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THE THINKING STYLES OF IT  
STUDENTS AND PRACTITIONERS

by

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## ABSTRACT

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IT expenditures and organizational performance have been disconnected in the past due to an economic transition from an era of competitive advantage on information, to one based on knowledge creation. The earlier era was characterized by slow change that could not be interpreted by most formal information systems (Lubbe, 1997). IT managers therefore need to develop a greater appreciation of their intangible human assets such as knowledge and inquiring styles. In other words, an investigation into knowledge creation rather than Knowledge Management needs to be undertaken (Lundin *et al.*, 2000). According to IT managers, attention should be paid to the human aspects of knowledge creation in current formulations of IT enabled knowledge management (Lundin *et al.*, 2000). This research therefore provides guidelines in overcoming the challenges of miscommunication and misunderstanding of IT people in knowledge creation and management. This research is structured in such a way that students and professionals as well as marketers and IT personnel can use it. This study has been conducted at the University of KwaZulu-Natal (Westville Campus), in the School of Information Systems and Technology. The population included all students studying Information Systems and Technology. The population for the Information Systems and Technology practitioners has been selected from the University of KwaZulu-Natal's School of Information Systems and Technology department.

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## DECLARATION

I, Rikesh Harypursat hereby declare that the contents of this dissertation is based on my own research and that the contents thereof has not been submitted to this or any other institution of higher education for the purpose of earning a qualification.

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Rikesh Harypursat

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Date

## CORE CONCEPTS USED IN THIS STUDY

- **Metaknowledge Management** is judicious or strategic management or leveraging of the different ways in which we come ‘to know’ so that we respond to situations appropriately.
- **Knowledge Management** is the explicit and systematic management of vital knowledge and its associated processes of creating, gathering, organizing, diffusion, use and exploitation.
- **Tacit Knowledge** is highly processed information gained after years of experience; hence known as personal knowledge.
- **Explicit Knowledge** can be easily described and specific enough to be documented and applied
- **Inquiring Modes** are basic sets of purposive methods for making sense of the world. They are built on early-acquired preferences, learned values and concepts about the world and the nature of reality.

## *Chapter One*

### **INTRODUCTION TO THE THINKING STYLES IN IT**

#### **1.1 Introduction**

According to Kienholz (2000) a solid understanding and appreciation of the different preferences that people hold for each of Churchman's inquiring systems (that is, Synthesist, Idealist, Pragmatist, Analyst and Realist thinking styles) can lead to improvements in the design of information and Knowledge Management systems. He adds that through metaknowledge management, individuals, groups and organizations can leverage their knowledge assets and collective wisdom to increase innovation and responsiveness for ethically and aesthetically based effectiveness, better than they could through IT enabled knowledge management.

Harrison and Bramson (1984) state that problem solving, a crucial aspect of how one thinks about one's environment, is an integral part of any job in the real world. Understanding the process of thinking is an essential part of problem solving. People do not think in the same way and by understanding and utilizing the different modes of thinking of different team members, the potential power of the team in solving a problem increases as more experiences and perspectives are understood.

This chapter therefore discusses the need for research about such thinking styles in the IT industry. With the rapid pace of IT development world wide, this study also looks at the contributions of this research to the IT industry. A problem statement is identified and the layout of the research is outlined together with some insight into what it entails. A brief overview of the aims of the research and methodology are also discussed.

## 1.2 The need for Thinking Styles in IT

IT expenditures and organizational performance have been disconnected in the past due to an economic transition from an era of competitive advantage on information, to one based on knowledge creation. In the early 1900s, competitive advantage on information was characterized by slow change that could not be interpreted by most formal information systems (Lubbe, 1997). During this period, information systems were based on programmable recipes for success that were able to deliver their promises of efficiency based on their belief for the given business contexts (Lundin *et al.*, 2000).

IT managers need to develop a greater appreciation for their intangible human assets such as knowledge and inquiring styles. In other words, an investigation into knowledge creation needs to be done rather than knowledge management (Lundin *et al.*, 2000). According to Lundin *et al.* (2000), attention should be paid to the human aspects of knowledge creation in current formulations of IT enabled knowledge management.

Harrison and Bramson (1984) argue that in order to create knowledge, one must possess problem-solving skills. Understanding the process of thinking is an essential part of problem solving. All people do not think the same way, therefore understanding the different methods of thinking can be useful in the knowledge creation process. Understanding a person's thinking ability is important, as it will enable the individual to improve his communication skills and influence others. It also helps to express ideas in such a manner that the recipient will be able to relate to them since it is expressed to them in a way that more closely meets his thinking styles (Harrison and Bramson, 1984).

Malholtra (1997) suggests that an inquiring systems approach be adopted to facilitate successful Information Systems and Technology projects, which is responsive to

change. This study tests this approach with reference to students and professionals in the field of Information Systems and Technology.

### **1.3 The envisaged contribution of this study to IT**

Within a few years from now, experienced managers and graduates, alike, will face a work environment where metaknowledge management will form an indispensable part of daily business. No business training will be complete without introducing students and professionals to the basics of metaknowledge management. Metaknowledge management deals with the manner in which we become aware of situations and how we respond to it, hence by learning to distinguish and choose the right style of thinking can enhance students and professionals, to achieve their goals and avoid making errors (Harrison and Bramson, 1984).

Research conducted by Lubbe and Pather (2002) indicates that business failure of web, Internet marketing and e-commerce cannot be ascribed primarily to IT people and web designers, but to a lack of metaknowledge management understanding. The development of e-commerce has also brought with it a totally new mindset and requires managers to rethink old approaches due to the accompanying principles of the new economy. Moreover, the pace of change is increasing and necessitates a special course to prepare students for their new roles. Students and professionals can thus adapt to change by understanding the different thinking styles and responding to situations appropriately (Harrison and Bramson, 1984). This research therefore attempts to provide guidelines for IT practitioners and students in overcoming communication challenges in knowledge creation and management. It is structured in such a way that students and professionals, marketers and IT staff can use it.

### **1.4 Problem Statement**

Harrison and Bramson (1984) note that there are misunderstandings and miscommunication that develop from the fact that individuals who used one style of thinking typically assumed that all other people used their own thinking styles. This

assumption produces much intolerance, impatience, abuse, frustration and inefficiency in the communication relationships formed between individuals.

Hence, this study focuses on the miscommunications and misunderstandings between individuals, in determining the way in which one gathers, acquires and shares information and how the whole field of knowledge acquisition, creation, sharing and management can be better informed through an inquiring systems approach.

## **1.5 Layout of the Research**

Chapter Two presents the literature review, which focuses on the characteristics of and the differences between the five thinking styles. The usefulness of the Inquiring Systems Approach and the strengths and weaknesses of each style of thinking is also defined. This chapter also identifies previous research conducted on the thinking styles in academia, with particular attention to IT students and the characteristics of IT practitioners. Past statistics collated by other researchers who have used the Inquiring Mode Questionnaire, is also discussed.

Chapter Three examines the research methodology and the research philosophy, which underpin this dissertation. The discussion also revolves around the aims of this research, the reasons why this research is important, the research design and the differences between quantitative and qualitative data. The measuring instrument as well as the sampling method and data collection method is also discussed. The data capturing method and analysis conclude this chapter.

Chapter Four discusses the data analysis and the findings. It also discusses the choice of research participants and the question of confidentiality within the research domain.

The final chapter concludes the research by answering the research questions in chapter two, section 2.12, and provides some recommendations and guidelines from the study.

## **1.6 Conclusion**

According to Harrison and Bramson (1984), an understanding of thinking styles will enhance effective communication among workers. This chapter therefore highlights the need for the different types of thinking styles in IT and their importance in improving effective communication among workers. This would be favourable in enabling workers/employees to achieve their individual and company goals.

The next chapter reviews the literature and research available on Thinking Styles and their roles in IT. It also discusses some recent research in the use of the questionnaire adopted for this study, as well as the uses of the five thinking styles. This chapter introduced Knowledge Management and renders an explanation of how the five Thinking Styles contribute to its development.

## *Chapter Two*

### **REVIEW OF THE LITERATURE**

#### **2.1 Introduction**

This chapter discusses the different types of thinking styles and the differences between each of them. The impact of the thinking styles on Knowledge Management, and IT students and practitioners are also examined. Past research on the Inquiring Mode Questionnaire and the strengths and weaknesses of thinking styles are also explained.

#### **2.2 Themes to be investigated**

The author has identified 9 themes from the research which are as follows:

1. Characteristics of the five thinking styles
2. Differences between the thinking styles
3. The usefulness of the Inquiring Systems Approach
4. Strengths and weaknesses of the Thinking Styles
5. Available statistics on the Inquiring Mode Questionnaire
6. The impact of Thinking Styles in academia
7. Definition of Knowledge Management
8. The Inquiring Systems Approach applied to Knowledge Management
9. Characteristics of IT practitioners

#### **2.3 Characteristics of the Five Inquiring Systems**

##### **2.3.1 The Five thinking styles**

Harrison and Bramson (1984) state that the technical name for thinking styles is Inquiring Modes. They define Inquiring Modes as basic sets of purposive methods

for making sense of the world. These are built on early-acquired preferences, learned values and concepts about the world and the nature of reality.

Harrison and Bramson (1984) have detected five distinct thinking styles in Western society. Most people have shown a preference for one or two of the styles. These researchers have consequently devised a test called the “InQ” which, when taken, will rate a preference for the different thinking styles. The five thinking styles comprise the Synthesist, the Idealist, the Pragmatist, the Analyst and the Realist. This study therefore concentrates on the text by Harrison and Bramson (1984) who were cited twelve times by other authors on this specific work. This has been determined through an internet search conducted by Ms Petro Coreejas Roberts of Cape Technikon on 26 February 2004. This study has been selected because the ideas in their book are based on years of research into people’s thinking patterns. Giving due consideration to thinking styles will improve individuals’ ability to communicate and improve their problem solving skills as IT students, academics or practitioners.

Kienholz (1999) argues that an effective means to leverage knowledge is for those involved to be mindful of the various ways people actually gather data, ask questions, solve problems and make decisions. This is where Harrison and Bramson’s Inquiring Mode Questionnaire (InQ) and their related education materials can be useful (Kienholz, 1999).

### **2.3.2. Definitions of thinking styles**

#### **2.3.2.1. The Synthesist**

According to Harrison and Bramson (1984), to “synthesize” means, essentially, to make something new and original out of things that by themselves seems different from each other. Hence, they note that Synthesists are integrators; they are likely to discover two or more things that no other people may appear to have little knowledge of or no relationship at all and find ways to fit them into a new, creative

combination. Facts to them are not as important as the inferences people make from them. They also found that Synthesists tend to be interested in conflict and also like change – often for their own sake. Synthesists tend to pride themselves on their “creativity,” incisiveness and often, secretively, on their cleverness (Harrison and Bramson, 1984: 11).

#### **2.3.2.2. The Idealist**

Harrison and Bramson (1984) take the view that the idealist mode of thinkers is people who prefer to take a broader view of things. Such people tend to be future-oriented. They are likely to think about goals and are also interested in social values. Idealists are like *Synthesists* in their focus on values rather than facts. Idealists like to be viewed by other people as useful, supportive, open and trustworthy. They tend to have a strong ethical sense and pride themselves on their high standards, though they are not always aware of just how high their standards are. They can become angry at and resentful of those who seem to care little for others, who lack integrity or who will settle for less than the best. The thought process of *Idealists* is receptive. In other words, they welcome diversity of views. With regard to solving problems, *Idealists* are at their best in situations where values, judgment, feeling and emotions are important. Idealists especially pride themselves on their “intuition” (Harrison and Bramson, 1984).

#### **2.3.2.3. The Pragmatist**

The motto of the Pragmatist is “Whatever works.” Pragmatists excel at finding new ways of doing things with the materials that lie at hand. They tend to approach problems in a piecemeal, incremental fashion. Pragmatists tend to be less predictable than people who prefer other thinking styles. Facts and values have equal weight for them. Again, the principle “whatever works” is important. They are also most likely to be interested in formulating strategies and tactics for getting things done and they often like to be liked, approved of, or at least accepted. The pragmatists’ approach is

flexible and they pride themselves in their adaptability (Harrison and Bramson, 1984).

#### **2.3.2.4. The Analyst**

The Analyst approaches problems in a careful, logical, methodical way, paying great attention to details. Analysts see themselves as factual, down-to-earth, practical people. They also tend to have a theory about almost everything. They analyze and judge things within a broad framework that will help to explain things and arrive at conclusions. Analysts see the world as logical, rational, ordered and predictable. More than anything else, *Analysts* want to be sure of things, to know what is going to happen next. They take pride in their competence, in the sense of understanding all the facets of whatever the situation in which they happen to be (Harrison and Bramson, 1984).

#### **2.3.2.5. The Realist**

The Realist's motto is: "facts are facts." Or maybe, "What you see is what you get." Realists firmly believe that any two intelligent people; properly equipped with eyes and other sense organs, will at once agree on the facts. Without agreement on the facts, the *Realist* believes, things do not get done. They also want to do things surely, soundly and firmly and be assured that once something is done, it will stay that way. The Realist always wants to get things done by proceeding on the facts that are at hand, rather than by gathering ever more data as Analysts do (Harrison and Bramson, 1984).

#### **2.3.3. Multiple thinking styles**

According to Harrison and Bramson (1984), no individual thinks with purely one style. Most people show preferences for a single style and some show equal preference for two styles. This section deals with the latter.

#### **2.3.3.1. Idealist-Analyst (I-A)**

The Idealist-Analyst is characterized by a broad, comprehensive view. They are careful, thoughtful people who want to achieve the ideal goal using the best method possible. They are unlikely to make quick decisions and possess a future-oriented, planned view of things (Harrison and Bramson, 1984).

#### **2.3.3.2. Analyst-Realist (A-R)**

The Analyst-Realist person is highly task-oriented and objective. Such a person prefers facts and structured approaches to problems. They are interested in finding the best methods for achieving concrete results. The A-R does not like situations that defy analysis and when confronted with such a situation, they tend to freeze or are unable to cope (Harrison and Bramson, 1984).

#### **2.3.3.3. Synthesist-Idealist (S-I)**

The Synthesist-Idealist thinking style is, in many ways, the exact opposite of the A-R. The S-I tends to focus on ideas and inferences rather than structure and facts. They are perceived as being conceptualisers and theorists by other individuals and therefore not very practical (Harrison and Bramson, 1984).

#### **2.3.3.4. Idealist-Realist (I-R)**

The Idealist-Realist is characterized by the twin thrust of high standards and concreteness. Such individuals know how things should be done and also have the skill set to execute them. They do not seek much recognition for their efforts (Harrison and Bramson, 1984).

#### **2.3.3.5. Pragmatist-Realist (P-R)**

The Pragmatist-Realist is highly task oriented but approaches things in a less structured manner than the A-R. This person tends to have considerable energy and drive and achieves things solely for the sake of achievement. Such individuals tend to make quick decisions with a minimal amount of data and, as a result, can quickly become overextended and may seem impulsive (Harrison and Bramson, 1984).

#### **2.3.3.6. Idealist-Pragmatist (I-P)**

The Idealist-Pragmatist combination is typical of someone who gains agreement on goals and then tolerates a great deal of latitude in method. They have a great concern for “people” issues and are more in tune with a person’s needs. As a leader, the I-P appears to be over permissive, allowing for much latitude (Harrison and Bramson, 1984).

#### **2.3.3.7. Analyst-Pragmatist (A-P)**

Although the Analyst-Pragmatist likes facts and structure, he/she is also willing to experiment. Such persons know what they want and how to get there but want to have fun along the way. This can be quite damaging in relationships due to the fact that serious goals and directions appear to be taken less seriously by the A-P (Harrison and Bramson, 1984).

#### **2.3.3.8. Analyst-Synthesist (A-S)**

The Analyst-Synthesist respects structure and logic. The Analyst style seems to be more dominant in this combination. Where the Analyst respects structure and logic, the Synthesist understands and values the opposite. This can be the source of great internal conflict and a profound lack of understanding by people around them. They can sometimes be very difficult to listen to, but have much to contribute (Harrison and Bramson, 1984).

#### **2.3.3.9. Synthesist-Pragmatist (S-P)**

The Synthesist-Pragmatist shows the greatest tolerance for change. They strive on ambiguity and uncertainty and have developed the coping mechanisms to deal with both. Their thinking style generates tremendous amount of creativity (Harrison and Bramson, 1984).

#### **2.3.3.10. Synthesist-Realist (S-R)**

The Synthesist-Realist is extremely rare due to the fact that the Synthesist and Realist are at the opposite ends of the thinking spectrum. The S-R is a person with great energy for unorthodox but firm achievement. They can clearly detect the proper course and also see that the opposite way is just as acceptable (Harrison and Bramson, 1984).

#### **2.3.3.11. Three Way Thinkers**

People who possess a strong preference for three of the five styles tend to be more creative. This flows from the idea that they have more thinking styles available to them. They are more versatile and can rely on the style that best suits an individual situation (Harrison and Bramson, 1984).

#### **2.3.3.12. Flat Profile**

The rarest of thinking style preferences is a person who shows no preference for any specific style. This is where the InQ test shows a relatively equal score for all five thinking styles. These people tend to be unpredictable, less intense and less recognizable than people with strong preference for other styles. They tend to be very adaptable to a situation but are unlikely to be leaders (Harrison and Bramson, 1984).

### **2.4 Differences between thinking styles**

Harrison and Bramson (1984) describe the differences between the thinking styles as:

- Idealists are like Synthesists in their focus on values rather than facts. The difference is that while Synthesists assume that no two persons will agree on the facts and therefore solutions to problems will come from creating something new to integrate opposing views; Idealists take quite a different approach. Idealists also understand that people differ but they like to believe that arguments and differences can be reconciled by emphasizing the

similarities that can be found even in opposing views. Unlike Synthesists, Idealists do not value and enjoy conflict.

- When it comes to problem solving, Idealists are at their best in situations where the values, judgments, feelings and emotions are important. Neither the Synthesist nor the Idealist approach is at its best when the problem is one that is well formulated, structured and can be calculated or put in mathematical terms.
- The Pragmatist is convinced that, in this world, things really do happen in a piecemeal way, one thing at a time. While the Analyst believes in predictability and the Idealist in a “grand design,” the pragmatist believes in nothing of the kind.
- The Realist is more closely related to the Analyst than to any other Style of Thinking. Both are factual oriented toward the objective and concrete, interested in an orderly and practical result.
- Both the Synthesist and the Realist tend to become easily impatient, especially with excessive analysis and rambling discussions.

The discussion above should provide some idea of what it entails to have preference for each of the thinking styles and how different people are in their approaches to problem solving and decision making.

## **2.5 The Usefulness of the Inquiring Systems Approach**

Harrison and Bramson (1984) claim that if one understands one’s own thinking style and that of others then one will be able to better understand how others think. They further state that this would improve one’s ability to communicate with and influence others. Understanding how others think will allow an individual to express

their ideas in such a manner that the recipient will be better able to relate to them, since the individual will express them in a way that will more closely meet others' thinking styles. Kienholz (1999) notes that the Inquiring Systems Approach is especially helpful in high knowledge fields where decisions are complex and diversity of approach is a recognised need.

According to Kienholz (2000), IT specialists can begin to apply their strengths most advantageously for "strategic thinking" when they come to "know themselves" in terms of how they think. Furthermore, since certain kinds of thinking can be more effective in dealing with a particular situation than others, this knowledge can also be used in matching people with projects and in forming dynamic teams.

DeLisi (2002) finds that the Inquiring Mode Questionnaire gives an indication of how people process information; something that IT professionals can easily relate to. He further states that this questionnaire avoids personality measurements such as introversion or extraversion, thereby avoiding the defensiveness that might result from a discussion of one's personality.

## **2.6 Strengths and Weaknesses of different Thinking Styles**

Harrison and Bramson (1984) hold the view that each thinking style has its strengths and weaknesses. The first step in using one's strengths is to understand and accept them.

If the individual, according to Harrison and Bramson (1984), is a **Synthesist** thinker, then one of his strengths is his tendency to look at a problem from many different perspectives. Such an individual usually arrives at some creative solutions because he enjoys conflict or being asked to offer solutions to the "unsolvable problem." Some of the limitations of the Synthesist is that he may seek conflict unnecessarily and try too hard for change and newness (Harrison and Bramson, 1984).

The **Idealist's** strength lies in setting goals and in a "coaching" style of leadership. This type of thinker works well in a more supportive and participatory style rather than a highly structured, hierarchical organization. The Idealist may delay from too many choices and try too hard for perfect solutions (Harrison and Bramson, 1984).

The **Pragmatist**, like the Synthesist, is a very resourceful and creative individual. These individuals are problem solvers and creators of solutions. Their solutions tend to be somewhat riskier than those of the Synthesist but are more innovative with a better payoff. Some of the disadvantages of being a Pragmatist is that he may rush too quickly to payoffs and may try too hard for expediency (Harrison and Bramson, 1984).

The **Analyst** is a specialist troubleshooter who thrives on detail. He does the best job possible with a task that requires a well thought out process and stepwise completion. Some of his faults is that he may over analyze and over plan. He can also be overly cautious and try too hard for predictability (Harrison and Bramson, 1984).

The **Realist** is someone who can provide a practical solution to a problem quickly. He has a very good grasp of a situation and reacts accordingly. The weakness of the Realist is that he may rush to oversimplified solutions and try too hard for consensus (Harrison and Bramson, 1984).

## **2.7 Previous applications of the Inquiring Mode Questionnaire**

Harrison and Bramson (1984) state that the most productive thinkers may simply be those who are capable of thinking well in all five dimensions. They further state that the styles of the Synthesist and Idealist are strongly oriented toward the "value" side of the dichotomy or substantive rationality while the approaches of the Analyst and Realist are clearly geared toward "facts" or formal, functional rationality. The

Pragmatist's contingent approach either bridges the gap between the two or perhaps ignores the question altogether.

Kienholz (1999) states that the Synthesist and Idealist's inquiring modes are substantive, value-oriented ways of thinking and knowing, while the Analyst and Realist are functional and fact oriented. He further states that about half of all people in his study preferred to think in one main way, 35% prefer two or more styles in combination.

Kienholz (2000) finds that a solid understanding and appreciation of the different preferences that people hold for each of the thinking styles can lead to an improvement in the design of information and Knowledge Management systems.

DeLisi (2002) has established from the results of his research that IT professionals are less likely than expected to employ an analytic thinking style and more likely to employ an idealist or pragmatist style.

Perpetuation of the stereotype that all IT professionals are analytical thinkers, as stated by DeLisi (2002), impacts on the role of IT professionals in the organisation in three ways:

- It limits their opportunities for job assignments that have strategic impact on the organisation,
- It limits their opportunities for promotion to the highest levels of the organisation,
- It affects their relationships with clients and senior executives.

These limitations subsequently affect the overall success of IT.

Before DeLisi (2002) administered the InQ questionnaire, the participants were asked which thinking style they believed will be most common among the sample

group. They stated almost universally that the analyst style will be most prevalent. This will tend to have a self-fulfilling effect; with IT professionals more likely to volunteer for activities that are detailed and analytical in nature rather than leadership positions that require a skill they do not perceive to possess. The contributions of these IT professionals are predominantly of an analytic nature that reinforces the stereotype and makes it less likely they will be involved in tasks that are truly significant to the enterprise. But a study conducted by DeLisi (2002) deduces that a large percentage of IT professionals tend to have idealist characteristics. Thus proving a contradiction to the stereotype.

Zhang (2002b) states that the thinking styles contribute to IT students' academic achievement beyond what can be explained by abilities. He also found that teachers could foster students' creativity by using the thinking styles. The understanding of how students think can help teachers in using different instructional styles and different assessment schema to foster creativity by accommodating and challenging the development of multiple thinking styles.

## **2.8 The impact of thinking styles in academia**

According to Zhang (2001), there are many reasons why some students score distinctions in their courses because there are various ways of explaining individual differences in academic achievement. He further states that, traditionally, many psychologists and IT educators have attributed IT students' successes and failures in academic achievement mainly to individual differences in abilities. However, in recent times, scholars have been examining other factors that affect students' learning outcomes. This could, in a way, be interpreted as IT students whose individual differences affect their academic successes and failures.

Zhang (2001) believes that the different thinking styles do more than just facilitate IT students' intellectual development. They also help enhance IT students' development in interpersonal relationships. As a result, IT students will learn how to work and

deal with their peers. He also found that the thinking styles were related to IT academic achievement and had implications for teacher training. He suggests that all teacher-training programs include a component that introduces knowledge on thinking styles. He deduces that an understanding of thinking styles could improve IT educators' teaching and thus, student learning.

Zhang (2001) states that thinking styles contributed to IT students' academic achievement. He found from previous studies that certain thinking styles statistically contributed to the prediction of academic performance beyond ability tests and it also suggested that students with particular thinking styles, namely idealists and realists, performed better on some forms of evaluation such as test and examinations than on others. Lin and Liu (2003) further outline that the thinking styles could assist IT educators in identifying individual differences among students and help them to consider students' individual needs in their teaching methods.

Zhang (2002b) identifies a variety of methods for inducing the use of the thinking styles. One of his methods was that educators should start giving consideration to the fact that repeated studies have found that both school and university curricula around the world tend to penalize creative thinking. He further states that in order to produce IT students who are going to be capable of adapting themselves to the ever-changing world, educators must start cultivating students' creative thinking during their educational career. Otherwise, the current generation of students will be overwhelmed by their future world of work.

Zhang (2002b) also finds that there are at least three ways in which IT educators can modify IT students' thinking styles:

- Firstly, IT educators could re-examine and redesign their instructional models. The new instructional models should be such that they allow multiple thinking styles and that they put together the specialized functions

of both the modes of thinking like idealist and realist (I-R) thinking styles. By making allowance for the different thinking styles, the IT educator is giving IT students an equal opportunity to benefit from their instructions and to experience IT academic success, despite the students' predominant thinking styles.

- Secondly, IT educators could also encourage the use of thinking styles by providing IT students with opportunities for participating in extracurricular activities such as projects outside the educational environment. This will lead to creativity-generated thinking styles and advanced cognitive development.
- Thirdly, an indirect approach can be adopted: allowing IT students to use multiple thinking styles and to be engaged in both modes of thinking such as Realist and Idealist thinking styles. Moreover, IT educators, themselves, should be allowed to use creativity-generated thinking styles in their teaching and interaction with students in general.

Zhang (2002a) furthermore finds that IT educators, who work in an environment where they are given flexibility and autonomy, would work in an innovative manner. Thus, IT educators could become role models for IT students in using thinking styles.

Bernardo *et al.* (2002) state that there could be some differences that may be observed between correlation patterns because of the different cultures in the education systems. According to Stuhlman (2004) culture is a combination of organisational history, shared experience, group expectations, unwritten or tacit rules, ethics and social interactions that affect the behaviour of everyone in the organisation. Bernardo *et al.* (2002) further state that formal educational institutions tend to promote knowledge and skill that are valued by the larger culture or society within which they operate. Accordingly, educational systems in different cultures

might also value and encourage different thinking. This may reflect cultural preference for thinking styles. By recognizing such differences in how educational institutions value some thinking styles over others, researchers can better understand how they affect performance in the different cultures.

## **2.9 How the thinking styles of IT practitioners influence their different approaches to Knowledge Management**

This section addresses the question whether the thinking style of IT practitioners influence their particular styles of Knowledge management. According to Gamble and Blackwell (2001), Knowledge Management focuses on exposing IT students, academics, practitioners and others to potentially useful information and facilitating the assimilation of information. It enhances their learning and understanding through the provision of information. Knowledge Management is about building core competencies and understanding strategic know-how, which has the potential to influence their actions and the way they think (Gamble and Blackwell, 2001). Thus, the discussion in the subsections below provides some insight into Knowledge Management and its impact on how IT practitioners reason. However, one should note that Knowledge Management is not confined to IT.

### **2.9.1 Knowledge and Information**

The Collins English Dictionary defines knowledge as facts, feelings or experiences known by a person or group of people (Baker *et al.*, 1997). Knowledge represents an individual's opinion at a moment in time and is created when information – which is raw material for knowledge - is applied to a particular context (Baker *et al.*, 1997). Wiig (1998) suggests that knowledge is made up of the insights, understandings and practical know-how we all possess and which allows us to operate intelligently. Knowledge is present in ideas, judgements, talents, root causes, relationships, perspectives and concepts (Baker *et al.*, 1997).

De Bono (2000) states that thinking is required to decide what information is needed and where it can be located. Thinking is also required to compile the information. De Bono further states that information is no substitute for thinking, nor is thinking a substitute for information.

De Bono (2000) has discovered two uses of thinking with regard to information:

- The first is directed at the information itself: acquiring information.
- The second is the use of the information to execute some thinking purpose: decision, action, choice, planning or design.

According to Gamble and Blackwell (2001), information is defined as data that are endowed with meaning and purpose. A collection of books acquires meaning if it is conceived as a library. A slight difficulty here is that people may not agree on the meaning. He further defines knowledge as information connected in relationships.

Larsson (2001) summarizes the definition of knowledge as a fluid mix of experiences, values, information and expert insight that provides a framework for evaluating and incorporating new experiences and information. In organizations, knowledge often becomes imbedded not only in the documents or repositories but also in organizational routines, processes, practices and norms.

Larsson (2001) further states the differences between the two types of knowledge:

- **Tacit Knowledge** is highly processed information and is gained after years of experience; hence known as personal knowledge. It is stored in the minds of individuals and is not usually institutionalized. This type of knowledge is usually lost when the individual is fired, downsized or retires.

- **Explicit Knowledge** can be easily described and is specific enough to be documented and applied. It is tacit knowledge given in flesh; in other words, it is knowledge that is “readily available”.

Nonaka and Takeuchi (1995) support these differences by stating that explicit knowledge is described as codified and refers to knowledge that is transmittable in formal systematic language, while tacit knowledge is personal, context specific and therefore hard to formalise and communicate.

Tacit knowledge comprises of insights, perceptions, opinions, judgments, experiences, know-how, mental models, intuition, hunches, skills, competencies, beliefs and emotions (Nonaka and Takeuchi, 1995, Baker *et al.*, 1997 and Bourdreau and Couillard, 1999). Two types of tacit knowledge can be distinguished: one is technical, related to deep know-how of the expert and the other, in the cognitive dimensions, consists of schemata, mental models, beliefs and perceptions (Bourdreau and Couillard, 1999).

Bourdreau and Couillard (1999) submit that a further form of knowledge should be distinguished, namely embedded knowledge. Embedded knowledge rests in the composition, design, layout and configuration of the organisation’s infrastructure. It encompasses people, plant, equipment, information systems and processes and relates to the “what, why, where, when and how” things are done in the organization. The importance of embedded knowledge is seen when a key employee who “knew” how and why things were done in a certain way leaves and a breakdown occurs (Bourdreau and Couillard, 1999).

### 2.9.2. Definitions of Knowledge Management

In this section the researcher summarises the definitions and expositions of various authors regarding the term “Knowledge Management”. At the end of the section a definition of the term is synthesised from the summaries.

The term Knowledge Management implies that knowledge is a tangible asset or resource that can be managed or indeed mismanaged (Baker *et al.*, 1997). For knowledge to be callable to an organization, it must be focused, current, tested and shared and continually updated. Knowledge is the only asset that grows as it is used; it is not depleted (Baker *et al.*, 1997).

Wiig (1998) proffers that the objective of Knowledge Management is to make the enterprise act intelligently as possible to secure its viability and overall success in an effort to realize the best value of its knowledge assets. He further argues that in order to reach these goals, advanced organizations build, transform, organize, deploy and use knowledge assets effectively. Stated differently, the overall purpose of Knowledge Management is to maximize the enterprise's knowledge related effectiveness and returns from its knowledge assets and to renew them constantly. Knowledge Management is to understand, focus on and manage systematic, explicit and deliberate knowledge building, renewal and application – that is, to manage effective knowledge processes. Wiig goes on to suggest that no general approach to managing knowledge is commonly accepted, although several isolated and, at times, diverging notions are being advanced. One notion deals with management of explicit knowledge using technical approaches. It focuses primarily on knowledge acquired from people, in computer knowledge bases, knowledge based systems and knowledge made available over technology-based networks using e-mail, groupware and other tools. A second notion focuses on management of intellectual capital in the forms of structural capital and human capital residing in the minds of people. A third notion for managing knowledge has a broader focus to include all relevant knowledge related aspects that affect the enterprise's viability and success. It encompasses the above notions to also include most other knowledge-related practices and activities of the enterprise.

Bourdreau and Couillard (1999) maintain that the purpose of Knowledge Management in organizations is to ensure growth and continuity of performance by

protecting critical knowledge at all levels, applying existing knowledge to all pertinent circumstances, combining knowledge in synergistic ways, acquiring relevant knowledge continuously and developing new knowledge through continuous learning that builds on internal experiences and external knowledge.

Larsson (2001) states that Knowledge Management is the explicit and systematic management of vital knowledge and its associated processes of creating, gathering, organizing, diffusing, using and exploiting. It requires turning personal knowledge into corporate knowledge that can be widely shared and appropriately applied throughout an organization.

For this reason, the increased realization of knowledge as the core competence, coupled with recent advances in Information Technology such as intranets and the World Wide Web, has increased organizational interest in the topic of Knowledge Management (Malhotra, 1997).

With this in mind, Kienholz (1999) states that Systems thinking is a conceptual framework - a body of knowledge and tools that was developed over the last 50 years - which serves to make clearer the full patterns of problems, issues and situations that confront us. The inquiring systems approach to systems thinking draws upon Churchman's (1971) five philosophically based inquiring modes for understanding how we go about gathering data, asking questions, solving problems and making decisions (Kienholz, 1999).

King (1999) states that Knowledge Management is about cognition, the dynamics of communication and human relations, behavioural science, organizational strategy and the process of capturing the collective knowledge of the organization, analyzing it and transforming it into a form that is easily recognized and usable. King further cites Knowledge Management as being able to bring people together to create an environment, both culturally and technologically, which will enable knowledge

sharing. He concludes that Knowledge Management should emphasize people involvement rather than Information management involvement, as knowledge exists in people.

Lombo (2004) argues that Knowledge Management is as old as humankind itself for in pre-historic times it gave bands of hunter-gatherers a survival advantage. Lombo therefore argues that Knowledge Management pre-dates the invention of writing systems about 5000 years ago. From Lombo's analysis one can infer that early humans attained a survival advantage through Knowledge Management because different groups of individuals within bands of hunter-gatherer nomads had specialised knowledge of particular aspects of hunting, gathering, crafting weapons for hunting and defence and other survival-related activities.

Lombo's proposition could also mean that such differentiated forms of specialised survival knowledge form the basis of differentiated preferential thinking styles among present-day humans. A further implication of Lombo's research is that organisations consisting of individuals who command different thinking styles would have a competitive advantage over organisations where all individuals think alike, provided that the organisations actively utilise the contributions that individuals with different thinking styles can make to the strategic operations of such organisations.

Thinking, as defined by Stuhlman (2004), is an internal mental process that uses information as input and integrates that information into previous learned material. The result may be knowledge acquisition or nothing. De Bono (2000) states that thinking is needed in Knowledge Management as it helps individuals decide on what information is needed and where to locate it.

Stuhlman (2004) notes the three kinds of thinking essential for successful Knowledge Management systems:

- Problem solving;

- Information integration, and;
- Analysis

Stuhlman (2004) defines Knowledge Management as a conscious, hopefully consistent strategy implemented to gather, store and retrieve knowledge and then distribute the information and knowledge in a timely manner to those who need it.

The strategy, according to Stuhlman (2004), includes rules, procedures and cultural aspects that help steer the Knowledge Management strategy into action. Knowledge Management is a framework and management mind-set that includes building on experiences and creating new avenues for exchanging knowledge. The strategy includes technology infrastructure and human aspects. These views are found to be fairly wide ranging and they can be summarized and combined to provide the following definition:

*Knowledge Management is a systematic, strategic organisational communication and human relations process that values the differentiated knowledge of the members of the organisation, and that captures the collective knowledge of all the members in an organisation, in order to analyse and transform such knowledge into forms that are easily recognizable and usable, thereby ensuring the growth of the organisation and the continuous optimal performance of the members of the group.*

### **2.9.3. Systems Approach to Knowledge Management**

King (2000) argues that IS professionals who deal with Knowledge Management must come to realize that systems almost never provide the total solution, as they sometimes do in the IS domain. This means that IS people must, at the very least, recognize that a great deal of informal communications will be necessary to supplement the explicated knowledge that is in the system. This may need to provide the forums for doing so or to facilitate the process.

King (2000) further argues that IS professionals are accustomed to thinking of the role of people in systems principally in terms of providing inputs and acting as users rather than processors. In other words data may be input by people and output to them, but the system is mainly electronic and automated. However, this is not so with Knowledge Management systems as people are necessary to evaluate and to decide to accept or reject the merits of proposed inputs. They may also be necessary to decide to whom a knowledge input should be communicated if users are not to be inundated with useless knowledge. In effect, these people become key components of the Knowledge Management system; the systems cannot operate without them (King, 2000).

Offsey (1997) puts forward a similar argument as King (2000) when he comments that technology is not the solution to an organization's Knowledge Management needs, but it is clearly required to enable the organization's Knowledge Management processes. Offsey (1997) describes an organization's Knowledge Management system as the collection of information technologies used to collect, organize, transfer and distribute knowledge among employees. Creating an organization-wide Knowledge Management system is not a simple task, but a well-designed system yields immense benefits such as awareness, accessibility, availability and timeliness (Offsey, 1997).

Offsey (1997) goes on to argue that no single technology fills all the criteria required by Knowledge Management systems, because Knowledge Management is not solely about technology. It is a multi-disciplinary field that draws on aspects of information science, interpersonal communications, organisational learning, cognitive science motivation, training, publishing and business process analysis.

Rowley (2000) suggests that structure is often imposed by systems, whether those systems are conceptual frameworks, communications networks or information systems. She further suggests that knowledge will be communicated through

information systems and stored in information systems, but that such systems must embrace people, hardware and software.

#### **2.9.4. The People Dimension to Knowledge Management**

Davis (1998) argues that Knowledge Management requires fundamental change in the way most organizations conduct business. He maintains that people are at the heart of any effective change, and that significant changes to measurements and rewards typically are required to support knowledge management.

King (1999), by referring to systems, suggests that it is important to develop a strategy to motivate people to use the system. The aim of this is to input expertise considering that these systems are unfamiliar to most people, a reward system to encourage use may be effective in getting people to try to use the system. Hansen *et al.* (1999) confirm that people need incentives to participate in the knowledge sharing process and that real incentives – not small enticements – are required. Nonaka and Takeuchi (1995) suggest that everyone has, to some extent, become a knowledge worker and that people management practices such as promoting diversity in people's work and allowing people time and space to engage in tasks not directly related to the job in hand, can promote knowledge creation.

With reference to management of professionals, King (2000) endorses the opinion that - in the professional environment - knowledge means power, independence and higher incomes. He goes on to suggest that the key to managing strategy in these situations lies in selecting a "team" of people with the desired balance of knowledge fields and personality characteristics – some may be introverted or contentious, flashy and brilliant, others may be absolute gluttons for meticulous detail and or simply gregarious and co-operative. The secrets in larger organizations are: not to let any one type totally predominate, to stimulate information sharing through joint incentives and to motivate better personal performances by exposing individuals as

much as possible to outside performance reviews by customers, peers, and head-to-head confrontations with competing groups.

#### **2.9.5. Use of IT in Knowledge Management**

According to Alavi and Leidner (2001) knowledge creation involves developing new content or replacing existing content within the organization's tacit and explicit knowledge. Through social and collaborative processes as well as individual's cognitive processes, knowledge is created, shared, amplified and justified in an organizational setting.

Gamble and Blackwell (2001) highlight the following characteristics that technologies require in order to support the Knowledge Management process:

- They should be well accepted by the community that has to use them.
- They should allow and support rich communication in a simple efficient way.
- They should have a way of conveying emotional overtones such as opinions and biases.
- They should support informal communications and multiple ways of expressing ideas and thoughts.
- Above all, they should not be imposed; they should feel 'natural'. To give this a label, the technology should seem 'transparent'.

Gamble and Blackwell (2001) further state that there are different ways of representing knowledge. They concede that traditionally, knowledge in organizations was recorded in a very formal way, such as in reports, manuals, computer databases and so on. When trying to communicate a difficult idea to someone, especially if they are not an expert in the field - an analogy, an anecdote or a diagram can make a critical difference both to understanding and to remembering. They support this

view by stating that knowledge managers make great use of pictures, anecdotes and 'war stories.'

The use of IT in knowledge creation is critical to the success of Knowledge Management. According to Ohlms (2002) IT is a critical enabler for knowledge management. He claims that there are specific types of software that allow access to existing knowledge – "Knowledge retrieval". He further states that this supports access to knowledge assets, bearers of competencies and helps to improve business processes through better flow of knowledge. Ohlms (2002) also found that software also exists in helping individuals' structure information – "Knowledge creation". He further explains that this software supports the capturing of unstructured and structured content and how knowledge is shared within the business processes.

## **2.10 MetaKnowledge Management and Knowledge Management**

Kienholz (2000) identifies Metaknowledge Management as a judicious or strategic management or leveraging of the different ways in which an individual comes "to know" so that he can respond to situations appropriately. Kienholz (1999) finds that there are implications which exist concerning the way we actually go about gathering, acquiring and sharing information and how the whole field of knowledge acquisition, creation, sharing and management can be better informed through an inquiring systems approach than with the constraint imposed by the current IT formulations (Kienholz, 1999).

The Inquiring Systems approach is preferred because the user responds to information and knowledge in different ways. How they apply this information and knowledge to a situation in the most appropriate way is important. These implications make it apparent that the awareness and understanding of the five inquiring systems are important to knowledge workers (Kienholz, 1999).

According to Furlong (2003), the management of the IT infrastructure for Knowledge Management is a critical success factor for an organization. In today's information driven society, much of an organization's environment is determined by its IT infrastructure. Therefore, as stated by Lundin *et al.* (2000), managers need to develop a greater appreciation for their intangible human assets, captive minds and experiences of their knowledge workers.

Wiig (1998) supports this argument by stating that understanding the human cognitive function is important in knowledge management. He further cites that people and their work behaviour are at the centre of the effective enterprise. Therefore, it is important to incorporate better professional understanding of cognitive aspects of how knowledge understanding, mental models and associations affect decision making and performing knowledge intensive work when deciding how to conduct knowledge management.

## **2.11 Characteristics of IT practitioners**

IT practitioners are continually updating their knowledge, questioning what has previously been accepted, redefining old problems, sensing new problems and searching for better solutions. With this in mind, it becomes apparent that an understanding of how IT practitioners think will enhance their Knowledge Management skills. This will, in turn, help them in problem solving. The discussion below describes the characteristics of IT practitioners and explains how their thinking patterns affect their assimilation of knowledge.

Hildebrand (1995) states that learning to work on teams - especially on distributed-computing projects - leads to more dynamic interaction between IT workers and the user, will be a challenge. The personality preferences of many computer professionals can be almost entirely opposed to those of the average worker. This makes it difficult for IT workers to deal with the social dynamics involved in teamwork.

DeLisi *et al.* (1998) state that communication skills are critical for determining needs and allocating resources. It is also important for ensuring that the accomplishments of IT are properly recognized. IT professionals thus understand the importance of communication, but according to DeLisi *et al.* (1998) are not gifted communicators.

In his report DeLisi (2002) states, that the stereotypical perceptions of IT professionals characterize them as introverted, analytical and detail-oriented individuals. Without any doubt, the professional training that IT professionals receive focuses on analytic skills, and the work of developing and debugging code requires a great deal of attention to detail.

DeLisi (2002) states that IT practitioners need the following skills to succeed in their positions:

- *General Management* – an understanding of the business as well as the company's markets; organizational development abilities and a broad background in various facets of activities are essential to the company's success.
- *Strategic sense* – a “big picture” view of the organization; the ability to synthesize and the ability to take calculated risks.
- *Interpersonal skills* – communication, education, salesmanship, recruiting/hiring/nurturing staff and leadership.

DeLisi (2002) further states that IT practitioners must continue to learn the business and continue to broaden themselves. In this manner, IT practitioners will be able to contribute to the discussions that truly bring value to the business. Hence, it is critical that IT practitioners continue updating their knowledge and manage it effectively to make significant contributions to discussions. Table 2.1 summarizes the themes and issues discussed in this chapter.

Author	Date	Theme	Journal	Important Points
Alavi and Leidner	2001	Knowledge management defined	MIS Quarterly	- Knowledge is created through cognitive processes
Baker <i>et al.</i>	1997	Knowledge and Information	Journal of Knowledge Management	- knowledge represents individuals' options
Bernardo <i>et al.</i>	2002	Thinking styles in academia	Journal of Genetic Psychology	- formal educational institutions promote knowledge and skill - educational institutions in different cultures encourage different thinking styles
Bourdreau and Couillard	1999	Types of Knowledge	Information Systems Management	- tacit knowledge comprises perceptions - two types of tacit knowledge distinguished - Knowledge Management ensures growth
Davis	1998	Systems Approach to Knowledge Management	The Executive Journal	- Knowledge Management requires change
De Bono	2000	Knowledge and Information	Book	- thinking is important to decide what information is important
DeLisi	2002	Characteristics of IT professional	Internet	- IT people can relate to InQ - IT professionals perceived as analytic thinking style
DeLisi <i>et al.</i>	1998	Characteristics of IT practitioners	Business Horizons	- communication skills between IT professionals are important
Furlong	2003	IT and Knowledge management		- IT infrastructure is important for Knowledge management
Gamble and Blackwell	2001	Knowledge and Information	Book	- knowledge is information connected in relationships - characteristics of technologies are needed in knowledge management

Author	Date	Theme	Journal	Important Points
Hansen <i>et al.</i>	1999	People dimensions	Harvard Business Review	- people need incentives
Harrison and Bramson	1984	Characteristics of the thinking styles	Book	<ul style="list-style-type: none"> <li>- five thinking styles</li> <li>- differences between the thinking styles</li> <li>- people can think in all five thinking styles</li> <li>- understanding thinking is an essential part of problem solving</li> <li>- understanding how others think is <i>important</i></li> </ul>
Hildebrand	1995	Characteristics of IT practitioners	CIO magazine	- Personality preferences of computer professionals differ.
Kienholz	1999	Usefulness of InQ	Internet	<ul style="list-style-type: none"> <li>- must become mindful of the ways people gather data</li> <li>- Inquiring Systems approach is helpful in high knowledge fields</li> <li>- Inquiring Systems approach is preferred</li> </ul>
Kienholz	2000	IT and Knowledge management	Working paper	- IT specialist can be matched and placed in project teams
King	2000	People dimensions	Information Systems Management	- people are important to Knowledge Management systems
King	1999	Systems Approach to Knowledge Management	Information Systems Management	- strategy to motivate people
Larsson	2001	Knowledge and Information	University of Washington	<ul style="list-style-type: none"> <li>- two types of knowledge</li> <li>- Knowledge Management requires turning personal knowledge to corporate knowledge</li> </ul>
Lin and Liu	2003	Thinking styles in academia	Int'l Journal of Instructional Media	- thinking styles can assist educators
Lombo	2004	Knowledge Management	Thesis	- Knowledge Management pre-dates the invention of the writing systems about 5000 years ago.
Lubbe	1997	IT investment	Thesis	- IT expenditures and organisational performances disconnected due to knowledge creation

Author	Date	Theme	Journal	Important Points
Lubbe and Pather	2002	Research on Knowledge management	European Conference on Research Methodology for Business and Management Studies	- business failure due to lack of Knowledge Management understanding
Lundin <i>et al.</i>	2000	Characteristics of IT professional	Second European Conference on IT	- IT managers need to appreciate intangible human assets
Malhotra	1997	IT and Knowledge management	3 <sup>rd</sup> Americas Conference on IS	- Advances in IT increase interest in Knowledge management
Nonaka and Takeuchi	1995	Knowledge and Information	Book	- tacit knowledge is hard to formalize and communicate
Offsey	1997	IT in Knowledge Management	Journal of Knowledge management	- no single technology fits into a knowledge management system
Ohlms	2002	IT and Knowledge management	Internet	- IT critical enabler for knowledge management
Rowley	2000	IT in knowledge management	Journal of Knowledge management	- IT must embrace people, hardware and software
Stuhlman	2004	Knowledge management defined	Stuhlman Mangement Consultants	- Knowledge Management is a management mind-set
Wiig	1998	Systems Approach to Knowledge Management	Knowledge Research Institute	- Knowledge Management maximizes enterprise knowledge
Zhang	2002a	Thinking styles in academia	Educational Psychology	- Thinking styles do contribute and impact on academic achievement
Zhang	2002b	Implications for education and research	Educational Psychology	- educators can modify students thinking styles

**Table 2.1** A summary of authors discussed in the Chapter

## 2.12 Research Questions

The above literature review and the critique thereof leads directly to the fundamental objective of this study - which is to investigate the Inquiring systems approach to

Knowledge Management in IT. Thus the following questions were identified: (i) What are the thinking styles of IT practitioners?; (ii) What are the thinking styles of IT students in relation to the marks they obtain?; (iii) Is it possible to produce a generic thinking style profile guideline?

### **2.13 Conclusion**

This chapter found the following: Malholtra (1997) suggests that an inquiring systems approach be adopted to enable successful Information Systems and Technology responsive to change. Kienholz (2000) supports this by stating that choosing the right style of thinking would enhance the performance of IT professionals especially when interacting in projects.

Lubbe and Pather (2002) find that most business failures of web and Internet communications are due to a lack of Knowledge Management understanding.

As seen from above, IT practitioners need to understand thinking styles in order to be successful. The following chapter discusses the research methodology undertaken as well as how the data is handled, in terms of sampling methods, data collection and statistical analysis.

## *Chapter Three*

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

According to Remenyi *et al.* (2000) research methodology is one of the important parts of a research and any judgment pertaining to the strength and quality of the research hinges on the clarity and relevance of the methodology.

This chapter therefore discusses the research methodology and the research philosophy, which underpin this dissertation. It also identifies the aims of the research and the research design which includes the purpose of the study, type of investigation, study setting and the unit of analysis. The measuring instrument, sampling method and data collection procedure are also discussed in this chapter. The data capturing, analysis and limitations of the study conclude this chapter.

#### **3.2 Aim of the research**

Remenyi *et al.* (2000) state that well-defined aims set in place all other things such as the selection of the most appropriate methods and the management of the research once it has been started. The aims of the research have therefore been defined as follows:

1. to determine the thinking styles of IT practitioners in relation to the positions they hold;
2. to determine the thinking styles of IT students in relation to the examination marks they obtain; and
3. to use the scores obtained to develop a generic profile of thinking styles appropriate for IT students and practitioners.

### **3.3 Research Design**

According to Sekaran (2000) research design involves a series of rational decision-making choices. He further states that the issues involved in the research design include: decisions regarding the purpose of the study, where the study will be conducted, the type of study it should be and the level at which the data will be analyzed.

#### **3.3.1 The purpose of the study**

Sekaran (2000) proposes that studies can be either exploratory or descriptive in nature or they can be conducted to test hypotheses. He states that a descriptive study is undertaken in order to ascertain and describe the characteristics of the variables of interest in a situation. He went on to state that the goal of a descriptive study is to offer a profile or to describe relative aspects of the phenomena of interest to the researcher. A descriptive study approach was undertaken for this study. This approach is appropriate for this study as the researcher is interested in describing the thinking styles of IT students and practitioners. The results from this study will help to understand the characteristics of IT people; how they are likely to behave and make decisions.

#### **3.3.2 Type of investigation**

The investigation can be either a causal study or a correlation study. According to Sekaran (2000) a casual study is when a researcher wants to delineate the cause of one or more problems. In other words, he wants to find out whether one variable causes another. In a correlation study the researcher is interested in delineating the important variables are associated with the problem. In other words, the researcher wants to establish if there is a relationship between variables. A correlation study is used in this research, as the researcher wants to establish if there are relationships between certain variables as stated in Section 3.2. Due to financial and time constraints placed on this research, a case study will not be done. However in future

studies on this topic a case study is recommended to get more meaningful interpretations of results produced.

### **3.3.3 Study setting**

Sekaran (2000) mentions two types of study settings: contrived and non-contrived settings. She explains that contrived settings are artificial while non-contrived settings are done in the natural environment where work proceeds normally. This study is conducted in a non-contrived setting where correlation studies are done, as Sekaran (2000) indicates. It is usually a field study done in an organisation.

### **3.3.4 Unit of Analysis**

Sekaran (2000) finds that unit of analysis refers to the level of aggregation of the data collected during the subsequent data analysis stage. There are five types of unit of analysis. These include individuals, dyads, groups, organizations and cultures. This study focuses on the thinking styles of IT students and practitioners. Hence, the unit of analysis will be individuals, from whom data is gathered.

## **3.4 Quantitative and Qualitative Data**

According to Sekaran (2000) quantitative data, in terms of frequencies, or mean and standard deviations, have become necessary for descriptive studies.

Zikmund (1997) states that the purpose of quantitative research is to determine the quantity or extent of some phenomenon in the form of numbers. Wherever possible, purely descriptive data should be converted into quantitative data after which, statistical techniques are applied.

Quantitative and qualitative techniques are not conflicting but are rather complementary. There will, however, always be qualitative data that cannot be quantified. Although some situations may appear to be similar, they are in fact unique. Statistical comparisons and correlations may actually lead to false assumptions and possibly, wrong conclusions.

### **3.5 Measuring Instrument**

#### **3.5.1 Research Events/Processes**

According to Alavi *et al.* (2001) there are various events/processes that a research can follow. They include laboratory and field experiments, field study, case study and surveys. It was decided to use a survey instrument in this research, as the survey requires people, as respondents, to supply information to verbal or written questioning. Verbal questioning involves the researcher posing oral questions from a structured list to the respondent. Written questioning is when the research includes a questionnaire being formulated. The respondent has to answer a list of specified questions on his own on an answer sheet provided. This research has been classified in section 3.4.1 as a descriptive study and therefore a survey would be appropriate. This survey research describes what is happening or it helps learn the reason for a particular behaviour (Alavi *et al.*, 2001). The written questioning method has been used in this study.

#### **3.5.2 Selection of elicitation instrument**

The researcher has decided to use a Questionnaire as an elicitation instrument to obtain the required data. Remenyi *et al.* (2000) state that the main purpose of questionnaire research is to obtain information that cannot be easily observed or that is not already available in written or computerized form. The purpose of using a questionnaire in this research is because the information cannot be easily observed. The author cannot determine an individual's thinking style without the use of a questionnaire as other forms of measurement may make individuals feel uncomfortable and withdrawn. This can generate mixed responses and may not be a true reflection of how the individual thinks.

The Inquiring Mode Questionnaire (InQ), designed by Harrison and Bramson (1984), is used for this study. According to DeLisi (2002) the InQ instrument is one of a number of instruments appropriate for collecting data (e.g. Sternberg and

Wagner (1993) - Thinking Styles Questionnaire and Grigorenko and Sternberg (1993) - Thinking styles questionnaires for teachers and students). It measures individual thinking styles and related variables but it differs from other instruments in that it looks at how people process information – something to which IT professionals can easily relate. It stays away from personality measurements such as introversion or extraversion, thereby avoiding the defensiveness that might result from a discussion of one's personality.

### **3.5.3 Assessment of the InQ Questionnaire**

According to Bruvold *et al.* (1983) the InQ attempts to assess the individual's relative standing on each of the five thinking styles. The assessment is accomplished by responding to 18 hypothetical situations. The InQ uses a forced ranking format. Each hypothetical situation is followed by five possible responses, which the individual must rank, from five, which is most typical of the individual's style, through to one, which is least typical of the individual's style. It is not pointed out to the respondent that responses represent the Synthesist, idealist, pragmatist, analyst and the realist thinking styles, respectively.

DeLisi (2002) finds that each possible response is linked to one of the five thinking styles and the values of the responses are summed to give a single score for each thinking style. Kienholz (2000) points out that the highest possible score is 90 (5 x 18) and the lowest is 18 (1 x 18). Scores of 60 or above are considered preferred modes of inquiry, while for those of 48 or less, a marked disinclination for that mode is indicated, with the person seldom using it.

A demographical sheet has been attached to the InQ questionnaire. Nominal measurement has been used to classify professional affiliation, gender, age, students' registration number, type of position held by current company and rank for IT professionals into a set of mutually exclusive measurement categories, so that all of

those employees in a particular category are alike in respect to the attribute being measured and those in different categories are different in respect to that attribute.

### **3.6 Sample Design and Sampling Methods**

Sampling, as explained by Coombes (2001) is the process of selecting individuals from a larger population with the purpose of investigating features of that population in greater detail. Remenyi *et al.* (2000) further state that the sample should be representative of the whole population; if not, then the results may be biased and will not be representative of the population.

#### **3.6.1 Sample Design**

Population refers to the entire group of people, events or things of interest that the researcher wishes to investigate (Sekaran, 2000). The population for this study was people in the Information Systems and Technology discipline – including a normal distribution of all Information Systems and Technology students and Practitioners.

This study was conducted at the University of KwaZulu-Natal (Westville Campus), Department of Information Systems and Technology. There were four population groups for students, which included undergraduate (at first and second year) and honours students studying Information Systems and Technology.

The population for the Information Systems and Technology practitioners were all the Information Systems and technology businesses and tertiary institutions in the Ethekwini area.

Sekaran (2002) defines a sample as a subset of the population, which comprises some members selected from the population. Zikmund (1997) supports this definition by stating that sampling involves using a small number of items or part of the whole population to make conclusions regarding the whole population. He also found sampling to be necessary as, in practice, it would be impossible to conduct a census

to measure the characteristics of all elements of a population. If taken properly, samples lead to accurate portrayals of the whole population.

Based on the table for determining sample size from a given population adopted from Sekaran (2002) the sample sizes for this research are as follows:

Population	Population size	Sample size
IT first year students	1300 students	297 students
IT second year students	230 students	144 students
IT Honours students	20 students	19 students
IT Practitioners	13 academics	13 academics

**Table 3.1** Sample sizes for this study

### 3.6.2 Sampling Technique

According to Remenyi *et al.* (2000) sampling techniques fall into two broad categories, namely non-probability samples, which are the domain of the phenomenologist; and probability samples used by the positivistic researcher.

The probability sampling technique has been used in this study. With such a technique, each person from the entire population of IT students and practitioners will have a known chance of being selected as subjects in the sample (Sekaran, 2000). Non-probability sampling refers to elements in the population that have no probabilities attached to them of being chosen as sample subjects. Non-probability sampling is not recommended - as stated by Sekaran (2000) - since the findings from the study of the sample cannot be confidently generalized to the population.

The samples for each of the three populations of IT students: Information Systems and Technology student at first, second and honours levels were selected using the simple random sampling technique. According to Sekaran (2000) this technique ensures that every element in the population has a known chance of being chosen as

subjects in a sample. The procedure used for selecting a sample of IT first level students included entering the names of the students into Microsoft Excel and thereby selecting the appropriate sample by randomly generating numbers statistically. This is outlined in section 3.7.3. The same procedure has been used in selecting samples from the other populations, mainly students studying Information Systems and Technology at second and honours levels.

The samples for the IT practitioners were conveniently selected from the IT academics at the University of KwaZulu Natal (Westville Campus) IT department.

These samples include a sufficient number of elements from the population so that a study of the sample and an understanding of the properties or characteristics of the sample subjects would be possible to generalize the properties or characteristics to the population elements (Sekaran, 2002: 267).

### **3.7 Data Collection Method**

Remenyi *et al.* (2000) note that data may be gathered by a variety of data collection methods. For this research a questionnaire has been used to collect the data as explained in section 3.6.2. The questionnaire used in this study is similar to the one used by Kienholz (2000) in the study entitled “Metaknowledge Management: Global Implications of Churchman’s Inquiring Systems for Knowledge Creation and Sharing.” The questionnaire has been personally administered to the respondents as, according to Sekaran (2002) this type of data collection method is less time consuming and less expensive.

This method is most appropriate - if respondents have any doubts on the questions, they can be clarified immediately. As compared to mail questionnaires, this method has a higher response rate. The use of interviewing as a means of collecting data is also inappropriate in this research as it may intimidate respondents into withholding their true answers to the questions (Sekaran, 2002).

The thinking styles of Information Systems and Technology students' has been measured using the InQ questionnaire and these scores then determined their thinking styles. Once their thinking styles have been established, all students with the same thinking style were grouped together and a correlation was established between the ranges of their examination marks and their thinking styles. Students have been asked to provide their professional affiliation, gender, age and registration number on the demographic sheet provided. Their examination marks were then verified.

The thinking styles of Information Systems and Technology practitioners were measured using the same questionnaire. A separate demographic sheet attached to the main questionnaire had been used. This demographic sheet collected data on the IT practitioners' professional affiliation, gender, age and type of position held by current company. The scores from these questionnaires determined their thinking style. Once their style of thinking has been established, a correlation had been determined between their type of occupation and their style of thinking.

The guidelines for selecting Information Systems and Technology project teams were determined from the results yielded in this study as compared to other studies completed.

### **3.8 Data capturing and analysis**

According to Remenyi *et al.* (2000), probability samples can be rigorously analysed by means of statistical techniques. Cooper and Emory (1995) state that analysis involves reducing accumulated data to a manageable size, developing summaries and looking for patterns. Microsoft Excel had been used to capture and analyze the data. It supported the analysis procedure by calculating the following statistical tests on the results from respondents:

### **3.8.1 The Mean**

The mean has been calculated first. The mean or the average is a measure of central tendency that offers a general picture of the data without unnecessarily inundating one with each of the observations in a data set (Sekaran, 2000). The mean of a collection of scores is calculated by the sum of the scores divided by the number of scores. The mean is calculated in order to analyze the variance for each of the factors. This can be compared to a similar study entitled “Metaknowledge Management: Global Implications of Churchman’s Inquiring Systems for Knowledge Creation and Sharing”, undertaken by Kienholz (2000).

### **3.8.2 Variance**

Variance is calculated by subtracting the mean from each of the observations in the data set, taking the square of this difference and dividing the total of these by the number of observations. The variance gives an indication of how the data in a data set are dispersed (Sekaran, 2000:398). The variance is also calculated in order to analyze the standard deviation for each of the factors in the questionnaire, that is, the manner in which the thinking styles scores are dispersed among respondents.

### **3.8.3 The Standard Deviation**

The standard deviation, which is a measure of dispersion for interval and ratio scaled data, offers an index of the spread of a distribution or the variability in the data. The positive square root of the variance is known as the standard deviation. The standard deviation is usually preferred to the variance because it is expressed in the same units as those of the original measurements (Huysamen, 1990). The standard deviation has been used to analyze the factors in the questionnaire, that is, the measure of dispersion of the thinking styles scores between respondents.

**Frequencies** refer to the number of times various subcategories of a certain phenomenon occur, from which the percentage and cumulative percentage of their occurrence can be calculated. In management research, frequencies are generally

obtained for nominal variables such as gender and educational level (Sekaran, 2000:396). The frequency distribution has been used to measure the biographical data, which has been determined from the demographic sheet explained in section 3.8. The respondents have been given demographic sheets to complete.

#### **3.8.4 Pearson Correlation Coefficient**

The Pearson Correlation Coefficient is a measure of linear association between two variables. It is useful when attempting to determine if there is a significant relationship between two variables (Huysamen, 1998). The Pearson's correlation coefficient has been used to establish the correlation between the IT students thinking style and their examination mark.

#### **3.8.5 Significant Mean Differences Among Multiple Groups: ANOVA**

Where the t-test would indicate whether or not there is a significant mean difference in a dependent variable between two groups, an analysis of variance (ANOVA) helps to examine the significant mean differences between more than two groups on an interval or ratio scaled dependent variable (Sekaran, 2000:406). This test is conducted to find if there is a significant mean difference between the different professional affiliations, age groups, gender and type of position held by current company for IT practitioners.

### **3.9 Bias In Research**

It is naïve to assert that any form of research is without bias. Even in the physical and life sciences, the researcher's bias is reflected in the subject researched, the experiments chosen as well as the way the experiment is conducted.

Subconscious bias on the part of the researcher could be a problem. This may not be easy to make with personal prejudices laying an overly influential and important role (Sekaran, 2000).

Sometimes, if not frequently, personal bias is so subtle that even the researcher is unaware of it. Thus, bias cannot be totally eliminated but should be recognized and its implications acknowledged and accepted.

### **3.10 Limitations**

According to the views of Remenyi *et al.* (2000) understanding the limitations of research is a critical part of a research degree. From this study, it is apparent that certain limitations do exist.

Table 3.1 reports the sample sizes for the number of respondents required for this survey. However, later on in the chapters, it is shown that these sample sizes have not been met. This is due to meeting the deadline for this dissertation and the merger between the Universities of Durban-Westville and Natal, which became the University of KwaZulu-Natal in January 2004. Therefore, this study does not make any causal claims of the Thinking Styles (requires a higher burden of proof). This is a pilot study and should be followed by further research that meets the sample size requirements of table 3.1.

In selecting IT practitioners, the researcher was unable to get a detailed list of IT firms in the Durban area because of financial constraints on the research imposed by the Computer Society of South Africa. Hence, IT academics from the University of KwaZulu-Natal's IT Department were conveniently selected as a sample of IT practitioners.

Due to time and also financial constraints, a case study research was not possible. However in future research on this topic, it is recommended that a case study be used in order to get more meaningful interpretations of "The impact of thinking styles in academia". The results of the study could also then be compared to the results of previous similar studies conducted in academia to ascertain the extent to which they concur or differ. In addition, the roles and responsibilities of the various

IT positions should also be explored as this has a direct influence on what the thinking styles of IT practitioners are. A separate analysis should also be done for IT analysts, academics, technicians and research assistants.

Although there is a link between knowledge management, knowledge creation and thinking styles, it must be noted that the questionnaire does not allow for direct comparison with the content of the exam paper. Due to the anonymity of the questionnaire, it was also difficult to tie the exam marks with people's scores, which made it difficult to do critical assumptions.

### **3.11 Summary and conclusions**

In conducting this research study a considerable amount of time and attention has been devoted to the issue of methodology because the researcher views this as the foundation on which the credibility of the research stands. Some of the methods used in this research rely on qualitative information, while others are based on highly quantitative approaches. This questionnaire method has been primarily used since it allowed the researcher to obtain information that cannot be easily observed.

According to a reliability and validity test of the InQ questionnaire researched by Bruvold *et al.* (1983), the InQ represents a promising instrument that deserves further use in settings that allow its validity to be assessed. As far as reliability is concerned, the InQ has been seen as profiles that were stable and did support the practice of profile interpretation. The questionnaire research strategy seems the most appropriate as the use of the InQ profile able to analyse and predict future behaviour in a group problem solving and work setting. Since most IT work is done in project teams it is important to establish whether individuals' thinking styles are matched appropriately to the designated groups.

The next chapter includes a discussion on the findings of the research. It also provides some information on the choice of participants and the question of confidentiality.

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## *Chapter Four*

### **RESEARCH AND DATA DISCUSSION**

#### **4.1 Introduction**

This chapter describes how the research was conducted, with reference to choice of participants and confidentiality. It also provides a summarized account of the respondents in the questionnaire research that was executed. A discussion of the findings of the research concludes this chapter.

This chapter groups the findings into the thinking styles of students at first, second, and Honours levels, as well as IT practitioners. Each of them is discussed separately and consolidated in the conclusion of the chapter. Once the findings have been stated, an interpretation is conducted through the use of theory and past studies on this aspect of study.

#### **4.2 Information Systems and Technology in the University of KwaZulu-Natal (Westville Campus) context**

The Department of Information Systems and Technology at the university maintains a highly sophisticated data network and places a strong emphasis on facilities for students. All students have access to the network through PC laboratories. All laboratories have consultants to assist students. Software available to students includes the standard office suites from Microsoft as well as more specialized academic software packages such as Pastel Accounting and SPSS. All students can create their own email addresses and have access to the Internet. More specialized facilities are reserved particularly for use by postgraduate students.

### **4.3 Choice of research participants**

In order to conduct a research project - which would add to the body of knowledge concerning knowledge management, it was decided to empirically explore actual thinking styles of IT students, academics and practitioners. As mentioned in Chapter Three, a questionnaire research strategy has been chosen as the approach for this project. The researcher approached selected respondents who agreed to answer the questionnaire, which measures how they think and make decisions. The respondents' chosen include IT students, academics and practitioners.

### **4.4 The question of confidentiality**

Before these respondents could participate in the research it was necessary to agree that nothing revealed in the questionnaire - linking their names to the statements - could be published without their written consent. Although individuals were prepared to answer the questionnaire freely, it was difficult to obtain approval to publish the material. As a result of the difficulty in obtaining written consent, the actual data has been used, without releasing names of the students, academics or practitioners. This has been done in order to publish the data.

### **4.5 Thinking Styles of First Year IT Students**

#### **4.5.1 The Results**

A total of 128 responses have been received from the first year students. According to Kienholz (2000) preference for a mode(s) is indicated by a score of 60 or more. Profiles are explained in terms of one-way thinkers, two-way thinkers, three-way thinkers and level profiles. Results for the group of 128 are as follows:

- One-way thinkers = 86 or 67% of the students. (Eight were Synthesists, twenty four were Idealists, twelve were Pragmatists, thirty eight were Analysts and four were Realists)
- Two-way thinkers = 40 or 31% of the students. (Four were

Idealist and Pragmatist, three were Synthesists and Idealist, sixteen were Idealists and Analysts, nine were Analysts and Realists, three were Synthesists and Analysts, one was a Synthesist and Realist, one was Pragmatist and Analyst, two were Idealists and Realists and one was Pragmatist and Realist)

- Three-way thinkers = 2 or 2% (one was a Idealist, Pragmatist and Analyst and the other was a combination of Idealist, Analyst and Realist)

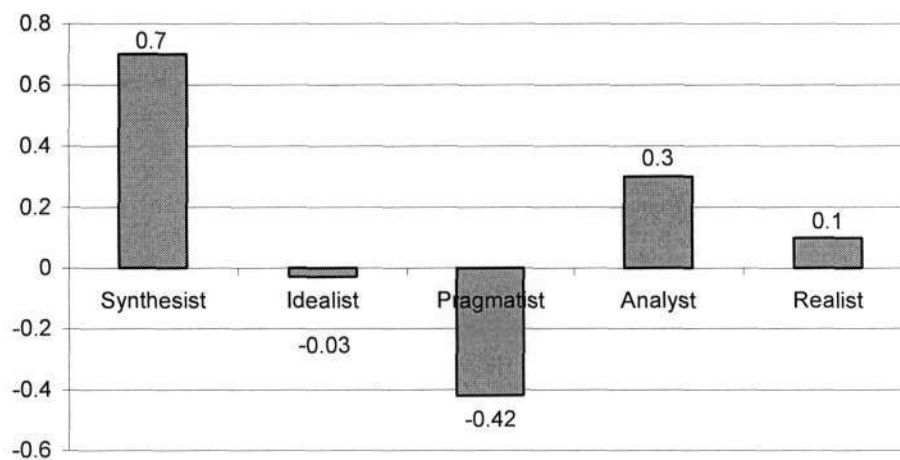
There were no students who preferred level profile that is no students preferred four or five thinking styles . It is important to note that IT people should think in more than one style of thinking. Harrison and Bramson (1984) state that an individual with more than one style of thinking is able to interact better in a group. This is critical for the success of IT project teams.

All students in the sample were aged between 18 and 27 years old. 38% of the sample was male while the rest was female. The questionnaire usually takes about 30 minutes to complete, but there were some students who took less that 30 minutes. The following table gives an indication of the mean differences as well as the percentage of students who scored 60 or more.

	Synthesist	Idealist	Pragmatist	Analyst	Realist
<b>Range</b>	(59-68)	(57-67)	(55-70)	(58-76)	(58-63)
<b>Differences</b>	9	10	15	18	5
<b>Group Means (N=128)</b>	62.25	62.55	60.50	65.24	59.50
<b>% of participants scoring 60 or above in each inquiring mode</b>	5	13	5	24	1

**Table 4.1 Statistics on individual thinking styles**

There were no participants who scored 48 or less in each inquiry mode. As demonstrated in Table 4.1, the range differences are close. The researcher therefore concludes that the students preferred the analyst style of thinking since 24% of the students had a score of 60 or above in this style of thinking. The range difference also indicates that the scores for each respondent in each style of thinking was quite close



**Figure 4.1: Correlation between students' examination marks and their thinking styles**

Figure 4.1 depicts the correlation between the students' examination marks and their thinking styles. Three of the thinking styles show a positive relationship between the style of thinking and the students' examination marks. The strongest relationships exist between the Synthesist and Analyst thinking styles and their relevant examination marks. A possible reason for the Synthesist having the strongest relationship is because they have a tendency to look at a problem from many different perspectives and can usually come up with solutions because they enjoy conflict or being asked to come up with solutions to the "unsolvable problem". The Analyst also shows a strong relationship because he can help look at a problem from different perspectives. This can lead to valuable insights. Analysts are useful when the situation can be calculated in a logical and analytical way.

The Idealist, on the other hand, has a low negative correlation because he delays from having too many choices and tries too hard for perfect solutions. He can also appear overly sentimental (Harrison and Bramson, 1984).

The Realist produces a low positive correlation because he rushes to oversimplified solutions and tries too hard for consensus (Harrison and Bramson, 1984).

The Pragmatist shows a high negative correlation as he is quick to agree with others' ideas and may keep people off balance by an apparent lack of structure or visible direction. He also finds it difficult to work with those who value idealism and stability. Therefore these students show a high negative correlation because they cannot fall on others ideas since the examination requires students to work on their own.

#### **4.5.2 Discussion of the Results**

More than half of the respondents in the sample are one-way thinkers. According to DeLisi (2002), about half of any population would be expected to have a peak in a single thinking style. The highest peak in the one-way thinkers comes from the analyst style of thinking. Kienholz (1999) states that the analyst masters the skills of paying attention to details, of checking and re-checking. Analysts like doing things in a logical manner despite people's preferences. However, DeLisi (2002) states that IT practitioners are not necessarily likely to possess analytical thinking in order to be successful. He further states that the perpetuation of the stereotype impacts on the role of IT practitioners in the following ways: It limits their opportunities for job assignments that have strategic impact on the organization; it impedes their opportunities for promotion to the highest levels of the organization and it affects their relationships with clients and senior executives. These limitations, in turn, affect the success of IT overall.

Figure 4.1 shows that although there are more analyst style of thinkers, the Synthesist has the highest correlation between the students scoring in the thinking styles and their examinations marks. Synthesists, explains DeLisi (2002), are highly creative people who are very interested in change and highly speculative.

Thus, the first year students' results show that a large percentage of students are analyst thinkers. However, when correlated with their marks the Synthesist thinkers correlated the highest. This shows that IT people need to possess an equal leverage of thinking styles to remain productive in all aspects of their work.

#### **4.6 Thinking Styles of Second Year IT Students**

##### **4.6.1 The Results**

A total of 134 responses has been received from the second year students. The results for the group are as follows:

- One-way thinkers = 122 or 91% of the students. (Seven were Synthesists, thirty-seven were Idealists, twelve were Pragmatists, sixty-two were Analysts and four were Realists)
- Two-way thinkers = 11 or 8% of the students. (One was an Idealist and Pragmatist, one was an Analyst and Synthesist, two were Analysts and Realists, four were Analysts and Pragmatists and three were Idealists and Analysts)
- Three-way thinkers = 1 or 1% (This person has a preference for Pragmatist, Analyst and Realist thinking styles)

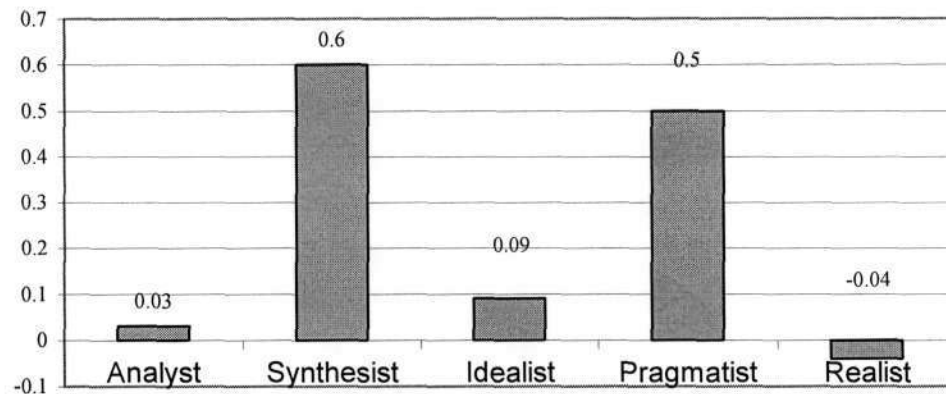
There were no students who preferred level profile. In other words, no students preferred four or five thinking styles. All students in the sample were aged between

19 and 28 years old. 35% of the sample was male while the rest was female. The following table gives an indication of the mean differences as well as the percentage of students who scored 60 or more.

	<b>Synthesist</b>	<b>Idealist</b>	<b>Pragmatist</b>	<b>Analyst</b>	<b>Realist</b>
<b>Range</b>	(57-66)	(56-75)	(58-67)	(59-73)	(61-63)
<b>Differences</b>	9	19	9	14	2
<b>Group Means (N=134)</b>	60.57	63.92	63.08	65.60	61.50
<b>% of participants scoring 60 or above in each inquiry mode:</b>	4	24	8	45	3

**Table 4.2 Statistics for individual thinking styles**

There were no participants who scored 48 or less in each inquiry mode. As demonstrated in Table 4.2, the range differences are very close. The researcher therefore concludes that the students show a preference for the analyst style of thinking since 45% of the students had a score of 60 or above in this style of thinking. The range difference indicates that the scores for each respondent in each style of thinking were quite close with a noticeably larger variance of 19.



**Figure 4.2: Correlation between students' examination marks and their thinking styles**

Figure 4.2 depicts the correlation between the students' examination mark and their style of thinking. Four of the thinking styles show a positive relationship between the style of thinking and the students' examination marks. The strongest relationships exist between the Synthesist and Pragmatist thinking styles and their relevant examination marks. The reason for the Synthesists having the strongest relationship is that they have a tendency to look at a problem from many different perspectives and they can usually come up with some pretty creative solutions because they enjoy conflict or being asked to come up with solutions to the "unsolvable problem." The Pragmatist is like the Synthesist therefore their correlations are very close. They are resourceful and creative individuals; they are problem solvers and creators of solutions as noted before. Their solutions tend to be rather riskier than those of the Synthesist but are more innovative with a better payoff and therefore support the findings by Harrison and Bramson (1984).

The Idealists, on the other hand, have a low correlation because they delay from too many choices and try too hard for perfect solutions. They can also appear overly sentimental (Harrison and Bramson, 1984). The analyst also produces a low correlation as they tend to over analyze and over plan. They can also be overly cautious and try too hard for predictability (Harrison and Bramson, 1984). Therefore, these findings support the findings by Harrison and Bramson (1984) in

section 2.3.2. The Realist produced a negative correlation because they rush to oversimplify solutions and try too hard for consensus (Harrison and Bramson, 1984).

The correlation between the examination marks and the one-way thinkers displayed a low positive relationship of 0.18, while the two-way thinkers had no correlation between their examination marks and both their thinking styles. The individual who had a three-way thinking style had a C examination score. This shows that a combination of thinkers might not be able to solve a problem co-operatively and will affect systems building. This will be confirmed in a follow-up study.

#### **4.6.2 Discussion of the Results**

The second year students also showed a high preference for the analyst style of thinking. However, when the examination marks were correlated with the analyst score, they were very low, the Synthesist style of thinking once again proved to have the highest correlation. According to Kienholz (1999) the Synthesist has the ability to identify the critical assumptions or key premises that underlie complex issues which constitute one of the most vital thinking strategies.

Hence, DeLisi's (2002) theory that an IT practitioner does not need to possess an analyst style of thinking proves true. With more thinking styles available to an individual, the higher the chances of success (Harrison and Bramson, 1984). This ensures more room for promotions with the IT domain.

### **4.7 Thinking Styles of IT Honours Students**

#### **4.7.1 The Results**

A total of 12 responses were received from the IT honours students. The results for the group are as follows:

- One-way thinkers = 9 or 75% of the students. (One was a

Synthesist, two were Idealists, one was a Pragmatist, four were Analysts and one was a Realist)

- Two-way thinkers = 3 or 25% of the students. (Two were Idealist and Pragmatists and one was a Analyst and Pragmatist)

There were no students who preferred three-way thinking or level profile. In other words, no student preferred four or five thinking styles. All students in the sample were between 20 and 28 years old. Sixty-two percent of the sample was male while the rest was female. The following table gives an indication of the mean differences as well as the percentage of students who scored 60 or more.

	Synthesist	Idealist	Pragmatist	Analyst	Realist
<b>Range</b>	(58-58)	(60-65)	(60)	(57-68)	(51)
<b>Differences</b>	0	5	0	5	0
<b>Group Means (N=12)</b>	58	62.50	60	58	51
<b>% of participants scoring 60 or above in each inquiry mode:</b>	0	2	1	1	0

**Table 4.3 Statistics for individual one-way thinking styles**

There were no participants who scored 48 or less in each inquiry mode. From an analysis of the data, the researcher therefore concludes that the students preferred the analyst style of thinking. Thirty three percent of the students obtained a score of 60 or above in this style of thinking. The correlation between their examination marks and their thinking styles shows a negative correlation of  $-0.6$ . This high negative correlation can be attributed to the fact that people with this style of thinking tend to over analyze and over plan. They can also be overly cautious and try too hard for predictability as noted previously (Harrison and Bramson, 1984).

The Synthesist, Pragmatist and Realist achieved examination symbols of D, D and C respectively. The two students who were idealists correlated perfectly with their examination marks, hence achieving a correlation of 1. The Idealists are goal - and future oriented, very receptive and display a broader view. They dislike conflict or open arguments as stated in Chapter Two.

There was one student in particular who was a Pragmatist and an Analyst. This respondent achieved a C Symbol. Two students indicated preference for the Idealist and Pragmatist thinking styles. The correlation between their examination marks and their thinking styles was 0.01, a score that is rather low.

#### **4.7.2 Discussion of the Results**

According to Harrison and Bramson (2002) the Analyst-pragmatist (A-P) likes facts and structures, but is also willing to experiment. Such an individual knows what he wants and how to get there but wants to have fun along the way. These characteristics would have a positive impact on IT work. However, Harrison and Bramson (1984) state that this can be quite damaging in relationships due to the fact that serious goals and directions will appear to be taken less seriously by the A-P. This will also impact negatively on IT teamwork.

The styles of Idealist-pragmatist show a low correlation as they have a great concern for “people” issues and are more in tune with a person’s needs. This has also been expressed by Harrison and Bramson (1984). As a leader, the I-P appears to be over permissive, allowing too much latitude. This hampers the promotion of IT workers and limits their level of hierarchical movement.

#### **4.8 Thinking Styles of IT Practitioners**

#### 4.8.1 Results and Discussion

A total of 13 responses were received from the IT practitioners. Six of the respondents were IT academics, two were IT research assistants, one was an IT analyst and four were IT Technicians. The results for the group are as follows:

- One-way thinkers = 9 or 69% of the practitioners. (One was a Realist, another an Idealist, five were Analysts and two were Synthesists)
- Two-way thinkers = 4 or 31% of the practitioners. (Two were Idealists and Pragmatists; one was a Pragmatist and Analyst and one was a Synthesist and Realist)

There were no practitioners who preferred three-way thinking or level profile. In other words, no practitioner preferred four or five thinking styles. All practitioners in the sample were aged between 24 and 55 years. Sixty-two percent of the sample was female while the rest was male.

There were no participants who scored 48 or less in each inquiry mode. The author therefore concludes from the analysis of the data that most IT practitioners preferred the analyst style of thinking. Eighty five percent of the practitioners had a score of 60 or above in their thinking styles. The Analyst style of thinking helps individuals to view problems from different perspectives. This can lead to valuable insights and will thus be useful in situations that are calculated in a logical and analytical way. These are some of the characteristics that IT practitioners need to possess. Although the analyst thinker is important in the IT workplace, having only the analyst thinking styles limits not only the chances for promotion, but also effective communication between the clients and executive management (DeLisi, 2002).

As mentioned in Chapter Two of this dissertation, DeLisi (2002) states, in his report, that the stereotypical perceptions of IT professionals characterize them as introverted, analytical and detail-oriented individuals. Without any doubt the professional training that IT professionals receive focuses on analytic skills, and the work of developing and debugging code requires a great deal of attention to detail. This would therefore, be attributed to the high preference of the analytical mode of thinking by IT practitioners (Harrison and Bramson, 1984).

#### **4.9 Conclusion**

This chapter includes the results and data discussion of the research. The sample comprises IT students and practitioners. The IT students included first, second and honours students. The preferred thinking style for most first year students was the Synthesist, followed by the Analyst style of thinking. Most second year students preferred the Synthesist followed by the pragmatist thinking styles, while more than half of the honours students preferred the Analyst followed by the Idealist thinking styles. Majority of the IT practitioners, who consisted IT academics, research assistants, Technicians and Analysts preferred the Analyst style of thinking. The following chapter concludes the research and its findings.

## *Chapter Five*

### **CONCLUSIONS**

#### **5.1 Introduction**

This chapter concludes the research by providing an overview of the research and a discussion of the main findings and recommendations. It also answers the research questions and provides a set of guidelines for thinking styles. Included in this chapter is also a note on further research needed in this area of study.

#### **5.2 The research and its findings**

The thinking style preferences of IT students and practitioners were as follows:

	Synthesist	Realist	Pragmatist	Analyst	Idealist
<b>First Year Students</b>	1			2	
<b>Second Year Students</b>	1		2		
<b>Honours Students</b>				1	2
<b>Practitioners</b>	2			1	

**Table 5.1 Summary of Findings**

The table 5.1 depicts a summary of the research findings. The number 1 indicates first preference, while the number 2 indicates the second preference of the group.

The main observation inferred from the table above is that the most preferred thinking styles lie between the Synthesist and Analyst modes. According to Harrison and Bramson (1984) people who have the Synthesist style of thinking do not consider facts as important as the inferences people draw from them while the Analysts see themselves as factual, down-to-earth, practical people. These two

thinking styles are quite contradictory. The author therefore deduces that as the IT practitioner develops from an IT student to an IT practitioner, he is sure to develop a style of thinking to suit the characteristics of his career. This can be substantiated by a report by DeLisi (2002) which states that the training IT professionals receive focuses on analytic skills and the work of developing and debugging code that requires a great deal of attention to detail. Hence, this statement is in line with Harrison and Bramson's (1984) definition that the Analyst style of thinking approaches problems in a careful, logical, methodical way; paying great attention to details.

### **5.3 Research Questions**

All respondents were from the IT industry. The first research question was to determine the thinking styles of IT practitioners. It was found that most of the respondents scored the highest for the analyst thinking styles. Hence it is important to note that the thinking styles of IT people in South Africa contrasts with the thinking styles of IT people in the other parts of the world. This is supported by DeLisi (2002) who states in his study that IT practitioners are not necessarily likely to possess analytical thinking in order to be successful. He further states that the perpetuation of the stereotype impacts on the role of IT practitioners in the following ways: It limits both opportunities for job assignments that have strategic impact on the organization and opportunities for promotion to the highest levels of the organization. It also affects their relationships with clients and senior executives. These limitations subsequently affect the overall success of IT.

The second research question was to determine the thinking styles of IT students in relation to the marks they obtain. The findings showed that students scored the highest in the analyst style of thinking. However, when their thinking style score was correlated with examination mark, the students who had the Synthesist thinking style had the highest correlation with their examination marks. One can thus conclude

that, IT people do not only need to have an analyst thinking style in order to be successful at their jobs.

For the last research question in this study, it was found that a generic thinking style profile guideline could not be produced as each individual thinks differently.

#### **5.4 Guidelines for IT practitioners and students**

The contributions of IT executives should not be predominantly of an analytical nature as stated in section 2.11, as it reinforces the stereotype.

According to DeLisi (2002) senior level executives should possess the idealistic style of thinking. The idealist thinker views things holistically and is future oriented with an interest in social values. The perception that IT practitioners do not possess this thinking style limits their opportunity to be placed in an executive capacity, as they are not seen as being successful in this post

IT organizations and academic in tertiary departments must ensure that staff or students involvement in teams receives the required attention. It may be achieved by ensuring that everybody in the team is aware of each others thinking styles, as it would ensure effective communication through better delegation of tasks. By delegating tasks that require a specific type of thinking style to the person that possesses it can contribute to a rapid solution to problems.

IT managers that develop action plans for their departments should know what they need to do and what to expect from their staff. This can be done by placing staff into positions that require their thinking styles. This would ensure faster attainment of departmental and organisational goals.

Look for IT practitioners across a wide range of the thinking styles that match the profile of a particular job description that is related to the IT strategy of the

organisation. Section 2.6 outlines the strengths and weaknesses of each of the thinking styles and can help in selecting an IT practitioner to fit the profile of a job description in the organisation. This should lead to successful outcomes of achieving project targets and organisational goals.

Staff should also be trained in communication strategies and be made aware of the various types of thinking styles that people possess and how to manage them. Section 2.3 provides an overview of the thinking styles as proposed by Harrison and Bramson (1984). Academics should also ensure that this component is also covered with students before group work takes place.

Organisations and academic departments should also develop support facilities such as training sessions, debate groups, and so on to help staff or students with problems. The basis should be a partnership between all stakeholders in such a way that communication channels exist between groups. This may help them to understand each others thinking styles and the usefulness that each of them brings to problem solving as stated in section 2.5.

### **5.5 Recommendation**

IT practitioners and students should be fully aware of their thinking styles and how such affects their ability to communicate with others who possess different styles.

Harrison and Bramson (1984) provide detailed suggestions on how one can extend one's thinking strategies. A brief summary follows:

To become more of a Synthesist, practise listening for conflict and disagreement and develop the third party observer viewpoint. This will ensure the ability to identify the critical assumptions or key premises that underlie complex issues. Analysts focus on the whole, not one "best way" and try to fit a number of different ideas into a single framework. They develop a skill in paying attention to details and checking and

double checking their work. To become more of a pragmatist, practise thinking incrementally and encourage others to experiment and to learn to think tactically. The realist focuses on concrete results. To develop your ability to think as a realist, one needs to be specific and provide examples when explaining an idea and ask others for examples when they make abstract statements. For one to become an idealist, data and theory need to be seen as equal. Idealists are well suited to building shared vision through their long range views and their propensity to set high goals and standards.

IT managers and academics need to educate their staff and students on thinking styles in general and the purpose they serve. Unless this is done, the commonly held assumptions that all people think alike will prevail. Once they understand the value of thinking styles, then only will they know their true benefit to the organisation.

By correcting the assumption that all IT people are analysts will go a long way in achieving faster solutions to IT problems.

### **5.6 Future research**

Future research needs to be conducted on other careers in order to determine whether each career field has its own type of thinking style. In addition, more research is required to determine the thinking styles of South Africans in the IT field as this research has revealed that they do not seem to be following the trends of the rest of the world.

### **5.7 Conclusions**

The theory and the findings of this research project as indicated in chapter four show that IT practitioners and students do not necessarily have to possess the analyst style of thinking. Individuals who possess only this style of thinking are limited in terms of promotion, opportunities and relations. Furthermore,

organisations benefit from the perspectives of members who command other thinking styles.

An understanding of an individual's thinking styles, and the utilisation of multiple thinking styles can better enhance the dynamics of an IT project team. In other words, teams will become more productive and focused in their objectives because their thinking styles will complement each other in providing more efficient and effective solutions.

Therefore, academics in the field of Informatics, IT practitioners and students should be more aware of the different thinking styles and how they affect communication between people with different thinking styles and how managers strategically manage the accrued knowledge of their organisations.

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## **APPENDIX A: ETHICAL CLEARANCE**

# University of KwaZulu-Natal

The Universities of Durban-Westville and Natal merged to become the  
University of KwaZulu-Natal on 1 January 2004

## RESEARCH MANAGEMENT AND ADMINISTRATION

01 MARCH 2004

**MR. R. HARYPURSAT**  
**INFORMATION SYSTEMS AND TECHNOLOGY**

Dear Mr. Harypursat

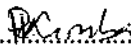
ETHICAL CLEARANCE – NUMBER: 040554

I wish to confirm that ethical clearance has been granted for the following project:

*"An inquiring systems approach to knowledge management in Information  
Technology"*

Thank you

Yours faithfully

  
.....  
**MS. PHUME XIMBA**  
**(for) HEAD: RESEARCH ADMINISTRATION**

**PS: The following general condition is applicable to all projects that have been granted ethical clearance:**

**THE RELEVANT AUTHORITIES SHOULD BE CONTACTED IN ORDER TO OBTAIN THE NECESSARY APPROVAL SHOULD THE RESEARCH INVOLVE UTILIZATION OF SPACE AND/OR FACILITIES AT OTHER INSTITUTIONS/ORGANISATIONS. WHERE QUESTIONNAIRES ARE USED IN THE PROJECT, THE RESEARCHER SHOULD ENSURE THAT THE QUESTIONNAIRE INCLUDES A SECTION AT THE END WHICH SHOULD BE COMPLETED BY THE PARTICIPANT (PRIOR TO THE COMPLETION OF THE QUESTIONNAIRE) INDICATING THAT HE/SHE WAS INFORMED OF THE NATURE AND PURPOSE OF THE PROJECT AND THAT THE INFORMATION GIVEN WILL BE KEPT CONFIDENTIAL.**

cc. Director of School  
cc. Supervisor

## APPENDIX B: QUESTIONNAIRE

A: WHEN I HEAR PEOPLE ARGUE OVER AN IDEA, I TEND TO FAVOR THE SIDE THAT:

☐  
☐  
☐  
☐  
☐

1. Identifies and tries to bring out the conflict
2. Best expresses the values and ideals involved
3. Best reflects my personal opinions and experience
4. Approaches the situation with the most logic and consistency
5. Expresses the argument most forcefully and concisely

B: WHEN I BEGIN WORK ON A GROUP PROJECT, WHAT IS MOST IMPORTANT TO ME IS:

☐  
☐  
☐  
☐  
☐

1. Understanding the purposes and value of the project
2. Discovering the goals and values of individuals in the group
3. Determining the steps to be taken to get the project done efficiently
4. Understanding how the project will pay off for myself and others
5. Getting the project organized and under way

C: GENERALLY SPEAKING, I ABSORB NEW IDEAS BEST BY:

☐  
☐  
☐  
☐  
☐

1. Relating them to current or future activities
2. Applying them to concrete situations
3. Concentration and careful analysis
4. Understanding how they are similar to familiar ideas
5. Contrasting them to other ideas

D: FOR ME, THE BACK-UP DATA IN A BOOK OR REPORT ARE USUALLY:

☐  
☐  
☐  
☐  
☐

1. Very important if they demonstrate the truth of the findings
2. Important only for checking on the accuracy of the facts that are cited
3. Useful, if supported and explained by the narrative
4. Important only in terms of the conclusions to be drawn from them
5. No more and no less important than the narrative

E: IF I WERE PUT IN CHARGE OF A PROJECT, I WOULD PROBABLY START BY:

☐  
☐  
☐  
☐  
☐

1. Trying to fit the project into broad perspective
2. Deciding how to get it done with the available time and money
3. Speculating about what the possible outcomes might be
4. Determining whether or not the project should be done at all
5. Trying to formulate the problem as thoroughly as possible

F: IF I WERE ASKED TO GATHER INFORMATION FROM PEOPLE, I WOULD PREFER TO:

☐  
☐  
☐  
☐  
☐

1. Form my own opinion on the facts and issues and then ask specific questions
2. Hold an open meeting and ask them to air their views
3. Interview them in small groups and ask general questions
4. Meet informally with key people to get their ideas
5. Ask them to give me their information in writing

G: I AM LIKELY TO BELIEVE THAT SOMETHING IS TRUE IF IT:

☐  
☐  
☐  
☐  
☐

1. Has held up against opposition
2. Fits in well with other things that I hold to be true
3. Has been shown to hold up in practice
4. Make sense logically and scientifically
5. Can be personally verified by observable facts

H: I CAN CONTRIBUTE THE MOST WHEN I'M ASKED TO:

☐  
☐  
☐  
☐  
☐

1. Identify the goals and objectives of a project
2. Identify priorities between competing projects
3. Identify how to save time and money on a project
4. Identify the practical effects of a project
5. Identify and assign the resources needed to carry out a project

I: WHEN I READ A NON-FICTION BOOK I PAY MOST ATTENTION TO:

☐  
☐  
☐  
☐  
☐

1. The relation of the conclusions to my own experience
2. Whether or not the recommendations can be accomplished
3. The validity of the findings, backed up by data
4. The writer's understanding of goals and objectives
5. The inferences that are drawn from the data

J: WHEN I HAVE A JOB TO DO, THE FIRST THING I WANT TO KNOW IS:

☐  
☐  
☐  
☐  
☐

1. What the best method is for getting the job done
2. Who wants the job done and when
3. Why the job is worth doing
4. What effect it may have on other jobs that have to be done
5. What the immediate benefit is for doing the job

K: I USUALLY LEARN THE MOST ABOUT HOW TO DO SOMETHING NEW BY:

☐  
☐  
☐  
☐  
☐

1. Understanding how it is related to other things I know
2. Starting in to practice it as soon as possible
3. Listening to differing views about how it is done
4. Having someone show me how to do it
5. Analyzing how to do it in the best way

L: IF I WERE TO BE TESTED, I WOULD PREFER:

☐  
☐  
☐  
☐  
☐

1. An objective, problem-oriented set of questions on the subject
2. A debate with others who are also being tested
3. An oral presentation covering what I know
4. An informal report on how I have applied what I have learned
5. A written report covering background, theory and method

M: PEOPLE WHOSE ABILITIES I RESPECT THE MOST ARE LIKELY TO BE:

☐  
☐  
☐  
☐  
☐

1. Philosophers and consultants
2. Writers and teachers
3. Business and government leaders
4. Economists and engineers
5. Entrepreneurs and journalists

N: GENERALLY SPEAKING, I FIND AN IDEA USEFUL IF IT:

☐  
☐  
☐  
☐  
☐

1. Fits in well with ideas that I have learned
2. Explains things to me in a new way
3. Can systematically explain a number of related situations
4. Serves to clarify my own experience and observations
5. Has a practical and concrete application

O: WHEN SOMEONE MAKES A RECOMMENDATION, I PREFER THAT HE OR SHE:

☐  
☐  
☐  
☐  
☐

1. Show clearly what benefits will be realized
2. Show how the recommendation can be implemented
3. Back up the recommendation with data and a plan
4. Show how the recommendation will support overall goals
5. Take into account the drawbacks as well as the benefits

P: I WOULD MOST LIKELY READ A BOOK ON AN UNFAMILIAR TOPIC BECAUSE OF:

☐  
☐  
☐  
☐  
☐

1. An interest in improving my technical knowledge
2. Having been told it would be useful by someone I respect
3. A desire to know more about how others think
4. A desire to find ideas that would challenge me
5. A wish to learn if the specific subject could benefit me

Q: WHEN I FIRST APPROACH A PROBLEM, I AM MOST LIKELY TO:

☐  
☐  
☐  
☐  
☐

1. Try to relate it to a broader problem or theory
2. Look for ways to get the problem solved quickly
3. Think of a number of opposing ways to solve it
4. Look for ways that others might have solved it
5. Try to find the best procedure for solving it

R: GENERALLY SPEAKING, I AM MOST INCLINED TO:

☐  
☐  
☐  
☐  
☐

1. Find existing methods that work, and use them as well as possible
2. Speculate about how dissimilar methods might work together
3. Strive for quality regardless of the cost
4. Look for new ways to do things
5. Be dissatisfied until I've found the best method



Tear off pages 1, 2 & 3 at the perforation line to expose the score boxes

# SCORING INSTRUCTIONS

Tear off pages 2, & 3 at the perforation line to expose score boxes. Add numbers horizontally (follow arrows). Now add score vertically (follow arrows), placing totals in boxes marked SIPAR. The sum of these boxes should equal 270.

