An analysis of the educational needs of end user and information systems personnel as perceived by each other.

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Abstract

One of the basic needs of both information systems practitioners and academics is in determining what skills and knowledge staff need in order to be able to perform adequately in their jobs (Nelson : 1991). This study was concerned with the information technology and information systems learning needs of two distinct classes of personnel; end users and information systems personnel. More specifically, it examines the perceptions that each group has of the other's particular deficiencies. It also compares the importance that each group accords to skill or knowledge in particular items for their counterparts, and how these expectations match their counterparts' own perceptions of item importance. The study was thus concerned with *cross*-perceptions; the perceptions that each group has of the other.

This study examined these perceptions by means of the analytical survey method. The research instrument used was an adapted version of an instrument previously validated and used by Nelson (1991). The research instrument was completed by 168 employees within ten different organizations. The findings suggest that within six different areas of knowledge and skill both end user and IS personnel perceived their counterparts to be most deficient in the area of general IS knowledge; particularly in knowledge of the fit between IS and the organization, the potential uses of IS/IT within the organization, and in the use of IS for competitive advantage. In addition, both groups of personnel perceived their counterparts to be particularly deficient in their ability to communicate effectively.The deficiency in general IS knowledge was aggravated by the finding that both groups expect their counterparts to carry more of the responsibility for knowledge in general IS matters than their counterparts appear willing to assume. The implication of this mismatch of expectations is that it must first be resolved by clarifying the respective roles and responsibilities of both end user and IS personnel before the deficiencies themselves can be dealt with.

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Chapter 1
Introduction

THE PROBLEM

One of the basic needs of both information systems practitioners and academics is in determining what skills and knowledge staff need in order to be able to perform adequately in their jobs (Nelson : 1991). This study is concerned with the information technology and information systems learning needs of two distinct classes of personnel; end users and information systems personnel. More specifically, it examines the perceptions that each group has of the other's particular deficiencies. It also compares the importance that each group accords to skill or knowledge in particular items for their counterparts, and how these expectations match their counterparts' own perceptions of item importance. The study is thus concerned with *cross*-perceptions; the perceptions that each group has of the other.

Nelson (1991) has stated that cross-perceptions may be valuable for the resolution of conflict between the two classes of personnel by suggesting the need for specific avenues of organisational communication. Earl (1984) has argued that because of the nature of information technology as a technology that is changing rapidly and becoming ever more ubiquitous that it is most effectively managed by the users of the technology themselves. Conversely many of the current developments in information technology require ever greater degrees of expertise from the information systems personnel who support the technology (Rockart : 1988). Because of these changes writers in the information systems literature have argued that end user and information systems personnel will both need to acquire some of the skills and knowledge that were formerly the exclusive domain of each other (Earl : 1984). More recently, researchers have argued that in order to be able to find innovative uses for new information technologies a partnership between line managers and information systems personnel is necessary (Lind and Zmud : 1991, Sambamurthy et al : 1992). As Kwan and

Curley (1989) have observed, such a partnership implies that the traditional roles and responsibilities of both line and information systems personnel will need to change and will even change over the cycle of adoption of a new technology.

The change in roles and responsibilities enjoins a corresponding change in the specific competencies required of the personnel involved (Rockart : 1988). Research by Lind and Zmud (1991) has shown that where the two classes of personnel do not agree in their understandings of the role of information technology in supporting business unit activities less innovation in the use of information technology occurs. Sambamurthy et al (1992) have characterised successful partnerships as ones that achieve harmony between the partners as to their respective competencies, expertise and contributions. By examining the perceptions that information systems and end user personnel have of each other's competencies and the extent of their agreement as to the desired levels of skill and knowledge for each group, this research hopes to shed light on how traditional end user and information systems personnel responsibilities may be changing in South Africa.

Objectives

This research has three main objectives. The first is to determine whether IS and end users do in fact discriminate between different areas of skill and knowledge when it comes to assessing what deficiencies their counterparts have. Clearly, if personnel do not discriminate between different areas when assessing deficiencies in their counterparts no ranking or other prioritising of deficiencies is possible.

The second objective is to identify differences in the importance accorded an area for one class of personnel by those within that class of personnel and by their counterparts outside. For example, an area of knowledge might be defined as "the use of Information System and Information Technology for competitive advantage." End users might rate this item as being of only moderate importance for themselves but very important for IS personnel. IS personnel, on the other hand, might concur that it is important for them to have a grasp on this area but also expect end users to treat it as more important than they do.

The third objective (assuming the first is met i.e. personnel do discriminate between areas when assessing deficiencies) is to determine the learning needs of both IS staff and end users by identifying the relative sizes of current perceived deficiencies, thus helping to prioritise their learning needs.

OVERVIEW OF THE THESIS

In addition to the aspects of IS and end user personnel educational needs already discussed, this chapter deals with the definitions and terms used in the remainder of the study and the limitations of the study.

Chapter 2 presents a more detailed survey of the literature on the educational needs of end user and IS personnel. Chapter 2 concludes with a discussion of a framework that details the areas of computer-related skill and knowledge that should be possessed by all employees. Using the literature survey as a basis the research hypotheses are developed and stated in Chapter 3. Chapter 4 outlines the development of the research instrument used, the research procedures followed, and an examination of the nature and representativeness of the research sample. The internal reliability of the instrument is also tested and the results compared with previous uses of a similar instrument. Chapter 5 presents the formal testing of the hypotheses followed by a discussion of the results. Chapter 6 concludes the thesis with a summary of the results and achievements of the study, recommendations for practitioners based on the results, and suggestions for further research.

DEFINITIONS AND TERMS USED

This section provides definitions of certain specialised terms that have been used throughout this study. The definitions of information systems, IS personnel, and end users are all drawn from the definitions set out in the survey instrument used in the study (see Appendix A). The survey instrument is an adapted version of one employed by Nelson and the definitions are his (Nelson : 1991).

Information Systems refers to a computer-based system that processes data into a form that can be used by the recipient. Information systems consist of transaction (data) processing systems (e.g. payroll or accounting systems), management information systems, decision support systems (e.g. semi- or un-structured modelling systems), and office automation systems (e.g. word processing, electronic mail, or calendar management systems). Information systems can be personal, departmental or organisational in scope. This research also makes use of the abbreviation *IS* to denote either an "Information System" or "information systems *as a field of study*". The latter is usually the case when referring to the *IS literature*, or to *IS research*.

The term *IS personnel* refers to individuals whose primary job responsibility involves the management, development, maintenance, or support of information systems within an organisation. The term *IS function* refers to the organisational

unit (made up of IS personnel) that manages the development, maintenance, and support of information systems within the organisation.

The term *end users* refers to the people (employees) who ultimately use the output of an information system. This definition is restricted to non-IS personnel, people outside the IS department.

The focus of this research is on the educational needs of end user and IS personnel. Certain terms form an inseparable part of any discussion of this subject notably the notion of *skill* as opposed to *knowledge*, and the particular meaning accorded the terms *usefulness*, *proficiency*, and *deficiency*. All of these terms and their specific meanings will be discussed in much greater detail in Chapter 2 which covers the literature pertinent to IS educational issues and in Chapter 4 which discusses the survey instrument used. Nevertheless the terms are briefly defined here.

Skill refers to a person's ability to do something well. It relates to expertness, a practised ability, a dexterity in performing a task. It is an outcome that flows from knowledge, practise, inherent abilities and an understanding of the task to be performed. It is a talent or proficiency, to the extent of mastery, in carrying out a particular task (Goldsworthy : 1993).

Knowledge is distinguished from skill and is defined as the distillation of information in a particular context, it is the theoretical construct or mental model within which people undertake and perform activities. It is the understanding of the situation and of what needs to be done. It is the sum total of a person's learning and experience (Goldsworthy : 1993).

This study makes use of the term *usefulness* to denote the necessity of skill or knowledge in an item to successful job performance on the part of the person being assessed (Nelson : 1991, Nelson and Cheney : 1987, Benbasat et al : 1980).

The "degree of skill possession" is referred to by the term *proficiency* (Nelson : 1991).

An employee's *deficiency* in a necessary skill or knowledge area is a function of both usefulness and proficiency. For the purposes of this study deficiency is defined as the difference between the usefulness of a knowledge or skill area (for successful job performance) and the proficiency in that area of the individual being assessed (Nelson : 1991).

The research made use of a survey instrument based on one developed by Nelson (1991). The survey instrument measures perceived deficiencies in a number of *areas* e.g. organisational knowledge. Each area is a composite measure made up of a number of individual *items*. Each item corresponds to an individual question in the survey instrument. In the statistical nomenclature composite measures of this sort, those that attempt to measure something not itself directly observable, are sometimes referred to as *constructs*. In general, the discussion in this research uses the terms *area* and *item*, except when describing statistical procedures used to verify the reliability of the survey instrument. In the latter case the term *construct* is used.

LIMITATIONS OF THE STUDY

The organisations and respondents involved in this study were not representative of all organisational environments. The organisations surveyed were all large companies (with more than five hundred employees) and with mature IS functions. The companies were all based in the Western Cape, or had large offices there, but operated throughout South Africa. The results of the survey are thus not generalisable to all environments.

A second limitation of this study was that it made use of cross-perceptions (the perceptions that end user and IS personnel had of each other) as a measure of such variables as usefulness and proficiency that yield a value for deficiency. Obviously perceptions do not measure the actual or real deficiencies. Perceptions are, however, valuable data in themselves and also serve as a surrogate for more concrete measures. The use of perceptions as a measure is discussed in detail in Chapter 4.

Having given a brief outline of the areas to be covered, an in-depth survey of the research literature pertaining to this study follows in Chapter 2.

Chapter 2
Literature Survey

The topic of this study covers the learning needs of two distinct classes of employees; end user and IS personnel. This chapter reviews pertinent literature from the fields of organisational learning, and general IS research with particular attention to the literature on end user computing (EUC). The chapter concludes by presenting a framework that describes six general areas of skill and knowledge required by all employees who are involved in the use of IT.

ORGANISATIONAL LEARNING

The subject of organisational learning has long been one of the top issues that concern IS managers. In a succession of Delphi studies aimed at identifying top issues for IS management it ranked 8th in 1980, 6th in 1983, 3rd in 1986, and 5th in 1989 (see Niederman et al : 1991, Brancheau and Wetherbe : 1987, and Dickson et al : 1984). IS executives believe that successful organisations will be those that learn to make appropriate use of new information technologies. The continued presence of organisational learning among the top ten issues reflects the finding that on-going learning about better ways to utilise the information resource and integrate new technologies into the organisation is required if their true benefits are to be realised (Niederman et al : 1991). This section outlines the development of organisational learning as a field of study and its application to IS.

Single- and double-loop learning

The pioneers of organisational learning theory were Argyris and Schon. Utilising concepts from systems theory they developed new ideas about the kinds of learning that occur in an organisational context (Argyris and Schon : 1988). Although they were concerned primarily with organisational rather than individual or computer-related learning many of their ideas were later adopted and modified

by IS researchers, notably by Curley and Pyburn (1982). Most important of these were Argyris and Schon's concepts of single- and double-loop learning.

Single-loop learning in an organisational context can be said to take place when a member of an organisation learns to direct his or her actions in order to achieve a pre-established norm for performance (Argyris and Schon 1978 : p21). There is a single feedback loop which connects detected outcomes of action to strategies and assumptions which are modified so as to keep performance within a range set by organisational norms. The norms themselves - for task performance, product quality or some other desired outcome - remain unchanged.

Single-loop learning takes place when people detect a match or mismatch between the outcome of an action and the expected outcome which confirms or contradicts their current theory-in-use. Where a theory-in-use could be a conceptual map of the workings of certain technology for example. In the event of a mismatch a process of error correction takes place. The learner must inquire into the sources of the error and then move to correct it by inventing new methods and strategies of operation.

In single-loop learning actions were directed with the aim of achieving pre-established norms for performance. In *double-loop learning* the norms for performance are themselves altered during the learning process. This learning has a double feedback loop which links detected outcomes of action not only to assumptions and strategies for effective performance but also to those very norms which define effective performance (Argyris and Schon 1978 : p22).

Argyris and Schon emphasise that double-loop learning is not automatically better than single-loop learning in any absolute sense. Both types of learning are appropriate to different situations. In cases where the task objectives and norms for performance are well known and can be adequately specified single-loop learning is indicated as its focus is precisely the task at hand. The thrust of single-loop learning is to improve efficiency. Double-loop learning on the other hand is concerned with a constant re-examination of the norms of performance; it involves thinking beyond the parameters of the task itself and considering overall objectives. The thrust of double-loop learning is to improve effectiveness.

The concepts of single- and double-loop learning have been applied to the IS field in an attempt to understand more about the kinds of learning necessary for the successful use of IT. The next section discusses these contributions.

Organisational learning and IS

The notion that different types of learning might be appropriate for different situations served as a departure point for the work of Curley and Pyburn (1982). Curley and Pyburn sought to apply the concepts of single- and double-loop learning to the way in which organisations learn to make effective use of IT. Other writers in the field of IS had commented on the existence of a gap between the potential of IT to increase organisational effectiveness and its actual use in most organisations (Heany : 1972, Nolan : 1979). Curley and Pyburn attempted to explain this gap by examining the nature of information technology itself. They characterised IT as different from more conventional "industrial" technologies, and concluded that a different kind of learning was required for effective use of IT.

Curley and Pyburn (1982), and later Earl (1984), maintain that traditional industrial technologies are usually quite rigidly defined in terms of their functions and capabilities. For example, a machine for producing a certain good has a highly restricted function and its capabilities in terms of the number of goods it can produce, the rate at which they are produced and their quality would all be limited to a certain range. Given these characteristics there are very few or no intangibles involved in the decision to purchase or use such a technology. The function of the technology is predefined and cannot be changed and the benefits, because they stem directly from the technology's capabilities, are easily quantifiable. As a result standard managerial accounting techniques can be used to evaluate decisions as to the purchase and use of such machines.

In contrast to the above characterisation of industrial technologies Curley and Pyburn introduced the notion of information technology as an *intellectual technology.* Examples of intellectual technologies include word processors, decision support systems, computer-aided design, computer-aided manufacture and personal computers. In their definition intellectual technologies are computer based and are programmable which leads to their having a number of fundamental differences from industrial technologies. First, programmability implies that the function of the machine is no longer rigidly predefined. The user is free to change the application of the machine (Curley and Pyburn 1982 : p33). In other words the technology can be used in many different ways and for many different applications. Secondly, information technology has a very different type of application as it is capable of being manipulated to solve problems and organise information.

Curley and Pyburn identify the type of learning required as one of the dimensions along which industrial and intellectual technologies differ (1982 : p33). In describing the kind of learning required for the use of information technology they

draw heavily on the conceptual work of Argyris and Schon. Other IS researchers, notably Nolan in his "Stages of DP Growth" model, had previously stated that different kinds of learning were required for IT. Nolan specified two learning objectives in the contagion stage of his model; skill acquisition and the "nurturing of innovation" (Nolan 1979 : p117). Curley and Pyburn utilised the work of Argyris and Schon and their own definition of intellectual technologies to arrive at a description of two similar types of learning which they term *training* and *on-going adaptive learning*.

Curley and Pyburn state that the use of any technology requires an initial training period during which the basic skills required to operate the technology are acquired. This process of skill acquisition is closely analogous to Argyris and Schon's single-loop learning. For an industrial technology the pre-established norm of performance already exists in the defined function and capabilities of that technology. Thus single-loop learning aimed at maintaining the constancy of that predefined state through processes of error detection and correction can take place and will be sufficient for the operation of that technology.

In the case of an intellectual technology however, the function and capability are not predefined and are capable of revision and redefinition, the only limitation being the ability of the users to envisage new applications. In this situation single-loop learning is inadequate as it will lead to a sterile utilisation of the information technology. The research done by Curley and Pyburn showed that only users who were able to progress beyond mere technical proficiency and penetrate to an awareness of the *potentialities* of the technology became successful users. Only these users were able to innovate, to envisage new uses for the technology that would allow them to better perform their jobs.

Given this finding, Curley and Pyburn come up with recommendations similar to those of Nolan (1979) as regards the implementation of information technology. They recommend committing time and resources to learning and experimentation and also a recognition that "some level of uncertainty in how the equipment will be used is a characteristic of the learning process and should be anticipated." (Curley and Pyburn : 1982 : p35).

Blennerhassett came up against a similar difficulty in her research into what and how to teach managers about information technology. She states that:

> ... a program had to be devised to prepare managers for tasks and responsibilities that were largely undetermined - contrary to normal practice where programme design follows, rather than precedes,

> analysis of participants' learning needs. (Blennerhassett : 1988 : p.5)

In other words not being able to specify the function of the technology in advance thwarted attempts to plan a rigid training programme that would cater to the learning needs of the managers concerned. Instead the objectives had to emerge from a process of on-going adaptive learning in which managers and instructors engaged in an on-going dialogue.

IS RESEARCH AND END USER COMPUTING

One of the first writers in the IS field to identify organisational learning as being of concern to IS managers was Heany, a practitioner and Executive Staff Planner at General Electric (1972). Heany was concerned by what he saw as a flaw in the way IS professionals were approaching the development and implementation of information systems. His basic thesis was that IS professionals were unprepared for the management education tasks that were latent in their own propositions; they were introducing systems that would have profound impacts on their organisations and were doing little to prepare user management to understand, and so manage, the impact these systems would have.

Heany characterised IS management as having a myopic view of their responsibilities. He found that they were unprepared with respect to what to teach managers, and also ignorant of the educational techniques appropriate to an audience of managers (Heany : 1972). In response to these perceived weaknesses he recommended that end user education should become a priority of IS management. He also recommended that IS managers attempt to keep track of the educational progress that their organisation and user management were making with respect to IS concepts and technology.

Heany perceived a general need for education and learning in IS concepts by line managers in organisations. A more comprehensive treatment of the types of IS learning that organisations undergo was undertaken by Nolan.

In 1973 and through subsequent revisions in 1974, 1977 and 1979 Nolan introduced his "Stages of DP growth" model. The basic logic of the model was that stages of management activity can be identified with periods of stability along the growth path of information technology use (King and Kraemer 1984 : p467). Moreover Nolan's model was one of the first to make explicit the crucial role that learning plays in the use and management of information technology. In his model it is the experience gained by the users of IT, and the understanding of IS

concepts, tools and techniques that they gain, that allows progress to subsequent stages.

There are two aspects to the learning that can be seen to take place in the contagion stage - skill acquisition and an awareness of the potential of the technology (nurturing of innovation). Nolan mentions in passing that both are important to the organisation's use of information technology but he does not probe further into the learning that goes on at this stage. Nevertheless his model does emphasise the importance of learning and also that learning must go beyond the mere acquisition of skill.

Unfortunately Nolan does not offer much, at least in his published *oeuvre*, in the way of techniques which could be used to manage the learning process necessary in the contagion stage. The recommendations he does make are very broad: "a combination of low control and high slack is the natural balanced environment to facilitate organisational learning" (Nolan : 1979 : p.118). He does not regard organisational learning as being at all problematic. He treats it as something that will occur naturally given an environment that allows people to experiment. His model takes no cognisance of factors that may curtail or inhibit organisational learning, still less does it suggest ways in which such learning could be managed and expedited. Nevertheless Nolan's model is important in that it is one of the first comprehensive theoretical treatments of the use of information technology that accords an important place to learning issues.

A characteristic of both Nolan and Heavy's approaches to the organisational learning was that the bulk of IT related learning was still located in the IS function. This situation changed radically in the 1980's with the arrival of end user computing as a phenomenon.

Research in end user computing

The rapid appearance and widespread adoption of personal computers (PCs) in the early 1980's led to an increased awareness of IT issues on the part of end users (Benson : 1983, Keen and Woodsman : 1984). The increasing pervasiveness of relatively cheap computing resources in the form of the PC and its associated software led many end users to undertake development tasks that were previously the sole preserve of IS professionals. This phenomenon became known as end user computing (EUC). IS researchers investigating the ramifications of EUC almost invariably drew attention to the educational needs of end users (Benson : 1983, Gerrity and Rockart : 1986, and in South Africa, Norton 1984).

One of the first research efforts in EUC was Benson's survey of end users and DP professionals (1983). Benson found that most users did not want highly technical training, they were more concerned to acquire general knowledge that would enable them to understand and organise problems in such a way that they could best be dealt with through IT. End users also wanted to know what the potential uses of IT for problem solving were, and what was available in specific application areas (Benson : 1983).

In South Africa, Norton (1984) interviewed IS managers at thirteen companies in order to determine what they felt the training and education needs of top (line) management, end users and their own staff were. The IS managers interviewed all felt that the biggest lack of IS personnel was in interpersonal communications skills and in knowledge of the business also, more specifically, IS staff did not understand the problems faced by line managers. End user managers were perceived as being unsure as to how IT could be used in business and not able to adequately define their information needs. Norton reports a general perception on the part of IS managers that user management should become involved in leading the IS function and in determining the use of IT in the organisation.

Interestingly, while all of the IS managers interviewed by Norton identified specific educational needs among both IS and end user staff, most organisations had only informal training programs. Only two of the companies had on-going training programs designed to keep their staff up to date. The other companies all relied on ad hoc in-house training programs or on training provided by vendors of computer hardware. The bulk of all training was directed at IS staff for technical purposes. The education or training of end users in IS concepts or skills was negligible.

Research by Rockart and Flannery (1983) and Gerrity and Rockart (1986) investigated different approaches to managing EUC. The approach Gerrity and Rockart suggested as being most effective was one in which end users were free to create, define and develop their own applications of IT while at the same time a central authority reviewed the feasibility of ideas, provided specialist technical support, and ensured that an appropriate technical policy was in place. This role would most likely be filled by the IS function. In order for this approach to succeed however Gerrity and Rockart identified a number of critical attributes. The most significant of these from the point of view of the present research was that there be an emphasis on education throughout the organisation. Gerrity and Rockart found, as had Earl (1984), that one of the major problems facing IS management was the presence of a large number of IT education gaps. IS personnel were often ignorant of the nature of PC based applications, senior management were

not aware of the changes brought about by EUC, and line managers were swamped by the IT but had no understanding of the way in which it could best be applied to particular tasks.

End user/IS partnerships

A growing body of writing in the IS literature contends that, in order to facilitate IT-based innovation, IS organisations should be structured in such a way as to promote partnership relations between IS staff and end user managers (Sambamurthy et al : 1992). This body of writing recognises that, by its very nature, IT poses special management problems (Earl : 1984). Earl characterised IT as consisting of many related technologies, which are developing rapidly, are dispersing throughout the organisation, and are pervading all aspects of business. While he did not explicitly suggest a partnership between IS and end users, Earl emphasised that the thinking required to exploit new developments in IT consisted as much of marketing, production and finance as of technological know-how (Earl : 1984 : p202). Essentially, a user/IS partnership structure attempts to manage the process of IT-based innovation by explicitly incorporating the contributions of non-IS personnel while at the same time more clearly delineating the roles and responsibilities of the different personnel involved.

One of the first writers to raise the possibility of partnership structures was Rockart (1988). In Rockart's model of how organisations conceive of and ultimately implement new uses of IT, line management is given a key leadership role. The reason for this is that only line management has the necessary power within the organisation to effect the changes in organisational structure that can result from new uses of IT. Rockart identified four stages in the implementation of a new strategic use of IT; system conception, design and programming, implementation, and operation. Line management would play a leadership role during the conception and implementation stages, although both line and IS would have some responsibility at each stage.

Kwan and Curley (1989) found that EUC passed through stages of growth similar to those Nolan (1978) reported with respect to the organisational use of IS. They identified three stages as being typical of the process an organisation passed through when coming to grips with a new application of IT. What distinguishes Kwan and Curley's model of this process from earlier efforts is that they prescribed different levels of involvement from end users and IS personnel at each of the stages. The stages they describe and the respective responsibilities of user and IS personnel are described briefly here.

The *initiation* stage sees the initial experimentation with the new IT (or new use of IT). At this stage Kwan and Curley see a crucial role for end users as they are better able to understand the business uses of the technology; it is therefore necessary for them to drive the innovations in use. IS personnel play a subsidiary technical support role, providing technical assistance with the implementation (much as envisaged by Dixon and John :1989).

In the *integration* stage the new IT has stabilised and the new application begins to spread throughout the organisation. The concerns that dominate this stage are the integration and co-ordination of the new application with existing organisational systems. IS personnel play the dominant role here as they have the necessary expertise in organisational standards of data access, security, and integrity necessary for a mainstream organisational application.

The final stage is the *maturity* stage. Here the application has become standardised and a part of the on-going business. Some of the responsibility for its day to day management would shift back to end users.

Significantly Kwan and Curley found that the idea of shared responsibility between end users and IS personnel was a common experience across various industries and that it was independent of the strategic importance of IT to the organisation. They observed that the division of responsibility provided the organisation with the necessary technical expertise while permitting innovation and continual learning as users monitored and assessed their own applications.

The models of both Rockart (1988) and Kwan and Curley (1989) imply a change in the traditional responsibilities of both end users and IS personnel. While the traditional IS responsibilities of project management, operations, consulting, training, and analysis and design remain important several new responsibilities are added. The new IS responsibilities fall into three main groups.

The first of these is closest to the traditional IS role and concerns the design and programming of increasingly complex mission critical systems (Rockart : 1988). The difference lies in the increased complexity of the systems and the demands they place on IS personnel to be skilled in such diverse areas as data communications, database management and design, project management and many other areas.

The second IS role is as the provider of an IT infrastructure for the organisation (Henderson : 1986, Howard and Weinroth : 1987, Rockart : 1988, and in South Africa, Franzen and Greathead : 1988). This infrastructure consists not only of the

hardware and software but also of the standards that are in place to ensure data integrity, security, and access.

The third group of responsibilities for IS professionals concerns the role that the IS function should assume in relation to the IT-related education and learning needs of the organisation. Early writers in the field such as Heany (1972) questioned whether IS had the competence, or even the mandate, to undertake an educational role. Most later writers, however, explicitly identify education and training of end users as a responsibility of the IS function. In the earlier EUC literature this is usually as an adjunct to the IS support role for EUC (Rockart and Flannery : 1983). Later work, such as that by Rockart (1988), however recommends a more proactive role. Rockart suggests that IS should undertake the "education of line management to its responsibilities", these being to lead the development of new uses of IT. As part of this process Rockart recommends that IS use their knowledge of technology and the business to "seed" line management with innovative ideas concerning effective uses of technology. In South Africa Franzen and Greathead's (1988) survey of 284 IS and end user managers found that training and education coupled with the use of EUC to create new uses of IT were important factors in successful EUC.

ZMUD'S FRAMEWORK

The literature has clearly identified a need for organisations to set up structures that can manage the use of IT, the innovative search for new uses of IT, and the ability to successfully integrate those new uses into mainstream organisational systems. Clearly both IS and end users need to play a part in these structures (Earl : 1984, Rockart : 1988, Kwan and Curley : 1989). As Sambamurthy et al (1992) point out, however, there has as yet been little empirical work done to verify the validity of the guidelines laid down by writers such as Rockart (1988) and Kwan and Curley (1989). Moreover there has been little empirical work done to confirm the disposition of roles and responsibilities between end user and IS personnel. Research by Lind and Zmud (1991) has found that where IS staff and end users achieved a convergence in their understanding of about the role of IT and the relative importance of business unit activities, greater IT innovation occurred. Sambamurthy et al state that this convergence requires an appreciation by the staff involved (both IS and end user) of the distinctive competencies, expertise and potential contribution each can bring to the process.

It is thus important that end user and IS personnel become aware of the specific skills and knowledge that each possess. This implies that each class of employee have some insight into the knowledge of the other. There is, however, a question

of degree. Naturally no one can be expected to know *everything* that might prove useful in the construction of new systems. In outlining what skills personnel should have researchers have often employed the concept of the "necessity" or "usefulness" of the skill (Benbasat et al : 1980, Miller and Doyle : 1987). The measure of usefulness can be coupled with a measure of the "degree of skill possession" (Nelson and Cheney : 1987) to arrive at an idea of the extent of any deficiency in a given area. Nelson's (1991) research employed these concepts. The way in which they are operationalised is explored in greater depth in Chapter 4 which covers the research methodology employed.

Zmud (1983) has suggested six areas of knowledge and skills that are required by all employees. Although the extent of their mastery of any area would vary some knowledge in each area would be desirable. The six areas are:

1. An **organisational overview** which would include a knowledge of the objectives, purpose, opportunities, constraints and the internal and external functioning of the organisation.

2. Specific **organisational skills** which would include skills in interpersonal communication and behaviour, group dynamics and project management.

3. A knowledge of the **target organisational unit** including its objectives, purpose, functions, resources, problems and its links with other internal and external units in the organisation.

4. **General IS knowledge**, including a knowledge of hardware and software concepts, the potential of IS/IT, organisational IS policies and plans, and the organisation's existing IS applications.

5. **Technical skills**, including the methods and techniques required to perform IS-related tasks.

6. The ability to use **IS product** including the specific application systems, office automation products, required procedures and documentation.

Zmud's framework is organised around some important distinctions. The distinction between organisational knowledge and knowledge in a specific functional area (in this case IS) and the distinction between knowledge and skills. These distinctions are not arbitrary but are based on distinctions that are made in the literature (Zmud : 1983, Nelson : 1991).

Organisational vs. functional levels

As the application of IT has spread within the organisation it has become increasingly necessary for IS staff (who support that technology) to become conversant with the goals, objectives and functioning of the business (Bartol and Martin : 1982). This need has become even more pressing with the arrival of the EUC phenomenon (Norton : 1984). The various line/IS partnership paradigms make it imperative (Rockart : 1988, Kwan and Curley : 1989, Sambamuthy et al : 1992).

As noted earlier however it is impossible for any one employee or even functional unit to know everything that might be relevant in innovatively applying IT. It is therefore necessary that end user personnel become familiar with IT and how it might be used to further the organisational mission (Panko : 1988, Earl : 1984).

The knowledge that end user and IS personnel should have of each other's domains has two levels; organisational and functional. The organisational level is concerned with the overall goals and objectives of the organisation and the constraints within which it operates. At the functional level however it is necessary that employees understand the specific nature of the individual work units involved. IS personnel who support the use of IT in line work units need to have an understanding of the specific problems that managers of those work units face (Norton : 1984). Conversely, it is necessary that end users understand the role that IS personnel play in supporting IT and the roles that various IS specialist play in this process (Sambamurthy et al : 1992). Nelson (1991) states that both types of learning, organisational and functional, are important to individual productivity and ultimately to the productivity of the organisation as a whole.

Skills vs. knowledge

As discussed in the section on organisational learning there are specific types of learning that need to occur if organisations are to learn effectively. Different authors have given these types of learning different names but the overall distinction is a common one (Nelson : 1991). In the IS field Zmud (1979) has stated that "both general intellectual abilities and a knowledge of specific content areas are believed to influence IS usage". Curley and Pyburn (1982) have used Argyris and Schon's (1978) concepts of single- and double-loop learning to further explore this idea. Their (Curley and Pyburn's) concept of IT as an intellectual technology leads them to conclude that effective use of the technology requires an on-going adaptive learning rather than the simple acquisition of a skill, a certain level of proficiency in the use of the technology.

On-going adaptive learning requires a different set of abilities to those required for the relatively simple acquisition of skills. The process of on-going adaptive learning requires learners to think beyond the immediate task and to let their consideration of problems encompass a knowledge of the overall goals and objectives that need to be achieved. Analytical and problem-solving skills are necessary to successful learning of this type (Nelson : 1991).

When attempting to impart skills or knowledge, educators need to be aware of the different techniques required. Nelson (1991) states that there is a distinction between learning via education and learning via training.

> In general, education teaches problem-solving approaches while focusing on the ability to reason abstractly. Training, on the other hand, provides the tools (i.e. skills) for implementing problem-solving approaches while focusing on the ability to work concretely. Education helps the student choose his or her activity; training helps the participant improve his or her performance in it. (Nelson : 1991)

In learning how to apply IT to business problems both types of learning are important (Bostrom et al : 1988, Curley and Pyburn : 1982). In addition different personnel at different levels of the organisation might require a different mix of skills/knowledge and also a different mix of organisational/functional knowledge (Nelson : 1991).

These distinctions are currently the subject of much debate in Australia as the professional computer bodies respond to the Australian government's programme to introduce national competency-based certification in many of the professions. In his contribution to this debate Goldsworthy (1993) has expressed concern that tests of competency do not measure knowledge, which is essential to the more creative, problem-solving aspects of IS practice. Higher educational institutions in Australia are concerned that competencies are really skills and that they place no emphasis on problem-solving abilities or education in the fundamental sciences. Universities also caution that if competency-based standards are in the hands of professionals then they may resist standards that are higher than they themselves have and be slow in adopting emerging world standards. The current debate focuses on how far "upward" competency-based standards can be driven in professions such as IS. As Curley and Pyburn (1982) have argued, the ability to find innovative uses for IT cannot be achieved through only having a certain proficiency in the use of IT (although that proficiency may be a requirement, it is not the only, or most important, one).

CONCLUSION

It has been argued in the IS literature that IT is different from other technologies (Earl : 1984). It is developing rapidly, consists of multiple interrelated technologies and is becoming pervasive throughout most organisations (Ibid.). IT also has a fundamentally different application in that it is used to process information and to solve problems. Researchers have argued that these differences imply that it should be managed differently. Earl (1984) argues that, as IT is now so widespread it is better managed at the site of use by the line managers who use it. Organisational learning researchers have argued that effective use of IT requires learning and innovation and that the kind of learning required is different from other technologies (Argyris : 1982, Curley and Pyburn : 1982). Managers in organisations need to become aware of the potentials of the technology and then actively seek ways in which these can be applied to furthering the goals of the organisation.

The skills of both IS and end users will be needed for this (Earl : 1984, Rockart : 1988). Line management will have to take on some IS knowledge and skill, and IS personnel will have to become more aware of business issues (Henderson : 1990, Nelson : 1991, Cheney : 1988). Rockart (1988) has observed that these "hybrid" skills are not yet possessed by many managers and that it should be a management priority to see that personnel move to acquire them. Delphi studies aimed at identifying key management issues support this prognosis; IS managers ascribe great importance to such topics as organisational learning and the development of IS knowledge about the business (Niederman : 1991, Dixon and John : 1989, Brancheau and Whetherbe : 1987).

The respective roles and responsibilities of line and IS personnel are changing both in response to the "hybrid" skills that are required of them (Rockart : 1988) and also in response to models of the IS/line relationship as a partnership (Kwan and Curley : 1989). Moreover these roles and responsibilities will continue to change over time and over the adoption cycle of a particular use of IT. Successful line/IS partnerships exhibit harmony between IS staff and line managers (Sambamurthy et al : 1992). Both parties share responsibilities and share some of the knowledge of their counterparts. An essential component of this harmony is that IS staff and line managers must be in agreement as to what their respective roles and responsibilities are. Lind and Zmud (1991) have found that when technology providers (IS staff) and end users achieved a convergence in their understanding of the role of IT and the relative importance of business activities, greater IT innovation occurred. It is argued that, where IS and end user personnel

are in disagreement about the levels of skill and knowledge they should have in IT and business areas, successful innovation is less likely to occur.

Zmud (1983) has suggested six general areas of knowledge and skill that are required by all employees. This research asks end user and IS personnel to rate their counterparts' performance in these areas in an attempt to uncover potential problems. In addition an attempt is made to gauge the extent to which end user and IS personnel are in agreement as to the level of skill and knowledge they each require.

Chapter 3
Development of Hypotheses

INTRODUCTION

The literature on EUC and line/IS partnerships suggests that the learning needs of both end user and IS personnel have changed over time in response to the need for greater innovation in the use of IT to support the goals and objectives of the organisation (Sambamurthy et al : 1992, Rockart : 1988). Both classes of personnel require a hybrid mix of skills and knowledge drawn from each other's traditional areas of expertise. Line managers and end users need to become more technology literate, and IS personnel need to become more "business literate" (Bartol and Martin : 1982, Rockart : 1988, Nelson : 1991). There are however many subtleties concealed in such a simplistic statement. Proficiency in both the IS and the business fields requires what Panko (1988) has described as a hierarchy of skills that need to be marshalled and directed by a knowledge of the organisational goals, objectives and constraints and a deeper understanding of the needs and problems of the specific business units involved. In characterising the learning that is required a number of distinctions have been made in the literature between organisational and functional learning, skills and knowledge, and training and education (Nelson : 1991).

Zmud (1983) has proposed a framework that incorporates these distinctions and which describes six areas of skill and knowledge necessary for both end user and IS personnel. These six areas have been discussed in the previous chapter and are reiterated briefly here.

1. **Organisational knowledge:** a knowledge of the objectives, purpose, opportunities, constraints and the internal and external functioning of the organisation.

2. Specific **organisational skills** which would include skills in interpersonal communication and behaviour, group dynamics and project management.

3. A knowledge of the target **organisational unit** including its objectives, purpose, functions, resources, problems and its links with other internal and external units in the organisation.

4. **General IS knowledge**, including a knowledge of hardware and software concepts, the potential of IS/IT, organisational IS policies and plans, and the organisation's existing IS applications.

5. **Technical skills**, including the methods and techniques required to perform IS-related tasks.

6. The ability to use **IS product** including the specific application systems, office automation products, required procedures and documentation.

This study makes use of Zmud's framework to organise the perceptions that end user and IS personnel have of each other's levels of skill and knowledge in the six areas. This study examines cross-perceptions (perceptions that each class of personnel has of the other class) as Sambamurthy et al (1992) have stated that an appreciation by both end user and IS personnel of the "distinctive competencies, expertise, and potential contributions" that each can bring to the process of innovation is essential to its eventual success. Stated negatively, if both groups of personnel perceive the other as deficient in key areas of skill or knowledge then the innovation process is less likely to be successful.

DIFFERENCES AMONG THE SIX AREAS

There is a lack of theory to suggest directionality for all six areas (Nelson : 1991). A knowledge as to the relative size of the deficiencies in different areas would aid practitioners in determining priorities in correcting deficiencies, and academics in understanding the current concerns of both groups of personnel.

The first hypothesis is stated in null and alternate form as follows:

H_0: There is no difference among the six areas with respect to the level of deficiency that IS personnel perceive *end users* as having.

H_1: There is a difference among the six areas with respect to the level of deficiency that IS personnel perceive *end users* as having.

This hypothesis asks whether the deficiencies that IS personnel perceive end users as having differ in terms of the six areas of knowledge and skill identified by Zmud (1983); organisational knowledge, organisational skills, target organisational unit, general IS knowledge, technical skills, and IS product. A *deficiency* is defined as the difference between the perceived *usefulness* of a knowledge or skill item to a particular class of employee and the perceived *proficiency* that members of that class display in the item.

Essentially the same question is then asked of end user personnel vis a vis their perceptions of IS personnel deficiencies.

H_0: There is no difference among the six areas with respect to the level of deficiency that end users perceive *IS personnel* as having.

H_1: There is a difference among the six areas with respect to the level of deficiency that end users perceive *IS personnel* as having.

THE CONGRUENCE BETWEEN IS/EU PERCEPTIONS OF EACH OTHER'S SKILL/KNOWLEDGE NEEDS

The second hypothesis is concerned with the extent to which end user and IS personnel agree on the level of skill or knowledge that each should have in the various items that make up the areas in Zmud's framework. The literature on line/IS partnerships suggests that only where line and IS staff achieve harmony as to their respective roles and responsibilities will the partnership be successful (Lind and Zmud : 1991, Sambamurthy et al : 1992). In order to fulfil their respective roles and responsibilities each group will need some knowledge from the domain of the other (Rockart : 1988). The different levels of skill and knowledge that each group perceives as necessary for the other provide surrogate measures for their perceptions of the role that they see the other group as filling (Maddox : 1990). Where end users and IS staff disagree on the importance of an item to one or the other group one can expect a disagreement as to the roles and responsibilities regarding activities supported by that item.

The second hypothesis is stated in null and alternate form as follows:

H_0: There is no difference between the perceptions of end user and IS personnel as to the usefulness of a knowledge or skill item for *end user personnel*.

H_1: There is a difference between the perceptions of end user and IS personnel as to the usefulness of a knowledge or skill item for *end user personnel*.

Essentially this hypothesis examines the perceptions that each group has of the importance of skill or knowledge in an item to end user personnel. If the null hypothesis is rejected and the alternative hypothesis accepted for an item then that difference points to a divergence in the agreement between the groups as to the roles and responsibilities of end users.

The second hypothesis would be repeated for IS personnel.

H_0: There is no difference between the perceptions of end user and IS personnel as to the usefulness of a knowledge or skill item for *IS personnel*.

H_1: There is a difference between the perceptions of end user and IS personnel as to the usefulness of a knowledge or skill item for *IS personnel*.

CONCLUSION

This chapter has set out two pairs of hypotheses. Each pair of hypotheses examines the perceived deficiency or perceived usefulness of an area of skill or knowledge to both end user and IS personnel.

The research methodology employed to test these hypotheses will be described in the next chapter.

Chapter 4
Research Methodology

The research made use of the analytical survey method. This chapter describes the survey instrument that was used, the distribution and collection procedures followed, the response obtained (including a demographic profile of the respondents), a discussion of the representativeness of the sample, and an examination of the reliability of the constructs used in the survey instrument.

THE RESEARCH INSTRUMENT

This study made use of an adapted version of a questionnaire first developed and used by Dr Ryan Nelson of the University of Virginia in 1989. Nelson's survey instrument was designed to measure the deficiencies that end user and IS personnel perceived *themselves* as having in various areas of knowledge and skill. The questionnaire was developed and pre-tested by Nelson, and later validated when he used it in his own research (Nelson : 1991).

Nelson's questionnaire consisted of two sets of thirty questions covering the six areas of knowledge and skill identified by Zmud (1983). Table 4-1 sets out the thirty individual items employed grouped within the six overall areas.

I. Organisational knowledge	**IV. General IS knowledge**
1. Organisational goals and objectives	12. IS policies and plans
2. Primary organisational functions	13. Fit between IS and the organisation
3. Critical success factors	14. Existing IS applications
4. Environmental constraints	15. IS/IT potential
	16. IS/IT for competitive advantage
	17. Privacy issues (re: databases)
II. Organisational skills	**V. Technical skills**
5. Interpersonal communication	18. Programming
6. Interpersonal behaviour	19. Use of software packages
7. Group dynamics	20. Model building
8. Project management	21. Model application
	22. Data access
	23. Database development
	24. Data communication
III. Organisational unit	**VI. IS Product**
9. Work unit objectives	25. Use of specific application systems
10. Work unit problems	26. Use of office automation products
11. Links with other work units	27. Use of operating systems
	28. Preparation of documentation
	29. Use/understanding of documentation
	30. IS evaluation and maintenance

Table 4-1 : Questionnaire items grouped by area.

For each question, the respondent was asked to assess the *usefulness* of skill or knowledge in that item. Usefulness was defined for respondents as being how important they believed that item to be in allowing them to successfully perform their job. In addition respondents were asked to rate their current level of *proficiency* for each item. All responses were captured via a Likert scale delineated from 1 to 5.

Nelson obtained *deficiency* ratings by subtracting the *proficiency* score for an item from the *usefulness* score for that same item.

As stated earlier the present study used a modified version of Nelson's questionnaire. This study was concerned not so much with the deficiencies that end user and IS personnel saw themselves as having, as with the deficiencies that they perceived their IS or end user counterparts as having. In other words, the study was concerned with *cross*-perceptions rather than *self*-perceptions. It should be noted that the investigation of cross-perceptions was mentioned by Nelson as a potential avenue for research in his 1991 article reporting on his original use of the instrument.

Respondents were asked to rate the *usefulness* of the various items to both end user and IS personnel. They were then, in a later section of the questionnaire, asked to rate how *proficient* they felt their counterparts (either end users or IS personnel) were in each item. Thus deficiency scores could be calculated that indicated where end user and IS personnel thought each other's shortcomings lay. The questionnaire used is included in Appendix A.

As respondents were requested to rate the usefulness of items to both their own group (IS or end user) and their counterparts, a second use of the questionnaire was to gauge the extent to which both groups were in agreement as to what levels of skill or knowledge they should have in each area. For instance this could be done by comparing the usefulness scores that IS personnel assigned for end users with the scores end users reported for themselves.

Apart from the shift from self- to cross-perceptions the Nelson questionnaire was altered only to make a few terminological changes to make it more suited to the South African environment. These terminological changes were relatively minor and involved, for example, substituting the term *matriculant* for the more American *high school graduate*. Apart from these changes the questionnaire was not altered in any way.

The use of perceptions as a measure

Some criticism may be levelled at the fact that the instrument explicitly measures *perceptions* of such qualities as the usefulness, proficiency and, hence, the deficiency of an item. Obviously the resulting scores do not measure any absolute, actual or "real" deficiency. Nevertheless, in the context in which these measures are being used, perceptions are a valid measure. Two lines of argument can be taken to justify the use of perceptions as a measure.

The first, which has its roots in Peter Checkland's Soft Systems Methodology, is that perceptions themselves are important as they represent world views; the recognition of differing world views can help to explain complex issues and to generate debate by the actors in a given situation (Le-Saint : 1991). As long as views remain unexpressed, there is little possibility of their validity or appropriateness being challenged and of more accurate or desirable assumptions being formed (Senge : 1990). Specifically, for the present research, if end user and IS personnel have very different views on how proficient they should be in different areas of knowledge and skill, it might be indicative of a deeper conflict about what each other's roles and responsibilities should be. For example, if IS personnel have significantly higher expectations about end user knowledge of the

use of IT for competitive advantage than end users themselves have it might indicate a potential problem. IS personnel would seem to expect end users to be more active in searching for ways to use IT for competitive advantage while end users would not see this as an important responsibility and be content to leave it to IS personnel.

The second justification for the use of perceptions as a measure is that, in the absence of more direct measures, perceptions are often the most widely used surrogate (Bohrnstedt and Knoke : 1988, Jaeger : 1990). An example from the IS research literature would be Davis' use of perceived usefulness and perceived ease of use in his studies of user acceptance of systems (Davis : 1989, and see also Hendrikson et al : 1993). Of more direct relevance to the present research, however, are Gore and Murray's use of perceptions of usefulness or importance in investigating the skills needed for individual success in organisations (Gore and Murray : 1991). In the IS research arena similar research has been done by Khan and Kukalis who investigated the relative importance/usefulness of technical versus non-technical skills for MIS professionals (Khan and Kukalis : 1990). In South Africa Miller and Doyle (1987), and Somerville (1984), made use of end user management perceptions in assessing the effectiveness of computer-based IS in the financial services and retail sectors. Miller and Doyle used a technique similar to that employed in this research as they asked user managers to rate both the *importance* of an item and the perceived *proficiency* of IS in that item. This allowed them to form a clearer picture of the relative weight to attach to perceptions of low proficiency.

In their research, Gore and Murray (1991) and also Khan and Kukalis (1990), ranked the perceived importance of various skills in order to identify those most important or most crucial to success. This research uses the same technique (see tables B-2, B-3, C-2 and C-3 in Appendices B and C) to identify where the largest deficiencies are perceived to exist. In addition this research attempts to determine the congruence between end user perceptions of the importance of skills (for themselves) and IS perceptions of their importance (for end users); and vice versa. This is the thrust of the second hypothesis. Very similar research has been done by Maddox, who investigated the congruence between line-managers' perceptions and the perceptions of business faculty as to the importance of communication skills for line managers (Maddox : 1990).

THE RESEARCH PROCEDURES

Distribution

Seventeen large organisations - companies with more than 500 employees - and with mature IS departments were initially selected as potential participants in the research. All of the organisations were based in the Western Cape or had their head offices in Cape Town, however, they all operated nationally throughout South Africa. The organisations were selected to provide a coverage of a variety of different industries and were based in the Western Cape to facilitate convenient distribution of the questionnaires. Of the companies approached ten indicated a willingness to take part in the research. Those organisations that declined to take part did so on the grounds it was "not company policy", or cited heavy previous exposure to survey/questionnaire type research.

Initial contact with each organisation was by telephone. In each case the IS manager was the initial contact point. The objectives and value of the research were explained as were the scope and nature of the organisational commitment required. It was then established whether or not the organisation was willing to participate and whether the IS manager was willing to be the organisational sponsor (in three cases they delegated this task to one of their subordinates). If requested a sample questionnaire was sent to the organisational sponsor. The organisational sponsors were requested to identify how many end user and IS questionnaires they would be able to distribute in their organisation. It was requested that each organisation take roughly equal numbers of end user and IS questionnaires and that they attempt to have a variety of personnel (i.e. personnel in different positions and from different organisational levels) take part in the survey.

It was also requested that the personnel taking part have some experience of dealing with their counterparts. This last requirement was not specified by Nelson in his use of the original questionnaire (1991), but it must be remembered that Nelson's instrument was focused on *self*-perceptions and that these obviously do not require a knowledge on the part of a respondent of anyone other than the respondent him- or herself. In the present research it was felt necessary to include only those respondents who had some knowledge of the people (their counterparts in end user or IS personnel) who they were being asked to evaluate.

Once the organisational sponsors had identified participants they were supplied with the requisite number of end user and IS questionnaires. They then distributed these to the participants. The questionnaires were completed by the respondents and mailed directly to the researcher.

THE RESPONSE

A total of 274 questionnaires were distributed among the ten participating organisations. Table 4-2 summarises the questionnaire distribution by participating organisation.

Organisation	End Users	IS Personnel	Total
Insurance Co. A	22	23	45
Insurance Co. B	15	16	31
Insurance Co. C	17	17	34
Retail Co. A	10	10	20
Retail Co. B	18	16	34
Retail Co. C	15	12	27
Oil Co. A	10	10	20
Investment Co. A	5	5	10
Investment Co. B	11	11	22
Local Government	15	16	21
Total	**138**	**136**	**274**

Table 4-2 : Questionnaire distribution by participating organisation and functional area.

Table 4-3 describes the questionnaire distribution by industry type for both end user and IS personnel.

Industry	End Users	IS Personnel	Total
Insurance	54	56	110
Retail	43	38	81
Oil	10	10	20
Investment	16	16	32
Local Government	15	16	31
Total	**138**	**136**	**274**

Table 4-3 : Questionnaire distribution by industry and functional area.

A total of 168 questionnaires were returned yielding a response rate of 61%. There was, however, a marked difference between the response rate for end users and that for IS personnel. A total of 65 end user responses were received making the end user response rate 47%. The IS response rate was 76% with 103 responses being received. One end user response was incomplete and was discarded, as was one IS response.

The marked difference in response rates can perhaps be accounted for by the fact that the organisational sponsor was in all cases a senior IS manager (if not

the IS manager) and the questionnaire could therefore reasonably be expected to have been taken more "seriously" by IS personnel. Another possibility is that the questionnaire dealt with IS subject matter and that this was not as central to the concerns of end users.

Table 4-4 presents a demographic profile of the respondents.

Variable	IS Personnel	End Users
Sex		
Male	71%	80%
Female	29%	20%
Age (mean)	33.5	36
Years in organisation (mean)	8.5	11
Years in current department (mean)	6	6
Highest educational qualification		
Matric	33%	28%
Technicon diploma	22%	23%
Bachelors degree	43%	43%
Masters degree	2%	6%
Doctoral degree	---	---
Organisational position		
Executive/top management	2%	8%
Middle management	34%	47%
Supervisory	25%	16%
Professional	22%	15%
Technical	16%	2%
Clerical	1%	10%
Other	---	2%

Table 4-4 : Profile of respondents by functional area.

Representativeness of the responses

In this research two populations were involved; the population of IS personnel, and that of end user personnel. In order to explore the representativeness of the sample of IS personnel the demographic profile of IS respondents was compared with that of a study carried out a year earlier by Couger and Smith (1992a).

Couger and Smith's study examined the motivation norms among South African computer professionals. Their survey was carried out under the auspices of the South African Computer Users Council (CUC). They received 2737 responses making their survey one of the most extensive (and representative) to be

performed among South African computer professionals. Table 4-5 compares the demographic profiles of respondents to the Couger and Smith survey with the demographic profiles of IS respondents to the present survey. The greyed areas serve to highlight those parts of the profiles that show the greatest differences.

Variable	Couger and Smith	This research
Sex		
Male	73%	71%
Female	27%	29%
Age		
under 31	45%	36%
31 to 40	38%	52%
41 to 50	13%	13%
over 50	4%	1%
Highest educational qualification		
Matric	33%	33%
Technicon	41%	22%
Bachelor degree	24%	43%
Masters degree	2%	2%
Doctoral degree	—	—
Organisational position		
Manager	23%	47%
Analyst	15%	10%
Programmer/Analyst	20%	20%
Applications programmer	19%	13%
System programmer	8%	1%
Data communications specialist	6%	3%
Operator	10%	2%
Information Centre consultant	—	5%

Table 4-5 : A comparison of the profiles of IS respondents.

One of the biggest areas of difference is in the organisational position of the respondents. The present research attracted over twice as many respondents who were in the position of manager as did Couger and Smith's survey. It is noteworthy that this increased proportion is at the expense of a lower proportion of the more technical positions such as systems programmer and data communications specialist as well as a much lower percentage of operators. These differences can be taken as providing some evidence that the organisational sponsors fulfilled the request to distribute questionnaires only to those who had contact with and experience of their end user counterparts; systems programmers, data communications specialists and operators might be expected to have much less contact with end users. Further the category of manager includes that of project manager and 49% of the managers identified by

the present research were project managers. Project managers would naturally have a relatively high degree of contact with end users.

The other areas of difference were in the ages of the respondents and in their educational qualifications. The present research showed more respondents in the 31 to 40 age group and also a much higher proportion of respondents with bachelor's degrees (balanced by a much lower proportion of respondents with technicon diplomas). These differences can be explained by the fact that the present research included more managers and that these respondents tended to older and to be those with degrees. Of the managerial level respondents 48% had bachelor's degrees (or higher qualifications), while for non-managerial respondents the proportion was only 35%.

Couger and Smith also comment on the proportions of males at different levels (Ibid. : 1992a). They report that the highest percentage of males was at the manager level with 91%. The figure for this research was very similar at 88%. Couger and Smith found the proportion of males lowest at the programmer level with 54%. The figure for this research was even lower, with only 42% of all programmers being male. Couger and Smith note also that the highly technical jobs (systems programmer and data communications specialist) were male dominated (85%). For this research only four of the respondents occupied these highly technical jobs, too low a number for meaningful comparison, all four were however male.

Unfortunately end users have not, at least in South Africa, been surveyed as a group in the same way as IS personnel were by Couger and Smith. It was thus not possible to compare the characteristics of the end user sample yielded by this research with that of other research to determine the representativeness of the sample. Nevertheless there is evidence that the organisational sponsors fulfilled the requirements for distribution to IS personnel and it can be expected that they would have fulfilled the same requirements when it came to end users.

Instrument Reliability

As was stated earlier the survey instrument attempted to measure thirty perceived deficiencies that were grouped into six areas, or, in the statistical nomenclature, constructs. The reliability with which the instrument measured each construct was calculated using the Cronbach alpha test applied to inter-item scores. The resulting reliability coefficients are presented in Table 4-6; the table also presents the reliability coefficients that Nelson reported for his research.

Area name	Nelson's Research		This Research	
	Usefulness	Proficiency	Usefulness	Proficiency
Organisational knowledge	0.79	0.85	0.81	0.82
Organisational skills	0.75	0.79	0.73	0.81
Organisational unit	0.81	0.82	0.79	0.83
General IS knowledge	0.82	0.86	0.85	0.87
Technical skills	0.77	0.85	0.85	0.89
IS Product	0.75	0.83	0.76	0.79

Table 4-6 : Instrument reliability coefficients as measured by Cronbach's alpha.

It should be noted that Nelson's instrument measured *self-perceived* usefulness and proficiency whereas the instrument used in this research measured *cross-perceptions* i.e. not how people see their own skills or knowledge, but the skills and knowledge of others (their counterparts in the end user or IS group). The constructs are thus not directly comparable (they are not measuring exactly the same thing) however the basis of comparison in Table 4-5 is the extent to which the individual items contribute to some aggregate category. For example the extent to which, say, skill in interpersonal communication, interpersonal behaviour, group dynamics, and project management together contribute to the aggregate abstract construct "organisational skills."

The values of alpha range from 0.73 to 0.89, and are generally within the typical 0.80 value for inter-item reliability (Nelson : 1991). Indeed, some researchers are of the opinion that coefficients that range in the .50s and .60s are not unusual and are "quite respectable" (Jaeger : 1990 : p232).

It is interesting to note that the two lowest reliability coefficients reported were the coefficients for the usefulness constructs in Organisational Skills and in IS Product. This was the case in both research efforts, perhaps indicating an area were the instrument could be further refined to improve the discriminability of these two constructs.

Conclusion

The survey instrument employed in this research is an adapted version of an instrument previously used, and validated, by Nelson (1991). The only difference between the two instruments is that Nelson's original instrument asked IS and end user personnel to rate the usefulness of areas of skill and knowledge to themselves and their own levels of proficiency in those same areas. Nelson's instrument thus measured self-perceptions. In contrast this research asked IS

and end user personnel to report on the usefulness to, and proficiency of, each other in the same areas of knowledge and skill. This research was thus concerned with cross-perceptions.

The modified research instrument was distributed to 274 IS and end user personnel in 10 organisations. A response rate of 61%, or 168 responses, was obtained. In order to check the representativeness of the respondents the demographic profiles of the IS personnel group were compared with those reported in a much larger South African survey (Couger and Smith : 1992a). This comparison found that, while there were differences, those differences could reasonably be explained by the request to organisational sponsors to distribute the instrument to IS personnel who had contact with end users. Respondents to this survey thus included more project managers and analysts and fewer operators and systems programmers than did the Couger and Smith survey.

The internal reliability of the instrument, the degree to which the individual items making up each aggregate construct vary in tandem with their construct score, was measured using Cronbach's alpha. The values obtained were within generally accepted limits indicating that the instrument was indeed internally reliable. The values also compared favourably with those reported by Nelson.

The following chapter discusses the results obtained from the instrument.

Chapter 5
Findings and Discussion

INTRODUCTION

This chapter presents the formal testing of the hypotheses, the results of these tests, and discussions arising from the results. The discussions explore the questionnaire data in greater depth and examine the effects of demographic factors such as age, length of service, and educational qualifications. In addition the influence of computer-related training is examined.

This research is concerned with two different classes of employee; end users and IS personnel. In order to make the presentation clearer the results of the analysis procedures as they apply to end user and IS personnel are presented separately. The formal testing of hypotheses and related discussion are thus presented in two symmetrical sections. The first of these deals with the results relating to end user personnel, and the second with IS personnel. These two sections are mirrored by two supporting appendices. Appendix B contains tables of results that pertain to perceptions of end user deficiencies, while Appendix C fulfils the same function for IS personnel.

Following the separate treatments of end user and IS personnel deficiencies the discussion is once again unified to deal with topics that concern both end users and IS personnel.

Levels of significance used

When formally testing hypotheses the hypotheses are stated in their statistical form of null hypothesis and corresponding alternative hypothesis. The significance level (p) gives the probability with which the null hypothesis can be rejected while it may in fact be true. As Mullany (1989) has commented there are no purely statistical criteria for deciding what value of p constitutes an acceptable

risk when decisively rejecting the null hypothesis. Reliance must be placed on precedents in the research discipline concerned. The only IS researcher who could be found who had explicitly examined this area was Mullany (1989). The levels employed in this study are based on his examination of the p values and their associated qualitative ratings (reported in table 5-1 below) that are currently in widespread use in the IS literature.

Significance level	Qualitative ratings
$p \leq 0.001$	Highly significant Null hypothesis strongly rejected Alternative hypothesis strongly supported
$0.001 < p < 0.05$	Significant Null hypothesis rejected Alternative hypothesis supported
$0.05 < p < 0.1$	Not very significant (inconclusive result) No strong reason to reject the null hypothesis Weak support for the alternative hypothesis
$p > 0.1$	Not significant No reason to reject the null hypothesis No support for the alternative hypothesis

Figure 5-1 : Qualitative rating assumed for different significance levels (source: Mullany : 1989).

PERCEPTIONS OF END USER DEFICIENCIES

This section is concerned, in the main, with responses from IS personnel and deals with the perceptions that IS personnel have of the skill and knowledge deficiencies of end users.

Differences among area deficiencies (H_1)

The first hypothesis asks whether the deficiencies that IS personnel perceive end users as having differ in terms of the six areas of knowledge and skill. A one-way analysis of variance was used to analyse the data as it pertained to this hypothesis. The hypothesis is stated statistically (in both null and alternate forms) as follows:

H_0 : $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6$

H_1 : not all are equal

where μ_1, for instance, refers to the mean deficiency score for the first area, organisational knowledge.

The test statistic was the F test. The results appear in table 5-1.

Source of variation	SS	df	MS	F	p
Between groups	21.65	5	4.33	5.76	3.43E-5
Within groups	455.51	606	0.75		
Total	**477.16**	**611**			

Table 5-2 : IS perceptions of end user deficiencies - one-way ANOVA.

Essentially what the F-test for one-way analysis of variance does is to compare the variation between the area means (across all responses) with the variation among the individual means (within each response). The sum of squares (SS) column in table 5-2 reports the total variation in each case. However the SS figures are not directly comparable as they are distorted by the large number of individual responses relative to the number of areas that are being examined. The number of degrees of freedom (shown in the df column) is therefore used to correct for this effect. The SS figure is divided by the degrees of freedom to arrive at a mean square (MS), these mean square figures are now directly comparable. As can be seen from table 5-2 there is much more variation between the overall area means than there is among the different area means for each individual response. The F-statistic expresses this difference in variation as a ratio - in this case there is 5.76 times (4.33 divided by 0.75) more variation between the overall area means (for a more complete discussion on the meaning and interpretation of ANOVA results see Jaeger : 1990). Clearly, the larger the F-statistic the more confident a researcher can be that there is a genuine difference between the different factors rather than the operation of chance. The degree of certainty with which this decision can be reached is obtained from tables of probabilities (Bohrnstedt and Knoke : 1988) and is reflected in the reported value for p.

In this instance since the main effect was highly significant ($p < 0.0001$) the null hypothesis (that the means are all equivalent) was strongly rejected and the alternative hypothesis strongly supported. It could thus be concluded that the means across the areas are not all equal.

The F test is the most widely used test for one-way analysis of variance (Jaeger : 1990). It is, however, a parametric test and relies on the normality of the parent population or on the approximate normality of the sampling distribution (Marascuilo and McSweeney : 1977). A nonparametric alternative to the F test is the Kruskal-Wallis H test. The Kruskal-Wallis test is characterised by a low sensitivity to differences in spread and form (it can be said to be *distribution-free*), but is most sensitive to differences in centres. For this reason the rejection of the

null hypothesis via the H statistic is almost certain to be equivalent to a difference in the mean, median, centre or some other measure of shift (Marascuilo and McSweeney : 1977 : p305).

The one-way analysis of variance was therefore duplicated using the Kruskal-Wallis test. The results were H = 28.68 with an associated significance level of p = 2.18E-5. The results of the F test were thus confirmed with the null hypothesis being strongly rejected and the alternative hypothesis strongly accepted.

To determine where the difference(s) revealed by the ANOVA might lie, multiple comparisons were performed using the Scheffe method. The relevant area means appear in table 5-3.

Area name	Area Mean
General IS knowledge	1.13
Organisational knowledge	0.87
Organisational Unit	0.74
Organisational skills	0.73
IS Product	0.61
Technical skills	0.56

Table 5-3 : IS perceptions of end user deficiencies - multiple comparisons test of area means.

Table 5-3 ranks the area means in descending order of magnitude. The highest mean deficiency exists within the area of general IS knowledge (1.13). The multiple comparison test revealed that, at the 95% confidence level, statistically significant pairwise differences exist between this area and all other areas. In addition statistically significant differences exist between the next most highly rated deficiency, organisational knowledge (0.87), and the two areas with the lowest rated deficiencies, IS product (0.61) and technical skills (0.56). The minimum significant difference between the values of pairs was 0.24 (with $p < 0.05$).

Differences in perceived usefulness (H_2)

The second hypothesis is concerned with the extent to which IS personnel and end users are in agreement as to the *usefulness* of the various knowledge and skill items for end users. A two-tailed *t*-test was used to analyse the data as it pertained to this hypothesis. The hypothesis is stated statistically (in both null and alternate forms) as follows:

$$H_0 : \mu_{EUi} = \mu_{ISi}$$

$$H_1 : \mu_{EUi} \neq \mu_{ISi}$$

In other words the null hypothesis as applied to an item states that for that item the mean usefulness reported by end users (EU_i) does not differ from the mean usefulness reported by IS personnel (IS_i). The alternate hypothesis is that the means do differ.

It should be noted that not all thirty items were suited to testing hypothesis two. The three work unit items had to be excluded as they were not directly comparable with each other. The two versions of the questionnaire, for end users and for IS personnel, each asked the respondents to rate the importance of knowledge of their own work area to their counterparts. Thus unlike the other questions IS and end users were not rating usefulness for the same thing (there were two different work areas involved); as they would be doing if they were rating the usefulness of, say, the ability to program.

Student's *t*-test is an appropriate statistical procedure for testing null hypotheses that involve the equality of population averages (Jaeger : 1990 : p199). The two-tailed *t*-test was used in preference to the one-tailed *t*-test as there is a lack of theory to suggest directionality for all items.

The results of the test of hypothesis two are presented in table B-4 in Appendix B. Of the twenty-seven items, nine show averages that are significantly different at the 95% confidence level. This might indicate that for those items end user and IS personnel show significant disagreement as to what the level of end user proficiency should be. Caution should, however, be used in interpreting these differences; for instance table B-4 reveals a difference in how useful end user and IS personnel feel that skill in *data communication* is to end users. This difference could owe more to a differing understanding of what data communication is, and what proficiency in it would entail, than to a difference in how important end users and IS personnel feel data communication skills are to end users. Each of the areas of disagreement will be examined in greater depth in more detailed discussion later.

Student's *t*-test is the most widely used test for equality of population averages. Nevertheless it is a parametric test and assumes, in addition to independent observations drawn from independent samples, that the underlying population variances are equal and that the error distributions approximate normality (Marascuilo and McSweeney : 1977 : p264). While the first two of these assumptions hold for the usefulness scores, the second two are less easy to

justify. Because of this the test of the second hypothesis was duplicated using a form of the Wilcoxon test, the Mann-Whitney test.

The Mann-Whitney test substitutes ranks for observed values. Put another way it makes use only of ordinal measures and does not use the interval properties of the data (Leedy : 1989). In other words the Mann-Whitney test does not assume (as does Student's *t*-test) that a usefulness rating of 4 is greater than a rating of 3 by the same interval as the rating of 3 is above a rating of 2, only that 4 is larger than 3. Not unexpectedly this means that the Mann-Whitney test is less powerful than its parametric counterpart, that is it tends to need larger sample sizes to yield the same level of significance. It is also less likely to differentiate between groups as sensitively as parametric methods do (Leedy : 1989).

In order to provide a check on the results derived via the Students *t*-test a Mann-Whitney test was conducted with results reported in table B-5 in Appendix B. It should be noted that, statistically stated, the hypotheses are subtly different as they involve a comparison of expected rank values rather than of means. The hypotheses for the Mann-Whitney procedure are:

$$H_0 : E(\overline{R}_{EUi}) = E(\overline{R}_{ISi})$$

$$H_1 : E(\overline{R}_{EUi}) \neq E(\overline{R}_{ISi})$$

In narrative form the null hypothesis is thus that for any item the expected rank value of the end user usefulness score is equal to the expected rank value of the IS usefulness score. The alternative hypothesis is that they are not equal.

The items that show a significant difference between end user and IS perceptions of items usefulness to end users are detailed in table 5-4. As can be seen from the comparison in table 5-4 (the detailed results are contained in tables B-4 and B-5 in Appendix B) the results obtained from the Mann-Whitney procedure are very similar to those obtained from the Student's *t*-test. At the 95% confidence level both procedures identify the same nine items as being where end users and IS personnel differ in their assessments as to item usefulness for end users. This agreement can most probably be ascribed to the relatively large (in statistical terms) sample size. According to Marascuilo and McSweeney where the sample size is large (typically where N > 50) most parametric methods are approximately distribution-free (Ibid. 1977 : p4).

Item	EU mean	IS mean	Student's t-test	Mann-Whitney
Interpersonal behaviour	4.08	3.68	0.016	0.020
Group dynamics	3.95	3.54	0.015	0.012
IS/IT potential	3.33	3.66	0.049	0.017
Privacy issues (re: databases)	3.97	3.46	0.009	0.007
Programming	1.78	1.40	0.002	0.020
Database development	2.34	1.84	0.003	0.004
Data communication	2.95	2.10	8.1E-6	1.1E-5
Use of operating systems	3.28	2.17	1.1E-8	1.0E-7
IS evaluation and maintenance	3.39	2.87	0.015	0.013

Table 5-4 : Comparison of the probability values obtained from the Student's t-test and Mann-Whitney procedures - items showing significant differences (at the 95% confidence level).

Figure 5-1 ranks those differences found to be significant.

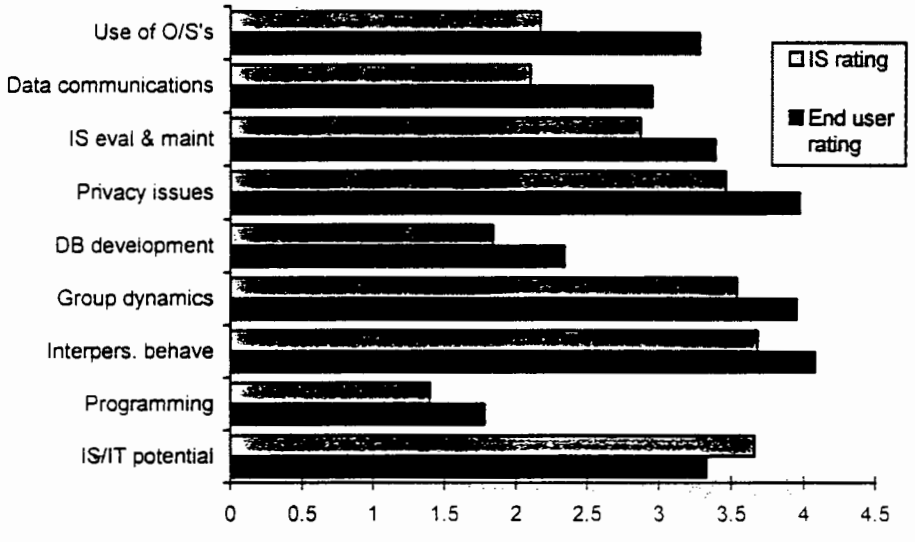

Figure 5-1 : IS and end user perceptions of item importance for end users - items where significant differences exist. Items are ranked in descending order of difference.

Interestingly, on all but one of the items showing significant differences in rated item importance, end users rated the item as being of greater usefulness than did IS personnel. For the technical skill items (use of operating systems, data communications, database development, and programming) this perhaps reflects a difference in opinion as to what constitutes a given level of skill rather than a real difference in what the desired level of competence is. In the case of database development, for example, end users might rate the ability to construct a flat file database as a skill item meriting a score of three while IS personnel rate it only as a two.

Two of the other items showing significant differences, group dynamics and interpersonal behaviour, come from the organisational skills area. Suggesting that IS personnel see these skills as being less crucial to end users than do the end users themselves.

In only one of the items, a knowledge of IS/IT potential, did IS personnel rate the item as being of greater importance than did end users themselves. Significantly this item is in the general IS knowledge area, the area that, as a whole, shows the greatest mean deficiency for end users. Any disagreement as to what constitutes useful knowledge in this area is therefore clearly a cause for concern as it suggests that more than a simple deficiency is at work. The IS/IT potential item is the item most directly concerned with the vital first step in any process of innovation - imagining a new application of a technology (see Curley and Pyburn : 1982, and also Sambamurthy : 1992).

It is however noteworthy that of the 27 items examined for differences in perceived usefulness the majority of items reveal no significant difference. This is an encouraging finding as it suggests that for many of the identified deficiencies end users are themselves already convinced of the utility of that skill/knowledge item. It can therefore be expected that they will be motivated to undertake the learning necessary to close the gap.

Having presented the results from the formal testing of the hypotheses the results are now discussed in more detail.

Discussion

Perhaps the most obvious finding of this research is that IS personnel perceive end users as having deficiencies in all items. This despite the fact that many individual responses showed negative deficiencies for some items; that is, the rated proficiency was higher than the perceived usefulness of the item. On average, deficiencies exist for all items.

Table B-1 in Appendix B summarises the item scores reported by IS personnel, showing means and standard deviations for all items as well as for the aggregate constructs. For exploratory purposes the mean deficiency scores were ranked in descending order in table B-2. The largest deficiency was in knowledge of the use of IS/IT for competitive advantage, the smallest in the ability to program. In addition the mean item usefulness scores from both end user and IS personnel were ranked in descending order in table B-3-1 and B-3-2. This allowed the different priorities of the two classes of personnel to be explored.

Caution should be exercised in evaluating the relative importance of the deficiencies. An item that attracts a low deficiency score should not necessarily be treated as unimportant. For instance the ability of end users to use specific application systems attracted a relatively low deficiency rating (0.52) when compared with their knowledge of the use of IS/IT for competitive advantage (1.59), which has a deficiency over three times as large (see table B-2). An examination of the rated *usefulness* of these items however reveals that they are nearly equal in perceived importance. Use of specific application systems ranks 8th with a mean usefulness score of 3.78 and IS/IT for competitive advantage ranks 6th with 3.97 (see table B-3). Both items are thus clearly considered important for end users (both are in the top ten) the different deficiencies are due therefore to differences in current levels of proficiency. Nevertheless it is suggested that *any* deficiency is cause for concern and where that deficiency touches an area perceived as important it warrants still closer examination. It should also be remembered that knowledge and skill (especially in the IS field) are not static states. On-going effort is required to keep them current (Blennerhassett : 1988, Norton : 1984).

Another general feature of the results that is worth noting is that the highest mean end user deficiencies are in areas of knowledge rather than of skill. It appears that the most keenly felt end user deficiencies are in knowledge of the organisation's functions and mission, and in how IS/IT supports those functions and could enhance them. Only two of the top ten items (data access and interpersonal communication) are skills related, the others are all concerned with more general IS and organisational knowledge (see table B-2). It is possible that this emphasis on more management oriented issues is a distortion introduced by the relatively high proportion (47%) of the sample who hold management positions (see table 4-4). Such an hypothesis is not supported by the data; if it were the case that managers where more likely to perceive deficiencies in knowledge areas one would expect a positive correlation between organisational level and deficiencies in general IS knowledge and organisational knowledge (i.e. the higher the organisational level the greater the perceived deficiency). An examination of table B-7 in Appendix B will show that no statistically significant correlations exist between organisational level and deficiency scores. The subject of possible distortions introduced by the high proportion of managers in the sample is returned to in the later discussion of the effect of the various demographic variables.

Figure 5-2 depicts IS respondents' perception of the relative usefulness of each of the six areas to end users. In no case does the perceived proficiency of end users

match the level of importance accorded the area and the shortfall is shown as the deficiency for that area.

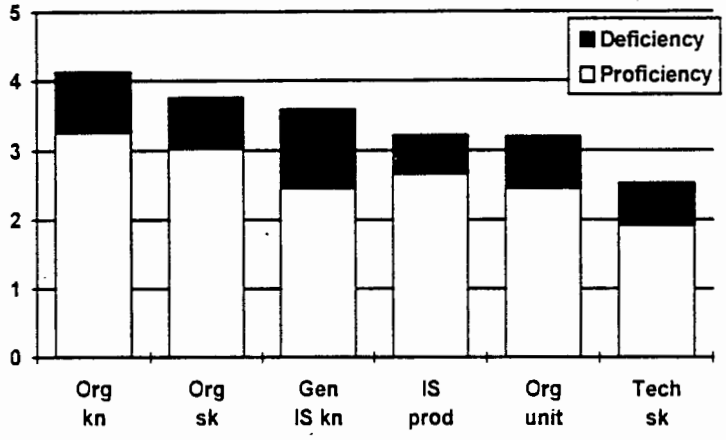

Figure 5-2 : Comparison of mean usefulness scores showing proficiency and deficiency.

The following sections discuss the deficiencies in each area in more detail.

General IS knowledge

The highest mean end user deficiency that IS personnel perceive exists within the area of general IS knowledge (1.13). The results of the multiple comparisons test show that this area has a mean deficiency significantly higher than that of any other. An examination of table B-2 shows that five of the top ten deficiency items are general IS knowledge items; IS/IT for competitive advantage (1st), IS/IT potential (3rd), the fit between IS and the organisation (4th), IS policies and plans (5th), and privacy issues (8th). The only general IS knowledge item not to make the top ten was knowledge of existing applications (20th) and it is distinguished from the others by the fact that it is more of a pure "knowledge" item than a management issue. Indeed, all of the other items (except data privacy) have long been identified as key issues for IS management (Niederman et al : 1991, Dixon and John : 1989, and, in South Africa, by Duffy : 1991).

Interestingly the mean usefulness score for general IS knowledge is 3.59 ranking it third in importance, after organisational knowledge and organisational skills (see table B-6-2). In other words IS personnel believe general IS knowledge to be moderately important to end users. The high deficiency score is therefore due to a very low perceived proficiency in this area. Only on technical skill items such as programming are end users rated as having less proficiency (see table B-1). So while expectations appear to be low, there is a perception that current levels of knowledge are lower still.

Knowledge on the part of end user management about many of these issues has been identified by Niederman et al as a prerequisite for solving many of the IS problems facing organisations today (Ibid. : 1991). Certainly given the pessimistic view that IS personnel appear to have of current end user ability in this area some of the more utopian visions of such IS management authors as Rockart (1988) and Kwan and Curley (1989) would seem to be at present unobtainable. Rockart posits an emerging hybrid manager with both line and IS skills and a general awareness on the part of end users of IS issues. This research suggests that while such a paragon may be wished for in the literature, the feeling on the ground in South Africa (as evidenced by the middling usefulness scores given to these items) is less fervid. Nevertheless a knowledge on the part of end users of general IS issues is clearly regarded as being of some importance by IS personnel.

Coincidentally the mean usefulness scores of both end users and IS personnel for the general IS knowledge area are identical at 3.59 (see tables B-6-1 and B-6-2). This is a hopeful sign as it suggests that end users are aware of their need to learn in this area. As many researchers in the field of adult and on-going education have noted, a perception on the part of the learner of the usefulness or job utility of an area of knowledge or skill is *the* essential motivating area in getting that person to acquire skills or knowledge in the area (Tough : 1979, Knowles : 1982a) Indeed, many organisational education efforts necessarily start with an attempt to get the participants to see the immediate job utility of knowledge in the proposed subject area (for a case study of a management learning effort focused on IS/IT see Blennerhasset : 1988).

An exception to the end user/IS agreement about the usefulness of general IS knowledge is the different rating given to the IS/IT potential item. This was one of the items where end user and IS personnel differed significantly in their perceptions of usefulness to end users (see table B-4). Much recent writing in the IS literature has contended that in order to facilitate IT-based innovation IS organisations should promote partnership relations between IS staff and business managers (Sambamurthy : 1992, Rockart : 1988 : Kwan and Curley : 1989). An essential feature of a successful partnership along these lines is that end user managers must understand the potentials of IT before they can conceive of new business uses for it (Kwan and Curley : 1989). This research shows that IS personnel rate such an ability fairly highly (it ranks 11th in importance, see table B-3-1) while end users give it a much lower rating (22nd, see table B-3-2). This should caution IS managers seeking to rectify this deficiency that a more subtle approach than simply educating it away is needed. End users will first need to be convinced of the utility of the item. Only then will they develop the motivation to

educate themselves. Adult education theory suggests that once made aware of the usefulness of an item, most adults will take charge of their own educational efforts (Knowles : 1982a). In this latter scenario IS staff could act as learning facilitators and resources of expertise (Blennerhassett : 1988).

As was noted earlier, a perception on the part of IS managers of the need for end user education in general IS knowledge has surfaced in the international IS literature a number of times (Niederman et al : 1991, Dixon and John : 1989). The same is true in South Africa. Norton (1984) conducted in depth interviews of the DP managers at thirteen Western Cape companies (including three that participated in this research) to determine what they saw as the key educational and training needs of DP personnel, top executives, and end users. Two of Norton's findings are pertinent. The first is that IS managers all felt that top management, end users, and their own staff were all unprepared for their new roles, and further, did not understand the responsibilities of the new roles. The "new roles" referred to here are concerned with what was then a relatively new phenomenon, end user computing (EUC). It should be remembered that many of the seminal articles in the EUC field appeared just a year earlier (Benson : 1983, Rockart and Flannery : 1983). For the first time the need for end users to be involved in the management and direction of IT, a new role for them, was becoming widely accepted (Auerbach and Slamecka : 1979). This research's finding that end users are perceived to have deficiencies in such items as the fit between IS and the organisation and in knowledge of IS policies and plans indicates that similar deficiencies are still felt to exist today.

The second of Norton's findings was closely related and was that, specifically, end users were unsure of how computers should be used in business, they were ignorant about what the technology could and could not do. This can be compared to this research's finding that IS personnel rate end user deficiency in knowledge of IS/IT potential as the third greatest deficiency.

These findings are depressing insofar as they indicate that many organisations are still facing deficiencies in end user knowledge that were first identified ten years ago. Unfortunately Norton's analysis does not separate the perceived deficiency into usefulness and proficiency components. It is therefore not possible to say whether the continued perception of a deficiency is perhaps due to subsequent increases in perceived importance that have not been paced by increases in proficiency, or whether the situation has been essentially static since 1984.

Interestingly, the results of Nelson's (1991) survey in the United States revealed a very similar set of deficiencies for end user personnel. Nelson's research was subtly different from this research in that end users were reporting on their own deficiencies and not on those of IS personnel nevertheless the results in this area are strikingly similar. Four of the top five deficiency items for end users were the same in both studies as can be seen from table 5-5.

Nelson's Research		
Rank	**Item**	**Mean**
1	Fit between IS and org.	1.22
2	IS/IT potential	1.12
3	IS/IT for competitive adv	1.01
4	Data access	1.01
5	IS policies and plans	0.98

This Research		
Rank	**Item**	**Mean**
1	IS/IT for competitive adv	1.59
2	Interpersonal comm.	1.33
3	IS/IT potential	1.29
4	Fit between IS and org.	1.28
5	IS policies and plans	1.10

Table 5-5 : Comparison of top deficiency items for end users in the USA and SA.

As can also be seen from table 5-5, IS personnel in South Africa tended to rate the deficiencies of end users as larger than end users in the United States rated their own deficiencies. This may reflect a tendency on the part of personnel to rate their own deficiencies as smaller than their counterparts might. Alternatively there may be a difference in the actual levels of deficiency between the United States and South Africa. The similarity between the findings of the two studies lends support to the notion that end users do have deficiencies in the general IS knowledge area and that these deficiencies are amongst the largest.

Organisational knowledge

The second highest mean deficiency was in the area of organisational knowledge (0.87). The results of the multiple comparisons test show that this area has a mean deficiency significantly higher than the mean deficiencies of the two lowest ranking areas (IS Product and Technical skills). Three of the top ten deficiency items are organisational knowledge items, namely knowledge of: organisational goals and objectives (7th), critical success factors (9th), and primary organisational functions (10th). It is also noteworthy that in terms of the perceived usefulness of the area both IS personnel and end users are in substantial agreement as to its utility for end users. The null hypothesis of equality for means could not be rejected for any of the items making up this area (see tables B-4 and B-5). Moreover both end users and IS personnel rate organisational knowledge as being the most useful area of all for end users. In this respect it is telling that both IS and end users rate three of the items (primary organisational functions, critical success factors, and organisational goals and objectives) as being among the four most important when ranked for usefulness (see tables B-3-1 and B-3-2).

The perception that the organisational knowledge area is most important for end users is not surprising as end users are typically involved in a more explicitly business (as opposed to a support) role. In this role a knowledge of the organisation's goals and objectives, primary functions and the critical success factors are of obvious importance. Because of the evident importance of knowledge in this area it is cause for concern that IS personnel perceive any deficiencies at all. That these deficiencies should be significantly higher than those in some other areas should serve to sharpen this concern still further.

Of the items contributing to the organisational knowledge area the environmental constraints item is something of an anomaly. While IS personnel see end users as deficient in knowledge of this item it does not rank in the top ten (it is 16th). In addition end users rank it only 13th in usefulness (while ranking the other items in the top three), although, in absolute terms, both groups regard it as being of roughly equivalent importance (see tables B-4 and B-5).

A deficiency in knowledge of the organisation or business is a charge often levelled at IS personnel (Niederman et al : 1991, Norton : 1984). It is interesting to see that IS personnel consider end users as being equally ignorant. The deficiency scores of each group are roughly equivalent; end users rate IS deficiency at 0.81 and IS rate end user deficiency at 0.87.

Organisational unit

The deficiency in the organisational unit area indicates that IS personnel feel that end users understand less than they should about the objectives and functions of the IS work unit, how it interacts with other work units in the organisation, and the problems it faces. To some extent this may mirror the IS dissatisfaction with end user knowledge of general IS matters. IS personnel see the largest deficiency in this area as being end users' lack of knowledge about the interdependence of the IS work unit with other work units in the organisation. This is followed by a perceived deficiency in end users' understanding of the problems faced by the IS work unit.

Organisational skills

The organisational skills area is made up of items that rate end users in terms of their skill in interpersonal communications and behaviour, their ability to work effectively in groups, and their ability to manage projects. All of these items were rated by IS personnel as being very important for end users. The mean usefulness of skills in this area was ranked second in importance by both IS personnel and end users themselves (see tables B-6-1 and B-6-2). Only

organisation knowledge items were rated as being of greater importance to end users.

Given the apparent importance attached to skills in this area the perception that end users have deficiencies is cause for concern. While most of the item deficiencies are below the "average" deficiency score for all items of 0.77 this should not be taken to mean that they can be ignored. As noted earlier any deficiency is important and should be investigated further.

One item in particular requires special attention; the second highest deficiency that IS personnel perceive end users as having is in their ability to communicate effectively with others (table B-2). The deficiency score for this item is twice that of any other organisational skill item: Moreover IS personnel rate interpersonal communication as the single most important skill for end users (table B-3-1). End users themselves rate it 4th in importance. There is an interesting inversion here; each group has the same items in the top four, but IS elevates interpersonal communication even above organisational knowledge, end users place the organisational knowledge items first and then interpersonal communication (see tables B-3-1 and B-3-2). It should be stressed that IS do not perceive end users as being poor at interpersonal communication in any absolute sense, they have a middling proficiency score of 3.20, rather they are perceived as poor relative to the exceptionally high importance attached to the item (it has a mean usefulness score of 4.53). An inability to communicate effectively is a charge traditionally levelled at supposedly technically minded IS personnel (Duffy : 1991, Norton : 1984). It is interesting that IS personnel feel that end users are also deficient in this area.

The organisational skill items interpersonal behaviour and group dynamics attract relatively low deficiency scores. A significant difference however exists in the ratings that end user and IS personnel attach to the usefulness of these items. End users rate both these skills as significantly more important for themselves than IS personnel feel they are (see tables B-4 and B-5). If the end user usefulness ratings were used in calculating deficiencies then the end user deficiencies would be 37% and 59% higher respectively (see table B-7). This change would be enough to make interpersonal behaviour one of the top ten deficiency items.

Technical skills

End user deficiencies in the technical skills area were, for the most part, perceived as being relatively low. There were two exceptions to this pattern; the ability to access data, which was among the top ten deficiencies. and the ability to

use software packages (see tables B-2 and B-1). Both of these items had markedly higher usefulness and proficiency ratings than the other technical skill items. In the other technical skill items IS personnel felt users had "no use" or very little use for the skills. For data access and use of software packages expectations were higher but proficiency was perceived as low to middling (table B-1) leading to the relatively high deficiency scores.

The technical skills area was the only area where a positive correlation of moderate strength (Jaeger : 1990 : p222) existed between the usefulness and proficiency scores of respondents (table B-11). This may indicate that in this area IS personnel were inclined to see as "useful" to end users only those items in which users currently have skills. Even technical skills which are not strictly within the preserve of IS, such as the ability to develop and recognise the applicability of management science models, were regarded as being of low utility to end users. Both end user and IS personnel were more likely to regard these skills as being of high utility to IS professionals than to end users (see table C-1). This tendency is worth noting as it suggests that IS has a view of itself as the sole architect (or at least the senior partner) of solutions to problems in the business domain, and that end users concur with this view and are content to leave the development of operations research type models to IS.

Not surprisingly the technical skills area contains the item with the lowest end user usefulness score; the ability to program (see tables B-2 and B-3). Both end user and IS personnel agree on the low utility of programming skill for end users. both groups assigning it the lowest usefulness score. It is interesting to note however that end users nevertheless rate the ability to program as being more useful to them than IS personnel do (table B-4 and B-5). This difference needs to be interpreted cautiously however as end users and IS personnel may have different understandings of what proficiency in programming involves.

IS product

The IS product area was the area of lowest mean end user deficiency (0.56). The items comprising this area covered the ability to produce and use the products of the IS function within the organisation. IS product included such items as the ability to use specific application systems, understanding documentation, and the ability to evaluate system performance.

Two of the six items could be classified as being more naturally the preserve of IS professionals; the ability to evaluate and maintain systems, and the use of operating systems. Not surprisingly these two items had amongst the lowest usefulness ratings for end users (see tables B-3-1 and B-3-2). The other items

were all rated as being of greater use to end users. End user proficiencies for these items were rated as averaging 2.95. While this implies that most IS personnel feel that end users have a fair proficiency in these items it is nevertheless something of a disappointing result as these are precisely the areas that end users could expect to receive most training in.

IS product was the only area where there were any discernible effects as a result of demographic factors. Managers were found to be significantly more likely to perceive higher end user deficiencies in these areas. This finding will be discussed in more detail in the section on demographic effects.

The role of Demographic factors

In order to determine whether demographic factors had any influence on IS personnel's perceptions of end user deficiencies Spearman rank correlations were calculated between the various demographic variables (in section D of the questionnaire) and the mean deficiency scores for each area. The detailed results of this analysis are reported in table B-8. In no case was any statistically significant correlation found, and the coefficients were, without exception trivial to the point of non-existence. The Spearman rank-order correlation coefficient was employed as it can be interpreted in exactly the same fashion as the more conventional Pearson coefficient and makes fewer assumptions about the data (Jaeger : 1990). Specifically, the Spearman coefficient is based only on the ordinal properties of the data (their ranks) and makes no assumptions about the sizes of the intervals between different rank values (Leedy : 1989). All correlation coefficients calculated in this study were Spearman rank-order coefficients.

There is, however, one exception to this finding and that concerns the sex of the respondents. The possible effects of sex were examined separately using a one-way analysis of variance (both the F test and the Kruskal-Wallis H test) as the Spearman correlation procedure is not suitable for a binary variable such as sex. Using ANOVA only one difference significant at the 95% confidence level was found. The difference was in the perceived deficiency in knowledge of IS product; female IS personnel perceived lower end user deficiencies than did male IS personnel. The F test proved significant at the 95% confidence level with $F = 5.143$ ($p = 0.026$) and this result was confirmed by a Kruskal-Wallis test that yielded an H value of 2.563 (with $p = 0.030$). In order to locate these differences the deficiency scores of male and female IS personnel for each item making up the IS product area were graphed (see figure 5-3).

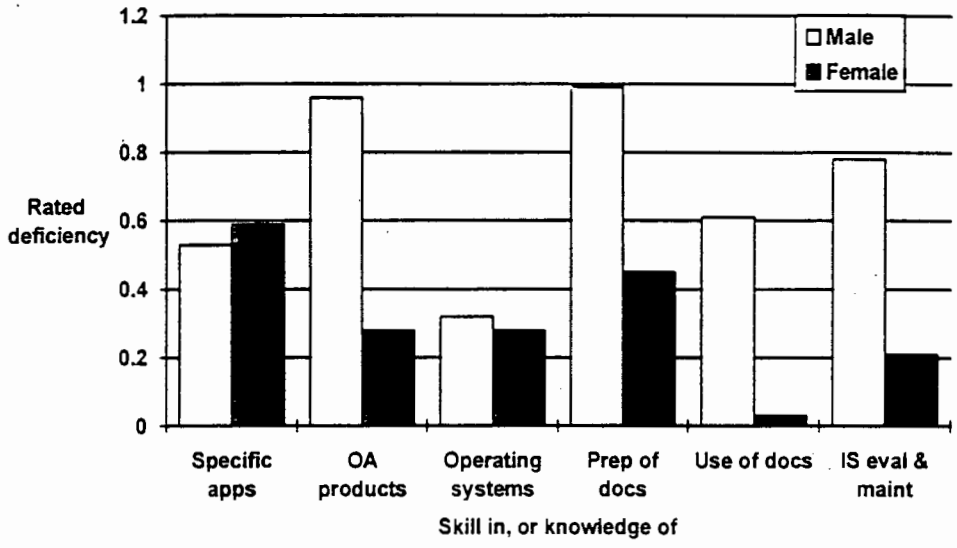

Figure 5-3 : *Differences in how male and female IS personnel rate end user deficiency in the IS product area.*

As can be seen from figure 5-3 in every item, except for the ability to use specific applications, male IS personnel report much higher end user deficiencies than do their female colleagues.

This difference stems from a difference in perceived proficiency rather than any difference in the perceived usefulness of the items to end users. The mean usefulness scores reported by males and females are very nearly equal at 3.25 for males and 3.22 for females. The mean proficiency scores are however very different with male IS personnel at 2.55 and females much higher at 2.93 (see figure 5-4).

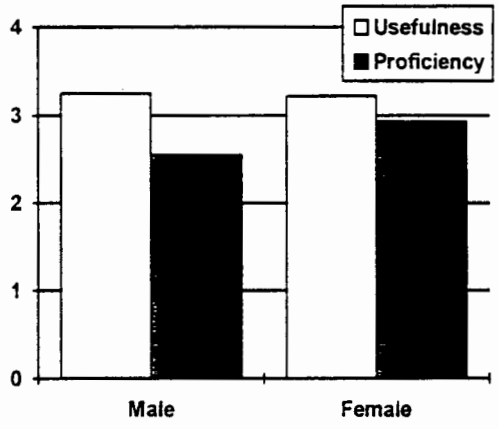

Figure 5-4 : *Different male and female scores for the usefulness and proficiency of knowledge in the IS product area.*

The question of course is why this should be the case. One possible avenue of inquiry is to attempt to establish if female IS personnel are different in other ways and then to examine the effects of those areas of difference. To this end various demographic factors were examined. One area of difference is age; female IS personnel are on average 4.8 years younger than their male counterparts. However given the absence of any significant correlation between age and rated deficiency in the IS product area (see table B-7) this cannot be used to explain the result. Similarly, differences in average organisational level (female IS personnel average 3.41, and males 3.08) were ruled out on the basis of there being no observable correlation between organisational level and the perceptions of the deficiency (see table B-7).

The problem with organisational level however is that it is a relatively blunt instrument as it gives no clue as to the actual function performed by a staff member. A more revealing way to classify IS personnel is by their job descriptions. To this end the job titles given by the IS respondents were used to classify them into eight different job categories. The categories used were, with one exception, those employed by Couger and Smith (1992) in their study of IS personnel motivation in South Africa. The exception was the addition of a category for Information Centre consultants.

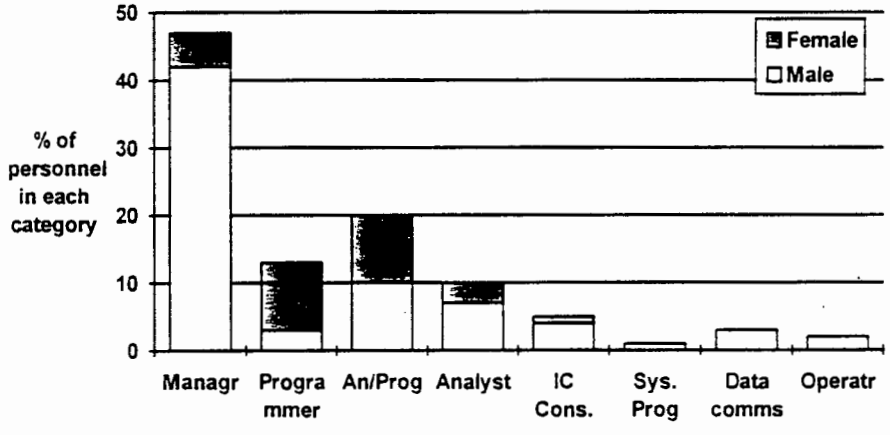

Figure 5-5 : *Chart showing the percentage of personnel (both male and female) in each job category.*

As can be readily seen from figure 5-5 a much lower proportion of female IS respondents are in the manager category (only 17% of female respondents are managers as compared to 58% of male respondents). There are however much higher proportions of females in the programmer and analyst/programmer categories were they comprise 60% of the staff.

Given these striking differences a one-way analysis of variance was conducted to see if the difference in mean deficiencies on the basis of gender could be explained as being perhaps due to the different proportions of males and females in the various job categories. The result of the F test bore out this hypothesis yielding an F value of 2.547 ($p = 0.251$). A multiple comparison test identified significant differences between the deficiencies perceived by Information Centre consultants (1.20) and managers (0.74) and those perceived by programmers (0.12). Interestingly, the highest deficiency rating came from Information Centre consultants although as the sample included only 5 IC consultants this result should be treated with caution.

Following this result the other mean deficiency scores were re-examined using ANOVA to determine if any other job category related differences existed. The results of these tests showed up no further differences.

It can thus be concluded that apart from a difference in how managers and programmers view end user deficiencies in the IS product area there are no discernible demographic effects on perceived deficiencies.

The role of education and training

Section C of the questionnaire asked respondents to describe the amount of computer-related training they had received from various sources. The training scores thus obtained were correlated with the deficiency means in order to determine whether the amount of computer-related training IS personnel received affected their ratings of end user deficiency. The results of this procedure are reported in table B-9. No statistically significant correlations were found and all the correlation coefficients obtained were trivially small (Jaeger : 1990 : p223).

This is not a surprising result as no theory suggests that there should be a relation between these variables. A more profitable line of inquiry would have been to examine the effect of business-related training on IS perceptions of end users. Unfortunately such data was not available. Nevertheless the amount of computer-related training yielded correlations with other variables that point to interesting relationships. These effects will be discussed in more detail in the later unified section that deals with the effects of training on both end user and IS personnel together.

PERCEPTIONS OF IS PERSONNEL DEFICIENCIES

This section is concerned, in the main, with responses from end user personnel and deals with the perceptions that end users have of the skill and knowledge deficiencies of IS personnel.

Differences among area deficiencies (H_1)

The first hypothesis asks whether the deficiencies that end users perceive IS personnel as having differ in terms of the six areas of knowledge and skill. As in the earlier section on end user deficiencies a one-way analysis of variance was used to analyse the data as it pertained to this hypothesis.

The test statistic was the F test. The results appear in table 5-6.

Source of variation	SS	df	MS	F	p
Between groups	6.06	5	1.21	1.74	0.124
Within groups	262.73	378	0.70		
Total	**268.79**	**383**			

Table 5-6 : End user perceptions of IS deficiencies - one-way ANOVA.

Since the main effect was not significant at the 95% confidence level there is no reason to reject the null hypothesis and no support for the alternative hypothesis.

As was the case in the earlier section covering end user deficiencies the one-way analysis of variance was duplicated using the Kruskal-Wallis test. The results were H = 10.19 with an associated significance level of p = 0.07. The results of the Kruskal-Wallis test are thus slightly stronger than those of the F test, although the result of the H test is less than conclusive. The H test provides no strong reason to reject the null hypothesis, and provides weak support for the alternative hypothesis. It would thus seem that any differences between the area averages are likely to be slight. To check on this a multiple comparisons test using the LSD was conducted with the results reported in table 5-7.

Area name	Area Mean
General IS knowledge	1.09
Organisational Unit	0.90
Organisational skills	0.87
Organisational knowledge	0.81
IS Product	0.72
Technical skills	0.72

Table 5-7 : End user perceptions of IS deficiencies - multiple comparisons test of area averages.

Table 5-7 ranks the area means in descending order of magnitude. The highest mean deficiency exists within the area of general IS knowledge (1.09). The multiple comparison test revealed that, at the 95% confidence level, statistically significant pairwise differences exist between this area and the two areas with the lowest rated deficiencies, IS product (0.72) and technical skills (0.72). There were no other statistically significant differences. The minimum significant difference between the values of pairs was 0.29 (with $p < 0.05$).

Differences in perceived usefulness (H_2)

The second hypothesis is concerned with the extent to which end users and IS personnel are in agreement as to the usefulness of the various knowledge and skill items for IS personnel. As was the case in the earlier section on end user deficiencies both a two-tailed *t*-test and a Mann-Whitney test were used to analyse the data as it pertained to this hypothesis. The results of these procedures are summarised in table 5-8 (the full details are reported in tables C-4 and C-5 in Appendix C).

Item	EU mean	IS mean	Student's t-test	Mann-Whitney
Primary organisational functions	4.41	4.22	0.133	0.027
Interpersonal communication	4.48	4.72	0.022	0.063
Interpersonal behaviour	3.83	4.17	0.025	0.023
IS/IT potential	4.66	4.36	0.009	0.014
IS/IT for competitive advantage	4.48	4.23	0.033	0.035
Privacy issues (re: databases)	4.59	4.32	0.045	0.005
Programming	4.75	4.22	2.5E-4	6.6E-5
Use of software package(s)	3.91	3.42	0.004	0.004
Database development	4.59	4.15	0.003	0.003
Data communication	4.69	4.08	1.3E-5	3.2E-5
Use of specific app. systems	4.31	4.01	0.030	0.037
Use/understand documentation	4.36	4.15	0.048	0.057

Table 5-8 : Comparison of the probability values obtained from the Student's t-test and Mann-Whitney procedures - items showing significant differences.

In this instance, and possibly because the sample size was smaller, there was not perfect agreement between the two procedures. The greyed areas in table 5-8 indicate areas were $p < 0.05$. The *t*-test identified eleven items where the assessments of usefulness differed at the 95% confidence level. The Mann-Whitney test confirmed nine of these. The two that were not confirmed did however fall within the 90% confidence level, in other words the results for both of these, although not conclusive, did provide weak support for the alternative hypothesis. This difference is not surprising given that even in ideal conditions (where the assumptions underlying the *t*-test can be satisfied) the Mann-Whitney procedure will have an asymptotic efficiency of only 95.5% of the *t*-test (Marascuilo and McSweeney : 1977). In an additional and unexpected result, however, the Mann-Whitney procedure identified another item as having a significant difference in the assessments of usefulness. This was the item for primary organisational functions.

In all but two of the twelve items where there was a significant difference (by the *t*-test or by Mann-Whitney) end users rated the items as being of more importance to IS personnel than did IS personnel themselves. The two exceptions were in interpersonal communications and interpersonal behaviour; IS personnel felt that interpersonal skills were more useful to IS staff than did end users. If it is assumed that IS personnel rate the usefulness of items to IS staff more accurately than do end users then it seems that end users have a tendency to overestimate the level of ability that is desirable. One of the effects this

overestimation would have is that the deficiencies that end users report IS personnel as having would be overstated.

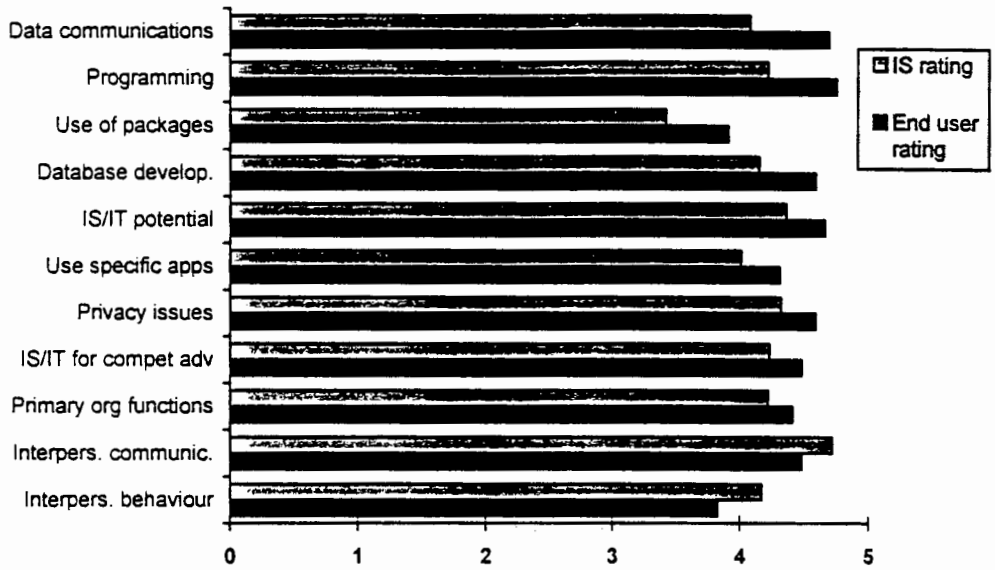

Figure 5-6 : IS and end user perceptions of item usefulness for IS personnel - items where significant differences exist. Items are ranked in descending order of difference

Figure 5-6 graphically depicts the differences in usefulness scores. As can readily be seen the four largest differences are all in the area of technical skills (data communications, programming, use of packages, and database development). On the surface it would seem that end users expect IS personnel to be much more competent in these areas than do IS personnel themselves. These differences should be treated with caution. It is likely that when it comes to technical skills end users would be much less discriminating than their IS colleagues. The disagreement may therefore have more to do with different ideas about what constitutes competence in the item than with an actual difference in the importance of the item. For instance, it is conceivable that for the data communication item users perceive the ability to install and correctly configure a fax-modem and its software as the extent of skill required. IS personnel could be expected to be aware many other competencies that would come under the heading "data communication". In short, comparability of usefulness scores depends on a common perception of exactly what skills and knowledge constitute an item. The large differences in the perception of the importance of certain technical skills may be an artefact of differences in end user and IS understanding of technical competence.

Perhaps the most interesting area of difference in table 5-4 is the presence of three items from the general IS knowledge area. This result is of particular

concern as general IS knowledge is also the area with the greatest deficiency for IS personnel. From these results it appears that not only is there a large perceived deficiency in this area but that there is also a substantial disagreement between end users and IS personnel as to what the desired level of IS proficiency should be. Specifically, end users appear to want IS personnel to have higher levels of proficiency in these items than IS personnel feel is necessary. In two of the items, IS/IT potential and IS/IT for competitive advantage, the wording of the questions in the questionnaire (see appendix A: questions A-8 and A-9 on page 4 of the questionnaire) stresses knowledge of the potential of IS/IT within and outside the organisation. An ability to imagine potential new applications of IT is vital if organisations are to be amongst the most successful users of IT (Curley and Pyburn : 1982).

It is worth noting however that, as in the case of item importance to end users, the majority of the 27 items examined for differences in perceived usefulness reveal no significant difference. This is an encouraging finding as it suggests that the picture is one of a few specific disagreements about role responsibilities within a broader context of overall agreement.

Having presented the results from the formal testing of the hypotheses the results are now discussed in more detail.

Discussion

As was the case in the earlier section dealing with IS perceptions of end users the most obvious finding is the presence of perceived deficiencies in all items. Although there were individual responses that showed negative deficiencies for some items on average deficiencies exist for all items.

Figure 5-7 depicts the relative importance of each of the six areas for IS personnel. When compared with figure 5-1, the equivalent graph for end users, it is evident that end users have higher expectations of IS personnel than IS personnel do of end users. End users give all except one of the areas an average usefulness to IS personnel of above four. IS personnel on the other hand give only one of the areas an average usefulness to end users of above four.

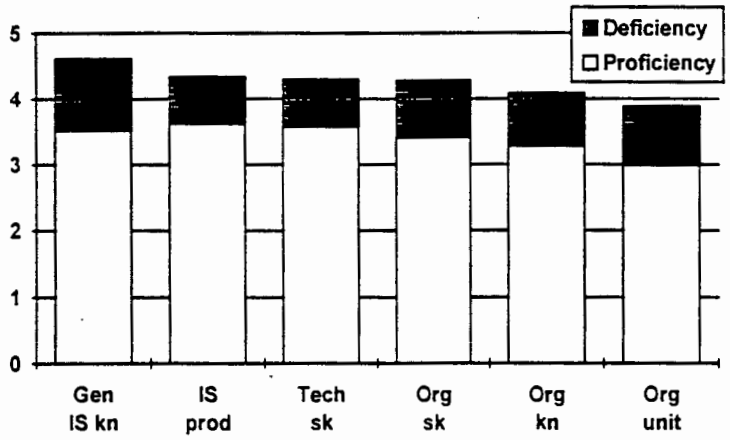

Figure 5-7 : Comparison of mean usefulness scores showing proficiency and deficiency for IS personnel.

General IS knowledge

End users rate knowledge in the general IS area as being of most importance to IS personnel with a mean usefulness score of 4.61 (see table C-6-2). It is also rated by IS personnel themselves as their most important area of knowledge with a mean score of 4.45 (table C-6-1). The multiple comparisons test revealed that the deficiency in general IS knowledge was significantly larger than the two lowest ranked deficiencies, IS product and technical skills.

Given that it is clearly an area of importance it is worrying that it is also the area in which end users see IS as having their greatest deficiency. Figure 5-8 shows the high importance attached to each of the individual items that comprise the general IS knowledge area.

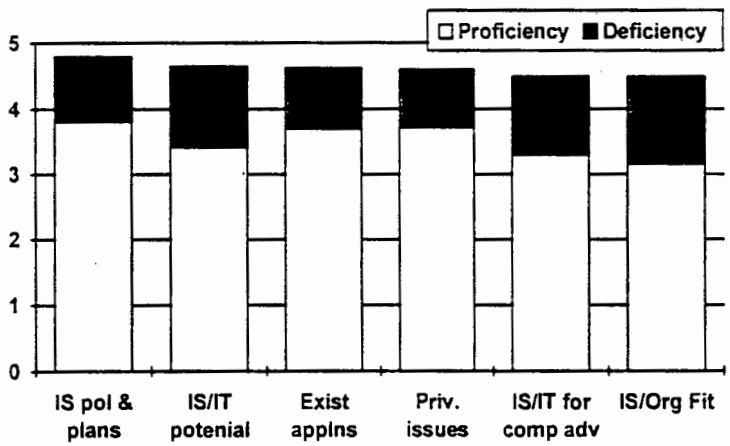

Figure 5-8 : *Mean useful scores of general IS knowledge items showing proficiency and deficiency components.*

The single largest deficiency in this area, and the largest item deficiency overall, was in a knowledge of the fit between IS policies and plans and the overall objectives of the organisation as a whole. When coupled with the high perceived deficiencies in interpersonal communication skills, knowledge of end user work unit problems, and the ability to manage projects the view that emerges of IS personnel is not flattering. It should be noted however that many of these deficiencies are not due to abysmal performance on the part of IS, merely that end users accord a very high importance to IS knowledge in these areas.

It is also noteworthy that three of the items in this area show significant disagreements between end user and IS personnel as to what the extent of IS knowledge should be (see tables C-4 and C-5). Items of particular interest are IS/IT potential and the use of IS/IT for competitive advantage. In both of these cases end users have significantly higher expectations of IS personnel knowledge than the IS personnel themselves have. Moreover IS/IT potential is also an area where end users feel they need know significantly less than IS personnel feel they should (see tables B-4 and B-5). This should alert IS practitioners to a potential mismatch of expectations about IS and end user roles and responsibilities in this area. Clearly IS personnel feel that end users should have a greater awareness of the potential applications of IS/IT as is advocated by many writers in the IS literature (Kwan and Curley : 1989, Rockart : 1988). End users would appear to disagree with this sentiment (or at least not agree to the extent that IS personnel would wish) and, moreover, to indicate that they feel a knowledge of IS/IT potential is more the responsibility of IS than it is of themselves. Both "sides" feel that their counterparts should take on more of the responsibility for knowing about potential uses of the technology, and both see this as being one of the areas where their counterparts are most deficient.

Organisational unit

Second in the ranking of end user concerns is the area of IS knowledge of their (the end users') work unit. In the items that make up this area end users rated how well they felt IS personnel knew the objectives, problems and functional linkages that affected their work unit. The biggest deficiency felt by end users is IS personnel's lack of knowledge about the problems end user work units face in achieving their objectives. This item was the deficiency ranked 7th.

Perceptions of IS deficiencies in this area are not new. In Norton's 1984 survey of IS managers at thirteen Western Cape organisations he found that IS staff were having to face a wide range of corporate staff for the first time and that they did not understand the problems that were facing user managers (Ibid. : 1984).

Norton also found that IS managers felt that their staff were lacking in communications skills and in business knowledge. This research shows that both of these deficiencies are very much still evident today.

Organisational skills

Two of the items that comprise organisational skills ranked amongst the top ten deficiencies. These were perceived deficiencies in interpersonal communication (5th) and in the ability to manage projects (6th). The latter is particularly worrying as project management and the position of project manager is very much a part of the organisational setting within which this research was conducted; 23% of the IS respondents gave their job title as "Project manager" or "Project leader". It is apparent that their end user counterparts do not feel that they are performing at the level they expect.

That IS personnel fare so poorly on ratings of their interpersonal communication skills is perhaps closely related to many of the other deficiencies that end users report. In organisational environments of increasing interdependence between IS and end user personnel the ability to communicate effectively will only become more important. Interestingly IS personnel rate the items interpersonal communication and interpersonal behaviour as being even more vital to them than end users feel they are (see tables C-4 and C-5). If the IS usefulness scores were employed as the correct desired measure of proficiency IS deficiencies in these items would be greater by 18% and 34% respectively (Table C-7).

Organisational knowledge

Both IS and end user personnel were in significant agreement as to the importance of organisational knowledge for IS personnel. A sole exception to this was the slightly higher importance that end users attributed to a knowledge of the primary organisational functions (see table C-5). End user perceptions of IS deficiencies in this area are thus not due to any difference in its perceived utility. Nor do end users consider IS personnel to have very low proficiencies in this area (proficiencies average 3.28), the deficiency is thus due to a relatively high expectation on the part of end users as to what the level of IS knowledge should be.

Technical skills and IS product

Technical skills and IS product, the traditional forte of IS personnel, were also the areas in which they are perceived as having the lowest deficiency. It is worrying however that end users perceive IS as having any deficiencies at all in these areas. The deficiencies are moreover higher than those that IS personnel

perceive end users as having in technical skills and IS product. The deficiencies in this area should be interpreted with care; end users are probably not the best judges of an IS professional's technical skill or lack thereof, however the deficiencies in this area can be interpreted as a lack of confidence in the abilities of IS personnel. Thus while the deficiency in this area should not be taken as being the "real" or actual deficiency the importance of this finding is that end users perceive IS personnel as less technically competent than they feel they should be.

An exception to this is the very high perceived deficiency in IS personnel's ability to prepare effective documentation for information systems. This item ranked as the second highest IS deficiency and was one of only two skill items to appear in the top ten deficiencies (see table C-2). Inadequate documentation thus appears to be a very specific concern of the end users surveyed. Both groups of personnel are in substantial agreement as to the importance of IS skill in this item (table C-4, C-5) and rectifying it should therefore be relatively simple.

The role of demographic factors

In order to determine whether demographic factors had any influence on end user personnel's perceptions of IS deficiencies Spearman rank correlations were calculated between the various demographic variables (in section D of the questionnaire) and the mean deficiency scores for each area. The detailed results of this analysis are reported in table C-8. In no case was any statistically significant correlation found, and the coefficients were, without exception trivial to the point of non-existence.

Overall satisfaction with IS/IT

One of the questions asked respondents to rate their overall level of satisfaction with the information systems and information technology that they used. While this is far from being the most sophisticated measure of user satisfaction it does serve to give a rough indication of the general quality of user feelings in this regard. The average satisfaction score was 3.25 with a distribution of responses depicted in figure 5-9.

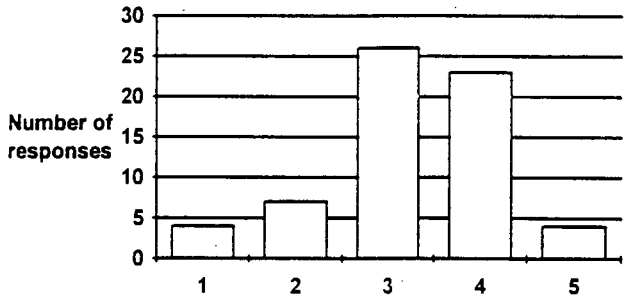

Figure 5-9 : *Distribution of end user IS/IT satisfaction scores.*

As is apparent from figure 5-9 most users surveyed are fairly satisfied with the technology they use. This relatively crude measure of overall satisfaction was correlated with the mean deficiency scores that end users reported for the various areas. The results of this procedure are reported in table 5-9.

Area	Coeff.	p
Organisational knowledge	(0.29)	0.021
Organisation skills	(0.39)	0.002
Organisational unit	(0.37)	0.003
General IS knowledge	(0.27)	0.032
Technical skills	(0.27)	0.035
IS Product	(0.31)	0.015

Table 5-9 : Spearman rank correlations between end users' overall satisfaction with IS/IT and their perceptions of IS personnel deficiencies .

Statistically significant low negative correlations were found to exist between three of the mean deficiency scores and the measure of overall user satisfaction. Coefficients in the .20s were regarded as being too low to be considered significant, all that can be said of them is that it is probable that the coefficient is not zero (see Jaeger : 1990 : p223). Despite the low correlation coefficients the result is intriguing as it implies that there may be a relationship between end user perceptions of IS deficiencies and their overall satisfaction with IS/IT, particularly deficiencies in organisational skill items and in IS knowledge of the end user's work unit. Such a result would be supported by previous research (Mullany : 1989). As mentioned earlier the measure used in this questionnaire consisted of a single item and is thus rather crude. More sophisticated measures of user satisfaction such as Pearson's 39 item scale might conceivably yield more powerful and interesting results (Bailey and Pearson : 1983).

GENERAL

One of the most significant findings of this research has been the extent to which the largest deficiencies are common to both classes of personnel. Of the top ten deficiency items six are common to both groups. Five of the six common items are concerned with knowledge rather than with specific skills, and are concerned with critical organisational success factors and with the role of IS within the organisation. Indeed the role of IS within the organisation and in particular the roles and responsibilities of IS and end user personnel is an area of some disagreement between IS and end users. Nevertheless both groups concede the importance of knowledge in this area. The only skill deficiency common to the top ten for both groups was in the ability to communicate effectively. The presence of this item is unlikely to be an accident and may well go some way to explaining the disagreements between IS and end user personnel as to the desired levels of knowledge in other areas.

General IS knowledge

General IS knowledge is seen by both classes of employee as their counterparts' area of greatest deficiency. Significantly, three of the top four deficiencies for both groups were deficiencies in: knowledge of the fit between IS and the organisation, the potential uses of IS/IT within the organisation, and in the use of IS/IT for competitive advantage. It is also noteworthy that in two of these items end users expect IS to have greater knowledge than do IS personnel themselves (table C-4, C-5). Further, end users are significantly less prepared to acquire knowledge of IS/IT potential than IS feel they should be (table B-4, B-5).

In order to reduce the deficiencies in these items it is essential that IS and end users first reach some sort of agreement as to what their respective roles and responsibilities should be. Only once this has been done will it be possible for the two groups to agree on the levels of knowledge desirable and to work towards eradicating the deficiencies.

Interpersonal communication

Both IS and end user personnel feel that one of the biggest deficiencies their counterparts suffer from is in the ability to communicate effectively with others. End users rank it as IS personnel's 5th largest deficiency (with 1.06), and IS as end users' 2nd largest (with 1.33). Weakness in interpersonal communication is a traditional charge against overly technical IS personnel (Duffy : 1991). This research shows that inability to communicate as effectively as is desirable is a more general problem shared by both groups of personnel.

Interestingly end user personnel have relatively low expectations of IS ability in this item (although still higher than end users expect for themselves). IS personnel rate interpersonal communication as being the item of most importance for end users and of second most importance for themselves. End users rank it as 12th in importance to IS and as 4th for themselves.

As noted earlier the high deficiency rating accorded this item is cause for concern. A deficiency in interpersonal communication is far more of a systemic deficiency than are deficiencies in specific areas of knowledge. An inability on the part of most staff to communicate effectively will hamper day to day operations and will tend to exacerbate deficiencies in other areas and hinder their successful resolution.

Computer-related training

Both end user and IS personnel were asked to describe the amount of computer-related training they had received from a variety of sources. The mean values reported are depicted in figure 5-10.

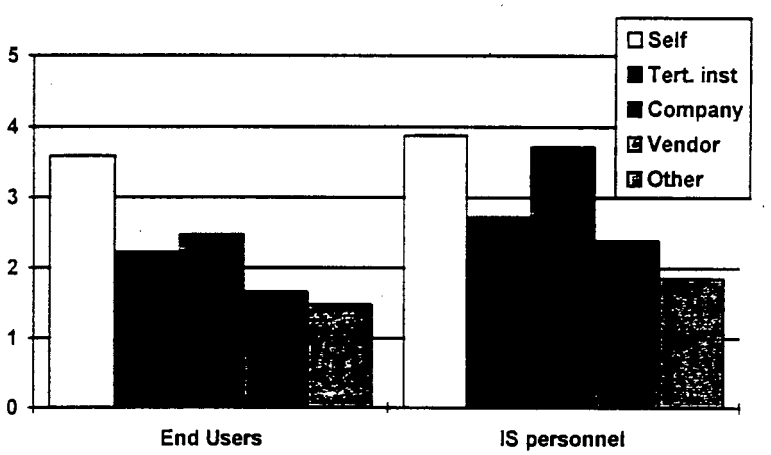

Figure 5-10 : *The amount of computer-related training end user and IS personnel receive from various sources.*

As is apparent from figure 5-10 IS personnel receive more computer-related training than do end users. The difference is, if anything, understated as IS personnel and end users are likely to have very different ideas about what constitutes a high amount of computer-related training.

Interestingly both end user and IS personnel give the same rankings in respect of the amount of training received from each source. For both classes of employee most of the computer-related training they receive is self training. This is followed by company training, training received while at a tertiary institution, vendor training and other training.

The most effective form of training seems to be company provided training. Both end user and IS personnel responses showed statistically significant correlations of medium strength between the amount of company training received and their overall satisfaction with the IS/IT that they used (see tables C-10 and B-10). The amount of company training received was sufficient to "explain" 21-25% of the variance in responses to the question on satisfaction with IS/IT indicating that training can be a major contributor to increased satisfaction both for end users and for IS personnel. Moreover in the case of end users an additional payoff exists in that statistically significant low to moderate negative correlations exist between the amount of company training received and their perceptions of IS deficiencies in organisational knowledge (low) and organisational skills (moderate). This is perhaps due to their increased contact with the IS personnel who run the in-house training courses. While the effects involved are small, they explain only between 11% and 18% of the variance in deficiency scores, they are worthy of further research attention. The correlations between training and perceived deficiency are set out in table C-9.

CONCLUSION

This research has found that while IS personnel differentiate fairly strongly between the deficiencies of end users in the different areas of knowledge and skill, end users do not differentiate as strongly between the deficiencies that they perceive IS personnel as having. Further, end user personnel expect generally higher levels of competence from IS personnel across the whole spectrum of knowledge and skill areas than do IS personnel of end users. Nevertheless end users do rate the IS personnel deficiency in knowledge of general IS matters as being significantly greater than the two lowest ranking IS personnel deficiencies. Thus both groups were perceived by their counterparts as being most deficient in general IS knowledge.

Chapter 6
Conclusion

This chapter summarises the objectives and achievements of this study, makes recommendations for practitioners on the basis of the results, and suggests directions for future research.

STUDY OBJECTIVES

One of the basic needs of both information systems practitioners and academics is to determine what skills and knowledge staff need in order to be able to perform adequately in their jobs (Nelson : 1991). This study was concerned with the information technology and information systems learning needs of two distinct classes of personnel: end users and information systems personnel. More specifically, it examined the perceptions that each group has of the other's particular deficiencies. It also compared the importance that each group accords to skill or knowledge in particular items for their counterparts, and how these expectations match their counterparts' own perceptions of item importance. The study was thus concerned with *cross*-perceptions: the perceptions that each group has of the other.

As outlined in the introductory chapter, the objectives of this study were threefold. The first objective was to determine whether IS personnel and end users did in fact discriminate between different areas of skill and knowledge when it came to assessing what deficiencies their counterparts had.

The second objective was to identify differences between IS personnel and end users as to the importance of areas of skill and knowledge to each group. Clearly if the two groups disagreed on the importance of a knowledge of, say, IS policies and plans to end users then there would be grounds for assuming that there

existed some conflict between them about the role and/or responsibilities of end users.

The third objective was to prioritise the learning needs of both IS staff and end users. Identifying the relative sizes of current perceived deficiencies would help to prioritise the learning needs identified by the study and to give some indication as to where training and educational resources might most profitably be applied.

KEY FINDINGS FROM THE LITERATURE

The survey of the literature in chapter two has suggested that successful use of IT requires a different kind of learning compared to that associated with more traditional technologies. Curley and Pyburn (1982) found that successful exploiters of IT were those organisations that engaged in on-going adaptive learning, rather than in simply acquiring basic skills in the use of the technology. Curley and Pyburn argued that this difference was similar to that developed by Argyris and Schon (1978) in their often cited work on single- and double-loop learning.

Discussion in the literature relating to the kind of learning required and the best techniques to achieve it frequently revolves around the difference between education and training as methods of instruction. According to O'Toole and Mitroff (1989):

> *Training* is directed toward learning to do the same things in the same way, the "right way" - that is, doing a specific job in a manner that is consistent, and thus measurable. *Education* is directed toward learning the analytical and conceptual skills needed to cope with ambiguity and change. One might say that training is concerned with facts and techniques, while education is concerned with developing the habits of mind needed for understanding (and as a preparation for lifelong learning) (p 49).

According to Nelson (1991) the distinction is one particularly relevant in information systems where the demands of changing technology require continual training leaving little time for education in the concepts of information management.

Another important distinction made by researchers is that between functional versus organizational learning. Functional learning is associated with acquiring knowledge and skill in a particular domain (finance, information systems, or sales) or within a particular work unit. Organisational learning, by contrast, involves the learner becoming more aware of the goals and objectives of the organisation and with its larger scale functioning. Clearly, both types of learning

are important contributors to individual productivity and to that of the organisation as a whole. Work by Rockart (1988), Kwan and Curley (1989) and Sambamurthy et al (1992) has stressed this point has and emphasised the importance to IS personnel of organizational knowledge and skills.

Zmud's (1983) framework uses the distinctions between skill and knowledge and between functional and organizational learning in arriving at six general areas of learning for all employees:

1. Organisational knowledge
2. Organisational skills
3. Knowledge of the organisational work unit.
4. General IS knowledge
5. Technical skills
6. Ability to use IS product

Proficiency in the first three areas would be as a result of organisational learning, while proficiency in the latter three would be a result of functional learning. Any attempt at evaluating the educational needs of employees should take these distinctions into account. The required mix of IS skills/knowledge and organisational skills/knowledge can be expected to vary from employee to employee and will be dependant on their organisational level and on their specific functional role (Zmud : 1983).

Nelson's research (1991) succeeded in operationalising Zmud's framework by utilising measures of self-perceived usefulness of, and proficiency in, a given area to arrive at a measure of the self-perceived deficiency that staff may possess in that area. This thesis extends Nelson's work by explicitly examining the cross-perceptions that end users and IS personnel have of each other.

ACHIEVEMENTS OF THIS STUDY

Whilst the learning needs of end user and IS personnel have been touched on by a number of South African studies the treatment has been either oblique (Miller and Doyle : 1987, Franzen and Greathead : 1987), or has been limited to those key educational concerns volunteered by IS or line managers (Norton : 1984). This study has attempted a more comprehensive survey which rates deficiencies in a wide variety of skill and knowledge areas derived from a comprehensive

organising framework. The analysis of responses has yielded profiles of the deficiencies in skill and knowledge of both end user and IS personnel. These profiles rate the deficiencies in terms of their relative severity and should provide a guide for practitioners seeking to prioritise efforts in computer-related education and training. In addition the relative importance that end user and IS personnel accord the various items of skill or knowledge was profiled allowing a more detailed examination of their respective roles and responsibilities.

As a diagnostic tool the survey instrument thus has two potential uses. It can be used to identify and prioritise deficiencies, and it can be used to identify areas of disagreement and potential conflict where the expectations of the two groups as to each others' knowledge and skill do not converge.

As noted in the previous chapter South African studies of deficiencies in areas of knowledge and skill (Norton : 1984) do not examine both IS and end user personnel and do not analyse deficiencies in terms of explicitly identified usefulness and proficiency scores. It is thus difficult to know if and how these might be changing over time. Therefore, from the viewpoint of IS research, a key contribution of this study has been the successful use of an adapted version of Nelson's (1991) "knowledge and ability" survey instrument in South Africa. Both studies achieved very similar reliability ratings (discussed in Chapter 4) and identified similar perceived deficiencies among the end user and IS personnel populations in the USA and South Africa. Having a validated instrument opens the way to its use in longitudinal studies. Such studies could examine changing patterns of knowledge and skill importance and deficiencies.

Important findings

With respect to the its first objective this research has found that while IS personnel differentiate strongly (for ANOVA $p = 0.0000343$, and for Kruskal-Wallis $p = 0.0000218$) between the deficiencies of end users in the different areas of knowledge and skill, end users do not differentiate as strongly between the deficiencies that they perceive IS personnel as having. Although, in part this may be due to the smaller end user response there is only weak statistical support (ANOVA $p = 0.124$, Kruskal-Wallis $p = 0.07$) for believing that end users do discriminate between all areas of knowledge and skill when rating IS personnel deficiencies. Nevertheless end users do rate the IS personnel deficiency in knowledge of general IS matters as being significantly greater than the two lowest ranking IS personnel deficiencies (IS product and technical skills).

With respect to the third objective (the second is discussed later) a significant finding of this research has been the extent to which the largest identified deficiencies are common to both classes of personnel. Of the top ten deficiency items six were common to both groups. These were the items for the fit between IS and the organisation, a knowledge of IS/IT potential, the use of IS/IT for competitive advantage, skill in interpersonal communications, a knowledge of IS policies and plans, and a knowledge of critical success factors affecting the organisation. Five of the six common items were concerned with knowledge rather than with specific skills, and were concerned with critical organisational success factors and with the role of IS within the organisation. Indeed the role of IS within the organisation and in particular the roles and responsibilities of IS and end user personnel was an area of some disagreement between IS and end users. Nevertheless both groups recognised the importance of knowledge in this area. Thus, the area of largest deficiency that both end users and IS personnel saw each other as having was in the area of general IS knowledge. Interestingly this result paralleled Nelson's (1991) findings in the USA which also identified the deficiency in general IS knowledge as being the largest.

The only skill deficiency common to the top ten for both groups was in the ability to communicate effectively. The presence of this item is unlikely to be an accident and may well go some way to explaining the disagreements between IS and end user personnel as to the desired levels of knowledge in other areas.

The ranking of all the identified deficiencies obtained through the research comprises a valuable finding in itself as it has the potential to assist practitioners in prioritising learning needs. The rankings are shown in graphical form in figures 6-1 and 6-2.

As is readily apparent from figures 6-1 and 6-2 both end user and IS personnel, on average, rate each other as being deficient in all of the knowledge and skill items. This is a significant result as it indicates that there is no room for complacency when considering deficiencies. Also, while it is tempting to ascribe some of the deficiency ratings to harsh perceptions on the part of another organisational group, it should be remembered that Nelson's (1991) research showed similar results even where the measure was self- rather than cross-perceptions.

Both figure 6-1 and 6-2 show that the greater deficiencies are in areas of knowledge rather than of skill. The average end user deficiency for knowledge items is 0.96 while for skill items it is 0.62. IS personnel have an average knowledge item deficiency of 0.96 while their average skill item deficiency is 0.76.

While this should not be used to downplay the significance of skill deficiencies it indicate that knowledge deficiencies are perhaps not receiving the attention that they should. Given that training is easier to supply than education (O'Toole and Mitroff : 1989) and that this is particularly so in a field such as IS where the "churn" factor in basic skills is high (Nelson : 1991) this is perhaps not surprising. Nevertheless managers should be alert to the problems that large deficiencies in knowledge items indicate for their organisations in the long term. As noted earlier many of these knowledge items, and the educational processes by which they are acquired, are directed towards building the analytical and conceptual abilities necessary to cope with change. With large deficiencies in these abilities organisations may be headed for trouble.

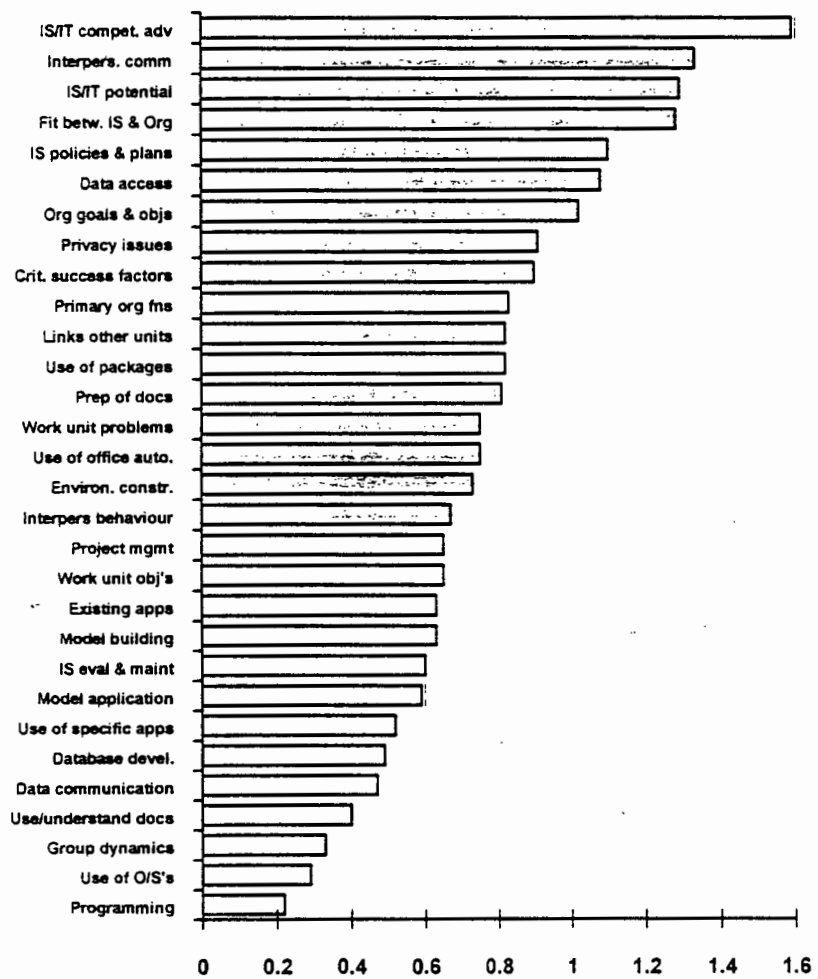

Figure 6-1 : Ranked deficiencies of end user personnel. A potential aid to prioritising organisational training efforts.

The ranked deficiencies of end users shown in figure 6-1 show this pattern clearly; the largest deficiency items are overwhelmingly concerned with general IS and organisational knowledge. The smallest end user deficiency items are in the

areas of specific technical skills such as operating system, application and package use.

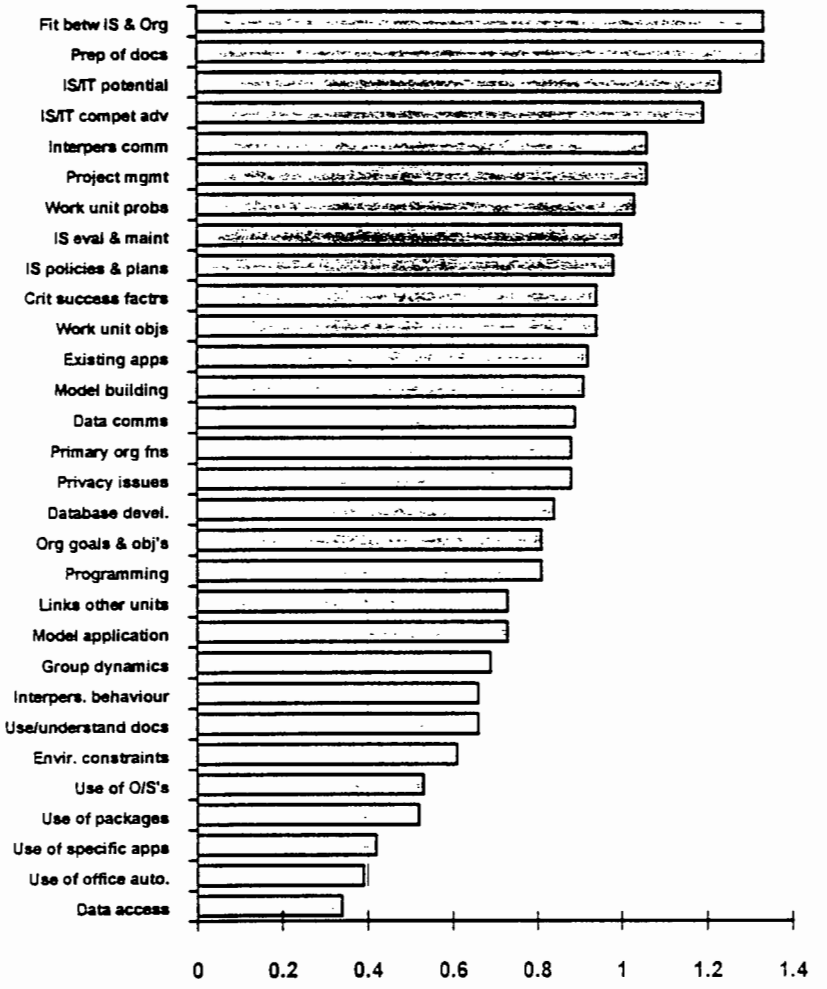

Figure 6-2 : Ranked deficiencies of IS personnel. A potential aid to prioritising organisational training efforts.

The ranked deficiencies of IS personnel show the same split between higher deficiencies in knowledge items and lower deficiencies in skill items. The only exceptions are in the preparation of documentation (2nd largest deficiency) and in project management (6th largest). The documentation deficiency shows a very high standard deviation (1.24) suggesting that it may not be a problem across all of the organisations surveyed. The relatively high project management deficiency may be because of its visibility as a job function.

The second major objective of this research was to identify on which skill/knowledge items IS and end user personnel differed significantly in their ratings of item importance. This comparison, it was thought, might have implications for the resolution of conflict between the two personnel groups by suggesting the need for specific organisational education regarding expected roles and knowledge.

Perhaps the most important finding in this regard were the significant differences in the perceived usefulness of items in the general IS knowledge area. Given that this area had the highest deficiencies the presence of significant disagreements about what the requisite levels of knowledge should be cause for concern. In two of the general IS knowledge items (IS/IT potential, and IS/IT for competitive advantage) end users expect IS to have greater knowledge than do IS personnel themselves. Conversely, end users attach significantly less importance to a knowledge of IS/IT potential than IS feel they should do.

In order to reduce the deficiencies in these items it is essential that IS and end users first reach some sort of agreement as to what their respective roles and responsibilities should be. Only once this has been done will it be possible for the two groups to agree on the levels of knowledge desirable and to work towards eradicating the deficiencies.

These findings are of particular importance for organisations concerned to exploit IT successfully and form the basis for the recommendations made in this study.

RECOMMENDATIONS

The finding of this study together with the review of the literature undertaken in Chapter 2 suggest a number of recommendations for IS academics and practitioners.

Improve the general IS knowledge of all personnel

The largest deficiencies that both end users and IS personnel see each other as having are in the area of general IS knowledge. It is apparent that both end users and IS personnel feel that their counterparts need to know more about issues such as the use of IS/IT for competitive advantage, the fit between IS and the organisation, and the potential uses of IS and IT in the organisation. Knowledge in these areas is essential to both classes of personnel if the partnership between line and IS is to become a reality (Rockart : 1988, Henderson : 1986). Interestingly, Nelson's (1991) survey of IS and end user deficiencies in the USA revealed the same pattern of deficiencies as this study found in South Africa.

As Nelson (1991) has noted, the items that make up the "general IS knowledge" category are prerequisites for addressing many of the key issues currently facing IS managers. Moreover, the items that make up general IS knowledge include many of those that Rockart (1988) and Kwan and Curley (1989) consider essential to both end user and IS personnel participating in a partnership structure. The mere presence of relatively large deficiencies in the general IS

knowledge area is thus cause for concern. What is even more worrying however is that in some of these items, particularly in crucial ones such as the knowledge of IS/IT potential and the use of IT for competitive advantage, end user and IS personnel are in widespread disagreement as to the desirable level of knowledge that each should have. Both groups have a tendency to project more of the responsibility for knowledge in these items onto their counterparts than their counterparts are prepared to accept. This suggests that a deeper disagreement as to the respective roles that each group should be playing is at work in addition to the perceived deficiencies. As Lind and Zmud (1992) have shown, unless technology providers and technology users can achieve a convergence in their understandings of the role of IT in the business a lower level of innovation can be expected.

Any action that practitioners take to remedy the deficiencies in this area should therefore be built upon an initial dialogue that should aim to harmonise the perspectives that each group has of the importance of these items and of their respective responsibilities (see Sambamurthy et al : 1992). As Blennerhasset (1988) has stated, such an initial dialogue can serve as a necessary precursor to the process of identifying what, precisely, end user managers need to know in order to eliminate their deficiencies in the general IS knowledge area.

Improve interpersonal communications skills of all personnel

This study found, as did Norton's (1984) study, that an inability to communicate effectively with others was one of the major deficiencies that end users perceived IS personnel as having. Interestingly, IS personnel rate end user inability in this area as even more severe. In addition both groups rate the ability to communicate effectively as more important to their counterparts than their counterparts' *self*-rating of usefulness. This perhaps suggests that both groups of employees project some of the blame for ineffective communication onto their counterparts.

As was noted in Chapter 5 there appears to be a small, but significant, negative relationship between the amount of company training end users receive and their perceptions of IS deficiencies in organisational skills and in organisational knowledge. While the exact working of this relationship needs further research, it is a hopeful sign as it suggests that with increased training, particularly company-based training, end user staff come to moderate their views of IS deficiencies (see table C-9). Practitioners could explore increased in-house training that promotes contact between the two classes of personnel as a means of improving end user perceptions of IS competency. Academics need to explore the nature of the change in perceived deficiencies that comes with training and increased

contact, and to determine whether IS personnel's perceptions of end user deficiencies are also affected by exposure to end users through training programs.

The potential payoffs from improvements in communication skills are large. As was noted in Chapter 5 the relatively large deficiencies in interpersonal communications skills are likely to exacerbate the deficiencies that both end user and IS personnel perceive in each other.

Apply a strategy to reduce skill and knowledge deficiencies

The learning needs of both end users and IS personnel have changed over time and are likely to continue to do so (Rockart : 1988, Nelson : 1991). If educational efforts are not to be misdirected it is therefore desirable that the learning needs of both classes of personnel be re-assessed from time to time. As was noted in the review of the literature in Chapter 2 however the role of IS management in educating line managers and end users in IT issues is open to debate. The current consensus seems to be that it is one of IS management's responsibilities; Rockart (1988) specifically identifies it as a new responsibility of IS management. Other authors have however questioned whether it is within the competence or mandate of the IS function (Heany : 1972).

If the IS-related learning needs of end users and line managers are accepted as being one of the responsibilities of the IS function however it then follows that the process will need to be explicitly managed. This implies the development of ways to measure both educational needs, and progress made towards meeting those needs. The survey instrument employed in this study could serve as a useful starting point in assessing the learning needs of both IS staff and end users by identifying the relative sizes of current deficiencies and thus helping to prioritise the learning needs. It is important to note, though, that the instrument employed in this research operates at a "macro" or company-wide level (Nelson : 1991). In order to derive more specific training objectives it would be necessary to go down to the level of individual business units.

Managing learning needs on an on-going basis would require a continual cycle of needs assessment, the prioritisation of deficiencies, the design of educational programs, the implementation of those programs, and a post-program review to determine program quality and effectiveness (Heany : 1972, Knowles 1982a, Blennerhasset : 1988). Nelson (1991) has outlined how a typical programme designed to address learning needs might be designed. The programme consists of five steps.

Step 1: Conduct skill/knowledge assessments

This research has been designed to identify educational needs across a number of South African organisations. The largest mean deficiency, in general IS knowledge, was also reported by Nelson (1991). This suggests that many of the identified learning needs will be common to other similar organisations. The needs of *specific* organisations will however diverge to a greater or lesser extent from those identified here. It is therefore important for organisations to conduct their own needs assessments and to follow up macro (organisation wide) assessments, such as this survey, with micro (department level) assessments within different functional areas.

Step 2: Identify specific areas of significant deficiency

While it is true that the results of this study suggest that in the area of general IS knowledge some sort of organisational educational effort is desirable, the concept of deficiency as a function of usefulness and proficiency can be used in a number of ways. Most notably, the usefulness of a particular item of knowledge or skill is affected by such factors as the organisational level and job description of the individuals being assessed. Managers will clearly need a different mix of IS skills/knowledge and organisational skills/knowledge than do clerical employees. Similarly programmers and end users will require different skill/knowledge mixes.

Step 3: Design appropriate education and training programmes

The different learning needs identified by the assessment stage need to be matched with effective methods of education and training based on the type of learning required and on relevant characteristics of the personnel involved. IS research that focuses on some these issues has been done by

While a comprehensive review of the education and training techniques that might be required falls outside the scope of this study table 6-1 summarises some of the more common techniques identified in the literature on adult education (for more detail see Knowles 1982a).

Type of behavioural outcome	Most appropriate technique
Knowledge: generalisations about experience, internalisation of information	lecture, debate, dialogue, interview, panel discussion, reading, TV
Understanding: application of information and generalisations	audience participation, demonstration, movie, games, dramatisation, Socratic discussion, case discussion
Skill: incorporation of new ways of performance through practice	role-playing, games, participative cases. skill practice exercises, drill, coaching
Attitudes: adoption of new methods.	Experience sharing discussion, group-centred discussion, role playing, critical incident process, case method, training groups
Values: adoption and priority arrangement of beliefs.	TV, lecture (sermon), debate, dialogue, symposium, colloquy, drama, guided discussion
Interests: satisfying exposure to new activities.	TV, demonstration, slide show, movie, drama, experience-sharing discussion, exhibits, trips

Table 6-1 : Matching educational and training techniques to desired behavioural outcomes. (source: Knowles 1982a)

In addition to the established body of research into adult education, there is a growing body of IS research in the area. Studies of the educational techniques most appropriate for end users have been done by Bostrom et al (1990), Cronan and Douglas (1990), Blennerhassett (1988), Sein et al (1987), and by Gatticker and Paulson (1987). Research has also been done by Bostrom et al (1990) into the effect of the learning styles of individuals on programme effectiveness. Olfman (1987) has done research on construct- versus application-based techniques and approaches to education and training.

Step 4: Implement the education and training programmes

Attention needs to be given to the timing of the different elements of the programme. Nelson suggests that the training components only be started after the requisite educational programs have been completed.

Step 5: Conduct post-education/training assessments

On-going assessments to evaluate the effectiveness of the learning effort are of critical importance and yet are often not carried out (Nelson : 1991). The continued contact is vital in cementing the newly learned behaviours. It is also critically important for employees to give feedback as to the quality of the education and training, whether and how they are making use of what they learned, and if any further training is necessary. Unfortunately, the measurement of learning outcomes and the benefits to the organisation are difficult to measure and research in this area is correspondingly thin (Earl : 1984, Knowles : 1982a,

Nelson : 1991). For a review of the measurement techniques available see Knowles (1982a and 1982b).

As Nelson (1991) has noted, institutions of higher education that offer IS courses could also benefit from the five steps identified above. Some research has been done in South Africa in this regard and interested readers are referred to the work of Smith et al (1992).

It is worth stressing, before leaving this topic, that any educational effort aimed at reducing IS-related learning needs will need to be on-going. As Earl (1984) has noted, one of the characteristics of IT is that it is constantly changing. Moreover, the kind of learning required for effective use of IT demands an on-going process of adaptation and innovation (Curley and Pyburn : 1982). These two characteristics of IT combine to produce a continual need for organisations to learn and to adapt. A measure of this on-going need is the continued presence of organisational learning as one of the key issues reported by IS managers (Niederman et al : 1991, Brancheau and Whetherbe : 1987).

AREAS FOR FURTHER RESEARCH

Organisational learning about IS issues has been an important topic for IS managers for the last ten years (Niederman et al : 1991). While some research has been done in the area (see Chapter 2) still more is needed. The results of this study, and many of its limitations, suggest areas for future research.

Need for longitudinal studies

As was noted in Chapter 5 many of the deficiencies identified by this study had been identified by earlier South African studies such as that of Norton (1984). It would thus appear that certain deficiencies persist over time. There are two possible reasons for this. The first is that organisations have made no progress in the intervening years. This may well be the case as Norton states that of the thirteen companies he surveyed only two had educational programs of an on-going nature. The second possible explanation is that the norms of performance have themselves shifted, so that while proficiencies may have improved they have not kept pace with higher requirements.

Unfortunately, given the lack of comparative data about both the usefulness and proficiency components of deficiency, it is not possible to choose between these two possible reasons. Such comparative information would however be useful in allowing IS academics to monitor changing educational requirements and provide an indirect means of observing the underlying changes in the roles and

responsibilities of end user and IS personnel. It is therefore important that surveys of the sort carried out in this study be repeated every few years. Nelson (1991) suggests a period of every five to ten years.

Need to examine effects of differing environments

The generalisability of this study is limited by the kinds of participating organisations - large corporations with mature IS functions. It is possible, even probable, that respondents from different operating environments may perceive different deficiencies. Some of the different environmental variables that future research could control for could be organisational structure (such as hierarchical depth), size, type of industry, and even differences between countries.

Need for more concrete measures of proficiency and deficiency

While perceptions are useful measures in themselves, and useful surrogates for more direct measures, they are not measures of the actual levels of deficiency that personnel may have. Nelson (1991) has noted a general lack of more concrete measures for proficiency and deficiency. Given the importance accorded organisational learning by many IS managers (Niederman et al : 1991) the development of such concrete measures should be a priority of IS research. Without such measures the management of organisational learning is hampered as there are only indirect ways of measuring progress. The existence of proficiency and deficiency "metrics" would make the job of managing organisational learning much easier.

CONCLUSION

The important achievements of this study have been the successful use of an adapted version of Nelson's (1991) knowledge and ability survey instrument in South Africa. The instrument has yielded important information about how end user and IS personnel view each other's current abilities. Specifically, both end user and IS personnel groups view their counterparts as most deficient in general IS knowledge specifically in the alignment of IS to the organisation, and in knowledge of potential uses of IS/IT. Moreover both groups expect their counterparts to carry more of the responsibility for knowing about these things than their counterparts appear willing to assume. The implication of this mismatch of expectations is that it must first be resolved by clarifying the respective roles and responsibilities of both end user and IS personnel before the deficiencies themselves can be dealt with.

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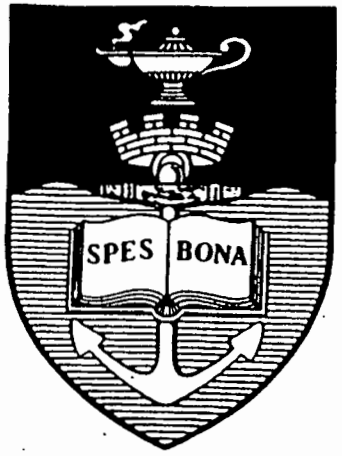
Appendix A
The Survey Instrument

Two distinct versions of the survey instrument presented in this appendix were used in the study; one for end user and one for IS personnel. The instruments were identical in all respects but one. The difference was that end user personnel were asked, in section B of the questionnaire, to evaluate the current level of knowledge and ability of IS personnel, while IS personnel were asked to evaluate end users.

The questionnaire that was distributed to **end users** is reproduced in this appendix.

The questionnaires were produced in booklet form. The two versions were distinguished by covers of different colours.



University of Cape Town
Information Systems Section
Department of Accounting
Faculty of Commerce

Knowledge & Ability Questionnaire

(Adapted from Ryan Nelson)

Questionnaire for IS Personnel

Conducted by:

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- 1992 -

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Welcome

You are about to participate in a study of opinions about the importance of various knowledge and abilities within your organisation. Before we begin, we would like to define a few terms for you. Please keep these definitions in mind when completing this questionnaire.

Information System (IS). A (computer-based) system that processes data into a form that can be used by the recipient. Information systems consist of transaction (data) processing systems (e.g., payroll or accounting systems), management information systems (e.g., exception or managerial reporting systems), decision support systems (e.g., semi- or un-structured modeling systems), and office automation systems (e.g., word processing, electronic mail, or calendar management systems). Information systems can be personal, departmental, or organisational in scope.

IS Personnel. Individuals whose primary job responsibility involves the management, development, maintenance, or support of information systems within the organisation.

End Users. People (employees) who ultimately use the output of an information systems (IS). This definition pertains only to NON-IS Personnel, i.e., persons outside the IS department.

Please ensure that you form part of the *IS Personnel*

NOTE: In completing this questionnaire, we are interested in your opinion of the importance of various knowledge and abilities within your organisation.

Also, please remember the following:

1. All the information you give will be kept confidential.

2. We need answers to all questions (i.e., please don't skip any).

3. We would like your opinion. Please don't talk to others about how to respond to the questions.

4. Move rapidly through the questionnaire. We are interested in your first impressions, so please don't spend an excessive amount of time on each question. **The questionnaire should take no more than 15 minutes of your time to complete.**

Raoul Du Plessis
Yann Kwok Kem Yen
Glen Lighton

n A

JCTIONS:

Please rate how important you believe proficiency in each item is for ____ to successfully perform their/your job.

a. IS personnel within your organisation,
b. end user personnel within your organisation, and
c. you

NOTE: Proficiency is defined as being advanced in knowledge or ability.

For all three scales, within each item, mark by a cross, a number from one to ve, indicating the importance of the item from the "of no use" represented by 1" to "of absolute necessity" represented by "5".

Knowledge about the goals and objectives of the organisation (i.e., the orporate-wide business entity) is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

nowledge about the primary functions of the organisation is ...

of no se	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no se	1	2	3	4	5	of absolute necessity ... for end users.
f no se	1	2	3	4	5	of absolute necessity ... for yourself.

A-3 Knowledge about the few key factors that must go right if the organisation is to succeed is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

A-4 Knowledge about the environmental constraints that the organisation operates within (e.g., government regulation, supplier relationships, competition, etc.) is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

A-5 Knowledge about information systems policies and plans within the organisation is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

A-6 Knowledge about the fit between IS policies and plans and the overall goals and objectives of the organisation is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

Knowledge about existing information systems applications within the organisation is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

Knowledge about the potential for information systems/technology within the organisation is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

Knowledge about the potential use of information systems/technology to achieve competitive advantage is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

Knowledge about the objectives of your work unit is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

A-11 Knowledge about the main problems your work unit faces in achieving its objectives is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

A-12 Knowledge about the level of interdependence between your work unit and other units within the organisation is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

A-13 Knowledge of the privacy issue and its implications on databases (both private and public) is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

A-14 The ability to communicate effectively with others is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

-15 The ability to recognize and manage personality problems which interfere with job completion is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

16 The ability to work effectively in groups is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

7 The ability to manage projects is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

3 The ability to program (e.g., in COBOL, FORTRAN, BASIC, etc) is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

A-19 The ability to use software packages (e g , LOTUS 1-2-3, Harvard Graphics, etc) is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

A-20 The ability to build models (e.g., formulate and solve complex simulation models) is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

A-21 The ability to recognize which management science (operations research) model is appropriate for a particular problem is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

A-22 The ability to access data (e g , data retrieval, queries, etc) is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

The ability to develop (design and implement) databases using a generalised database management system (e g , IMS, TOTAL, DB2, dBASE III, etc) is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

The ability to handle data communications is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

The abillty to use specific application systems is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

The ability to use office automation systems (e g , electronic mail, voice mail, text editing, calendar management, etc.) is ...

of no use	1	2	3	4	5	of absolute necessity ... for IS personnel.
of no use	1	2	3	4	5	of absolute necessity ... for end users.
of no use	1	2	3	4	5	of absolute necessity ... for yourself.

A-27 The ability to use operating systems is ...

of no use	1	2	3	4	5	Of absolute necessity ...	for IS personnel.
of no use	1	2	3	4	5	Of absolute necessity ...	for end users.
of no use	1	2	3	4	5	Of absolute necessity ...	for yourself.

A-28 The ability to prepare effective documentation for an information system is ...

of no use	1	2	3	4	5	Of absolute necessity ...	for IS personnel.
of no use	1	2	3	4	5	Of absolute necessity ...	for end users.
of no use	1	2	3	4	5	Of absolute necessity ...	for yourself.

A-29 The ability to use and understand documentation is ...

of no use	1	2	3	4	5	Of absolute necessity ...	for IS personnel.
of no use	1	2	3	4	5	Of absolute necessity ...	for end users.
of no use	1	2	3	4	5	Of absolute necessity ...	for yourself.

A-30 The ability to evaluate system performance and make needed adjustments to a system after implemetation is ...

of no use	1	2	3	4	5	Of absolute necessity ...	for IS personnel.
of no use	1	2	3	4	5	Of absolute necessity ...	for end users.
of no use	1	2	3	4	5	Of absolute necessity ...	for yourself.

Section B

would like for you to focus on the current level of knowledge/ability of the ERS. For each item, cross out a number from one to five indicating THEIR nowledge/ability from "extremely low" represented by "1" to "extremely high" ed by "5".

nowledge about the goals and objectives of the organisation (i.e., the rporate-wide business entity).

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

nowledge about the primary functions of the organisations

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

nowledge about the few key factors that must go nght if the organisation is to cceed.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

nowledge about the environmental constraints that the organisation operates thin (e.g., government regulation, supplier relationships, competition, etc).

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

nowledge about information systems policies and plans within the ganisation

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-6 Knowledge about the fit between IS policies and plans and the overall goals and objectives of the organisation.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-7 Knowledge about existing information systems applications within the organisation.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-8 Knowledge about the potential for information systems/technology within the organisation.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-9 Knowledge about the potential use of information systems/technology to achieve competitive advantage.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-10 Knowledge about the objectives of your unit.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-11 Knowledge about the main problems your work unit faces in achieving its objectives.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-12 Knowledge about the level of interdependence between your work unit an other units within the organisation.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-13 Knowledge about the privacy issue and its implications on databases (both private and public).

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-14 Ability to communicate effectively with others.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-15 Ability to recognise and manage personality problems which interfere with job completion.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-16 Ability to work effectively in groups.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-17 Ability to manage projects.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-18 Ability to program (e.g., in COBOL, FORTRAN, BASIC, etc.).

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-19 Ability to use software packages (e.g., LOTUS 1-2-3, Harvard Graphics, etc.).

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-20 Ability to build models (e.g., formulate and solve complex simulation models).

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-21 Ability to recognise which management science (operations research) is applicable to a particular problem.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-22 Ability to access data (e.g., data retrieval, queries, etc.).

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-23 Ability to develop (design and implement) databases using a generalised database management system (e.g., IMS, TOTAL, DB2, dBASE III, etc.).

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-24 Ability to handle data communications.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-25 Ability to use specific application systems

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-26 Ability to use office automation systems (e.g., electronic mail, voice mail, text editing, calendar management, etc.).

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-27 Ability to use operating systems.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-28 Ability to prepare effective user documentation for an information system.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-29 Ability to use and understand documentation.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

B-30 Ability to evaluate system performance and make needed adjustments to a system after implementation.

End-users' Level of Knowledge/Ability	Extremely Low	1	2	3	4	5	Extremely High

Section C

C-1 How would you describe the amount of computer-related training that YOU have received from each of the following sources ? Mark by a cross the appropriate number in each area.

Self Training	Extremely Low	1	2	3	4	5	Extremely High
College Training	Extremely Low	1	2	3	4	5	Extremely High
Company Training	Extremely Low	1	2	3	4	5	Extremely High
Vendor Training	Extremely Low	1	2	3	4	5	Extremely High
Other Training	Extremely Low	1	2	3	4	5	Extremely High

Specify: _____

C-2 Overall, how satisfied are you with the information systems/technology that you have used ?

Extremely Low	1	2	3	4	5	Extremely High

C-3 On the average day, how many hours do you spend using information systems/technology to do your job ?

_____ Hour(s)

Section D

ly, we would like to ask a few questions about yourself for statistical purposes. d you please indicate:

Your **sex** (circle number of your answer):

1 Male 2 Female

Your present age: _____ years

Your department: _____

Your job title: _____

Years you have worked in your current department: _____ years

Years you have worked in this organisation: _____ years

What is the highest level of education that you have completed ? (circle number)

1. Matriculant
2. Technikon Diploma
3. Bachelor's Degree
4. Master's Degree
5. Doctoral Degree

Circle the number which best describes your job with respect to organisational level.

1. Executive/Top Management
2. Middle Management
3. Supervisory
4. Professional
5. Technical
6. Clerical
7. Other (Please specify)

_____

Thank you very much for your participation !

If you wish to add any comments or further observations, please use the space below.

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To receive a Copy of the Results:

If you wish to receive a copy of the study findings please write your name and address below (or attach your business card). Alternatively, you may request a copy of the findings under a separate cover.

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Appendix B
Perceptions of End User Personnel

This appendix gathers together all of the tables of results that pertain to IS perceptions of end users (and which are not included in the body of the thesis). The tables contained in this appendix are listed below.

Table	Description
B-1	IS personnel's perception of item characteristics for end users. Means and standard deviations for usefulness, proficiency, and deficiency.
B-2	Deficiency rankings of items for end user personnel (as perceived by IS personnel).
B-3	Rankings of item usefulness to end users. Two tables one showing usefulness as ranked for end users by IS personnel and another by end users themselves.
B-4	Differences in perceived usefulness of items. Parametric statistics using Student's *t*-test.
B-5	Differences in perceived usefulness of items. Nonparametric statistics using Mann-Whitney.
B-6	Summary tables showing factor averages for perceived usefulness.
B-7	Table showing what percentage of a rated deficiency is ascribable to a difference in perceived usefulness between end user and IS personnel.
B-8	Spearman Rank Correlations of IS demographic variables with factor averages of deficiencies.
B-9	Spearman Rank Correlations of IS personnel training (by source) with factor averages of deficiencies.
B-10	Spearman Rank Correlations of IS personnel training (by source) with overall satisfaction with IS/IT.
B-11	Spearman Rank Correlations of mean usefulness scores with mean proficiency scores.

Table B-1 : IS perceptions of end users : Item characteristics

Area of knowledge/skill	Usefulness Mean	Usefulness S.D.	Proficiency Mean	Proficiency S.D.	Deficiency Mean	Deficiency S.D.
Organizational knowledge	4.13	0.78	3.26	0.80	0.87	0.83
Organizational goals and objectives	4.22	0.91	3.20	0.95	1.02	1.01
Primary organizational functions	4.18	0.90	3.34	0.94	0.83	0.97
Critical success factors	4.15	0.96	3.25	0.95	0.90	1.04
Environmental constraints	3.99	0.98	3.26	0.97	0.73	1.23
Organizational skills	3.76	0.79	3.03	0.65	0.73	0.96
Interpersonal communication	4.53	0.71	3.20	0.79	1.33	1.02
Interpersonal behaviour	3.68	1.10	3.01	0.82	0.67	1.33
Group dynamics	3.54	1.08	3.25	0.79	0.29	1.24
Project management	3.31	1.24	2.67	0.99	0.65	1.45
Organizational unit	3.20	0.95	2.46	0.78	0.74	0.99
Work unit objectives	3.34	1.14	2.70	1.04	0.65	1.38
Work unit problems	3.05	1.21	2.30	0.95	0.75	1.25
Links with other work units	3.22	1.12	2.39	0.88	0.82	1.19
General IS knowledge	3.59	0.76	2.46	0.69	1.13	0.91
IS policies and plans	3.44	1.00	2.34	0.94	1.10	1.17
Fit between IS and organization	3.60	1.08	2.31	0.83	1.28	1.17
Existing applications	3.44	1.01	2.81	1.01	0.63	1.28
IS/IT potential	3.66	1.09	2.36	0.91	1.29	1.27
IS/IT for competitive advantage	3.97	1.12	2.38	0.99	1.59	1.44
Privacy issues (re: databases)	3.46	1.23	2.55	1.17	0.91	1.26
Technical skills	2.54	0.60	1.92	0.48	0.61	0.58
Programming	1.40	0.58	1.19	0.44	0.22	0.57
Use of software package(s)	3.53	1.06	2.71	1.07	0.82	1.11
Model building	2.61	1.18	1.98	1.05	0.63	1.15
Model application	2.46	1.17	1.87	0.91	0.59	1.16
Data access	3.80	1.20	2.73	1.12	1.08	1.38
Database development	1.84	0.96	1.35	0.55	0.49	0.94
Data communication	2.10	1.12	1.63	0.77	0.47	0.95
IS Product	3.22	0.73	2.66	0.63	0.56	0.84
Use of specific application systems	3.78	1.33	3.26	1.05	0.52	1.27
Use of office automation products	3.67	1.16	2.92	1.17	0.75	1.38
Use of operating system(s)	2.17	1.07	1.87	0.84	0.29	0.96
Preparation of documentation	3.25	1.47	2.44	1.09	0.81	1.52
Use/understand documentation	3.59	0.92	3.19	1.02	0.40	1.33
IS evaluation and maintenance	2.87	1.33	2.27	1.16	0.60	1.25

* Deficiency = Usefulness - Proficiency

Note: The greyed areas show the statistics for the six aggregate constructs.

Table B-2 Deficiency rankings for End Users (as perceived by IS personnel)

Rank	Item	Mean
1	IS/IT for competitive advantage	1.59
2	Interpersonal communication	1.33
3	IS/IT potential	1.29
4	Fit between IS and organisation	1.28
5	IS policies and plans	1.10
6	Data access	1.08
7	Organizational goals and objectives	1.02
8	Privacy issues (re: databases)	0.91
9	Critical success factors	0.90
10	Primary organizational functions	0.83
11	Links with other work units	0.82
12	Use of software packages	0.82
13	Preparation of documentation	0.81
14	Work unit problems	0.75
15	Use of office automation products	0.75
16	Environmental constraints	0.73
17	Interpersonal behaviour	0.67
18	Project management	0.65
19	Work unit objectives	0.65
20	Existing applications	0.63
21	Model building	0.63
22	IS evaluation and maintenance	0.60
23	Model application	0.59
24	Use of specific application systems	0.52
25	Database development	0.49
26	Data communication	0.47
27	Use/understand documentation	0.40
28	Group dynamics	0.33
29	Use of operating systems(s)	0.29
30	Programming	0.22

Table B-3 Item usefulness for end users, as ranked by IS personnel and end users themselves.

Table B-3-1 : As ranked by IS

Rank	Item	Mean
1	Interpersonal communication	4.53
2	Organizational goals and objectives	4.22
3	Primary organizational functions	4.18
4	Critical success factors	4.15
5	Environmental constraints	3.99
6	IS/IT for competitive advantage	3.97
7	Data access	3.80
8	Use of specific application systems	3.78
9	Interpersonal behaviour	3.68
10	Use of office automation products	3.67
11	IS/IT potential	3.66
12	Fit between IS and organization	3.60
13	Use/understand documentation	3.59
14	Group dynamics	3.54
15	Use of software package(s)	3.53
16	Privacy issues (re: databases)	3.46
17	IS policies and plans	3.44
18	Existing applications	3.44
19	Work unit objectives	3.34
20	Project management	3.31
21	Preparation of documentation	3.25
22	Links with other work units	3.22
23	Work unit problems	3.05
24	IS evaluation and maintenance	2.87
25	Model building	2.61
26	Model application	2.46
27	Use of operating system(s)	2.17
28	Data communication	2.10
29	Database development	1.84
30	Programming	1.40

Table B-3-2 : As ranked by end users

Rank	Item	Mean
1	Primary organizational functions	4.42
2	Critical success factors	4.42
3	Organizational goals and objectives	4.39
4	Interpersonal communication	4.30
5	Interpersonal behaviour	4.08
6	Work unit objectives	4.06
7	Links with other work units	3.97
8	Privacy issues (re: databases)	3.97
9	Group dynamics	3.95
10	Work unit problems	3.92
11	Data access	3.86
12	IS/IT for competitive advantage	3.78
13	Environmental constraints	3.75
14	Project management	3.61
15	Use of software package(s)	3.59
16	Use of specific application systems	3.56
17	Fit between IS and organization	3.53
18	Existing applications	3.50
19	Use of office automation products	3.50
20	IS policies and plans	3.42
21	IS evaluation and maintenance	3.39
22	IS/IT potential	3.33
23	Use/understand documentation	3.33
24	Use of operating system(s)	3.28
25	Preparation of documentation	3.22
26	Data communication	2.95
27	Model building	2.67
28	Model application	2.63
29	Database development	2.34
30	Programming	1.78

Table B-4 The perceived usefulness of the various areas of knowledge and skill for End User Personnel.

Here IS perceptions of usefulness for end users are compared with end user perceptions of usefulness for themselves. The statistical procedure is two-tailed *t*-test.

H_0 is that the means are equal.

Area of knowledge/skill	EU	IS	"t"	reject H_0?	p
Organizational knowledge					
Organizational goals and objectives	4.39	4.22	1.29		0.199
Primary organizational functions	4.42	4.18	1.80	o	0.07
Critical success factors	4.42	4.15	1.90	o	0.06
Environmental constraints	3.75	3.99	(1.52)		0.13
Organizational skills					
Interpersonal communication	4.30	4.53	(1.79)		0.075
Interpersonal behaviour	4.08	3.68	2.44	●	0.016
Group dynamics	3.95	3.54	2.45	●	0.015
Project management	3.61	3.31	1.50		0.134
Organizational unit					
Work unit objectives					
Work unit problems	*These items are not directly comparable.*				
Links with other work units					
General IS knowledge					
IS policies and plans	3.42	3.44	(0.12)		0.904
Fit between IS and organization	3.53	3.60	(0.38)		0.704
Existing applications	3.50	3.44	0.37		0.715
IS/IT potential	3.33	3.66	(1.98)	●	0.049
IS/IT for competitive advantage	3.78	3.97	(1.04)		0.295
Privacy issues (re: databases)	3.97	3.46	2.63	●●	9.4E-3
Technical skills					
Programming	1.78	1.40	3.15	●●	1.94E-3
Use of software package(s)	3.59	3.53	0.36		0.70
Model building	2.67	2.61	0.34		0.70
Model application	2.63	2.46	0.88		0.38
Data access	3.86	3.80	0.29		0.77
Database development	2.34	1.84	3.05	●●	2.68E-3
Data communication	2.95	2.10	4.61	●●	8.06E-6
IS Product					
Use of specific application systems	3.56	3.78	(1.05)		0.30
Use of office automation products	3.50	3.67	(0.90)		0.36
Use of operating system(s)	3.28	2.17	6.02	●●	1.1E-8
Preparation of documentation	3.22	3.25	(0.16)		0.87
Use/understand documentation	3.32	3.59	(1.77)	o	0.07
IS evaluation and maintenance	3.39	2.87	2.45	●	0.015

o = reject H_0 at the 90% confidence level (i.e. $p < 0.1$)
● = reject H_0 at the 95% confidence level (i.e. $p < 0.05$)
●● = reject H_0 at the 99% confidence level (i.e. $p < 0.01$)

Table B-5 The perceived usefulness of the various areas of knowledge and skill for End User Personnel.

Here IS perceptions of usefulness for end users are compared with end user perceptions of usefulness for themselves. The test procedure is Mann-Whitney.

H_0 is that the expected rank values are equal.

Area of knowledge/skill	EU	IS	Z	reject H_0?	p
Organizational knowledge					
Organizational goals and objectives	87.4	81.1	(0.90)		0.366
Primary organizational functions	91.0	78.8	(1.74)	o	0.083
Critical success factors	91.7	78.3	(1.91)	o	0.057
Environmental constraints	76.2	88.1	1.62		0.104
Organizational skills					
Interpersonal communication	78.1	86.9	1.32		0.188
Interpersonal behaviour	94.0	76.9	(2.33)	●	0.020
Group dynamics	94.8	76.3	(2.50)	●	0.012
Project management	90.4	79.1	(1.51)		0.130
Organizational unit					
Work unit objectives					
Work unit problems	*These items are not directly comparable.*				
Links with other work units					
General IS knowledge					
IS policies and plans	82.4	84.1	0.23		0.822
Fit between IS and organization	82.1	84.3	0.29		0.773
Existing applications	84.8	82.7	(0.28)		0.776
IS/IT potential	72.7	90.3	2.39	●	0.017
IS/IT for competitive advantage	78.0	86.9	1.21		0.224
Privacy issues (re: databases)	95.7	75.8	(2.69)	●●	7.2E-3
Technical skills					
Programming	93.1	77.5	(2.33)	●	0.020
Use of software package(s)	86.0	81.9	(0.56)		0.579
Model building	85.1	82.5	(0.35)		0.729
Model application	87.8	80.8	(0.93)		0.352
Data access	84.4	82.9	(0.20)		0.844
Database development	96.5	75.4	(2.90)	●●	3.7E-3
Data communication	103.5	70.9	(4.39)	●●	1.1E-5
IS Product					
Use of specific application systems	78.3	86.8	1.16		0.247
Use of office automation products	78.8	86.4	1.03		0.305
Use of operating system(s)	107.8	68.2	(5.32)	●●	1E-7
Preparation of documentation	81.9	84.5	0.34		0.735
Use/understand documentation	75.7	88.4	1.76	o	0.079
IS evaluation and maintenance	94.9	76.3	(2.47)	●	0.013

o = reject H_0 at the 90% confidence level (i.e. $p < 0.1$)

● = reject H_0 at the 95% confidence level (i.e. $p < 0.05$)

●● = reject H_0 at the 99% confidence level (i.e. $p < 0.01$)

Table B-6 The perceived usefulness of the various areas of knowledge and skill for End User Personnel.

Here IS perceptions of usefulness for end users are compared with end user perceptions of usefulness for themselves.

Table B-6-1 : Factor averages reported by end users themselves

Factor name	Factor Mean
Organizational knowledge	4.25
Organizational skills	3.99
General IS knowledge	3.59
IS Product	3.38
Technical skills	2.83

Table B-6-2 : Factor averages reported by IS personnel

Factor name	Factor Mean
Organizational knowledge	4.13
Organizational skills	3.76
General IS knowledge	3.59
IS Product	3.22
Technical skills	2.54

Table B-8 Intercorrelations between demographic variables and the six aggregate deficiency constructs.

Table B-8 investigates possible relationships between the demographic characteristics of IS personnel (age, level of education, etc.) and their perceptions of end user deficiencies.

The correlation coefficients are Spearman Rank Order correlations.

	Age	Years in curr. dept	Years in Org.	level of education	Org. level
Organizational knowledge	(0.007)	(0.085)	(0.016)	0.135	(0.045)
Organizational skills	0.063	0.131	0.185	0.103	(0.194)
Organizational unit	(0.028)	(0.132)	(0.174)	0.022	(0.083)
General IS knowledge	(0.0003)	(0.111)	(0.077)	0.085	(0.067)
Technical skills	0.077	0.018	0.085	0.084	(0.062)
IS Product	0.102	0.011	0.055	0.175	(0.167)

- • Correlation is significant at the 95% confidence level ($p < 0.05$)
- •• Correlation is significant at the 99% confidence level ($p < 0.01$)

Note: No significant correlations were found between the various demographic variables and the deficiency constructs. Moreover even the largest coefficient (0.194) is so small as to be regarded as bordering on the trivial (see Jaeger : 1990 : p223).

Table B-9 Intercorrelations between degree of computer-related training (by source) and the six aggregate deficiency constructs.

Table B-9 investigates possible relationships between the amount of training that IS personnel received from various sources and their perceptions of deficiencies on the part of end users.

Spearman Rank Correlations

	Self Training	Tert. inst Training	Company Training	Vendor Training	Other Training
Organizational knowledge	0.130	0.111	(0.135)	(0.077)	(0.028)
Organizational skills	(0.028)	(0.055)	0.107	(0.135)	(0.072)
Organizational unit	(0.025)	0.043	(0.067)	(0.155)	0.002
General IS knowledge	0.063	0.095	(0.158)	(0.048)	(0.013)
Technical skills	0.040	(0.023)	(0.090)	(0.117)	(0.094)
IS Product	(0.063)	0.169	0.018	0.065	(0.093)

- • Correlation is significant at the 95% confidence level ($p < 0.05$)
- •• Correlation is significant at the 99% confidence level ($p < 0.01$)

Note: No significant correlations were found between the various training variables and the deficiency constructs.

Table B-9 Intercorrelations between degree of computer-related training (by source) and the six aggregate deficiency constructs.

Table B-9 investigates possible relationships between the amount of training that IS personnel received from various sources and their perceptions of deficiencies on the part of end users.

Spearman Rank Correlations

	Self Training	Tert. inst Training	Company Training	Vendor Training	Other Training
Organizational knowledge	0.130	0.111	(0.135)	(0.077)	(0.028)
Organizational skills	(0.028)	(0.055)	0.107	(0.135)	(0.072)
Organizational unit	(0.025)	0.043	(0.067)	(0.155)	0.002
General IS knowledge	0.063	0.095	(0.158)	(0.048)	(0.013)
Technical skills	0.040	(0.023)	(0.090)	(0.117)	(0.094)
IS Product	(0.063)	0.169	0.018	0.065	(0.093)

- • Correlation is significant at the 95% confidence level ($p < 0.05$)
- •• Correlation is significant at the 99% confidence level ($p < 0.01$)

Note: No significant correlations were found between the various training variables and the deficiency constructs.

Table B-10 Intercorrelations among the variables of training (by source), overall satisfaction with IS/IT, and hours per day spent using IT.

Table B-10 explores the relationships between the amount of training IS personnel receive from various sources and their overall level of satisfaction with the IS/IT that they use.

Spearman Rank Order correlations.

	Self Training	Tert. inst Training	Company Training	Vendor Training	Other Training	Satisf. with IS/IT	Hrs/day use IT
Self Training							
Tert. inst Training	(0.103)						
Company Training	(0.051)	(0.092)					
Vendor Training	0.086	0.114	0.015				
Other Training	0.174	0.127	(0.043)	0.167			
Satisf. with IS/IT	0.043	(0.086)	0.502●●	0.120	0.076		
Hrs/day use IT	0.233●	0.013	0.007	(0.005)	(0.026)	0.038	

- ● Correlation is significant at the 95% confidence level ($p < 0.05$)
- ●● Correlation is significant at the 99% confidence level ($p < 0.01$)

Note: The correlation between *overall satisfaction with IS/IT* and *company training* is in fact highly significant ($p < 0.0001$), and not merely significant at the 99% level.

Table B-11 Correlations between usefulness and proficiency.

Spearman Rank correlation coefficients

Factor name	Coefficient	p
Organizational knowledge	0.40	0.0001
Organizational skill	0.13	0.197
Organizational unit	0.37	0.0002
General IS knowledge	0.16	0.103
Technical skills	0.46	0.0000
IS product	0.25	0.012

Appendix C
Perceptions of Information Systems Personnel

This appendix gathers together all of the tables of results that pertain to end user perceptions of IS personnel (and which are not included in the body of the thesis). The tables contained in this appendix are listed below.

Table	Description
C-1	End users' perception of item characteristics for IS personnel . Means and standard deviations for usefulness, proficiency, and deficiency.
C-2	Deficiency rankings of items for IS personnel (as perceived by end users).
C-3	Rankings of item usefulness to IS personnel . Two tables one showing usefulness as ranked for IS personnel by end users and another by IS personnel themselves.
C-4	Differences in perceived usefulness of items. Parametric statistics using Student's *t*-test.
C-5	Differences in perceived usefulness of items. Nonparametric statistics using Mann-Whitney.
C-6	Summary tables showing factor averages for perceived usefulness.
C-7	Table showing what percentage of a rated deficiency is ascribable to a difference in perceived usefulness between end user and IS personnel.
C-8	Spearman Rank Correlations of end user demographic variables with factor averages of deficiencies.
C-9	Spearman Rank Correlations of end user training (by source) with factor averages of deficiencies.
C-10	Spearman Rank Correlations of end user training (by source) with overall satisfaction with IS/IT.
C-11	Spearman Rank Correlations of mean usefulness scores with mean proficiency scores.

Table C-1 : End user perceptions of IS personnel : Item characteristics

Area of knowledge/skill	Usefulness Mean	Usefulness S.D.	Proficiency Mean	Proficiency S.D.	Deficiency Mean	Deficiency S.D.
Organizational knowledge	**4.09**	**0.73**	**3.28**	**0.62**	**0.81**	**0.82**
Organizational goals and objectives	4.25	0.94	3.44	0.85	0.81	0.98
Primary organizational functions	4.41	0.86	3.53	0.68	0.88	0.88
Critical success factors	4.25	0.94	3.31	0.83	0.94	1.07
Environmental constraints	3.45	1.03	2.84	0.91	0.61	1.25
Organizational skills	**4.27**	**0.62**	**3.41**	**0.77**	**0.87**	**0.93**
Interpersonal communication	4.48	0.77	3.42	1.03	1.06	1.09
Interpersonal behaviour	3.83	0.99	3.17	0.91	0.66	1.29
Group dynamics	4.25	0.94	3.56	0.86	0.69	1.18
Project management	4.53	0.66	3.47	0.92	1.06	1.09
Organizational unit	**3.90**	**0.80**	**2.99**	**0.99**	**0.90**	**1.13**
Work unit objectives	4.00	0.81	3.06	1.18	0.94	1.13
Work unit problems	3.84	1.00	2.81	1.09	1.03	1.35
Links with other work units	3.84	1.05	3.11	1.02	0.73	1.44
General IS knowledge	**4.61**	**0.42**	**3.52**	**0.65**	**1.09**	**0.62**
IS policies and plans	4.80	0.64	3.81	0.73	0.98	0.84
Fit between IS and organization	4.48	0.68	3.16	0.79	1.33	0.97
Existing applications	4.63	0.60	3.70	0.91	0.92	0.92
IS/IT potential	4.66	0.57	3.42	0.93	1.23	1.10
IS/IT for competitive advantage	4.48	0.68	3.30	0.93	1.19	1.06
Privacy issues (re: databases)	4.59	0.84	3.72	1.07	0.88	1.05
Technical skills	**4.31**	**0.50**	**3.58**	**0.64**	**0.72**	**0.64**
Programming	4.75	0.66	3.94	1.10	0.81	1.07
Use of software package(s)	3.91	1.09	3.39	1.11	0.52	1.10
Model building	4.05	1.08	3.14	1.04	0.91	1.09
Model application	3.86	1.03	3.13	0.89	0.73	1.18
Data access	4.30	0.98	3.95	0.84	0.34	1.19
Database development	4.59	0.72	3.75	0.94	0.84	1.03
Data communication	4.69	0.56	3.80	0.81	0.89	0.97
IS Product	**4.34**	**0.51**	**3.62**	**0.69**	**0.72**	**0.71**
Use of specific application systems	4.31	0.85	3.89	0.77	0.42	0.92
Use of office automation products	3.69	1.00	3.30	1.10	0.39	0.99
Use of operating system(s)	4.50	0.79	3.97	0.98	0.53	1.10
Preparation of documentation	4.58	0.79	3.25	1.00	1.33	1.24
Use/understand documentation	4.36	0.60	3.70	0.82	0.66	1.05
IS evaluation and maintenance	4.59	0.63	3.59	0.96	1.00	1.13

* Deficiency = Usefulness - Proficiency

Table C-2 Deficiency rankings for IS personnel (as perceived by end users)

Rank	Item	Mean
1	Fit between IS and organisation	1.33
2	Preparation of documentation	1.33
3	IS/IT potential	1.23
4	IS/IT for competitive advantage	1.19
5	Interpersonal communication	1.06
6	Project management	1.06
7	Work unit problems	1.03
8	IS evaluation and maintenance	1.00
9	IS policies and plans	0.98
10	Critical success factors	0.94
11	Work unit objectives	0.94
12	Existing applications	0.92
13	Model building	0.91
14	Data communication	0.89
15	Primary organizational functions	0.88
16	Privacy issues (re: databases)	0.88
17	Database development	0.84
18	Organizational goals and objectives	0.81
19	Programming	0.81
20	Links with other work units	0.73
21	Model application	0.73
22	Group dynamics	0.69
23	Interpersonal behaviour	0.66
24	Use/understand documentation	0.66
25	Environmental constraints	0.61
26	Use of operating systems(s)	0.53
27	Use of software packages	0.52
28	Use of specific application systems	0.42
29	Use of office automation products	0.39
30	Data access	0.34

Table C-3 Item usefulness for IS personnel, as ranked by end users and IS personnel themselves.

Table C-3-1 : As ranked by end users

Rank	Item	Mean
1	IS policies and plans	4.80
2	Programming	4.75
3	Data communication	4.69
4	IS/IT potential	4.66
5	Existing applications	4.63
6	Privacy issues (re: databases)	4.59
7	Database development	4.59
8	IS evaluation and maintenance	4.59
9	Preparation of documentation	4.58
10	Project management	4.53
11	Use of operating system(s)	4.50
12	Interpersonal communication	4.48
13	Fit between IS and organization	4.48
14	IS/IT for competitive advantage	4.48
15	Primary organizational functions	4.41
16	Use/understand documentation	4.36
17	Use of specific application systems	4.31
18	Data access	4.30
19	Organizational goals and objectives	4.25
20	Critical success factors	4.25
21	Group dynamics	4.25
22	Model building	4.05
23	Work unit objectives	4.00
24	Use of software package(s)	3.91
25	Model application	3.86
26	Work unit problems	3.84
27	Links with other work units	3.84
28	Interpersonal behaviour	3.83
29	Use of office automation products	3.69
30	Environmental constraints	3.45

Table C-3-2 : As ranked by IS

Rank	Item	Mean
1	IS policies and plans	4.81
2	Interpersonal communication	4.72
3	IS evaluation and maintenance	4.56
4	Existing applications	4.53
5	Data access	4.47
6	Group dynamics	4.46
7	Work unit objectives	4.43
8	Fit between IS and organization	4.43
9	Use of operating system(s)	4.37
10	Preparation of documentation	4.36
11	IS/IT potential	4.35
12	Critical success factors	4.32
13	Privacy issues (re: databases)	4.32
14	Project management	4.29
15	Work unit problems	4.25
16	IS/IT for competitive advantage	4.23
17	Primary organizational functions	4.22
18	Programming	4.22
19	Links with other work units	4.20
20	Organizational goals and objectives	4.17
21	Interpersonal behaviour	4.17
22	Database development	4.15
23	Use/understand documentation	4.15
24	Data communication	4.08
25	Use of specific application systems	4.01
26	Model building	3.91
27	Model application	3.61
28	Environmental constraints	3.54
29	Use of software package(s)	3.42
30	Use of office automation products	3.41

Table C-4 The perceived usefulness of the various areas of knowledge and skill for IS Personnel.

Here end user perceptions of item usefulness for IS personnel are compared with IS personnel perceptions of item usefulness for themselves. The test statistic is Student's t.

H_0 is that the averages are equal.

Area of knowledge/skill	EU	IS	"t"	reject H_0?	p
Organizational knowledge					
Organizational goals and objectives	4.25	4.17	0.61		0.542
Primary organizational functions	4.41	4.22	1.51		0.133
Critical success factors	4.25	4.32	(0.57)		0.571
Environmental constraints	3.45	3.54	(0.57)		0.570
Organizational skills					
Interpersonal communication	4.48	4.72	(2.31)	•	0.022
Interpersonal behaviour	3.83	4.17	(2.26)	•	0.025
Group dynamics	4.25	4.46	(1.60)		0.111
Project management	4.53	4.29	1.93	o	0.055
Organizational unit					
Work unit objectives					
Work unit problems	*These items are not directly comparable.*				
Links with other work units					
General IS knowledge					
IS policies and plans	4.80	4.81	(0.20)		0.838
Fit between IS and organization	4.48	4.43	(0.47)		0.637
Existing applications	4.63	4.53	(0.96)		0.340
IS/IT potential	4.66	4.36	2.66	••	8.5E-3
IS/IT for competitive advantage	4.48	4.23	2.15	•	0.033
Privacy issues (re: databases)	4.59	4.32	2.02	•	0.045
Technical skills					
Programming	4.75	4.22	3.75	••	2.49E-4
Use of software package(s)	3.91	3.42	2.90	••	4.26E-3
Model building	4.05	3.91	0.75		0.456
Model application	3.86	3.61	1.40		0.163
Data access	4.30	4.47	(1.18)		0.241
Database development	4.59	4.15	3.01	••	3.05E-3
Data communication	4.69	4.08	4.48	••	1.39E-5
IS Product					
Use of specific application systems	4.31	4.01	2.09	•	0.03
Use of office automation products	3.69	3.41	1.61		0.109
Use of operating system(s)	4.50	4.37	0.91		0.367
Preparation of documentation	4.57	4.36	1.61		0.108
Use/understand documentation	4.36	4.15	1.99	•	0.048
IS evaluation and maintenance	4.59	4.56	0.31		0.755

o = reject H_0 at the 90% confidence level (i.e. $p < 0.1$)
• = reject H_0 at the 95% confidence level (i.e. $p < 0.05$)
•• = reject H_0 at the 99% confidence level (i.e. $p < 0.01$)

Table C-5 The perceived usefulness of the various areas of knowledge and skill for End User Personnel.

Here IS perceptions of usefulness for end users are compared with end user perceptions of usefulness for themselves. The test procedure is Mann-Whitney.

H_0 is that the expected rank values are equal.

Area of knowledge/skill	EU	IS	Z	reject H_0?	p
Organizational knowledge					
Organizational goals and objectives	88.5	80.4	(1.14)		0.255
Primary organizational functions	93.0	77.5	(2.22)	●	0.027
Critical success factors	83.9	83.2	(0.10)		0.923
Environmental constraints	80.2	85.5	0.73		0.465
Organizational skills					
Interpersonal communication	76.5	87.9	1.86	o	0.063
Interpersonal behaviour	73.4	89.9	2.28	●	0.023
Group dynamics	78.0	87.0	1.30		0.192
Project management	90.9	78.9	(1.75)	o	0.081
Organizational unit					
Work unit objectives					
Work unit problems	*These items are not directly comparable.*				
Links with other work units					
General IS knowledge					
IS policies and plans	85.7	82.1	(0.76)		0.449
Fit between IS and organization	85.5	82.3	(0.47)		0.639
Existing applications	87.6	81.0	(1.02)		0.309
IS/IT potential	93.7	77.1	(2.47)	●	0.014
IS/IT for competitive advantage	92.6	77.8	(2.11)	●	0.035
Privacy issues (re: databases)	95.1	76.2	(2.83)	●●	4.5E-3
Technical skills					
Programming	99.5	73.5	(3.99)	●●	6.6E-5
Use of software package(s)	96.5	75.3	(2.86)	●●	4.2E-3
Model building	86.7	81.4	(0.72)		0.471
Model application	89.1	80.0	(1.25)		0.211
Data access	78.3	86.8	1.31		0.192
Database development	96.0	75.7	(2.98)	●●	2.9E-3
Data communication	101.1	72.4	(4.20)	●●	3.2E-5
IS Product					
Use of specific application systems	92.7	77.8	(2.08)	●	0.037
Use of office automation products	90.5	79.1	(1.54)		0.125
Use of operating system(s)	86.8	81.5	(0.80)		0.426
Preparation of documentation	90.7	79.0	(1.78)	o	0.075
Use/understand documentation	91.5	78.5	(1.91)	o	0.057
IS evaluation and maintenance	83.8	83.3	(0.08)		0.934

o = reject H_0 at the 90% confidence level (i.e. $p < 0.1$)

● = reject H_0 at the 95% confidence level (i.e. $p < 0.05$)

●● = reject H_0 at the 99% confidence level (i.e. $p < 0.01$)

Table C-6 The perceived usefulness of the various areas of knowledge and skill for IS Personnel.

Here end user perceptions of factor usefulness for IS personnel are compared with IS perceptions of factor usefulness for themselves.

Table C-6-1 : Factor averages reported by IS personnel themselves

Factor name	Factor Mean
General IS knowledge	4.45
Organizational skills	4.41
IS Product	4.14
Organizational knowledge	4.06
Technical skills	3.98

Table C-6-2 : Factor averages reported by end users.

Factor name	Factor Mean
General IS knowledge	4.61
IS Product	4.34
Technical skills	4.31
Organizational skills	4.27
Organizational knowledge	4.09

Table C-8 Intercorrelations between demographic variables and the six aggregate deficiency constructs.

Table C-8 investigates possible relationships between the demographic characteristics of end users (age, level of education, etc.) and their perceptions of IS personnel deficiencies.

The correlation coefficients are Spearman Rank Order correlations.

	Age	Years in curr. dept	Years in Org.	level of education	Org. level
Organizational knowledge	(0.129)	(0.128)	(0.162)	0.091	(0.041)
Organizational skills	(0.122)	(0.186)	(0.239)	0.132	(0.187)
Organizational unit	(0.098)	(0.152)	(0.163)	0.090	(0.108)
General IS knowledge	(0.223)	(0.202)	(0.157)	0.171	0.031
Technical skills	(0.148)	(0.098)	(0.127)	0.055	0.102
IS Product	(0.084)	(0.180)	(0.153)	0.192	0.091

- ● Correlation is significant at the 95% confidence level ($p < 0.05$)
- ●● Correlation is significant at the 99% confidence level ($p < 0.01$)

Note: No significant correlations were found between the various demographic variables and the deficiency constructs.

Table C-9 Intercorrelations between degree of computer-related training (by source) and the six aggregate deficiency constructs.

Table C-9 investigates possible relationships between the amount of training that end users received from various sources and their perceptions of deficiencies on the part of IS personnel.

Spearman Rank Correlations

	Self Training	Tert. inst Training	Company Training	Vendor Training	Other Training
Organizational knowledge	(0.013)	(0.077)	(0.330)●●	(0.216)	(0.014)
Organizational skills	0.121	0.144	(0.430)●●	(0.236)	(0.053)
Organizational unit	0.191	0.219	(0.116)	(0.016)	(0.060)
General IS knowledge	0.111	0.196	(0.227)	(0.143)	(0.220)
Technical skills	(0.032)	0.009	(0.142)	(0.144)	(0.067)
IS Product	0.047	0.026	(0.254)●	(0.019)	(0.003)

- ● Correlation is significant at the 95% confidence level ($p < 0.05$)
- ●● Correlation is significant at the 99% confidence level ($p < 0.01$)

Note: The moderate negative correlation between the amount of *company training* end users received and their perceptions of *IS deficiencies in organizational skills* is in fact highly significant ($p = 0.0006$), and not merely significant at the 99% level.

Table C-10 Intercorrelations among the variables of training (by source), overall satisfaction with IS/IT, and hours per day spent using IT.

Table C-10 explores the relationships between the amount of training end user personnel receive from various sources and their overall level of satisfaction with the IS/IT that they use.

Spearman Rank Correlations

	Self Training	Tert. inst Training	Company Training	Vendor Training	Other Training	Satisf. with IS/IT	Hrs/day use IT
Self Training							
Tert. inst Training	0.333●●						
Company Training	0.032	0.142					
Vendor Training	0.011	0.350	0.396●●				
Other Training	(0.096)	0.005	0.144	0.294●			
Satisf. with IS/IT	0.130	0.219	0.459●●	0.233	0.075		
Hrs/day use IT	0.298●	0.198	0.086	0.086	0.028	0.062	

● Correlation is significant at the 95% confidence level ($p < 0.05$)

●● Correlation is significant at the 99% confidence level ($p < 0.01$)

Note: The correlation between *overall satisfaction with IS/IT* and *company training* is in fact highly significant ($p = 0.0003$), and not merely significant at the 99% level.

Table C-11 Correlations between usefulness and proficiency.

Spearman Rank correlation coefficients

Factor name	Coefficient	p
Organizational knowledge	0.14	0.264
Organizational skill	0.005	0.970
Organizational unit	0.16	0.218
General IS knowledge	0.34	0.008
Technical skills	0.40	0.002
IS product	0.35	0.006