mean indicates the importance of the skills where higher value indicates that the skill was more important and lesser value indicates that the skill was less important.

Table 23: Distribution of respondents' in current important skills (N=100)

Skills	Number of respondents									Mean	Standard Deviation
	1	2	3	4	5	6	7	8	9		
Analysis and Design Skills	-	-	-	-	4	25	22	31	18	7.34	1.15
Programming Skills	-	-	-	8	8	18	35	19	12	6.85	1.37
Interpersonal Skills	-	5	9	17	21	13	9	15	11	5.70	2.02
Environment/ Platform Skills	8	10	20	14	11	7	8	12	10	4.83	2.48
Business Skills	23	12	15	4	7	12	6	8	13	4.38	2.86

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Application Knowledge	13	17	24	17	11	3	2	4	9	3.87	2.32
Computer Language Knowledge	5	7	5	10	20	15	12	10	16	5.72	2.30
Database Knowledge	21	22	3	23	10	7	6	1	7	3.71	2.35
Multimedia Knowledge	30	27	24	7	8	-	-	-	4	2.60	2.01

Based on the survey, most of the respondents ranked Analysis and Design Skills will be the most important skills for their challenging career in the future with the mean of 7.34. This skill is essential for IT professional to analyze the complex problem within their job scope. Since most of respondents are programmers and software engineers and they expect themselves with to be promoted to the senior level in a five years time, there will be a decrease in importance of Programming Skills in the future.

Meanwhile the importance of Interpersonal Skills and Business Skills will be increased because career advancement requires respondents to communicate effectively in order to gather requirements and also involved in consulting role. It is understandable that Application Knowledge and Multimedia Skills would gain more importance in future as career advancement also requires respondents to have good domain knowledge in certain areas and ability to give powerful and attractive presentation. However there are skills which will decrease in importance in the future, they are the Environment or Platform Skills, Computer Language Knowledge and Database Knowledge.

From the data collected we can suggest that IT professionals in future should possess combination of interpersonal, business and technical skills which will allow them to analyze problems, integrate application and implement new business process.

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3.3 Summary

From the survey conducted, most of respondents involved in this study are male and working as software engineers. Based on survey's data, most of IT professionals in Malaysia have obtained at least a degree before start their profession. Mainly most of them are majoring in Computer Science and IT studies and involved in Software and Telecommunications industries. The survey also shows most of respondents involved in this survey have more than 3 years working experience in IT industries and working in an organization with more than 200 employees.

The survey shows that, most of respondents have good Interpersonal Skills since the overall mean in this category is higher compared to other categories. The second highest rated skill is Environment and Platform Skills followed by Database Knowledge. But when the respondents were asked to rate the important skills for their working environment currently, most of them choose Analysis and Design Skills as the most important skill, followed by Programming Skills and Computer Language Knowledge. Based on these results, it clearly shows that the skills possess by most of IT professionals does not match the industry requirements. Therefore, a major change should be done in current Computer Science and IT curriculum in order to provide preferred graduates for IT industry in the future.

The finding also shows most of respondents feel universities and colleges are moderate in providing IS skills for their students. 46% of respondents disagree that the universities

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and colleges have provided preferred graduates for the industries. The respondents also rated, most of them acquire IS skills by their own through attending seminars, online tutorials and on job-training.

The findings also shows that, for the future (5 years time) Analysis and Design skills is rated as most important skills to IT professionals followed by Programming skills and Computer Language Knowledge. The survey results also show the importance of Interpersonal skills and Business Skills has been increase among IT professionals in the future.

To support the findings from the survey IS skills assessment tool has been developed. Since there is no existing IS skills assessment tool in the market, ISSAS (Information System Skills Assessment System) which was developed as a part of this research will be a prototype system and reference to develop more sophisticated and effective skills' assessment tool in the future. Development of ISSAS was explained in detail in the following mention chapter.

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