A teaching environment for learning soft skills applicable to Information Systems Development

by

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ABSTRACT

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KEYWORDS: Information Systems Education, Joint Application Development, JAD, co-operative learning, soft skills development, diversity, actor-network theory.

Information Systems development (ISD) is a complex, social process. The art of Information Systems (IS) development has changed over the years and there has been a growing recognition that Systems Analysts need more than just technical skills in order to do their job. Developing these skills, along with the technical skills is the challenge facing IS lecturers today.

IS departments at tertiary institutions have tended to prepare students very well for the technical needs of systems development. They have given the students the tools and techniques that they need to develop systems in a mechanistic way. There, has been some neglect of the skills that the students need in order to be able to find shared meanings, practise argumentation and be effective in working with users, however. This does not mean that the technical should be neglected, but that students should be able to augment their technical skills with business and interpersonal skills.

This research determined a method by which the techniques of Joint Application Development (JAD) workshops could be combined with the techniques of co-operative learning in order to create an environment where students could learn the soft skills that they need while also learning the modelling skills that are necessary for Information Systems development. The research followed a cyclical pattern of reflecting on the situation, doing literature studies to determine how the learning environment needed to be adapted, working out a theoretical framework for the learning environment, applying the learning methodology and analysing the results obtained from that situation.

The result of the research was a framework that was developed that showed how the JAD and co-operative learning techniques could be used effectively in a classroom with diverse students.

I declare that

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is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

T A Thomas

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Chapter 1

Introduction

1.1 BACKGROUND TO THE PROBLEM

Information Systems development (ISD) is a complex, social process. The art of ISD has changed over the years and there has been a growing recognition that Systems Analysts need more than just technical skills in order to do their job. Developing these skills, along with the technical skills is the challenge facing IS lecturers today.

Information Systems (IS) departments at tertiary institutions have tended to prepare students very well for the technical needs of systems development. They have given the students the tools and techniques that they need to develop systems in a mechanistic way. There, however, has been some neglect of the skills that the students need in order to be able to find shared meanings, practise argumentation and be effective in working with users as change managers. This does not mean that the technical should be neglected, but that students should be able to augment their technical skills with the business and interpersonal skills.

"For quite some time, conventional systems development approaches have acknowledged the importance of the social element of ISD. Nevertheless, they concentrate on the technical process of systems development. They equip the developer with, neither the tools, nor the knowledge, for dealing with the social processes intrinsic to ISD. Simple platitudes such as "get the support of senior management" or "involve the end user" are hardly sufficient to guide systems development. They tend to mask the social nature of ISD or portray it in simplistic ways. They do not allow developers to understand, let alone fully appreciate, the social nature of systems development." [Hirschheim & Newman, 1991]. This problem also occurs in tertiary institutions where

students are prepared for the technical side of ISD but not the social.

Joint Application Development (JAD) methods have been used in industry in order to allow diverse groups of users to become involved in the process of designing their own systems. The method brings together users from different parts of the organization and allows them to debate, in a structured way, about their needs for a new system. The users meet with IT professionals in a structured workshop. Techniques for effective management of group dynamics are used and a facilitator manages the creativity and conflict resolution among the participants [Purvis & Sambamurthy, 1997].

Bringing the JAD methods into the classroom should foster debate in the classroom in a structured manner. Students discuss their ideas about the modelling of systems with one another, debate their ideas and come up with a group model for the systems. Incorporating the JAD techniques used in industry into the classroom, enables students to get more practice at working in groups while learning the modelling techniques used at the same time. The method allows the students to get a deeper understanding of the material, as they have to defend their own ideas and hear the perspectives of others. They are also confronted with their own misconceptions. At the same time, they should also be learning the group, communication and interpersonal skills that are so important in IS development. JAD places an emphasis on group dynamics issues and how to deal with making a group work effectively, getting the group to participate and ensuring that the group comes to consensus about decisions made. If these skills can be learned by the students, then they will become better IS developers.

The research described in this thesis develops a theoretical framework for bringing the JAD techniques into the classroom in order to enhance students' learning of modelling techniques while also helping them develop the skills that they need for interacting with others, working with diverse people, working in groups and conflict handling in groups. Co-operative learning methods were combined with the JAD techniques in order to promote more effective learning in the classroom. These methods were also adapted for use in a classroom with diverse student groups.

The research was done at Technikons in South Africa. A Technikon is a tertiary institution that offers career-oriented programmes and degrees.

1.2 RESEARCH QUESTIONS

Process-based research suggests that the researcher should try to use the different research paradigms in order to view the problem from different perspectives. Instead of doing the research from one particular point of view, the researcher tries to pose a variety of questions that will explore the different aspects of the problem [Roode, 1993].

Roode [1993] proposes that research questions should be structured around the following:

- What is.....?
- Why is .....?
- How does.....?
- How should.....?

1.2.1 What is.....?

The what is.... questions are aimed at determining the underlying structure of the problem or finding the underlying meaning of concepts or ideas. This allows a precise and unambiguous description of the problem [Roode, 1993].

The type of questions that one would need to answer here are:

- What is involved in IS development?
- What social skills are needed by an IS developer?
- What is JAD?
- What is the social constructivist learning theory?
- What is co-operative learning?
- What is meant by diversity?
- What is actor-network theory?

1.2.2 Why is.....?

This question allows one to focus on the real-life behaviour and characteristics of the problem and the relationships that exist within the domain of the problem [Roode, 1993].

- Why should tertiary institutions help IS students develop interpersonal and group skills?
- Why do people use JAD in industry?

1.2.3 How does.....?

The How does..... question allows the researcher to determine how the problem has been manifest in real life.

Questions about how things work that need to be answered are:

- How does JAD work in industry according to the literature?
- How does a diverse student population affect the classroom?

1.2.4 How should.....?

This question focusses on the conclusions and implications of the research results. The answers to these questions allow the researcher to explain the new insights obtained during the research and the conclusions that can be drawn from that [Roode, 1993].

- How should we model JAD in industry?
- How should one deal with diverse students in the classroom and in groups?
- How should lecturers combine the methods of JAD and the methods of co-operative learning in their classrooms?
- How should a framework be designed in order to promote the learning of group skills, interaction skills and modelling skills in a classroom with diverse students?

1.3 RESEARCH OBJECTIVES

The main objective is to develop a framework, that models how JAD and co-operative learning techniques can be used to promote the learning of group skills, interpersonal skills, communication skills and modelling skills in a classroom with a diverse student population. This framework will help lecturers who wish to use the JAD techniques in the classroom to do so in a way that is effective for learning.

In order to do this, the following sub-objectives had to be achieved:

- The first sub-objective was to determine if one can take the methods of JAD used in industry and use them effectively in the classroom. This included determining what teaching, learning and group strategies (like co-operative learning methods) should be used in order to make the method effective.

- The second sub-objective was to determine if this method of learning was effective in helping students to learn the modelling techniques that need to be learnt for Systems Analysis and Design.

- The third sub-objective was to determine if the students perceive that their social skills improve using this method of learning. This included their skills acting as a facilitator, as well as the interpersonal and communication skills needed for working in a group.

1.4 METHODOLOGY

Research methodology and the reasons for choosing a particular paradigm and research design are described in detail in Chapter 2. An overview of what was done is given here but the motivation can be found in Chapter 2.

The research paradigm chosen was a pluralistic one, mixing the critical and interpretive approaches to research. The researcher was involved in the research situation which meant that an objective view was not possible.

A framework for this learning environment was developed. A combination of using Case Studies and Action Research was used in order to build the framework. The Case Studies were used to get an in-depth, contextual understanding of the situation. This analysis was then studied to determine what problems were experienced and what changes were needed. Literature studies were done and the ideas gleaned from these were used to help determine the changes that were needed to make the classroom environment more effective. These changes were then incorporated into the framework. Figure 1.1 gives an indication of the research approach used.

During the first cycle of the research a literature study on IS development and the use of JAD in industry was done to determine the skills needed by an IS developer and to help determine how the JAD techniques could be adapted for use in the classroom. The initial framework was developed for the use of JAD in the classroom and this was evaluated using the first case study. The first cycle is shown in purple on the diagram in Figure 1.1. The first case study was done as a pilot study in 1998 with the Information Systems II students at the Port Elizabeth Technikon. A questionnaire giving both quantitative and qualitative results was used to study the situation as it existed in 1998.

On the basis of this study, it was decided that many of the problems experienced could be addressed by incorporating some of the ideas of co-operative learning. Co-operative learning methods were studied and these ideas were added to the framework and a further study was done in 1999 with the Information Systems II students at Port Elizabeth Technikon. This is shown in the second cycle in pink in Figure 1.1.

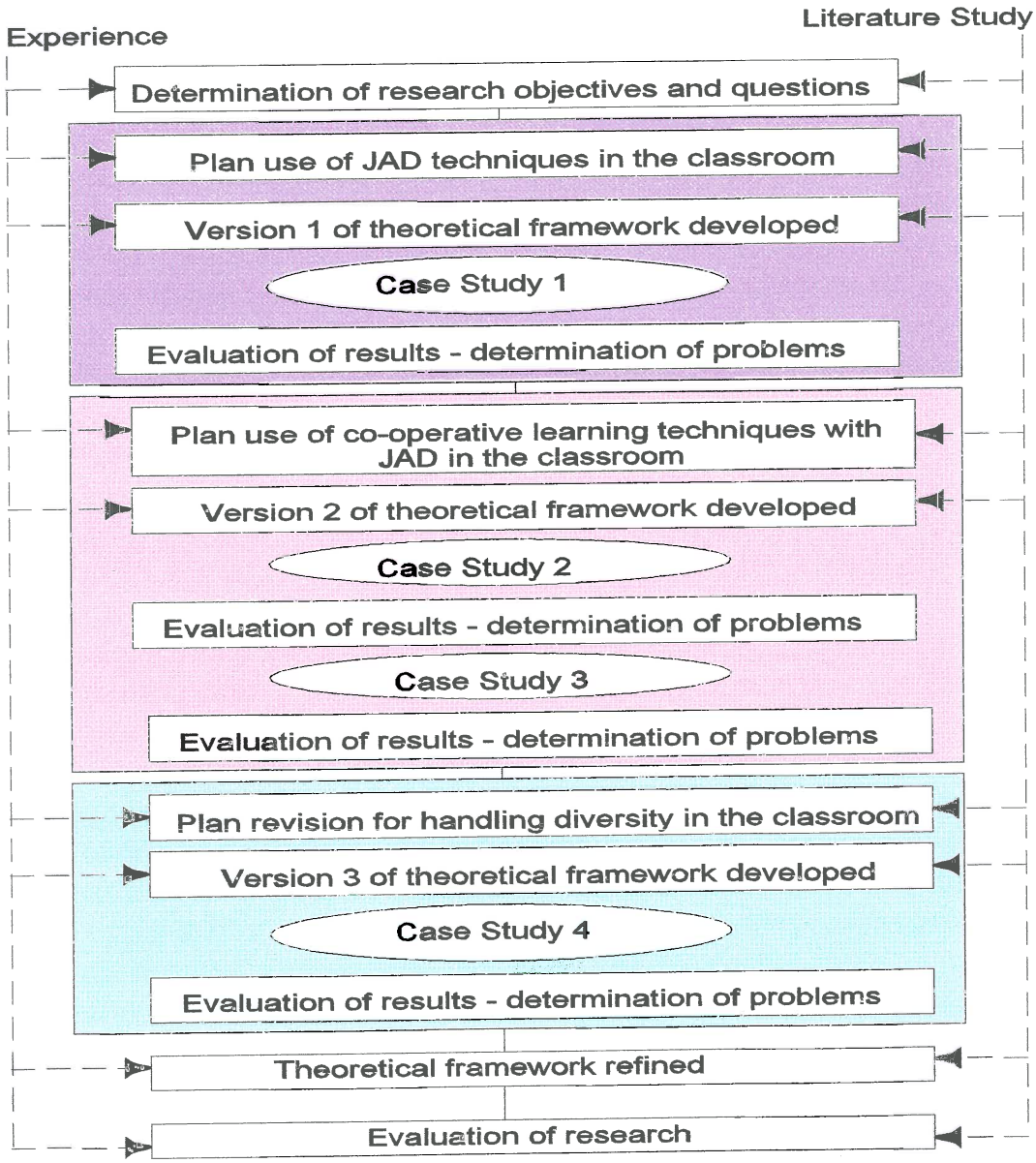


Figure 1.1: Research approach used

Although a significant improvement was found, there were still some problems. Some of these problems seemed to be experienced by the Xhosa-speaking students in the class. It was suspected at this stage that the problems being experienced were as a result of the diverse cultures in the group and not because of the Xhosa-speakers inherent culture. It was therefore, decided to test the same framework in a situation where the groups were almost homogeneously Xhosa speaking. This was done at the

Border Technikon with their third year students. The Xhosa speakers had no difficulties interacting and participating in the homogeneous groups. The problem was thus a result of the diversity of the students, as suspected. This was still part of the second cycle shown in pink in Figure 1.1.

Methods of dealing with diversity, particularly in group work, were then studied and ideas from this were incorporated into the framework. This was done in Cycle 3 shown in turquoise in the diagram. These ideas were tested in a fourth case study done at the Port Elizabeth Technikon.

The final framework was then developed and the research itself evaluated.

1.5 LIMITATIONS OF RESEARCH

The research was carried out in the Eastern Cape region of post-apartheid South Africa. The possibility exists that the results of the research cannot be generalised to other parts of the world or even to South Africa a few years in the future. The context for the research is described in detail so that the readers can consider if the findings would be applicable in their own setting.

The method has only been used on Information Technology students at Technikons and not on traditional university students or students from other disciplines. It is probable that adaptions might be necessary to cater for different types of students.

1.6 A ROAD MAP TO THE THESIS

Figure 1.2 gives an indication of the structure of the thesis. This road map will be given on the introductory page for each chapter in order to position each chapter within the thesis.

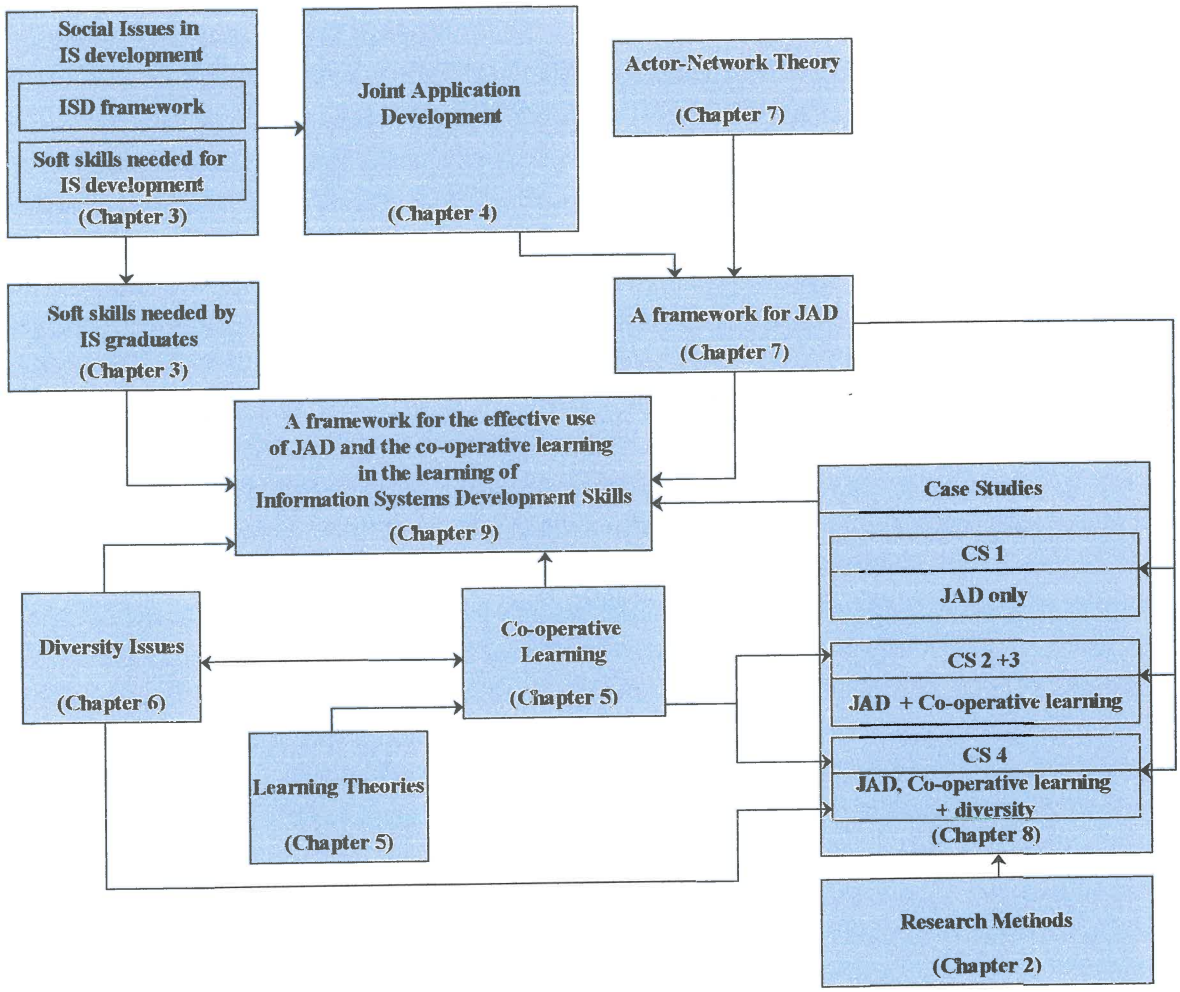


Figure 1.2: A road map to the thesis

Chapter 2 describes research paradigms and designs that are currently in use in IS research. The rationale for the choices of research paradigm, design and methodologies for this study are given in this chapter.

Chapter 3 gives an overview of the social side of IS development. The chapter describes a framework presented by Hirschheim, Klein & Lyytinen [1996] for IS development. These systems development issues are used to motivate that IS developers require not only technical skills, but also business and social skills. Lastly the chapter looks at what this means for tertiary education in terms of social skills development for students. The research questions answered in this chapter are: "*What is involved in IS development*?",

"What social skills are needed by an IS developer?" and "*Why should tertiary institutions help IS students develop interpersonal and group skills?*".

Chapter 4 describes the JAD process and techniques that foster its effective use in industry. The research questions answered are; "*What is JAD?*", "*Why do people use JAD in industry?*" and "*How does JAD work in industry according to the literature?*".

Chapter 5 gives a background to the educational side. Different learning theories are briefly described with an emphasis on the constructivist learning theory. This then leads into a literature study of co-operative learning. Research questions answered in Chapter 5 are: "*What is the social constructivist learning theory?*" and "*What is co-operative learning?*".

Chapter 6 deals with the issues around a diverse student population. During the study, it was found that the diverse student population caused some difficulties for the different students in the groups. This chapter looks at the research questions: *"What is meant by diversity?", "How does a diverse student population affect the classroom?"* and *"How should one deal with diverse students in the classroom and in groups?*".

Chapter 7 gives an overview of actor-network theory (ANT). Parkin's ANT network for decision making in a group is presented and used to develop a framework for the use of JAD in industry. This network is then used as a basis for the development of the framework for the thesis. The research questions answered in this chapter are: "*What is actor-network theory?*" and "*How can we model JAD in industry?*".

Chapter 8 gives an overview of the research done in determining the best method of combining JAD and co-operative learning methods in the classroom. The four case studies are described and the framework is developed as the research progressed. Research questions addressed in this chapter are: "*How should lecturers combine the methods of JAD and the methods of co-operative learning in their classrooms?*" and "*How*

should the framework be designed in order to promote the learning of group skills, interaction skills and modelling skills in a classroom with diverse students?".

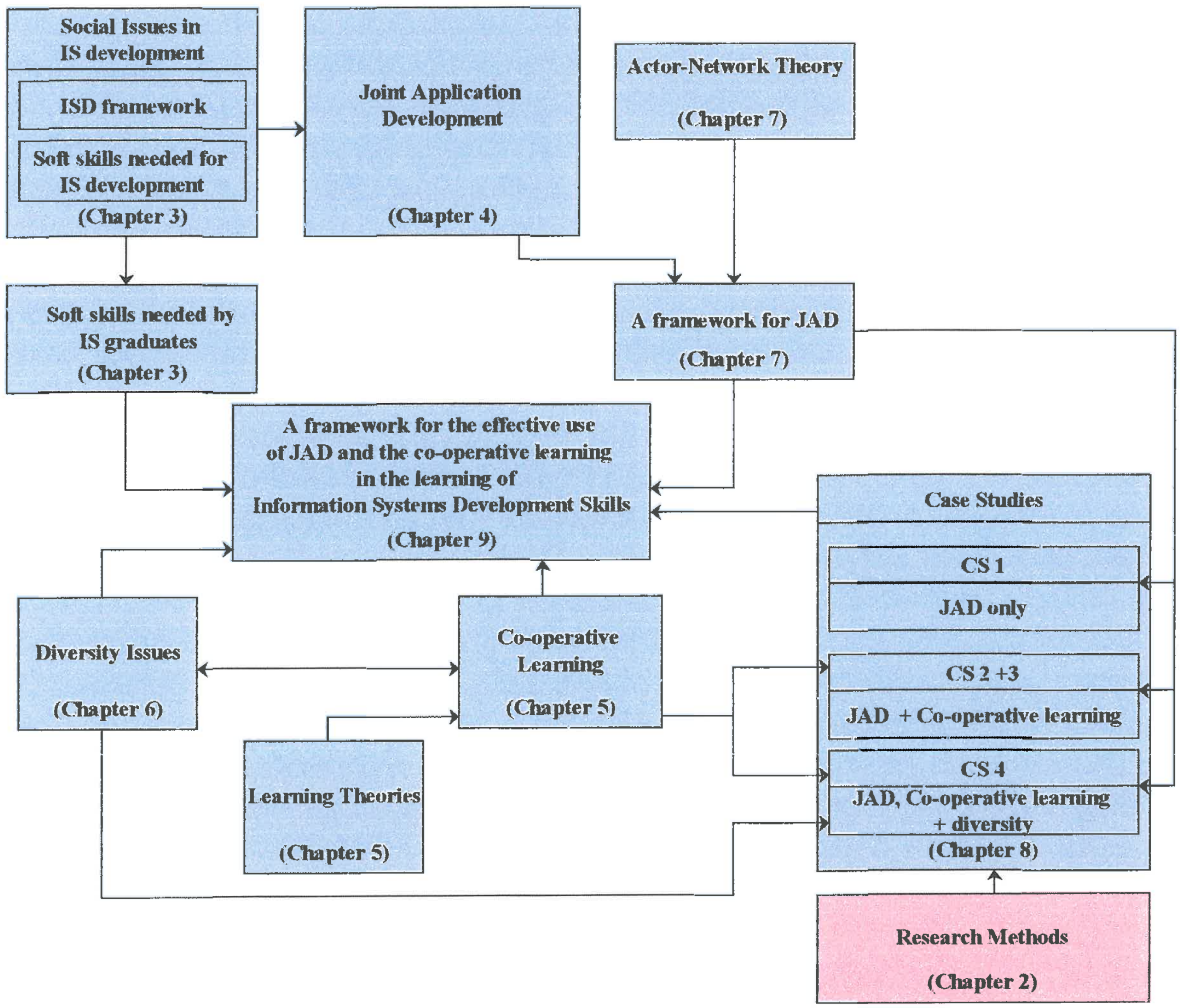
Chapter 9 presents the final framework and completes the answers to the questions addressed in Chapter 8.

Chapter 10 revisits each of the research questions and shows how they were answered. The research is evaluated and ideas for future research are proposed.

The questionnaires used in the case studies are found in Appendix A. Appendix B gives some of the details of the results of the case studies and Appendix C gives some examples of the types of exercises given to the students.

Chapter 2

Research Methodology



Chapter 2

Research Methodology

The purpose of research is to extend knowledge. This can involve research into areas where little is known or trying to fill in the gaps in existing knowledge [Behr, 1988]. Wagner [1993] extends this by saying that research can be used to *"fill in the blank spots"* when doing research to answer questions already posed, and *to "illuminate blind spots"* when doing research that provokes one to ask new questions. He defines research as a strategy for reducing ignorance rather than a method of pursuing truth.

Research in IS, especially in the United States, has been primarily empirical over the last twenty years with almost all of the research reflecting a positivist orientation [Alavi & Carlson, 1992; Orlikowski & Baroudi, 1991; Lee, Barua & Whinston, 1997]. This means that the researchers have assumed that IS can be studied in an objective manner using the methods that have been so successful in the natural sciences.

Davenport and Markus (1999) suggest that IS researchers should emulate researchers in medicine and law rather than those in business or science in order to make sure that more relevant research takes place. Commenting on this Lee (1999) notes that medicine and law are professions rather than natural sciences. He suggests that "*Inquiry in the natural sciences pursues the goal of truth in formal propositions; inquiry in the professions pursues the goal of effectiveness in actions. Inquiry in the natural sciences produces knowledge about what the world is; inquiry in the professions produces knowledge about how to intervene in the world and change it in order to satisfy real world needs.*" [Lee, 1999, p.29]

IS is about more than just technology, however, and IS research has shifted in recent years from the technological to include the social and organisational aspects [Banville,

1991; Hirschheim & Newman, 1991; Myers, 1997; Iivari, Hirschheim & Klein, 1998]. Researchers in Europe have been using alternative approaches for a number of years and have criticised the emphasis placed on quantification [Lee, Barua & Whinston, 1997; Mumford, 1991, Nissen, Klein & Hirschheim, 1991]. In natural science research the nature of the phenomena being studied does not change. In social sciences, however, researchers enter the real world and the actors in the research are affected by the research [Orlikowski & Baroudi, 1991]. Many IS and Management Information Systems' (MIS) researchers [Alavi & Carlson, 1992; Nissen, Klein & Hirschheim, 1991; Orlikowski & Baroudi, 1991; Walsham, 1995] have come to believe that using a positivist approach to research alone is restrictive. They promote the use of alternative methods to study IS and the relationships between information technology, people and the organisation.

The same problems have been found in educational research, also a social science, where researchers are also calling for more flexible approaches [Gage, 1989; Martin & Sugarman, 1993]. Martin and Sugarman [1993, p.19] take the position that "*research on teaching has been misconstrued as a primarily empirical activity and that, as a consequence, it has been overly preoccupied with question of methodology*". Traditional educational research has been depicted as being inadequate to make any important decisions about how teachers should work in a classroom [Gage, 1989].

This chapter firstly introduces the Research Methodology terminology. The different research paradigms and designs are then described. As each one is described, its appropriateness for the study of the social sciences, and in particular, IS and Education will be discussed. This chapter only discusses designs suitable for doing in-context research. The chapter will conclude by discussing the research paradigm/s, design and methods that will be used for the doctoral study and the motivation for using them.

2.1 INTRODUCTION

Before discussing research in more detail, it is important to clarify the terms that will be used and how these relate to one another.

The term **paradigm** refers to the philosophy or school of thought that underlies the research approach. It can be seen as the beliefs and values that are shared by the research community using that paradigm [Farhoomand, 1992]. The different paradigms will be described in Section 2.2.

The term **design** refers to how the approach is handled with respect to issues like representativeness and causal attribution [Hedrick, 1994]. It refers to the way in which a person goes about doing the research. One design may use different methods or techniques [Galliers, 1992]. Quantitative designs are considered scientific and adopt such approaches as experiments and quasi experiments with representative samples and statistical analysis. Qualitative researchers are not as concerned with generalising results in their research designs. The research is often used for exploratory or descriptive research. Some designs, for example case studies, may use either a qualitative or a quantitative approach or both. Research designs will be described in Section 2.3.

The term **method** refers to how data collection occurs and what form that data will take [Hedrick, 1994]. The most important issue here is how the data exists and whether it can be quantified or whether it is qualitative. Quantitative methods tend to use systematic approaches to gathering data whereas qualitative methods are more concerned with broadening the information base. Some forms of qualitative data may be coded and used quantitatively as, for example, in text analysis of unstructured interviews [Lacity & Janson, 1994]. The research methods or techniques themselves will not be described in this chapter. Their appropriateness within the different research paradigms and research designs will be mentioned but a detailed explanation of their use is not given.

2.2 RESEARCH PARADIGMS

A paradigm can be defined as consisting of "*assumptions about knowledge and how to*

acquire it, and about the physical and social world" [Hirschheim & Klein, 1989, p.1201]. It is a fundamental philosophy or set of assumptions that allow the members of the research community to share their perceptions and engage in similar practices.

Orlikowski and Baroudi [1991] suggest three paradigms covering the three research epistimologies of positivism, interpretivism and critical. Gage [1989] also uses the traditional/scientific (positivist), interpretive and critical theory paradigms when discussing the paradigms for educational research.

Braa and Vidgen [1999] propose the research framework given in Figure 2.1 for doing in-context IS research. The points in the framework represent the research outcomes with prediction being aligned with reductionism as depicted by the positivistic approach, understanding being aligned with the interpretive approach and change with the intervention approach.

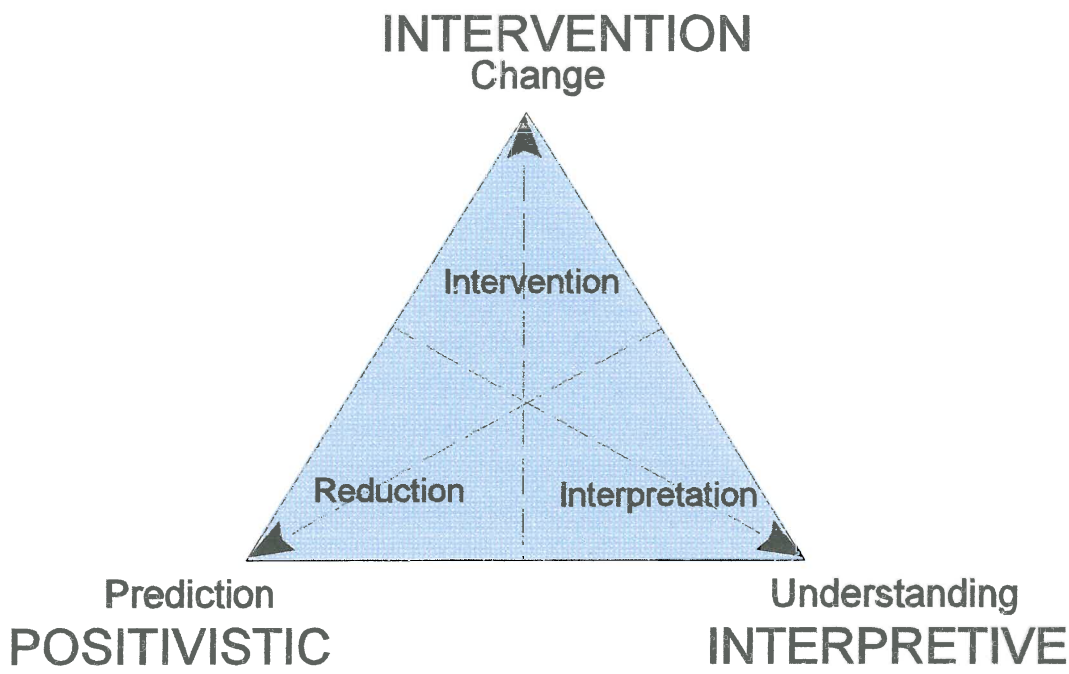


Figure 2.1: An IS research framework for in-context research [Adapted from Braa and Vidgen, 1999, p.28]

Prediction is shown as the outcome of the positivistic method of research as this method

is seen as being able to control and predict. Change is the outcome of intervention as this research method is motivated by the desire to improve the situation. Interpretive research should help to promote understanding of the situation being researched. The points of the triangle are seen as ideal and are not really attainable in practice, according to Braa and Vidgen [1999]. The dotted lines represent the research dynamics as movements towards or away from these ideal types. The space of the triangle implies that the three dynamics, namely reduction, intervention and interpretation are all present but with different mixes and emphasis. As the researcher moves, for example, towards a greater process of interpretation, greater understanding will be achieved.

The discussion that follows describes the three main paradigms, namely positivistic, interpretive and critical, in terms of their beliefs about physical and social reality, knowledge and the relationship between theory and practice. Beliefs about social and physical reality include the ontology (subjective versus objective), human rationality and social relations. Knowledge includes beliefs about epistemology (how knowledge is constructed and evaluated) and methodologies that are appropriate to the research paradigm. The relation between theory and practice looks at the purpose of the research in practice [Orlikowski & Baroudi,1991; Iivari, Hirschheim & Klein, 1998]. The possibility of using a pluralistic paradigm is then considered.

2.2.1 Positivist Paradigm

The positivist paradigm has its roots in natural science research. It has been linked to the so-called "scientific" approach. This approach has been very successful in the natural science field and has helped to assure quality research and build knowledge. Studies done in positivist research are usually done to test theory.

2.2.1.1 Positivist beliefs about physical and social reality

Positivist researchers assume that there is an objective physical and social world that exists independently of humans. They assume that one can objectively measure and

categorize that world. The role of the researcher is to measure dimensions of that world in order to discover the social and physical reality. It is assumed, by positivists, that all objects in the universe, whether they be inert, living, conscious or rational, can be studied in the same way and are fundamentally and qualitatively the same [Oliga, 1991].

Human action is seen by positivists to be intentional and rational. Humans are perceived to interact with their environment in a deterministic manner. The activities of man are perceived to be completely determined by the situation or environment in which he or she is found [Iivari, Hirschheim & Klein, 1998].

Positivists believe that human beings interact in stable and orderly ways. They do not see conflict and contradiction as being normal in society - they are rather seen as dysfunctional and something to be suppressed [Orlikowski & Baroudi, 1991]. Positivists believe that there is only one valid way of accounting for any social situation [Walsham, 1995].

2.2.1.2 Positivist beliefs about knowledge

The epistemological belief of positivists is that research consists of the empirical testing of theories to see if they are true or false. Positivistic researchers use controlled experiments with universal rules and impersonal procedures to gain knowledge [Oliga, 1991]. They work deductively to try to discover causal relationships and believe that one can predict and control events if one can determine that certain principles and premises explain that event. Positivists search for laws that can be generally applied [House, 1994].

Positivists tend to believe that there are only a few appropriate research methodologies from which knowledge can be obtained. The research instruments must be proved to be valid and reliable and any samples used must be representative. The use of experimental designs with subjects assigned randomly to groups and control groups is promoted. Hypothesis testing is another common method of positivist research. Surveys

are also used for data collection. Positivists believe that the "scientific method" is appropriate for all forms of research [Hirschheim, 1992].

Braa and Vidgen [1999] say that positivism tries to reduce the area of investigation in order to be able to make predictions and explanations that are reliable. In order to do this they use methods of reductionism and focus on experiments that are repeatable and irrefutable. Complexity is tackled by reductionism [Fitzgerald & Howcroft, 1998].

2.2.1.3 Positivist beliefs about the relationship between theory and practice

Positivist researchers assume a value-neutral stance. They believe that researchers must distance themselves from the research in order to objectively evaluate or predict what happens. The researcher must not get involved in moral judgements or subjective opinion [Ackoff, 1991].

Positivists believe that if they can know the general laws and can manipulate the initial conditions, they will be able to produce the desired state of affairs - whether they be natural or social. The world is believed to conform to fixed laws of causation [Fitzgerald & Howcroft, 1998].

2.2.1.4 Applicability of positivism for information systems and cooperative learning research

While the positivist approach has been successful in the natural sciences and engineering, its applicability to the social sciences and IS research has been questioned [Orlikowski & Baroudi, 1991]. Positivists try to look for universal laws ignoring the influences of history and context on humans. Aspects like time, locale, politics and culture can influence the development and use of IS and education and this needs to be recognised. Smith [1990, p.125] describes the problem this way: *"In applying natural science methods and techniques to social science problem, positivist approaches assume that social science is at a point of development whereby methods and*

techniques appropriate to explanation and prediction may be employed and that much of the complexity of social phenomenon can be ignored."

Glass introduced a BITNET electronic discussion on educational policy by saying that "*Education is no science. Nothing like it has ever yielded its mysteries to scientific investigation*" [Glass, 1993, p.17]. Educational systems have historically been seen as "machine bureaucracies" which could be studied using a positivist approach [Capper & Jamison, 1993]. Some educational researchers are questioning this and calling for alternative or pluralistic approaches [Capper & Jamison, 1993; House, 1991; Martin & Sugarman, 1993]. Smith [1994] comes out strongly against using only a positivist approach to educational evaluation, saying that it leads to distortion and oversimplification, while sacrificing relevance in order to claim to be objective and rigorous.

Despite this there have been a great number of studies in the field of cooperative learning that do try to adhere to the positivist paradigm [Slavin, Sharan, Kagan, Lazarowitz, Webb & Schmuck, 1985; Sharan, 1990; O'Malley, 1995a]. The negative view of positivism is not shared by all educational researchers. Schrag [1992] argues that even critics of positivist research must admit that they need to follow a positivist approach in order to test many of their propositions. He seems to suggest that all causal research is positivist, which is untrue according to Eisner [1992]. He says that the positivist paradigm is much more than just causal research, it also believes in separating value from fact, methodological monism and a view that ethical claims are meaningless. For these reasons Eisner deems the positivistic approach unsuitable for educational research.

2.2.2 Interpretive Paradigm

Interpretive researchers try to understand the situation being studied from the perspective of the participants. They try to gain a deep understanding of the situation and use that to inform people in similar situations. Interpretivists believe that reality is

"incapable of being understood independent [sic] of the social actors (including the researchers) that construct and make sense of that reality." [Orlikowski & Baroudi, 1991, p.13]. Interpretive researchers thus focus on the complexities of human sense making within the research situation [Klein & Myers, 1999].

2.2.2.1 Interpretive beliefs about physical and social reality

The interpretive paradigm emphasises subjectivity. Researchers try to understand the subjective meanings that participants give to situations. Our knowledge of reality is believed to be a social construction by the people who participate in that reality [Walsham, 1995]. Human beings (including researchers) will interpret a situation in different ways and if they are aiming at understanding a situation fully, then they will need to try to understand the insider's point of view [Braa & Vidgen, 1999]. There is thus no universal truth [Fitzgerald & Howcroft, 1998].

The social world is believed to be produced and reinforced by people as they interact within the organisation, groups or with each other. This means that organisations and groups cannot be studied and measured in some objective way [Orlikowski & Baroudi, 1991]. The interpretivists thus lean towards a voluntaristic view of human nature and human beings are seen as being creative in their dealings with their environment [Burrell & Morgan, 1979]. Interpretive researchers will focus on people's assumptions, beliefs and desires [Henfridsson, 2000].

The interpretivists believe, with the positivists, in orderly interaction within society but believe that this is a result of the shared norms and interests of the people involved. Cultural and political issues will affect how people interact and will also affect the shared meanings, social rules and interpretations that people experience. Interpretive researchers believe in social systems being open to more than one interpretation [Walsham, 1995]. Social reality cannot be discovered but must rather be interpreted.

2.2.2.2 Interpretive beliefs about knowledge

In order to understand social processes, the interpretive researcher believes that one has to get involved with those that participate in that process. People working together will share language and norms and in order to understand their social reality and gain knowledge, the researcher must understand how these people practise and form meanings. Boland [quoted in Orlikowski & Baroudi, 1991, p.14] says that "*individuals act towards things on the basis of the meanings that things have for them, that meanings arise out of social interaction, and that meanings are developed and modified through an interpretive process*". Reasoning, ideas and spontaneous individual insights are seen as the source of knowledge [Klein, Hirschheim & Nissen, 1991].

The interpretivist does not seek generally applicable laws, like the positivist, but rather seeks understanding [House, 1994]. This understanding allows the researcher to get a basic descriptive foundation which may lead to the generation of an hypothesis [Fitzgerald & Howcroft, 1998].

Field studies are used a lot in interpretive studies as these enable the researcher to study people within their social settings. The researcher does not have pre-defined sets of constructs and measuring instruments for doing the research, but rather attempts to derive these from the study of the situation and the people involved. Experimental methods are replaced by more context-dependent observational methods [Walsham, 1995]. Qualitative techniques are used, sometimes with quantitative techniques, in order to interpret and illuminate [Fitzgerald & Howcroft, 1998].

Interpretive researchers attempt to get a rich, comprehensive, in-depth understanding of what has happened from the point of view of the participants. They try to incorporate all the available information into a pattern in order to explain and understand the situation. Inconsistent information is incorporated into the explanation rather than ignored [Datta, 1994].

Klein and Myers [1999] propose that, when doing interpretive field study research using in-depth case studies or ethnographic research, one should cater for most if not all of the following seven principles:

- Principle of hermeneutic circle - This suggests that understanding can only be reached by studying both between the parts and the whole of the phenomenon.
- Principle of contextualisation - The social and historical context of the research must be taken into account in the research situation.
- Principle of interaction between the researchers and the subjects - This requires critical reflection on how the research materials were constructed and what the interaction was between the researcher and the subjects.
- Principle of abstraction and generalisation - Theoretical abstractions and generalizations should be carefully related to the context-specific situation being studied. Giving rich insight helps readers to know if they can abstract and generalise to their situation.
- Principle of dialogical reasoning - This principle suggests that the researcher must be sensitive to possible contradictions between the theoretical preconceptions and the actual findings. Any preconceptions or prejudices of the researcher should be confronted and related to the results achieved.
- Principle of multiple interpretations - The researcher should acknowledge and be sensitive to the fact that the different participants in the research might have various interpretation of the situation being studied.
- Principle of suspicion - The researcher must be aware of possible biases and distortions in the stories told by the participants.

They say that these principles must not be thought of as mandatory, but should be used as a guide by the researcher in determining what is appropriate for his or her research. These principles will be explained further where they are used to evaluate the research in the final chapter.

2.2.2.3 Interpretive beliefs about the relationship between theory and practice

Interpretivists believe that the researcher can never be neutral and will always be involved in the situation being studied. The researchers' prior beliefs, values and interests will always influence their research. The researcher interacts with the actors in the situation being studied and comes to share a set of meanings about the situation [Orlikowski & Baroudi, 1991].

2.2.2.4 Applicability of interpretivism for information systems and education research

Walsham [1995] describes a shift in what mainstream MIS journals are saying that they will accept from positivistic research alone to include interpretive research. Henfridsson (2000) believes that interpretive research is particularly useful to the IS researcher wanting to understand IS in a cultural and social context., however.

Educational researchers are also recognising that multiple interpretations of reality are possible and that subjectivity is unavoidable [Capper & Jamison, 1993]. Gage [1989] says that interpretive research will help us examine the meaning created by students and teachers and this can form a basis for explaining the differences among students' achievement and morale.

Some criticisms of the interpretive paradigm are that [Orlikowski & Baroudi, 1991; Jackson, 1991]:

- It does not examine the external conditions that give rise to certain meanings and experiences.
- It does not explain unintentional consequences of actions.
- It does not address structural conflicts and contradictions in society. It cannot explain why participants' accounts of their behaviour are inconsistent with their actual behaviour.
- It is limited in its ability to bring about change in social systems.

It does, however, allow a deep understanding to be gained of a particular situation and helps to get varying viewpoints of the situation being researched.

2.2.3 Critical Theory Paradigm

The primary objective of critical theory, according to Ngwenyama [1991], is that of improving the human condition. The critical theory researcher tries to investigate the social reality and critically evaluate and transform it. The researchers use research to reveal any conflicts and contradictions within the system being studied and then try to overcome these problems through their understanding.

The word "critical" need not necessarily have negative connotations, but rather involves the examination of reality and becoming self aware [Boughey, 1998]. Critical research is usually started as a response to the experiences, desires or needs of an oppressed group of people [Lather, 1986]. Fien and Hillcoat [1996] mention three related objectives for critical inquiry, namely scientific understanding, social critique and social transformation. This suggests that the research carried out must be scientific, critical and practical.

2.2.3.1 Critical theory beliefs about physical and social reality

Critical theorists believe that although social reality is produced and reproduced by humans, it also has objective properties. They thus see both the subjective and objective sides of social reality. While the other paradigms are satisfied with understanding and analysing the status quo, critical theory tries to find alternatives to the status quo.

Critical researchers maintain that our subjective views are not only internally constructed but are also influenced by outside social forces. This means that individuals should not be considered outside of their social context [Fien & Hillcoat, 1996]. The goal of critical inquiry is to alleviate oppression making people aware of who they are and making them

conscious of themselves as people with a choice [Lather, 1991].

Social relations are seen as based in history and must be studied in this context. Social forms will have contradictions, inequalities and conflicts and these must be exposed by research so that new social forms can emerge.

People are thought to be the creators of their world and they can change that world if they wish [Ngwenyama, 1991]. Critical theorists perceive man as being able to understand himself and what he has become through society, **but** man can also liberate himself and this contributes to a better society [Boughey, 1998]. Central to critical research is self reflection and the gaining of a deeper understanding by the people being researched [Lather, 1986].

Critical theorists see society as an oppressive social system which needs enlightenment and emancipation of the oppressed individuals [Jablonsky, 1991]. Human beings are perceived as dominant or dominating figures and an awareness must be created of this in order to eliminate it. This is based on Marxist theory. Critical theorists often assume that this conflict is between management and labour and ignore the fact that other factors like race or gender could also lead to dominating social relations [Orlikowski & Baroudi, 1991].

Social reality is seen as a system which must be looked at in totality and where the parts cannot be studied in isolation but should be studied in the context of their relationships within the system. Organisations, for example, need to be studied in the context of the industry, society and nation wherein they operate.

2.2.3.2 Critical theory beliefs about knowledge

Knowledge is grounded in social and historical practices. Critical theorists believe that they need to understand the language of the people they are studying but also believe that this is bound by time and space. Historical analysis is necessary in order to

understand the situation. Interpretation of the social world is not enough, the conditions of domination in that world must also be understood. This means that the knowledge gained from this research is usually not generalisable but is used to "*illuminate the forces that work in society as a totality*" [Orlikowski & Baroudi, 1991, p.20].

The knowledge gained by critical theory research will not necessarily be generally valid as it is valid within the limits of the interconnections and consequences found in the situation being researched. This knowledge will change over time and any predictions made will only be able to be realised by the purposeful actions of people [Thomas & Lockett, 1991]. Critical inquiry is often concerned with studying the "oppressed" as they are in a process of transformation [Lather, 1986].

Methodology is viewed by critical researchers as inherently political and is often tied to issues of power and legitimacy [Lather, 1991]. Critical theorists tend to use longitudinal studies including long-term historical studies and ethnographical studies. Quantitative methods are seldom used. Critical system thinkers advocate the use of pluralistic methods where the different research approaches are used in a complementary fashion [Schecter, 1991].

Research methods are required to be practise-oriented, focussing on change. They must support inquiry into both the organization and the social context. The methods should support individual and organizational needs. Research methods must be collaborative in that the participants must be able to adapt the research to their needs. The methods must allow for critical self-reflection [Ngwenyama, 1991]. Methods like action research, discourse analysis and critical ethnography are applicable in the critical paradigm [Fien and Hillcoat, 1996].

2.2.3.3 Critical theory beliefs about the relationship between theory and practice

The role of the researcher in a critical theory research situation is to determine the problems, contradictions and conflicts of the status quo. This should then be used to

initiate change and help to eliminate these problems. Researchers cannot avoid bringing their values into the research as all scientific knowledge is socially constructed [Ngwenyama, 1991]. The role of the researcher is, therefore, to study and theorize in order to effect a change in what is being studied. This is depicted in Figure 2.2.

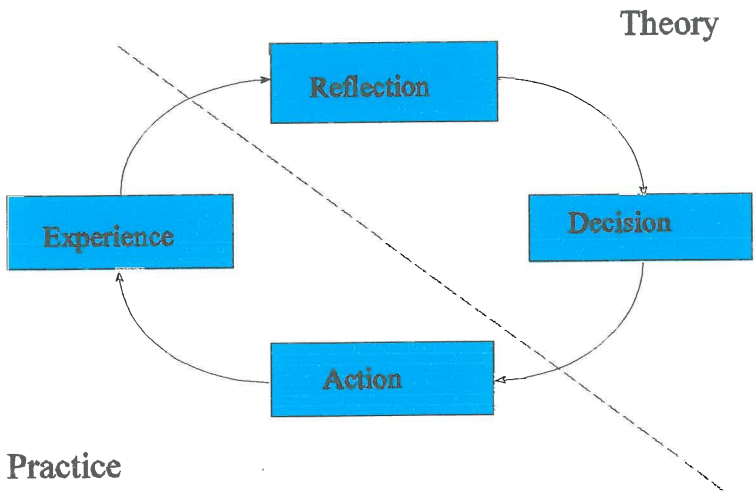


Figure 2.2: The Critical Social Theory and Practice Change Process [Ngwenyama, 1991, p.272]

Theory and practice cannot be separated by the critical theorist as the point of research is not just to analyse or interpret what is happening in the world, but to change it [Thomas & Lockett, 1991]. The results of a critical inquiry would suggest why people should change but the subjects must be given an opportunity to reject that change. The participants must be able to critically reflect and react to the researchers findings.

Critical research must be scientific, critical and practical [Fien & Hillcoat, 1996]. "*A growing concern of critical social science discourse is how to generate knowledge in ways that turn critical thought into emancipatory action.*" [Lather, 1991, p.12]. It can be a problem if researchers with liberal intentions impose their own meanings on situations. It is thus important that the meaning of a situation be negotiated with participants in the research [Lather, 1991].

The process of research should be a self-sustaining process of analysis, reflection and action over a period of time [Lather, 1986].

2.2.3.4 Applicability of critical theory for information systems and education research

A critical researcher of IS will study the information system and its place in the industry, society and culture within which it is found. This is a paradigm that recognises the complexity of systems like information systems.

The critical theorists emphasise power in society and the function of the schools in defining that power. Critical researchers in education stress how schools have traditionally served the interests of the dominant social class [Gage, 1989]. Educational research, from a critical perspective, is geared towards changing this so that people are properly educated and motivated rather than dominated by the system.

Gibson [quoted in Fien & Hillcoat, 1996, p.28] suggests that teachers should be interested in critical theory because it can help answer many of the questions that concern them such as:

> *"Why do some children persistently fail at school? Why are some pupils so unmotivated and so difficult in the classroom? Why do we teach what we do? Why are schools organised as they are?"*

They go on to suggest that critical theory is important to educational researchers as it can help to explain the origins of everyday practices and problems. It also helps foster better relationships with the classroom and move towards a more rational society. *"Critical educational research is grounded in a vision of social change and democratic values, in that it seeks to empower teachers and students to participate in programmes of research."* [Fien and Hillcoat, 1996, p.29].

2.2.4 Pluralistic Approaches

Paradigms can be restrictive in that they can rigidly define a field, thus determining what should be studied, what questions must be asked and what rules must be followed to interpret the answers. A paradigm can restrict a scientist and cause him/her to observe only what the paradigm says should be observed and put other factors away as irrelevant. This could limit the progress of the field [Banville & Landry, 1989]. A paradigm should rather be seen as "*a lens to illuminate research issues, not as blinkers to help achieve closure.*" [Fitzgerald & Howcroft, 1998].

As information systems are seen from a wider perspective to include technological, social and organisational factors, the research area has become more complex, imprecise and ambiguous. This has led to a need for using the interpretive and critical approaches as well as the more traditional positivist approach. Alavi & Carlson [1992] believe that a plurality of approaches will be important to progress in the field as researchers will be able to gain greater insights. This is echoed by Achterberg, van Es & Heng [1991] who suggest that as IS includes the study of so many different disciplines, it should include the methodologies of those disciplines and form hybrid methods if necessary.

Braa and Vidgen [1999] proposed the triangle given in Figure 2.1, as a framework for in-context research in IS. They say that achieving the "ideal" interpretive, intervention or positivistic research method is impossible in research carried out in an organisation. The containment of the triangle is seen as implying that all three dynamics are present regardless of the research method used. They do not believe that a hybrid method of doing research that satisfies all the needs of change, prediction and understanding and is in the middle of the triangle, is possible. Although this would be great for multi-disciplinary research, it is not possible to maximize all of these. If one wants to have a well-designed experiment, then realism will have to be forfeited to some degree, for example. It is also not possible for a researcher to make interventions and be part of the change process, while also being an objective observer and produce rigorous results in

the positivistic tradition.

The call for multiple paradigm approaches is also reflected in research on educational evaluation [Smith, 1990; Salomon, 1991]. Smith [1994, p.43] says that multiple approaches are the *"only path to rapprochement and true synthesis in the field"*. This is supported by Martin and Sugarman [1993, p.19] who go so far as to say that pluralistic methods are signs of a "*natural and mature state"* in educational research. Multiple paradigms can complement each other rather than being opposing [Salomon, 1991].

Klein, Hirschheim and Nissen [1991] have proposed that there are four approaches to using more than one paradigm or research method. These are:

- The advocates of contingency in research believe that there are a range of research methods, each with their own strengths and weaknesses and that the choice should be made depending on the focus and objectives of the research.
- Pluralists believe that different research methods can be used on the same problem and that each should be judged on its internal merits. Looking at a research problem from different perspectives will allow one to gain different insights.
- Eclectics believe that there are different methods appropriate to a particular research situation but that one can pick and choose methods to build an approach that is best suited to the problem.
- Dialectics try to synthesis the opposing approaches of positivism and anti-positivism (which includes interpretivism and critical theory) and conserve some of the best ideas of both.

Walsham [1995] proposes that the positivist and interpretive approaches are not really opposed and can be reconciled. He claims that there are three levels at which we must try to gain understanding:

- the subjective understanding of the people involved in the social situation;
- the interpretive understanding that the research gains from interacting with the participants; and

- the positivist understanding from testing in an objective manner those understandings.

This would support the idea that a synthesis of the two approaches is possible.

2.3 RESEARCH DESIGNS FOR IN-CONTEXT RESEARCH

The research design determines how the research is carried out within the constraints of the paradigm chosen. The different designs can be implemented using one or more different research methods. The term design thus refers to the basic plan or strategy of the research and the logic behind it [Oppenheim, 1992]. Braa and Vidgen [1999] propose the diagram in Figure 2.3 to show how some of the research methods fit into their framework presented in Figure 2.1. They say that field experiments are used mostly for prediction, case studies to get understanding and action research to change the situation being studied. Hard case studies are not purely positivistic or interpretive and are a mixture of understanding and prediction. Quasi-experiments are a mixture of prediction and change. The action case study is a term that they have labelled themselves and they see this as a hybrid of understanding and change. Techniques like

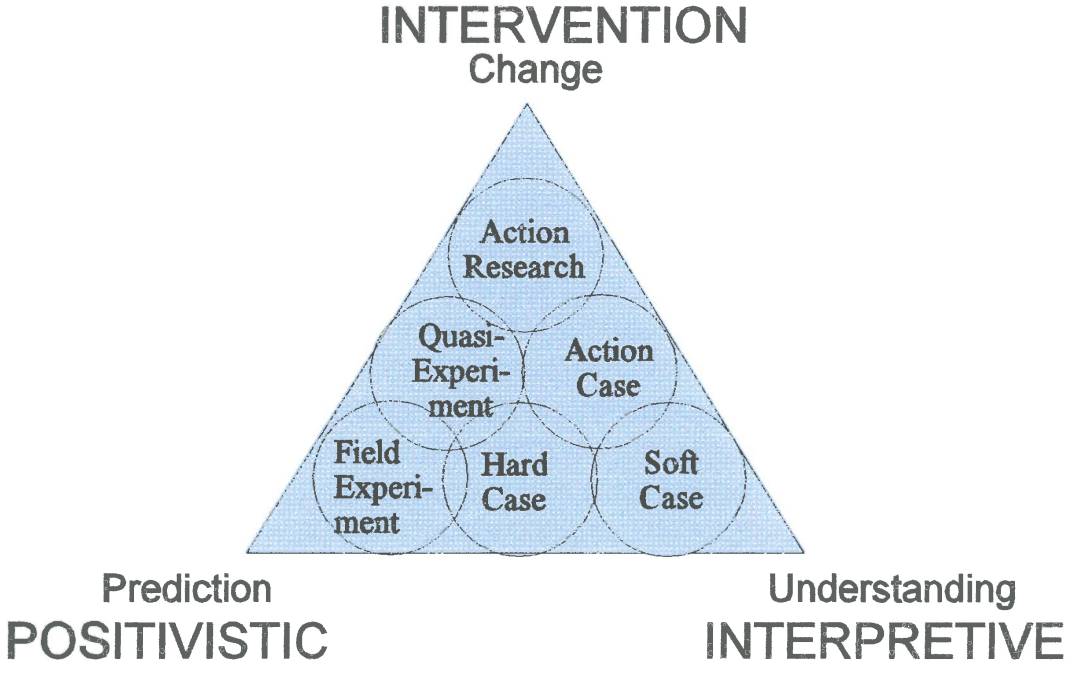


Figure 2.3: Methods to use for in-context IS research [Adapted from Braa and Vidgen, 1999, p.32]

surveys and interviews are seen as orthogonal to the triangle.

This discussion does not try to be exhaustive but chooses a few of the more prominent research designs used in in-context IS and educational research and gives an overview of their structure, their weaknesses and their strengths.

2.3.1 Survey research

Surveys are seen by Braa and Vidgen [1999], as being orthogonal to their framework as they can be used in any of the three research paradigms. Surveys are undertaken at a particular point in time using questionnaires or structured interviews. Their purpose is to obtain information about prevailing conditions in a planned way [Behr, 1988]. Surveys may be taken from an entire population or from a representative sample of the population [Wynekoop & Conger, 1991]. The survey can collect data from a large number of people at one time. It is not concerned with individual cases but with the overall statistics, and quantitative techniques are usually used to analyse the results [Behr, 1988].

Surveys enable the researcher to investigate many more variables than would be possible with the experimental approaches [Galliers, 1992]. If the samples are properly chosen, the results can be generalized to wider populations [Wynekoop & Conger, 1991].

Surveys are most appropriate when [Pinsonneault & Kraemer, 1993]:

- We want to determine what, how much of and how many, or even how and why, something is happening;
- the control of the independent and dependent variables is not possible or not desirable;
- the phenomena to be researched are studied in their natural setting; and
- the phenomena to be studied occur currently or in the recent past.

Weaknesses of the survey method occur if the sample sizes are too small; if the

respondents are unwilling and give inaccurate answers; or if the respondents are only those who want to respond and the sample becomes biassed in one direction [Wynekoop & Conger, 1991; Galliers, 1992]. The populations of any samples must be "*carefully chosen, clearly defined and specifically delimited in order to set precise parameters for ensuring discreteness of the population.*" [Leedy, 1993, p.187].

Surveys usually give little insight into the causes or the processes behind what is being studied as they are only able to report that a relationship exists and not prove that the relationship is causal [Oppenheim, 1992].

2.3.2 Experimental designs

The purpose of experimental research is to test a belief or hypothesis in a given situation or under given conditions. An experiment consists of objective observation or measurement of variables under carefully designed conditions [Behr, 1988]. The experimental design assesses the cause and effect relationship within a system of controlled conditions [Leedy, 1993].

Experimental designs attempt to identify the precise relationship between different variables. This is often done in a designed laboratory situation but may be done using field experiments [Galliers, 1992]. The experimental method must define the relationship to be investigated and then two groups must be set up, namely an experimental group and a control group. The two groups must be similar in every respect except for the factor being investigated [Behr, 1992]. Subjects are often randomly assigned to groups or matched in the hopes of reducing differences. As may be expected setting up two similar groups is problematic especially for field experiments.

The researcher manipulates the treatment variables (independent variables) to determine what happens to the dependent variables. Variables that are not part of the experiment are assumed to have zero impact [Galliers, 1992].

Two types of experimental designs can be used in in-context research, namely field experiments and quasi-experiments. Field experiments fall within the positivistic paradigm and quasi-experiments between the positivistic and intervention paradigms [Braa & Vidgen, 1999].

Field experiments

Field experiments are an extension of the laboratory experiment into the real world. An attempt is made to construct the experiment in a more realistic environment. They, like the laboratory experiment, use experimental and control groups with extraneous variables being controlled [Wynekoop & Conger, 1991]. The field experiment also tries to identify precise relationships between the chosen variables and uses quantitative analytical techniques to study the situations [Braa & Vidgen, 1999]. They are seen as positivistic and aim to predict results as shown in Figure 2.3.

Field experiments have the advantage that they take place in a more realistic environment, but it is usually difficult to get two groups that are similar to make a control group and an experimental group. It is also very difficult to control the situation sufficiently to assure replication if only the treatment variables are altered [Galliers, 1992]. The major difficulty, according to Wynekoop and Conger [1991] is that of finding, matching and coordinating the research at different field sites.

The experimental approach has been used extensively in cooperative learning research with field experiments being widely used [Slavin et al., 1985; Sharan, 1990; O'Malley, 1995]. Many authors do acknowledge the difficulties in trying to have an experimental and a control classroom that match in every respect except for the cooperative learning, however [Lazarowitz & Karsenty,1990; Knight & Bohlmeyer, 1990].

Salomon [1992] agrees that the research situation in cooperative learning is not one where there is a single or few independent variables that you can relate to a specific independent variable with everything else held constant. The cooperative learning

classroom is "*a complex package of interdependent and mutually defining variables each of which is 'independent', 'mediating', and 'depending' at the same time*" [Salomon, 1992, p. 65].

Quasi-experimental approach

The Quasi-experimental approach is an adaption to the 'true' experimental approach. In a field experiment, one would either have multiple treatments, or one would have one treatment and a control group. Randomization and experimental control are kept as near as possible to the laboratory experimental approach. The quasi-experimental approach does not meet these three criteria but still tries to preserve as much of the experimental approach as possible [Braa & Vidgen, 1999].

The quasi-experimental approach recognises that there are situations where random selection and assignment are not possible. This means that the design of the experiment must take into account the variables that the design is unable to control [Leedy, 1993].

2.3.3 Action Research

Bastide [quoted in Thomas & Lockett, 1991, p.87] says that "*The truth is that which our revolutionary action verifies... theoretical knowledge develops at the same time as practical knowledge.... Human intervention in social reality is both action and science at once, since it permits us at the same time to change the world, and, in changing it, to discover it.*" Action researchers realise that complex social situations cannot be reduced for study. It tries to study a complex situation by introducing changes to the process and studying the effects of those changes [Baskerville & Pries-Heje, 1999]. Davison and Vogel [2000, p.7] call action research a "*change-oriented research methodology that seeks to introduce changes with positive social values, the key focus being on a problem and its solution.*"

Action research attempts to contribute to the people concerned in the situation being

researched while also adding knowledge to the social field being studied [Thomas & Lockett, 1991]. Action research can help to build theory and descriptions within the context of practice itself [Braa & Vidgen, 1999]. The researcher works with the participants in a collaborative manner to inquire into the problems of the situation and to learn from that inquiry [Jönsson, 1991]. Action research allows participants to find out the meaning of what they do [Achterberg, van Es & Heng, 1991].

Action research is guided by the following principles [Kember, 1997, Ngwenyama, 1991]:

- It is concerned with social practice.
- The researcher is a participant in the process. Researchers work with participants in a collaborative action for learning and to support change.
- The aim of the research is to improve the process. In order to do this researchers practise critique of the status quo and a search for alternatives to it.
- It is cyclical.
- It promotes systematic inquiry.
- It requires a critical reflection and self-awareness.

Action research can be interpretive or critical [Jönsson, 1991]. No attempt is made to be objective as the researcher is involved in the object of his/her research. The output from action research projects will be specific to the situation being studied but may include output that can be applied in other situations. Action research cannot always be planned as the researcher must be prepared to adapt to what happens in the research situation [Baskerville & Pries-Heje, 1999].

Checkland [1991] establishes 7 steps to the process of action research. These are depicted in Figure 2.4. Checkland and Scholes [1990] have used action research extensively for their research into the soft systems methodology. Much of their work has been in the field of ISD.

Action research shares with the critical theory paradigm the following assumptions [Ngwenyama, 1991]:

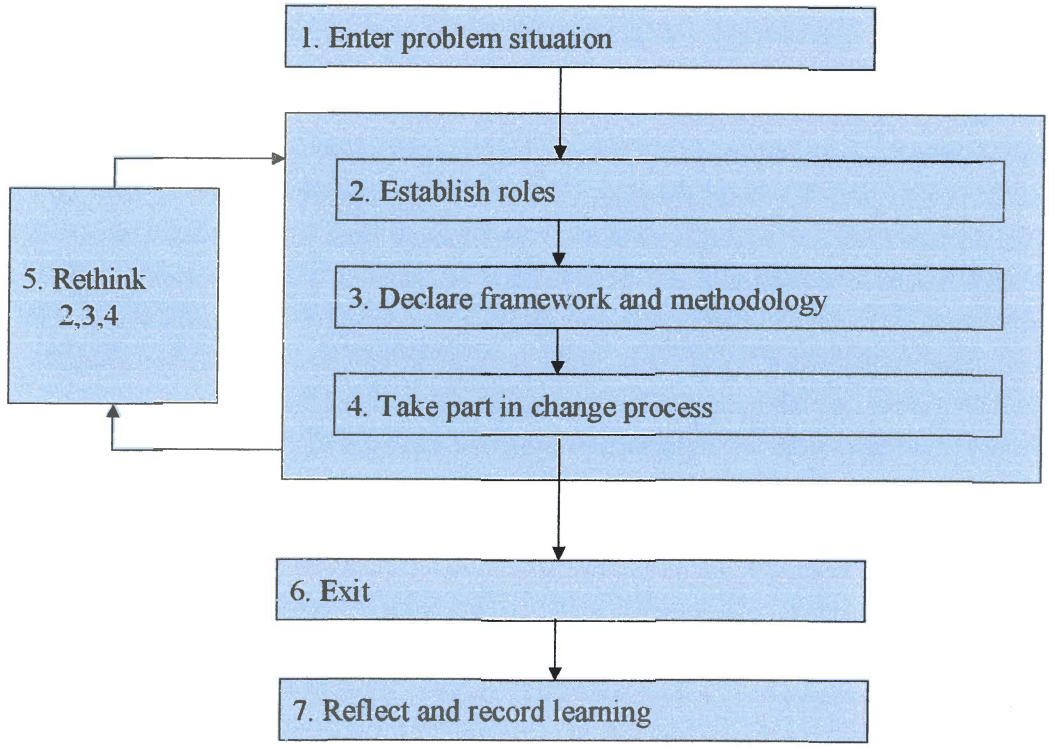


Figure 2.4: The process of action research [Adapted from Checkland, 1991, p.402]

- critique of the status quo and a search for alternatives to it;
- collaborative action for learning and to support change;
- participation by individuals in the creation of their social world; and
- critical self-reflection in order to improve self-awareness and promote transformation.

There has been a move in educational research towards regarding the teacher as a producer or mediator of knowledge rather than just a recipient of research [Richardson, 1994]. Action research, in the educational sphere, is used for practical inquiry on the part of the teacher or practitioner. The practitioners become systematic in thinking about their problems, collecting and analysing data related to those problems and through this try to understand and improve their practice of teaching [Richardson, 1994]. The

research is used to suggest new ways of looking at the problem and possibilities for changes in the practice rather than as a means of developing general laws. Formal research can be done in conjunction with action research. This will help teachers to apply the research in their teaching instead of regarding formal research as irrelevant to their day-to-day practice.

2.3.4 Case Studies

Case studies are intensive evaluations of individuals, groups, organisations, systems or tools in their natural setting. The main purpose of case studies is for explanation, description and hypothesis generation [Wynekoop & Conger, 1991]. They are used for investigation and interpretation of the attributes, characteristics and behaviour patterns of the entity [Behr, 1988].

Braa and Vidgen [1999] differentiate between hard case studies and soft case studies. They say that **soft case studies** are used within the interpretive approach. They must use plausible and logical reasoning in order to describe results and draw conclusions. The aim of the case study is to gain understanding rather than to have a representative case from which generalities can be extrapolated. Soft case studies depend on the plausibility of logical reasoning used to describe the case study results in order to draw conclusions. **Hard case studies**, on the other hand, try to put a more positivistic method to the study of the case although they are still not able to control variables and behaviour.

Case studies can be used in a variety of ways. Critical cases can be used to explore hypotheses or deviant cases can be studied to show problems with hypotheses. A case study can be used to show threats to generalising. Multi-case studies can be used to make logical conclusions and provide support for theories. One can study cases at different sites or over different time periods. Choosing case studies with divergent properties can be useful if one is trying to discover explanations but will limit the ability to generalise results. Using interpretation techniques for case studies can help to clarify

and understand complexities [Firestone, 1993; Peshkin, 1993].

The strength of the case study approach lies in its ability to capture reality at a deep level and in great detail [Galliers, 1992]. The capture of rich data enables the results to be used for explanations, developing new concepts, elaborating on existing concepts, providing insights, clarifying complexity and developing theory [Peshkin, 1993].

One of the weaknesses of the case study approach lies in its restriction to a single individual, group or organisation which means that it is difficult to draw generalisations from the individual case study. Firestone [1993] maintains that one can have a form of generalisation from case studies using a method called case-to-case transfer. Case-to-case transfer occurs when a person in one setting adopts a program or idea from another setting. If one is to do this then a person must make sure that the original case study is factual, appropriate, reasonable and that the case study can be more generally applied. It should not only have worked because of the specific conditions of the study. The onus of deciding to apply findings from one case study to another situation is left to the reader - not the case study researcher. The researcher must supply a rich, detailed, thick description of the case so that readers can draw their own conclusions. Peshkin [1993] supports this, saying that the goal of case studies is not to generalise so that one can create theory but is rather to describe what is happening as accurately as possible. It is left to the reader to determine how to apply the case in new contexts.

Some authors [Galliers, 1992; Wynekoop & Conger, 1991] claim that a further weakness of case studies is that one is not able to determine cause and effect in a case study approach as control of the variables is usually problematic.

Smith [1990] questions the argument that case studies should only be used for the "exploration, classification and hypothesis development stages of the knowledge building process". He says that this assumption is based on the criticism of case studies being unrepresentative. Smith differentiates between two types of inferencing, namely, statistical inferencing and logical inferencing.

- Statistical inferencing draws conclusions about the relationships between variables in a large population based on the study of a sample of that population.
- Logical inferencing draws conclusions based on some systematic explanation or theoretical propositions.

Case studies use logical inference rather than statistical inference, so the question of representativeness is irrelevant, according to Smith [1990]. The selection of cases are, therefore, not so much by how representative they may be, but rather for their explanatory power.

2.3.5 Action Case

The term action case was used by Braa and Vidgen [1999] in order to refer to case studies that are a hybrid of those aiming to gain understanding and those wanting to effect change. (See Figure 2.3.) This method is a trade-off between the researcher being someone who can make interpretations and bring understanding and the researcher being involved in creating change in practice. Action case tries to gain a deep contextual understanding of a particular case and then to question events and apply new concepts, thus marrying action research and case studies without doing full-scale action research projects.

2.4 RESEARCH METHODOLOGY FOR THIS STUDY

This study attempts to determine how the techniques of JAD (Joint Application Design) and co-operative learning can be used within the classroom and to research if the techniques can be effective for learning and for developing the social skills needed by students. The method will be studied and modified in order to develop a framework to illustrate how these techniques can be used effectively within the classroom.

2.4.1 The Research Paradigm for this study

The situation to be studied was a complex one where the researcher was involved in the situation as a lecturer. An objective approach was, therefore, not possible. The cultural background of the students and their situation were expected to influence the research and were not controlled. The research attempted to study the changing students in their changing environment. The positivist approach was thus rejected as an option in this study. This did not mean, however, that no quantitative techniques were used.

An interpretive approach was thought to be applicable to the study. The researcher attempted to understand the subjective meanings that the students gave to the situation. While some quantitative results were used, most of the understanding was reached by allowing the students to use their own words to describe their experiences from their own perspective. It was believed that the cultural and political backgrounds of the students would affect their experience and this too was studied.

The purpose of the research was not to create generally applicable laws but to give a rich understanding of the process of learning, using the JAD and co-operative learning techniques and the students' experiences of that process. This is in line with the interpretive paradigm which believes that the purpose of research is not generalisability but rather understanding.

The research was designed in cyclical fashion using the process of reflection, decision, action and experience but the purpose of the research was not to emancipate the oppressed. Thus although there may be a hint of the critical paradigm, the research is thought to be essentially within the interpretive paradigm.

During each case study an interpretive approach, without intervention, was practised. The students' experiences of the learning environment were studied in order to gain understanding. These experiences were then used to analyse the problems that some

of the students experienced as well as to determine which students were experiencing the problems. These problems then led to reflection and further literature studies to determine how the learning environment should be adapted.

2.4.2 The Research Design for this study

The research design determines how the research is carried out within the constraints of the paradigm chosen. The paradigm is interpretive which means that methods like case studies, action case or possibly even action research are possible.

The research was done using the action case study approach described by Braa and Vidgen [1999]. The action case study used a series of case studies. During each case study the situation was studied in order to get a deep understanding of the situation. Modifications were then made to the learning method to overcome any problems. The actor-network theory (described in Chapter 7) was used to analyse the situation and to create a framework for the learning environment. The modified method was then used in the subsequent case studies.

The action research design is able to combine the theoretical and the practical. It is a design that allows one to gain an understanding of the situation and to search and test alternatives. Action research also fosters participation. Action case studies also have these characteristics.

Case studies can be used in their natural setting. This allows for a more real situation than if a laboratory setting were used. The students were divided into classes based on the subjects that they take, rather than randomly. This precluded using an experimental approach. The case study was felt to be an ideal design for gaining a deep, rich understanding of the learning environment. The situation is a complex one, as mentioned before, and this complexity could be studied intensively using case studies. The action case study allowed the researcher to look at each case study critically in order to determine how the framework for the effective use of JAD in the multicultural

classroom should be adapted.

Carbonne and Kaasbøll [1998] suggest that validity and credibility of research in education are enhanced by gathering data from more than one source, by using observers and by carrying out several cycles in an iterative development. These suggestions were used in this study.

2.5 CONCLUSION

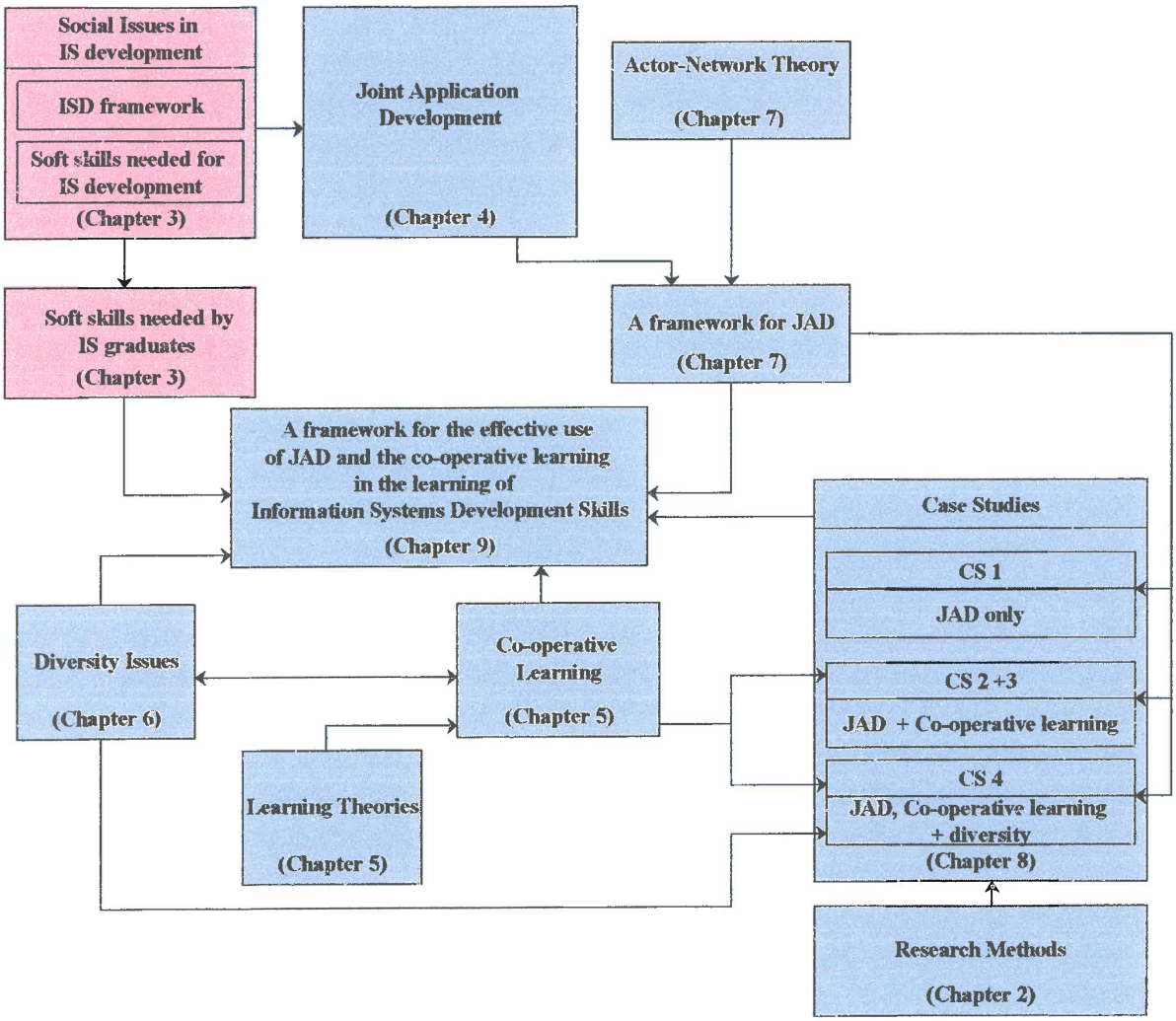
"*When we judge a research project solely on the apparent truthfulness of its parts, we neglect its larger purpose: generating new knowledge about education and schooling*" [Wagner, 1993, p.15]. This does not mean that the researcher should not be truthful but rather that the researcher should explore different approaches to truthfulness in order to gain knowledge. There is a lot of debate about which paradigm, design or method is best. It would seem that the different paradigms can be complementary to one another, that the best design or combination of designs and methods should be used according to the research questions being asked.

This study tries to develop a framework for the effective use of JAD techniques in the classroom. Carbonne and Kaasbøll [1998] suggest that a study like this should include a comprehensive document of the students' experiences and thoughts as well as the lecturer's model or theory of the students' learning, the lecturer's strategy for lecturing and detailed accounts of how to teach using the strategy. This thesis will attempt to do this.

The next four chapters answer some of the what and why questions posed in the first chapter. First the social side of ISD is discussed, then the JAD process as it is used in industry. The following chapter describes the educational theories and co-operative learning strategies, followed by a chapter discussing the issues around handling diversity in the classroom. These chapters form the background to the literature that was used in the research.

Chapter 3

Social Issues in Information Systems Development



Chapter 3

Social Issues in Information Systems Development

Information Systems can be defined as the set of technical and human resources devoted to the management of information in organisations [Ciborra, 1998]. It is thus a combination of the human with the technical. This chapter will show that the development of IS is a social process as well as a technical one.

ISD is a complex, social process which involves interaction between many stakeholders [Kirsch & Cummings, 1996]. IS professionals need not only technology skills, but also skills in business operation, management and interpersonal skills in order to cope with the world of Information Technology [Lee, Trauth & Farwell, 1995]. Dahlbom & Mathiassen [1993] suggest that systems developers need to combine a mechanistic understanding of computers with a romantic appreciation of the complexities of social issues.

This chapter gives an overview of a framework that has been proposed for ISD and shows where this research fits into this framework. This leads to a discussion of the social skills needed by IS developers and the implications of this for tertiary education.

3.1 A FRAMEWORK FOR ISD

ISD includes the analysis, design, construction and implementation of information systems. Hirschheim, Klein & Lyytinen [1996] have proposed a federated framework for ISD that emphasises the diverse nature of ISD. They claim that the framework helps us to understand the dynamics of ISD and provides us with categories for interpreting and

relating the research. The authors claim that the field of ISD is too wide to be catered for by one paradigm and that the framework is necessary in order to incorporate all the domains and orientations necessary. Hirschheim et al's [1996] paper has been termed by various authors as "seminal" and "bold" [Introna, 1996], " well-structured and significant" [Kerola, 1996], "worthwhile" and "of considerable interest" [Walsham, 1996] and "rich and suggestive" [Ang, 1996]. It is obviously important and is also fairly current and has therefore been chosen as the framework within which to place this research.

3.1.1 Behavioural orientations

Hirschheim et al. [1996] use Habermas's social action theory to divide ISD into four behavioural orientations that underlie the behaviour of the various actors during ISD. These orientations are used to capture the underlying values, goals and epistemological underpinnings that drive the development activity. These four behavioural orientations are:

- **Instrumental (control) orientation**, which is concerned with achieving the predefined end-results and treats everything in the domain as controllable objects;
- **Strategic (control) orientation,** which is concerned with achieving the predefined end-results but treats each human active in the domain as an independent conscious agent with a will of their own;
- **Communicative (sense-making) orientation,** which is concerned with achieving a common understanding through communication; and
- **Discursive (argumentation) orientation,** which is concerned with achieving clarification and justification and providing reasons and evidence.

The first two orientations emphasise control but differ in how they see people as subjects of that control. The first sees people as objects whereas the second sees people as intelligent agents. The communicative orientation emphasises creating shared meanings through sense-making. The primary emphasis in the discursive orientation is argumentation which makes sure that claims made during communication are clarified

and called into question.

A diagram, showing how the four behavioural orientations are combined with domains of change in order to create the federated framework, is given in Table 3.1 later in this section.

3.1.2 Domains of change

Etzioni's malleability hypothesis is used by Hirschheim et al. [1996] to define three domains of change in ISD. This helps to define what is being changed during the development. They identify the following three domains of change:

- **Technology**, which includes the physical means and technical know-how that are used to accomplish information processing tasks;
- **Organisation**, which includes the organised behaviour affected by the ISD, for example the work arrangements and procedures, roles, power and culture of the organisation; and
- **Language,** which is used by IS developers in the handling of symbols and is required to carry out the human transactions and co-ordinate them. Language is the medium that allows communication to take place and includes any form of symbolic representation that conveys meaning.

Kerola [1996] points out that it must be understood that all these categories change in all systems development and that it is only in their relative differences that we can identify what the focus and source of change are. This is supported by Dittrich and Floyd [1996] who say that real ISD and research must combine different views and cannot restrict themselves to one perception of what the domain of change is.

Kerola [1996] suggests that Hirschheim et al. need to add a fourth domain of change in order to cater for the development and use of information systems in societies. This fourth dimension is:

- **Actor/frame dimension**, which focuses on the change in the values and frames

of the human actors involved in the ISD.

While this sounds like a valid argument, Kerola does not analyse or explain it much further. No further articles have been found that do expand on it and it has, therefore, been left out of the federated framework presented in the following section.

3.1.3 Federated framework

The framework proposed by Hirschheim et al. [1996] cross-relates the domains and orientations to form the object system classes shown in Table 3.1.

DOMAINS	ORIENTATIONS			
	CONTROL		SENSE-MAKING	ARGUMENTA-TION
	INSTRUMENTAL	STRATEGIC	COMMUNICATIVE	DISCURSIVE
TECHNO-LOGY	Information Technology Systems			
LANGUAGE	Formalised Symbol Manipulation Systems	Manipulative Communica-tion Systems	Symbolic Interaction Systems	Systems for Rational Argumentation
ORGANISA-TION	Mechanistic Social Systems	Political Systems	Cultural Social Systems	Systems for Institutional Checks & Balances

Table 3.1: A federated framework for ISD [Hirschheim et al., 1996, p.17]

As the technology domain only consists of physical and not human artifacts, the strategic, communicative and discursive orientations are not used for this domain as they require human traits. Language and organisation, on the other hand, will always include human actors and all four orientations are appropriate for them. We are, therefore, left with nine object system classes in the original Hirschheim et al. [1996] framework.

As mentioned before, Dittrich and Floyd [1996] propose that there is some problem in trying to classify and restrict oneself to a particular domain of change and thus to a particular class. As one may have multiple domains of change and different perspectives on those domains, the development strategy will go across the boundaries of the object classes. They proposed that the object system classes are more useful for clarifying the different perspectives that one might have of a system rather than trying to match the development strategy being used to a particular class.

This is the view held by this author and is the reason why this research is placed with the sense-making (communicative) and argumentation (discursive) orientations across the language and organisation domains of change. It is also why the author has chosen to discuss from an orientation point of view in the following subsection.

Hirschheim et al. [1996] predict that although most IS efforts at the moment are directed at the top-left of their framework, this is changing and that more effort must be directed at the bottom-right part of the framework. Walsham [1996] agrees with this analysis although he objects to their use of "biassed language" that he says they use in order to support this.

3.1.4 Development strategies across the orientations

Development strategies will differ for IS, depending on the orientation and domains of change. This thesis will investigate the development strategies of the control, sense-making and argumentation orientations. The discussion will be augmented and compared with hard systems, soft systems and dialectic approaches to systems development proposed by other authors [Checkland, 1993; Checkland & Scholes, 1990; Dahlbom & Mathiassen, 1993].

3.1.4.1 Control orientation (hard systems)

Control implies that one can predict the behaviour of the system and can take corrective

action (if necessary) to make the system achieve its given purpose. The development strategies for this orientation thus assume that by setting up the criteria properly and determining all the variables that affect the system, one should be able to achieve the expected outcomes.

The key methods of development are based on engineering principles and using those principles in determining requirements, design and implementation. Determining requirements' definitions from an engineering perspective assumes that one can define the problem and determine a solution which meets the technical standards of reliability, adequate performance and cost-efficiency. One of the main aims is to find a fit between the information needs of the organisation, the task and the information system that should meet those needs. Structured design, analysis of code, data flow architectures and modelling user behaviour are important in this method [Hirschheim et al., 1996].

Development strategies must take into account who controls communication and the meaning of language. This is seen as a means of manipulating the design rather than a search for real truth. The solution looked for in the requirements definition, is often that determined by a particular group, rather than the organisation as a whole. Design is concerned with accumulating power, authority and other means of influence for personal or group advantage according to Hirschheim et al. [1996]. The communication will be distorted by this. Walsham [1996] objects to Hirschheim et al.'s bias which he says is evidenced by their use of the word "manipulative" and by their indicating that the communication is distorted in this class.

In the control orientation the IT personnel act as "experts" who know things that the users do not [Wilson, 1997]. The end-user is not seen as a conscious, reflective actor in the design process.

The control orientation has similar characteristics to hard systems thinking. Those who practise hard systems thinking expect that they will be able to get a clear and exact representation of the world. The world is seen as stable and ordered. This enables a

developer of a system to be able to get an exact picture of the problem and to be able to find an optimal solution to that problem through engineering principles [Dahlbom & Mathiassen, 1993]. The hard systems methodology assumes that an objective can be defined and the system is engineered to reach the objective [Checkland, 1993].

While the hard systems methodology has been successful in some spheres where rational human decision-making is possible, it may be more difficult to apply in the field of IS. Hard systems, as mentioned before, assumes that the problems can always be expressed and the objectives can always be defined and agreed upon. This is not always true for social systems where the problems are often "fuzzy" and difficult to define [Checkland, 1993; Schecter, 1991].

The control orientation is very important in ISD but needs to be augmented, enhanced or even replaced by strategies for sense-making and argumentation. These will be described below.

3.1.4.2 Sense-making orientation (soft systems)

Sense-making emphasises the potential role of the IS for achieving mutual understanding. It is important to find "*acceptable, understandable interpretations of ambiguous or unintelligible events which typically do not make sense within established viewpoints and policy frames of reference*" [Hirschheim et al., 1996, p.35]. All the players are confronted with the challenge of trying to understand the "*alien meaning, irrational behaviour and shifting boundaries of meaning, situations and actions*" of the other players [Hirschheim, 1996, p.46]. One of the most difficult problems in ISD is to create a shared vision with the user of what the final product should look like [Wiegers, 1993]. This can cause products to fail as they do not match the expectations of the user community.

Development methodologies for this orientation depend on our ability to converse with one another and to facilitate consensus building by contact with one another. The

emphasis is on building shared meanings and shared use of language between users and developers. Direct participation of both groups is needed. Sense-making involves the elicitation and creation of knowledge in order to make a situation clear. This is especially needed in complex, ill-structured domains [Nosek & McNeese, 1997].

From an organisational perspective, the structures must be created that facilitate formal and informal interaction, thereby allowing the sharing of opinions and observations. The emphasis here is on the roles, institutions, practices and cognitive frames of the people in the organisation.

A special focus is placed on the hidden, taken-for-granted organisational practices, as it is these that help to make sense of the organisation. Studies must be made of the organisations co-operative work practices in order to determine these. The outcomes of this strategy are to delineate these hidden and taken-for-granted practices in order to modify and mould the contexts within the organisation so that sense can be made of these practices [Hirschheim et al., 1996].

This orientation has many similarities with soft systems thinking. As human beings we cannot help but attribute different meanings and different interpretations to our world. These perceptions can lead to actions which could be effective or disastrous [Checkland & Scholes, 1990]. Soft Systems Thinking tries to get us to consider different perspectives and to learn about the world by expressing and debating those perspectives. The idea is that developers should compare the beliefs and attitudes of the different stakeholders and learn from those differences. The world is not seen as a structured, stable environment but is seen as constantly changing [Dahlbom & Mathiassen, 1993]

The Soft Systems Methodology (SSM) and its derivatives, like the Multiview methodology, are appropriate methods to be used for sense-making [Checkland, 1993; Checkland & Scholes, 1990]. They claim to be able to deal with unstructured problems and enable the developers to get different perspectives on the problem and possible

changes that might be needed to achieve success.

In their original forms these methods can be criticised for focussing on the requirements definition and design aspects of ISD, thus forcing a waterfall-type approach to systems development. Avison, Wood-Harper, Vidgen & Wood [1998] have recently proposed an amendment to Multiview, that they call Multiview2, which overcomes this problem and combines the aspects of organisational analysis, information modelling, sociotechnical analysis with software development into, what they call, an interpretive scheme. They thus cross the different domains of change defined by Hirschheim et al [1996] within the orientation of sense-making. Mediation is used to pull the different perspectives together.

Soft Systems thinking has been criticized, however, for not dealing with issues of power and social change. According to Schecter [1991] soft systems thinkers have an idealistic view of the world and assume that free, open and democratic debate among stakeholders is possible whereas, in reality, communication is often distorted by the domination of some people over others. (This is a critical systems thinking view of soft systems thinking. Critical thinking will be briefly described in the following subsection.)

3.1.4.3 Argumentation orientation (dialectic/ critical systems)

The argumentation orientation aims to achieve clarification and justification of claims and provide reasons and evidence for them. It is important to provide supporting rational argument in the design and use of IS [Hirschheim et al., 1996].

The idea of rational argument is that everyone should have the chance to put forward their argument and that they should be able to have a rational debate about the claims. Unfortunately, as Walsham [1996] suggests, the problem occurs when everyone has put forward their rational arguments and there remains disagreement as to which argument is better. The ideal situation may be difficult to achieve in real life.

When ISD is viewed as an argumentative process, then one would expect that there would not be a well-defined set of activities that can be planned and systematically carried out. As statements and solutions are made and different viewpoints are made, they are scrutinized and debated. This is an iterative process. Each solution, generated by the argument, is debated and modified and the new solutions put forward. These are again debated until consensus is reached [Koh & Heng, 1996].

The outcomes of the argumentative orientation are that the level and understanding of an argument is improved by improving the available evidence and clarifying communication breakdowns. Tools like prototyping, JAD and statistical analysis can be used to raise doubts and provide evidence. The principles involved are that all claims must be tested and that warrants for or against claims must be found [Hirschheim et al., 1996]. Critical examination and self reflection are essential elements of this orientation [Wilson, 1997].

From an organisational perspective the methodologies used should try to eliminate any distortion brought about by the hierarchical nature and other forms of power of the organisation. There should be methods to cross-check and make sure that bias and self-deception are reduced. Critical thinking is imperative.

Walsham [1996] maintains that it is infeasible to expect that one can eliminate any distorting effects of power and that power and rationality are inseparable and should be studied together. He says too that one should be careful of labelling everyone who is in a position of power as being ready to abuse that power as most senior managers do try to do the right thing. The importance of the concept of "power" is also described by Introna [1996] who sees it as something that needs to be understood and analysed when considering developing IS within the framework given. *"Power is not an obstruction forced upon ignorance or vested interests, but a relationship of inequality between human beings."* [Beirne, Ramsay & Pantelli, 1998, p.303]. It is thus inevitable that power will affect any participative design methods.

Methods of making sure that self-managed teams are democratic, unbiased and critical of their own work must be fostered. The widest possible number of stakeholders should be involved in the development process.

Dahlbom & Mathiassen [1993] suggest a more critical approach to systems development, which they call a dialectic approach. The argumentation orientation has similarities with this approach. Reality is seen as a set of contradictions which are related and dynamically changing. The world is seen as a place of chaos and conflict which we cannot really understand. When developing systems, the development team must understand and challenge existing established traditions and intervene to change them if necessary. They will need to find out what the actual practice is in the organisation rather than the method that has been defined.

While critical systems thinking cannot really be equated to the argumentative orientation or the dialectic approach, there are many points of similarity. Critical systems thinking rests on three commitments, namely [Schecter, 1991]:

- Commitment to critique, which means that practitioners are committed to questioning the methods, practice and theory of their disciplines;
- commitment to emancipation, which is commitment to a free and equal participation by all; and
- commitment to pluralism, which indicates that critical systems thinkers do not imply that hard and soft systems thinking should be done away with, but rather feel that all these approaches have a contribution to make and that one would be inadequate to deal with the complexities of systems design.

3.1.4.4 In summary

Software development should not be seen as an engineering discipline where one is merely making a product that must be reliable, efficient and cost-effective. While these factors are important, one must also realise that an Information System can change the way people work and there is thus, a complex interplay between technology and

society.

Users must be involved and developers need to develop the skills necessary to work with those users in order to achieve the best results. Dahlbom & Mathiassen [1993] maintain that the developers need to be "sociotechnical experts" who are critical about their work.

Dahlbom & Mathiassen [1993] suggest that if the problem is well structured and certain then a hard systems approach could be appropriate, but if the problem is unstructured and uncertain, then a soft systems or dialectic approach should be used. Schecter [1991] suggests a pluralistic path that recognizes each of the approaches and deals with different dimensions of the problem.

Most systems development methodologies acknowledge the need for getting the support of senior management and involving the end user but they do not give guidelines as to how this can be done. Systems developers do not really understand the social nature of systems development and find it difficult to adapt [Hirschheim & Newman, 1991]. The next section looks at some of the skills, besides the technical skills, that IS developers need to develop.

3.2 USER PARTICIPATION

It is important for all the stakeholders to have a say in the development of the IS. User participation is considered to be necessary for effective ISD and for systems to be accepted. User participation is called for in almost every IS development methodology according to Kirsch and Beath [1996]. The difference is in the degree to which users are able to influence that design [Damodaran, 1996]. The users are often seen as providers of information rather than decision-makers, for example.

There have been conflicting reports on user participation and its benefits to the IS

process. This section will look at different types of user participation and then take a look at how user participation has changed over the years. The methods that can be used to ensure effective user participation will then be described.

3.2.1 Levels of user participation

There is a difference between user participation and user involvement. User participation can be seen as the various behaviours and activities that the users or their representatives take part in during the process of ISD. User involvement is concerned with the psychological state of the individual and how they relate to the IS [McKeen & Guirmaraes, 1997; Kirsch & Beath, 1996]. User involvement is thus subjective and is determined by how relevant the system is to the person and the person's perception that their views were incorporated into the design of the system. With user involvement, the user must just be convinced that their views are represented, either by a colleague, a manager or someone else in whom they have confidence [Jones & Harrington, 1996].

Not all users can or want to actively participate in the development process. User participation, on the other hand, refers to the specific activities or behaviours that the users engage in during the design of the system.

Lawrence and Low [1993] determine three levels of user participation in systems development. These are:

- **Consultative participation** - In this type of participation the main decisions are made by information systems personnel with the user only acting in a consultive role.
- **Representative participation** - In representative participation a team is formed using representatives of the users and systems analysts and the team designs the system and manages the project.
- **Consensus participation** - This type of participation uses a democratic approach and tries to involve all users continuously throughout the design process. This is only feasible if there are only a few users.

The JAD technique, described in the next chapter can be used in both the representative and consensus levels of user participation. It helps bring users and developers together throughout the systems development cycle in order to improve communication and help users to reach consensus about what is needed in the system.

Dean, Lee, Pendergast, Hickey and Nunamaker [1998] suggest that different levels of user participation are needed throughout the Systems Development Life Cycle (SDLC). They suggest that user representatives, user groups and the user community as a whole will each play a part in the development process.

3.2.2 An historical perspective of user participation

Participation by users has long been acknowledged as important in ISD. This was especially true in Scandinavian countries where much research has been done in this area. There has, however, been some controversy as to what this participation should involve.

Clement and van den Besselaar [1993] did a study of papers on participative design over the years and have made the following observations:

- During the 1970's user participation was mostly concerned with providing users with knowledge about new technologies and how they would be used. They also helped users understand how their working conditions would be affected by the introduction of those new technologies.
- Trade unions were also involved in the 1970's but only so far as encouraging them to develop and implement their own technology solutions to control their activities.
- This changed during the 1980's when IT was being used more in offices and service industries and not only in the manufacturing arena. More women were using computers which led to greater involvement on their part in the design of computer systems.

- The emphasis during the 1980's was more involvement on the part of users and top management.
- During the 1990's trade unions did not seem to worry as much as they previously had about the use of technology and it became more difficult to get them committed to development projects. This is supported by Bjerknes and Bratteteig [1995] who say that trade unions are not as powerful as they used to be and that new methods of achieving democracy within an organisation have come to the fore.

Scandinavian researchers have been at the forefront of the field of participative ISD for many years. They have emphasized the importance of considering human requirements and the work activity of users when designing technical systems. This has led to a socio-technical approach where human-centric analysis is used to investigate the impact that a potential computer system will have on humans. It also considers ways in which technology can be designed more effectively for people [Sutcliffe, 2000].

It is important when designing a computer system for an organisation as a whole to realise that the ISD will need to be a compromise between various groups. The different interest groups or stakeholders will have partly conflicting goals and interests. This has led to a recognition that something more is needed than the socio-technical approach. The collective resource approach notes that developers must negotiate between workers and management or workers from different parts of the organisation in order to reach acceptable solutions for the organisation as a whole [Bjerknes & Bratteteig, 1995].

Business Process Reengineering (BPR) has been an important development in systems implementation during the 1990's. BPR involves a change process where it is not only the computer system which changes, but jobs may be lost, responsibilities change and employees are faced with new challenges. This process is one that is full of conflict and power struggles and means that IS developers need new skills to work in these situations [Bjerknes & Bratteteig, 1995]. Clement [1994] noted that there had been a move to the use of computers to empower the users. Users have been given the

information to enable them to do their jobs better. They no longer have to pass decisions to be made up to their superiors. This helps workers to be able to act more independently.

The people involved in this type of project need to be involved throughout the ISD in helping to define the system. Users and system developers need to develop more constructive and respectful relationships in order to foster a more democratic system [Clement, 1994]. The methods and rules used in JAD workshops try to foster this relationship as discussed in the next chapter.

3.2.3 Effective user participation

The choice of the user participants is important. Users should be chosen according to their role in the company, their experience, the respect that they receive from their peers, their interpersonal skills and their ability to pass knowledge on to other users. Users must be chosen across the spectrum of users from operational to management staff. Damodaran [1996] proposes that users should go on training in order to understand their role and ensure that they have the basic IT skills necessary.

One of the key strategies for successful user participation, according to Hunton and Beeler [1997] is that the user must want to participate. In order to facilitate this the project leader will need to provide the user with meaningful opportunities for participation.

Shared participation is better than token participation [Kirsch & Beath, 1996]. In token participation, the users play a minor role and in reality the IS personnel provide all the expertise and make all the decisions. Shared participation has the developers and the users working together towards a solution. Users are seen as the domain experts and IS personnel as the technical experts but they share roles, work together in a number of duties and coordinate with one another. Hunton and Beeler [1997] go a step further and suggest that the user should have control of the project. McKeen and Guirmaraes

[1997] have done research, which showed that user involvement must be high when the task or the system is complex.

Conflict can have a negative effect on information systems development. It should, however, be seen as a necessary and important part of the systems development process [Kirsch & Beath, 1996]. In the framework presented previously, argumentation is one of the orientations of systems development. IS developers must learn to resolve conflict in a positive way. Even user resistance is not necessarily bad, according to Hirschheim and Newman [1991]. Users are able to tell if something will work in their setting whereas system developers only look if it is technically feasible. They say that one needs to realise that there should be constructive conflict. When designers and users from different departments meet there may be conflict but the aim should be to reach consensus and methods of achieving this should be promoted. This would enable participation to be genuine rather than manipulative. They suggest creating encounters to reveal and resolve conflict. JAD workshops, which are described in Chapter 4, are one way of doing this.

Three principles for effective user-centred approaches are proposed by Nodek & McNeese, 1997]:

- Shared communication must be actively employed;
- knowledge must be able to be expressed without constraint; and
- the knowledge representation methods used must be compatible with the capabilities, limitations and needs of the stakeholders.

One of the problems of IS development has been the communication gap between the user and the IS developers. This can be exacerbated by the use of IS jargon and the insistence that users sign off specifications that they do not truly understand. Nosek and McNeese [1997] suggest that there are three factors that should be catered for in order to facilitate getting information from groups of users. They are:

- An active means of facilitating group communication must be employed.
- Users should be able to express their knowledge without constraint.

- The modelling methods used to model that knowledge must be understood by all the stakeholders.

This is supported by Checkland [1993] in his Soft Systems Methodology. Checkland says that there should be a relationship between the user and the developer and that the methods used must be suitable for both. These suggestions are also followed in the JAD sessions discussed in the following chapter.

Users should be chosen who feel that the new IS will be relevant and important to them [Hunton & Beeler, 1997]. They must also be representative of the users so that the other users will feel that they are involved. It is the perception of user involvement that is important to the success of the system [Lawrence & Low, 1993]. User representative will need to help the other users understand the objectives of the system, receive training and keep them up to date with the progress of the system. Champions must be sought who can lead from a users perspective. It is also important that the users come from the different departments that will be involved and that they have support from top management.

"*Central to the whole notion of user participation is the right of people to have a direct influence on matters that concern them in their work. It cannot be restructured simply to the design of information systems, but inevitably brings in wider elements of working life.*" [Clement & van den Besselaar, 1993, p.36]. If an organisation involves the users in the design process then they must be willing to introduce those designs otherwise the whole process will be merely an illusion [Bjerknes & Bratteteig, 1995]. The whole process must be self-sustaining in that even after the system has been rolled out, user participation is critical [Clement & van den Besselar, 1993].

The next chapter describes the process of JAD which is a method that tries to create a forum for effective user-developer interaction.

3.3 SKILLS NEEDED BY IS PROFESSIONALS

As IS development moves from the technical to the language and organisation domains and from the control to the sense-making and argumentation orientations, the skills needed by IS developers have changed. As Lee, Trauth and Farwell [1995, p.313] put it "*The requirements for IS professionals are becoming more demanding in multiple dimensions, particularly in the areas of business functional knowledge and interpersonal/management skills*".

In the sense-making orientation it is important for the IS developer to be able to find shared meanings with the users. Communication and interpersonal skills are imperative. Opportunities for developing shared meanings should be fostered. The IS developer must be able to act constructively within the sense-making situation. He or she should be able to know how to ask the right questions to get to the hidden meanings and taken-for-granted practices.

The argumentation orientation requires IS developers who can use rational argument and debate in order to achieve consensus. The ability to evaluate solutions and think critically is important in this orientation.

IS developers need to be prepared for working in an environment where user participation is the norm and where they will be expected to interact with people who are diverse from themselves. As users become more sophisticated in their use of personal computers, they will demand a greater say in the construction of their systems.

In a study done by Hunter [1993], users, sponsors, clients, systems analysts and business systems managers were asked to describe their experiences with good and bad systems analysts. They did the research at two organisations and found that communication skills were considered the most important factor with attitude holding second place. Communication skills were considered about twice as important as knowledge, which was in third place.

A survey, conducted by van Slyke, Kittner and Cheney [1998], found that general thinking, communication and interpersonal skills were considered to be the most important characteristics needed by IS graduates.

A more recent study by Doke and Williams [1999] determined what skills are considered important for seven different categories of IT jobs. Overall interpersonal skills came out first, with IS design and implementation second, IS analysis third, oral and written communication fourth and interpersonal behaviour and project management tied for fifth place. In seventh place was group dynamics. Once again, the soft skills were considered as important as the more technical skills.

Another way that some authors see the changing role of the IS professional is that the person becomes an agent for change and that they, therefore, need the skills to promote change within an organisation [Trauth, Farwell & Lee, 1993]. Effective change management requires IS professionals to work together with the users and prepare them for the changes. This does not mean just telling them what will happen, but rather means making sure all the diverse clients are served, listening to and valuing input from all the clients and sharing credit with those clients [Markus & Benjamin, 1996].

The skills of listening, negotiating, conflict management, persuasion and working in teams have thus become more important to the IS professional. Effective communication skills are considered essential to fostering teamwork [Spiegel, 1995].

3.4 IMPLICATIONS FOR IS CURRICULA AT TERTIARY INSTITUTIONS

IS departments at tertiary institutions have tended to prepare students very well for the control orientation of systems development. They have given the students the tools and techniques that they need to develop systems in a mechanistic way. There has been some neglect of the skills that the students need in order to be able to find shared meanings, practise argumentation and be effective in working with users, however.

"Employers want IS graduates who can think, communicate, and work well with others. They also want individuals who have a good grounding in basic IS skills such as systems analysis and design and database concepts. These employers seem to be less interested in more specific technology skills." [Van Slyke, Kittner & Cheney, 1998, p.10]

The environment in the tertiary institution tends to be one which is controlled and where there is only one best answer for a particular problem. In the real world, this is rarely true, however. Goyal [1995/1996, p.135] claims that "*Most students entering the job market struggle through the difficult transition from the university environment, which demands controlled, encapsulated thinking to the real world environment which demands creative, unstructured thinking*". Lecturers define problems and give "model solutions" to those problems instead of actively involving the student in the process.

The demand for IS professionals who are multi-dimensional across the fields of technology, business and interpersonal skills is increasing, according to a study done by Lee, Trauth and Farwell [1995] and all of these aspects should be built into an IS curriculum. As business needs to get new employees productive as soon as possible, the more of these skills that can be focussed on during the IS course, the better. This does not mean that the technical should be neglected, but that students should be able to augment their technical skills with the business and interpersonal skills [Todd, McKeen & Gallupe, 1995].

Another aspect that should be considered is that, in industry, IS professionals are expected to work in teams. Research has shown that people attracted to the field of IS often have a very low "*social need strength*" coupled with a high "*growth need strength*". This means that they do not feel the need to interact socially but are more achievement oriented and love a challenge [Spruell & Le Blanc, 1992]. Tertiary institutions often emphasize the individualistic rather than promoting group work among students [Moad, 1995]. Group work can give the students some of the essential skills of team work needed for their career. Communication skills like listening skills, the ability to manage conflict, the ability to deal with criticism assertively rather than aggressively, being able

to persuade and influence others, as well as how to negotiate are considered important in today's world and can be practised in the group environment [Rooff-Steffen, 1991].

The IS '97 Curriculum [Davis, Gorgone, Couger, Feinstein & Longenecker, 1997] recognises this need for the softer skills and has communication skills and interpersonal skills as two of the main characteristics needed by an IS graduate. This is shown in Table 3.2. Communications skills include listening skills, negotiating skills, interviewing skills, facilitation skills, observation skills and presentation skills. The skills of leadership, small group communication skills, small group organisation and working with diverse people are listed among the interpersonal skills needed.

Characteristic	With the ability to	Using the knowledge of .....
Communication	- accurately observe, note and explain observations of events - actively listen and express complex ideas in simple terminology - organise and make presentations - write memos, reports and documentation	- listening, observing and documenting - interviewing and speaking - negotiation and facilitation - presentation and interpretation of data - multimedia development and utilization - computer and video conferencing techniques
Interpersonal relationships	- effectively work with people of diverse backgrounds - effectively work with people at all corporate levels - lead and facilitate teams in a collaborative environment - develop win-win approaches - empathetically listen and seek synergistic solutions	- leadership, management and organizations - small group communications and motivation - organization, team and individual goal setting - shared vision and responsibility - cultural diversity

Table 3.2: Capabilities and knowledge expected for IS program graduates [Davis, Gorgone, Feinstein & Longnecker, 1997, p.12]

Personal and interpersonal skills are also deemed important in the Informatics Curriculum Framework 2000 (ICF-2000) for higher education [Mulder & van Weert, 2000]. This curriculum was developed by the International Federation for Information Processing (IFIP) for the United Nations Educational, Scientific and Cultural Organisation (UNESCO). They identify three broad categories of Informatics

professionals, namely information users, information appliers and information workers. While the IS'97 curriculum suggests that activities that foster communication skills and interpersonal skills should be integrated into the curriculum, the ICF-2000 curriculum goes further, and suggests that these skills should be credit bearing.

In their curriculum for Instrumental Users, for example, they suggest that 4 of the 20 credits should be dedicated to personal and interpersonal skills. (One credit is equal to one day of study.) For information workers, they suggest that at the final level 12 of the 160 credits should be on the topic of personal and interpersonal skills. This is added to the 17 credits of the lower levels to give a total of 29 credits, or 29 days of study on the topic.

Fostering these soft skills in IS students, while still finding the time for them to learn the technical skills is a difficult process.

3.5 CONCLUSION

This chapter answered the research questions: "*What is involved in IS development?*", "*What social skills are needed by an IS developer?*" and "*Why should tertiary insitutions help IS students develop interpersonal and group skills?*".

The world of ISD is changing and as it does the skills needed by IS professionals are changing. It is no longer sufficient to have only technical skills. These need to be augmented with business and interpersonal skills. As the IS developer is asked to move from the control orientation, where all aspects of the system were seen as being able to be predefined, to the sense-making and argumentation orientations, his or her skills in communication, negotiation, achieving consensus and debating must improve.

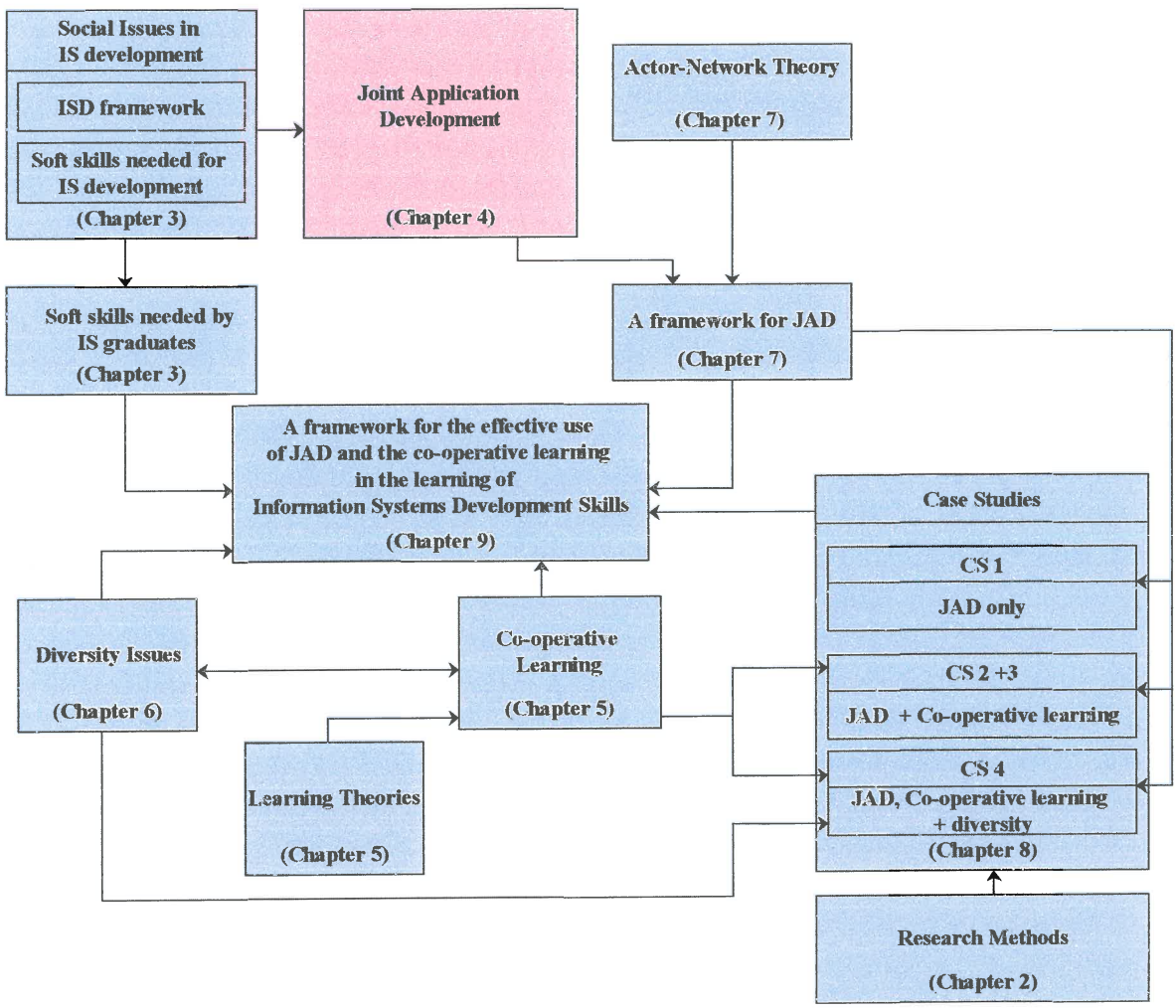
It is these skills, together with the more technical ones, that make a successful IS developer, and it is these skills, together with the more technical ones, that need to be

developed in students of IS. This thesis looks at how JAD can help students to develop some of these skills while helping them to learn the modelling tools.

JAD is a method of bringing together the different user groups and IT developers in order to facilitate understanding of the system to be built. The next chapter describes how this technique is used in industry.

Chapter 4

Joint Application Development



Chapter 4

Joint Application Development

Good communication among the systems developers, users and top management is essential for the production of a satisfactory system. Lockwood [1989] poses the following questions: "*How can systems professionals deal with the nagging problem of getting top management and users to pay attention to systems details during the crucial early phase of requirements specification? Furthermore, how can honest disagreements in requirements specifications be resolved in a timely manner and with a consensus of the people involved?*" JAD offers one method of trying to answer these questions.

In terms of Hirschheim et al.'s [1996] framework, JAD can be seen as a method of trying to achieve shared understanding and manage the process of argumentation in order to support the organisation and communication domains. JAD focusses on "*facilitated interactions between users and designers wherein group techniques are employed for eliciting and refining ideas.*" [Carmel, Whitaker & George, 1993, p.40]

Eliciting information from users in the traditional way has meant relying on many user interviews and surveys. Serial interviews with a large number of users is inefficient. It is also difficult to resolve conflicts in requirements between the different user groups [Dean, Lee, Pendergast, Hickey & Nunamaker, 1998]. JAD is a method that tries to enable all the stakeholders to reach consensus on requirements for a proposed system. Central to JAD is the structured workshop. During the structured workshop, a carefully selected group of people from the users and developers, gather to work towards a common goal or set of goals [Geier, 1996]. The workshop can be anything from a couple of hours to days long.

JAD is based on four philosophical principles [Sims, 1998, p.1]:

- The people who do the job have the best understanding of that job.

- People who are trained in IT have the best understanding of the possibilities of that technology.
- Information systems and business processes rarely exist in isolation. They transcend the confines of a single system and work across related departments. The people working in those different departments have valuable insight on the role of the system in the larger community.
- The best information systems are designed when all of these groups work together on a project as equal partners.

Some people define JAD as Joint Application Design and only look at the design of the project. JAD can, however, be used throughout the systems development life cycle (SDLC) and it is for this reason that it is termed Joint Application Development in this thesis. The diagram in Figure 4.1 shows how Gottesdiener [1994] of EBG Consulting sees methods of using JAD during the different life cycle phases.

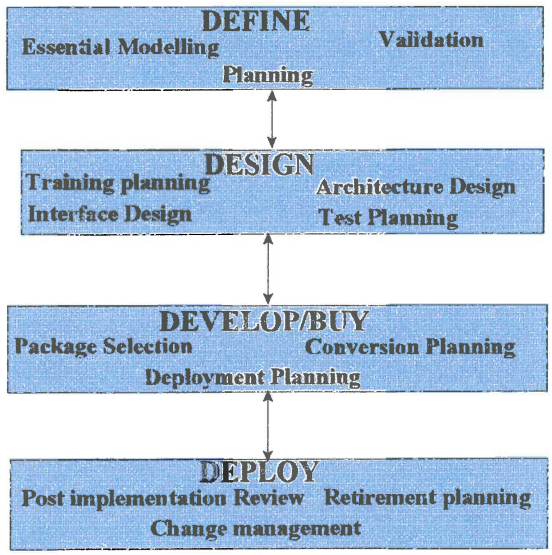


Figure 4.1: Uses for JAD in the Systems Development Life Cycle [Adapted from Gottesdiener, 1994]

JAD meetings early in the SDLC deal with high-level issues like defining the objectives and the scope of the system or decomposing the domain into smaller parts. Increased detail is required as the later design phases are reached [Carmel, Whitaker & George,

1993].

The theoretical basis for JAD is minimal. Many of the ideas for the running of the JAD workshops comes from the study of group dynamics. Carmel, Whitaker and George [1993] note in their article in Communications of the ACM, that there has been little academic interest in JAD. Most of the literature on JAD thus comes from practitioner journals rather than high-quality research journals.

This chapter will first give some detail on the composition of the team for the JAD workshop. The JAD process will then be described. Problems and techniques for promoting effective participation will be presented within the description of the various JAD processes. Lastly some perceptions on the value of the JAD process will be discussed.

4.1 THE JAD PARTICIPANTS

It is important to make sure that the right people attend the JAD sessions. There should be participants from both the Business and Technical sides. Potential users from the Business side are included to give their input on how the system should be designed or implemented. The developers are present to analyse the needs, as expressed by the users, and to gain clarity on what the system should do. A JAD facilitator is used to control the meeting and act as mediator or guide and a scribe records the proceedings of the meeting. Each of these will be described in more detail below.

It is suggested that there be less than 15 people in the JAD workshop [Lockwood, 1989; Knowles, 1995]. A ratio of 3:1 of business users to technical personnel is considered to be good. The roles of the different participants and guidelines for choosing them are given below.

4.1.1 The users

It is important for the success of a project that there is an executive sponsor. This person should try to attend at least the first JAD session and should be available throughout the period of the JAD sessions. The sponsor is usually from the End user community or a Vice President of the company [Netmation, 1998]. The sponsor ensures that the users and technical staff are given the time and the financial support needed to develop the system and attend JAD sessions.

End user involvement is necessary for JAD to succeed. It is the users who give the input into the meeting. One of the problems with user involvement has been with IS developers not listening and not giving opportunities to users to participate effectively. JAD tries to overcome this by getting users together to define or test a system. The role of the user is expanded and they collectively are asked to articulate, negotiate and help develop the system [Purvis & Sambamurthy, 1997]. The users present their differences in their expectations for the new system and negotiate the differences within the structure of the JAD workshop.

In order to achieve this, users must be chosen who know the business. It is important to have a mix of the decision makers from a department and the operational staff who know about the day-to-day operation of the department [Knowles, 1995]. Lockwood [1989] suggests that the users in the JAD workshop should be made up of 10% executives, 20% managers and 70% operational staff. If the system is to serve more than one department then the users must be carefully chosen to represent the different departments. Problems can occur if a critical person is forgotten [Wood & Silver, 1995].

The users should also be able to communicate effectively in order to describe their needs, problems and processes to the others in the workshop [Knowles, 1995]. They should be committed to the objectives of the workshop, for example, designing a quality system. Users should be involved, not only at the requirements stages, but throughout the development of the project. They should know that they will be required to work in

the JAD sessions, follow up on those sessions, evaluate prototypes and even beta test the systems. This participation will enable users to feel that they are part of the project rather than just having someone else's ideas forced upon them [Dodson, 1994].

4.1.2 The IT specialists

The IT specialists' primary responsibilities are to advise the users and to listen and make sure that they get enough detail to be able to build the system.

The IT specialists should be people who understand the organisation and the business area involved. They should be good listeners and should be able to empathise with the end users [Netmation, 1998]. Some authors suggest that they should be silent and only observe the proceedings [Botkin, 1994; Lockwood, 1989]. The IT personnel should definitely not be allowed to take over and control the meeting [Geier, 1996]. They are there to learn rather than to get the users to rubber stamp decisions that they have made previously.

Carmel, Whitaker and George [1993] suggest that historically JAD required silent participation from IS members but that JAD workshops now emphasize the idea of the JAD group being a team. This is supported by Jackson and Embly [1996] who also see users and IT personnel working as a team in the JAD sessions.

4.1.3 The facilitator

The facilitator is key to the JAD workshop. The facilitator is used to guide the team towards the goals set for the workshop. The facilitator is also the person responsible for the planning of the workshop and making sure that the documentation is prepared after the workshop. The facilitator's role in the workshop is to help guide the discussion in order to achieve the goals of the workshop. This involves keeping the group on track and making sure that the participants understand one another. Grove Consultants [quoted in EBG Consulting,1998, p.1] say that facilitation is "*the art of leading people*

through processes toward agreed-upon objectives in a manner that encourages participation, ownership and productivity from all involved".

The facilitator is not there to offer opinions and act as a consultant. His or her job is rather to keep the team members actively engaged [Geier, 1996]. Rettig [1990] suggests that the facilitator is there to get the best possible use of the resources of the group. The facilitator must also make sure that the team members do not get expectations which are too high. Limitations due to budget, technology and time table should be explained to users by the facilitator [Dodson, 1995].

The facilitator will need to know how to handle people and get the best out of them. He or she will also need to be respected by the other team members [Netmation, 1998]. A facilitator must be able to [Bacal, 1998; Wood & Silver, 1995]:

- remain objective;
- be skilled at understanding and handling group dynamics;
- adapt to changing situations;
- think quickly and logically;
- use time and space intentionally;
- evoke participation and creativity from others;
- ask for the opinions of others rather than always offering their own;
- lead the group to consensus rather than compromise;
- demonstrate professionalism, self-confidence and authenticity;
- listen without interrupting;
- communicate clearly and expressively;
- build relationships rather than be task oriented;
- be more like a coach than a scientist and more like a counsellor than a sergeant; and
- keep the big picture in mind while working on the detail.

JAD facilitation skills may need to be learnt as many of these skills will not come naturally to someone. Training in group dynamics is essential for a JAD facilitator

[Davidson, 1999].

Some authors suggest that it may be worth considering an independent consultant as a facilitator in order to assure neutrality and avoid having the person perceived as being biassed [Geier, 1996; Lockwood, 1989]. Wood and Silver [1995] maintain that the person should be politically neutral. This does not seem to be common in practice, however. As Knowles [1995] reports, their research has shown that 89% of facilitators were from the IT departments of their organisations.

4.1.4 The scribe

The scribe is the person who records the proceedings of the JAD workshop. In order to do this the person will need to be more than a secretary as they will need to have some knowledge of the modelling techniques and the subject matter [Geier, 1996]. The scribe will need to learn to capture important decisions made, who made them and why they were made. This documentation forms an important record of the session which can be used for later reference.

The scribe works closely with the JAD facilitator to make sure that all decisions are captured. All participants should be able to ask the scribe to ensure that a particular point has been documented [Netmation, 1998]. The scribe should also act as a sounding board and ask for clarity on any point that is not clear [Sims, 1998]. It may be necessary for the scribe to use CASE tools in order to capture information. The person should, in that case, be an expert in the tool as they will need to input the model as the discussion progresses. The task of the scribe is not an easy one and should not be underestimated.

4.2 THE JAD PROCESS

In order for the JAD process to be successful, the workshops must be properly planned, executed, documented and acted upon. These steps in the JAD process will be

described briefly below.

4.2.1 Preparation for the workshop

JAD workshops must be properly planned in order to achieve their goal. Some authors divide the preparation into three steps, namely project definition, research and preparation [Wood & Silver, 1995; Damian, Hong, Li & Pan, 1999].

During the project definition phase, the purpose, objectives and scope of the session must be determined and agreed upon. The participants should be carefully chosen as specified in the previous section. Each participant should be scheduled to attend and should understand why they need to be there. They should thus all be talked to before the JAD workshop [Geier, 1996]. This will increase their commitment to the project. The JAD facilitator and the scribe must be assigned. Sometimes the job of informing the participants of their role is assigned to the facilitator. Management commitment must be gained for the project and for the time that the participants will need to spend in the workshop [Gottesdiener, 1994].

Research is needed to determine what needs to be placed on the agenda and to determine how work is presently being done [Wood & Silver, 1995]. Some of the user requirements are explored. This research is then used to set up an agenda and a time frame for the workshop [Gottesdiener, 1994]. Participants should be told of any reading or other work that they may need to do before the workshop.

The preparation phase involves preparing everything that is needed for the JAD workshop. The venue for the JAD session should be chosen. It is usually best if the location can be away from the work environment of the participants so that they do not get called out to deal with problems during the workshop [Wood & Silver, 1995]. The actual room where the JAD session will be held is usually set out as indicated in Figure 4.2 [Carmel, Whitaker & George, 1993].

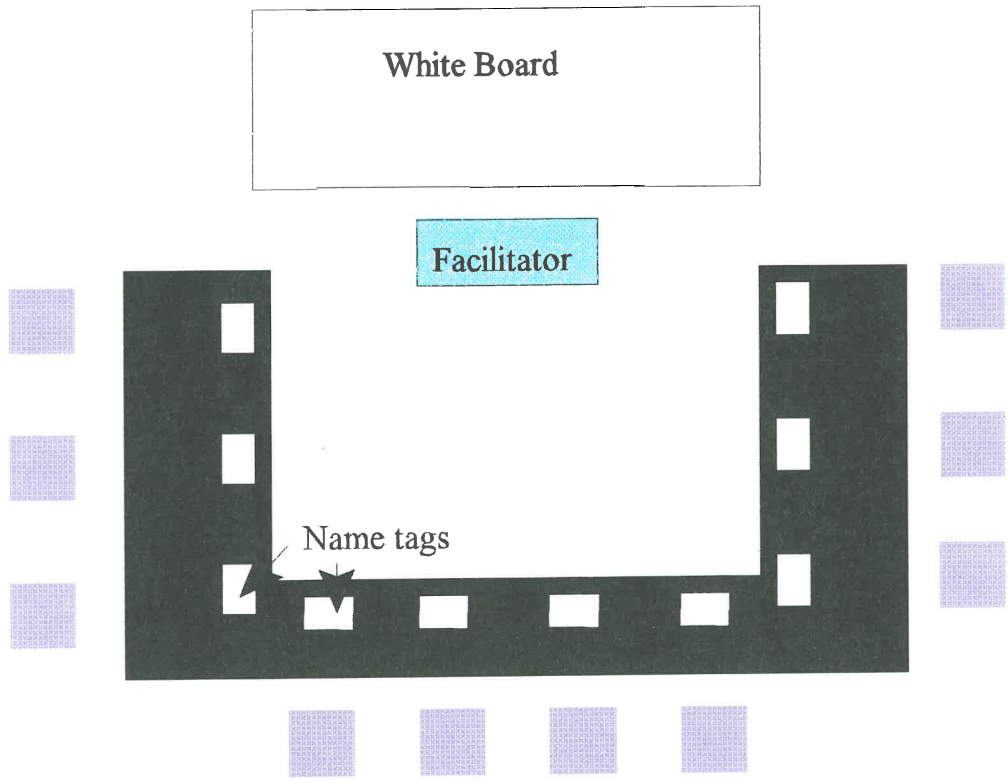


Figure 4.2: A typical JAD room

The participants sit in a horseshoe shape so that they can all see each other and the board. Visual aids might be prepared and these might be put onto the walls around the venue. Data projection or overhead projectors might also be used and should be planned for. Logistics like food, transport and, if necessary, accommodation must also be arranged.

4.2.2 The structured workshop

The workshop should be started in a positive way. Make sure that everyone understands the objectives for the workshop. The ground rules for the session should be established first. Some of these ground rules might be [Gottesdiener, 1994; Geier, 1996; Handley, 1998]:

- All participants are equal. Managers should be prevented from dominating the session, especially when the operational detail is being determined.
- Only one conversation will be allowed at once.
- No idea is bad - everyone should respect the ideas of the other group members.
- All speakers will be allowed to finish their thought without interruption. Everyone in the group will become active listeners and try to listen without letting their preconceived ideas interfere with their ability to hear.
- The group must accept responsibility for the deliverables.
- Off the target discussions will be limited but a record will be kept of any issues that should be returned to at a later date.
- Everyone must be on time for each session of the workshop.
- Computer jargon should be avoided.

4.2.2.1 Working towards a common goal

The JAD facilitator should control the workshop. He or she should make sure that participants stick to the agenda and work towards the agreed-upon goal. The facilitator should not dominate the session him- or herself as it is the opinions of the users that are sought, and not those of the facilitator [Geier, 1996]. JAD is a time-consuming activity as it requires a number of key personnel to be available for an extended period of time. The facilitator must, therefore, make sure that this time is used effectively.

4.2.2.2 Communication

The facilitator stands at the board at the front of the U of the horseshoe, in order to write down decisions on the board while controlling the meeting. The users and the developers should not be placed on opposite sides of the horseshoe as this will create the impression of "us" and "them". Separating participants will also help to reduce the opportunities for people to carry on their own private conversations during the session.

IT personnel should try to be clear when asking questions and discussing with users.

They should try to avoid computer jargon. While users may pretend to understand what they are talking about, it may be discovered later that they were covering for their ignorance [Wood & Silver, 1995].

Simple diagramming techniques should be utilized in order to express the requirements. Whatever technique is chosen, it should be one that is understood by both the users and the developers [Geier, 1996]. The scribe should record the model as well as any side issues for discussion later or detail that should be remembered. Users can get frustrated with IT staff if they use models as a form of "computer jargon" to confuse them [Davidson, 1999].

Some of the JAD team members might be shy or withdrawn while others might be dominating. This can cause problems for the facilitator who should be trained to handle this. The problem is even more serious if the dominator is the boss of some of the other team members or is the person responsible for the system. The dominating member may be spoken to by the facilitator during a break. The idea behind JAD should be explained to the person. It is even better to explain the concepts before the time so that the problem does not occur [Wood & Silver, 1995]. The shy person may be asked direct questions to try to foster his or her participation. While asking them the questions, the facilitator may also have to try to stop the other people from answering them.

Another problem occurs when employees know their jobs well but have never before been asked to communicate what they do to someone else. They may have difficulty doing this in a way that is clear to the rest of the group. Again it is the job of the facilitator to be patient and supportive to the group member and to persevere until the team has a clear picture of the person's work [Dodson, 1994]. In order to do this the facilitator should have done his or her homework so that they themselves have enough of an understanding of the system to ask the right questions of the person.

Listening to the other people in the team is important in a JAD session and this must be stressed with the participants. Horowitz [1996] suggests that poor listening can add to

the cost of systems development. IS people are notorious for poor listening. They tend to race ahead and try solving the problem before they truly understand what is needed. The facilitator can use the method of reflexive listening where he or she paraphrases what the person has said in order to make sure that the person is understood by all.

4.2.2.3 Group dynamics

Group dynamics techniques are needed for inspiring creativity, solving disagreements and handling communication within the group [Carmel, Whitaker & George, 1993].

Conflict is an important part of the design process. It can be educational if it is handled correctly [Purvis & Sambamurthy, 1997]. Gottesdiener [1994] claims that "*healthy disagreement can be a source of creativity and strength to the whole group and should be encouraged.*" The success of the system could be related to the facilitator's ability to manage conflict and achieve consensus. The potential for conflict is especially high in information systems that cross departmental boundaries, especially if political issues mean that there is already tension between those departments. The conflicts should not be ignored in order to get a workable system quickly as this may lead to a less useful system. Purvis and Sambamurthy [1997] contend that the diverse perspectives of the team members must not be stifled, their commitment must be maintained and group cohesiveness should be encouraged while solving conflicts. This is not an easy task and is another aspect of facilitation that may need to be taught to the facilitator.

Compromise is not consensus according to Constantine [1992]. Compromise tries to find a middle road which may leave you with a solution that is worse than any of the original alternatives. Consensus tries to take advantage of all the skills and experiences of the members of the JAD team. Constantine gives some guidelines that can help with this. He says that each of the team members should be persuaded that it is possible to reach consensus and that it is more important to get the best design than it is to get their preconceived idea into the result. Each idea must be judged on its own merits and should not be seen a part of a point-scoring system where concessions made in one area

are traded for concessions in another area. The facilitator is meant to guide this process [Rettig, 1990].

Another skill that needs to be learnt by the team and fostered by the facilitator is the skill of separating fact from opinion. The team must be able to get reliable information. Opinions are not bad and are often useful but they should not be confused with facts and true analysis [Constantine, 1992].

Group cohesion concerns the positive attitudes that the team members have towards the group. It is the individual's sense of belonging to that group and his or her feelings associated with being a member of that group. Group cohesion should be strengthened as this makes the group more effective according to Jones and Harrison [1996]. They found in their research that higher levels of perceived group cohesion led to increased perceived IS team performance.

One problem with groups is that positive factors like group cohesion can force members to be compliant with group positions and this can lead to the problem of group think. This is where the group agrees because they feel that they should agree rather than because they actually think that the decision is right [Gottesdiener, 1994]. One method of overcoming this is to view the topic from another perspective in order to get new ideas.

4.2.2.4 Role of the facilitator

As can be seen from the above, the facilitator needs to be experienced in modelling techniques, group dynamics, conflict management and other interpersonal skills in order to achieve the best results from the workshop. A competent facilitator is essential to the workshop but he or she cannot work alone. The scribe, the users and the IT professionals must all be committed to the process and must be willing to learn the skills necessary for promoting trust within the team.

4.2.3 Post workshop

All documentation concerning the meeting should be published and distributed as soon as possible after the meeting. This will enable the participants to check what has been done and provide corrections to the scribe [Botkin, 1994]. The checking should be done while the JAD workshop is still fresh in the participants' minds [Wood & Silver, 1995]. Any corrections are consolidated into the document which is then redistributed to the group until it is correct.

It is useful if a CASE tool has been used for the documentation as this can then serve as a repository of the decisions taken. The repository, whether it be in a CASE tool or some other form of documentation, will become the group memory for use during the development of the system.

4.3 PERCEPTIONS AND RESEARCH OF JAD

Many claims are made about the effectiveness of JAD. Some of these claims are [Gottesdiener, 1994; Purvis & Sambamurthy, 1997; Carmel, Whitaker & George, 1993]:

- JAD enables IT people to learn about the organisation while enabling users to learn about technology.
- Communication is improved among users, designers and other parties.
- A better understanding of the requirements is achieved, thus realising a better quality product.
- The creeping scope problem is reduced.
- Productivity is increased.
- The users sense of commitment and ownership is increased as their control over the project is promoted using the JAD workshops.
- Cooperation, understanding and teamwork are promoted.
- Consensus is sought and managed more effectively.
- Users resolve their differences in the workshop rather than having the IT personnel try to resolve any conflicts.

- The users are more satisfied with the system.

Few of these claims have been researched, however. As Carmel, Whitaker and George (1993) say, most of the ideas for the effectiveness of JAD come from the study of group dynamics, but these ideas have not really been researched much in the IT sphere. Only two research studies on the effectiveness of JAD could be found in recent literature.

The first research study compares the effects of JAD and traditional design methodology with regard to their perceptions of the design success [Purvis & Sambamurthy, 1997]. They looked at three perceptions of users and designers, namely:

- Perceptions with respect to the user-designer interactions;
- perceptions with respect to the effectiveness of consensus management; and
- perceptions with respect to user acceptance of the designs.

They found that there was significant indication that both users and developers agreed that the JAD methodology promoted better interactions among the participants. This included more user participation and influence, greater partnerships and improved communication. The developers thought that JAD was superior in promoting effective consensus management and user acceptance. The users did not have this perception, however. There was no significant difference in the users perceptions of consensus management and user acceptance between the JAD and traditional methodologies.

In trying to explain this, the authors suggest that the problem may be due to a number of factors. The first is that the developers acknowledged that they were not very confident in using the JAD method and had less experience with the method. The developers' facilitation skills were also not as good as they should have been and this may have been detrimental to the process. Another factor that they identified was that the developers were glad to pass some of the responsibility for the design onto the users. JAD shortened the life cycle for them and allowed them to resolve conflicts more efficiently within the JAD workshop. The users, however, did not like to confront the differences in their expectations and needs in the JAD session. They had to reach

consensus with other members themselves instead of leaving this task to the IT personnel. With inexperienced JAD facilitators the problems in reaching consensus were exacerbated. The users had to give more commitment to the system than with traditional methodologies.

Purvis and Sambamurthy [1997] conclude by saying that it is important for the success of the JAD process to gain the same degree of enthusiasm from users as is expressed by the developers.

The second research study was reported by Davidson [1999]. He studied three organisations that were very competent in the use of JAD in order to determine whether JAD was perceived to be helpful in improving systems.

He found that in most of the projects, people felt that the analytical tasks and models had been well-documented in the JAD workshops. The specifications from the JAD sessions were partially or completely applied during the next stage in the project in 70% of the projects. Looking more closely at this result, he found that while the specifications were used in 100% of the small projects and 67% of the medium size projects, they were only used in 40% of the more complex projects. It seemed like the size and complexity of the project influenced the effectiveness of JAD as a systems specification method.

Most of the people who participated in the workshops found that they were well conducted and were supportive of the method. Some of the benefits that they mentioned were: better quality of requirements were defined, better relationships between the IS team and the users and the chance to learn about how the business worked. The IS developers felt that it was a more efficient use of their time. Many of these factors were mentioned as advantages of JAD in the non-researched list at the start of this section.

Davidson [1999] also found that the JAD workshops adapted to suit the organisations within which they were run. Most of the organisations did not feel that the users could participate full time in JAD workshops so they would have multiple shorter JAD sessions.

The JAD participants were also often the managers rather than a mixture of management and operational staff. These factors limited the potential effectiveness of JAD according to Davidson [1999]. Another problem was the use of IS models of which the user participants had no prior knowledge. This led to communication difficulties and frustrations on the part of the users.

It would seem from this research that JAD is more useful in the smaller to medium-size projects. How JAD is actually practised compared to how it is theoretically defined can also influence the effectiveness of JAD in the systems development process.

4.4 JAD IN THE THEORETICAL FRAMEWORK FOR ISD

JAD can be used as a tool within the sense-making and argumentation orientations of Hirschheim et al's [1996] framework discussed in the previous chapter.

4.4.1 The use of JAD in the sense-making orientation

The sense-making orientation tries to get a shared vision among the different players as to what is needed in an information system. This involves building shared meanings and shared use of language between developers and users and implies the direct participation of both. Formal and informal interaction is required among the different role players.

The JAD workshop can be used as a tool to help to get this shared vision and promote interaction between the different role players. The objectives of the JAD session include making sense of the needs of the organisation and the needs of the various users represented in the workshop. Sense making is thus very much a part of the JAD workshop.

4.4.2 The use of JAD in the argumentation orientation

The argumentation orientation aims to achieve clarification and required developers to justify their claims and provide reasons for what they are doing. Rational argument is required where everyone has a chance to put forward his or her ideas and debate is fostered. Each solution is investigated critically and debated until consensus is reached.

This is what should happen in the JAD session. The JAD workshop provides a structured forum for debate, providing evidence and reaching consensus between the different players in the IS development team. Getting the different users and IT developers together helps the team to challenge established traditions and its own thinking in order to promote change if necessary. The JAD workshop can, therefore, be used very effectively as a tool to promote an argumentative development orientation.

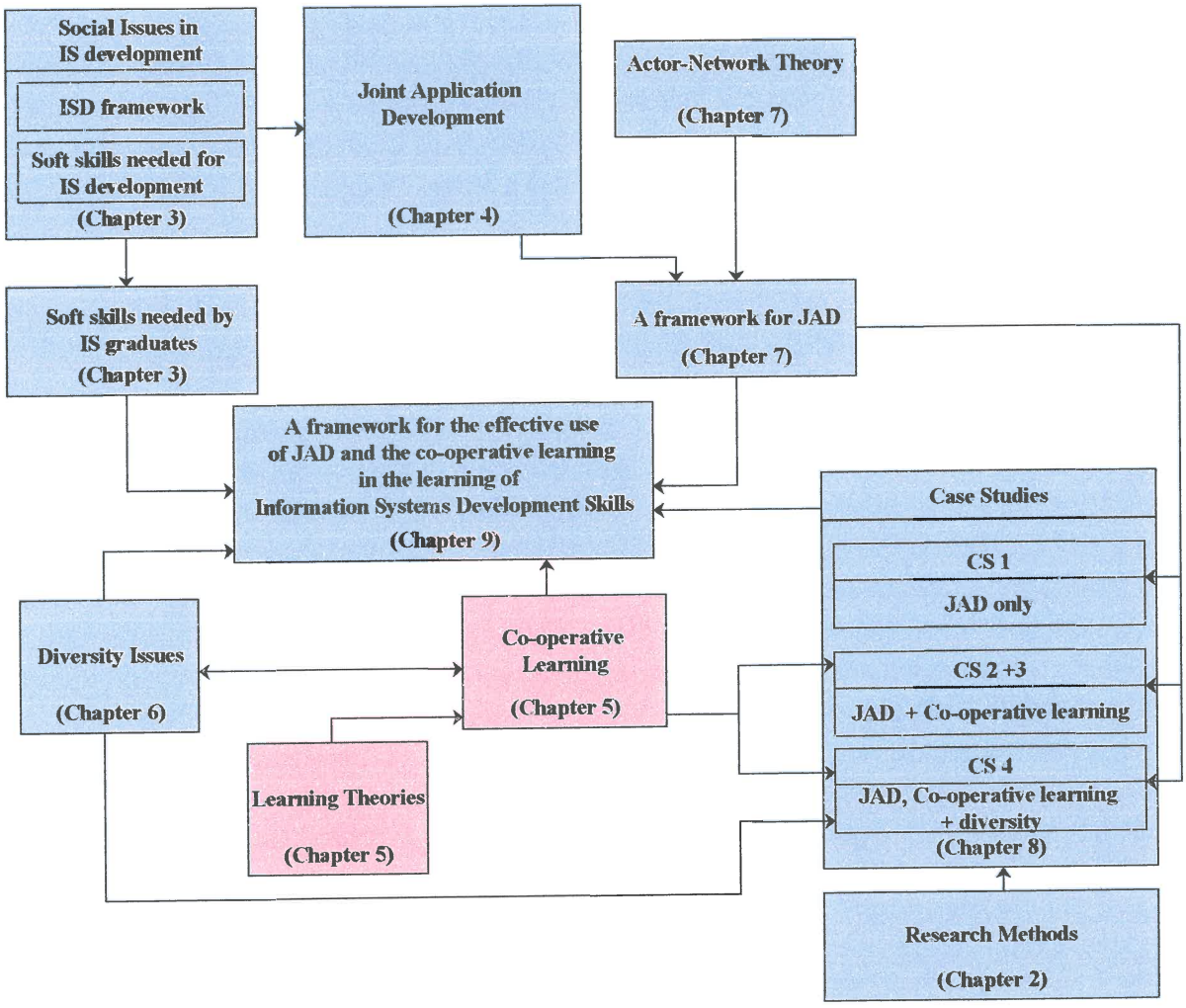
4.5 CONCLUSION

Chapter 4 answered the research questions: "*What is JAD?*", "*Why do people use JAD in industry?*" and "*How does JAD work in industry according to the literature?*". JAD sessions are a method of bringing together people with different backgrounds into one structured workshop in order to work towards a common goal - developing a system that will suit all the players. The people in the workshops communicate, listen to one another, negotiate and solve conflicts while working in a small to medium size group. The facilitator is required to show leadership, listen, help resolve conflict situations and keep the members working towards a goal. Sense-making and argumentation skills are fostered.

These are all skills that IS students should learn. In addition they need to learn the modelling techniques that would be required to design a system. This study looks at how the techniques of JAD can be brought into the classroom and combined with the techniques of co-operative learning in order to learn effectively. The next chapter looks at co-operative learning and how it can be used to promote learning in the classroom.

Chapter 5

Learning by Co-operation



Chapter 5

Learning by Co-operation

The skills and dispositions that are needed by people in order to achieve success include "*the capacity for critical thinking and complex problem solving, respect for people different from oneself, principled ethical behaviour, lifelong learning and effective interpersonal interaction and teamwork.*" [Gardiner, 1994, p.1]. Fostering the learning of these skills is difficult.

This chapter firstly presents some of the learning theories that are the basis of the idea of learning by collaboration. Collaborative and co-operative learning are then described, together with techniques for making co-operative learning more effective. Co-operative learning techniques were combined with the JAD techniques in order to foster more effective groups and more effective learning during the second, third and fourth case studies reported in Chapter 8.

5.1 LEARNING THEORIES

Three learning theories that are relevant to the concept of learning by collaboration will be briefly described in this section. These are the Sociocognitive Learning Theory of Piaget, the Sociocultural Learning Theory of Vygotsky and Social Constructivist Theory, which is the learning theory upon which the research is based.

5.1.1 Piaget's Sociocognitive Learning theory

Knowledge is a state of understanding that is acquired by learning [Wells, Chang & Mahler, 1990]. Knowledge cannot be passed from one person to another in the same way that a book or map can be passed, as individuals must make sense of that information for themselves. Knowledge can only exist in the mind of an individual.

Piaget believed that a person structures reality using internal structures that he termed schemas. As people learn they can develop new schemas (by a process of **assimilation**) or they may modify existing schemas (by a process of **accommodation)**. These two processes of assimilation and accommodation occur in most effective learning [Brady, 1985]. According to Piaget [Brady, 1985], a person tries to achieve a state of equilibrium whereby anything new that is assimilated is compatible with what is in the existing schemas. When a person assimilates information that conflicts with existing schemas then there is a lack of balance and changes in the cognitive structure are necessary.

Piaget's theory was concerned with individual development, but also emphasised, in his earlier work, the importance of social interaction on that development [O'Malley, 1995b]. Interacting with one's peers will lead to a recognition that there are alternative perspectives, this will produce cognitive conflict and will motivate one to change existing schema in order to arrive at a solution that allows equilibrium.

When peers are working together, there needs to be a difference in perspectives in order for social cognitive conflict to occur. Piaget thus predicts that the members of the groups should be at an equivalent level of understanding, so that one member of the group does not dominate the other, but should differ in their underlying conceptions of how to solve a problem [O'Malley, 1995b]. Group members should, however, recognise the need to reach agreement and justify their different points of view. They should also recognise that each member has equal rights.

Language is seen as important, in that it is the method whereby the groups express their thoughts and argue with one another. There must be shared understanding of the language being used [Brady, 1985].

5.1.2 Vygotsky's Sociocultural Learning Theory

Vygotsky believes that all individual development has its origins in social processes.

Vygotsky [quoted in O'Malley, 1995b] proposed that "*any higher mental function was external and social before it was internal.*" He believed that interaction between people formed the foundation of "inner dialogues" and that it is through these inner dialogues that we structure our thoughts [O'Malley, 1995b]. He proposes that internalised language is the basis of thought and that all higher functions like memory, attention and perception develop from relations between people that become internalised [Smith, 1992].

Vygotsky predicts that attempts to co-ordinate perspective and jointly get to a solution will be more valuable than just having different perspectives of what the solution should be [O'Malley, 1995b]. Learning is seen as a social process that involves human beings in communication with one another.

Bereiter [1994] criticises this view saying that there is evidence from Piagetian studies that children learn much from their physical world before they could have learnt from social or cultural interaction with others. He says that while social learning plays a major role in learning, it cannot be said to be the only method by which people learn.

As the learner learns they become inducted into the culture of the specific community and the more experienced member can support the less experienced member [Magadla, 1996]. The nature of the collaboration should be such that the students help one another to reach the solution – this means that students in the group do not need to be equal in ability but may have experts and more novice people paired together.

Rogoff [reviewed in O'Malley, 1995b] suggests that how the groups are formed may depend on what the learning outcomes are for the group. Piaget was concerned with changing perspectives and restructuring of concepts and therefore advocated using groups with group members of equal academic ability. Vygotsky, on the other hand, was interested in acquiring understanding and skills and therefore advocates using mixed ability groups who jointly construct solutions.

The lecturer's role is seen as that of a mediator between the students' personal meanings and culturally established meanings of the broader academic society [Cobb, 1994]. The students and lecturers are involved in a process of negotiation and both contribute towards the learning and development process within the classroom. Lecturers and students use one another's contributions to make learning possible.

5.1.3 Social Constructivism

Constructivism is a theory that helps us to understand how people learn by constructing knowledge. Radical constructivism is based on the work of Piaget and promotes the idea that there is no shared understanding and that learning is a process of individual self-organisation of thought. Social constructivism, on the other hand, recognises that knowledge construction is a social process and that learning involves developing a personal meaning as well as being able to communicate with others in the discipline [Magadla, 1996]. Social constructivism studies the process of collaborative construction of knowledge that occurs when groups of people interact [Stacey, 1998].

Radical constructivism is concerned with the mental activities of the learner. Socioculturalism pays attention to the cultural practices of the learner's situation. Social constructivism does not see that these things are incompatible [Bereiter, 1994]. Cobb [1994] supports this by saying that the sociocultural perspective helps to define the conditions under which learning can take place while the constructivist perspective focuses on what students learn and the processes by which they learn. Social constructivism tries to marry these two ideas.

The process of constructing knowledge, dealing with misconceptions and using social interaction to promote learning will be described below. The implications of this for learning are then presented.

5.1.3.1 Constructing knowledge

Constructivism emphasises the active role of learners in constructing their own knowledge [Dufresne, Gerace, Leonard, Mestre & Wenk, 1996; Ben-Ari, 1998]. Different students will learn in different ways. They use their existing knowledge to make sense of any new knowledge presented to them. Although we teach all our students in a class the same way, they may each come away with a different understanding of what has been presented [Mestre, 1994].

The content, the context, the learner's activity, the prior knowledge of the learner and the goals of the learner will all determine what the person understands [Savery & Duffy, 1995]. Constructivists see "*a relationship between the practices of knowing and what is known. Knowledge is envisioned as tentative and uncertain, having multiple constructions and forming through negotiation with community boundaries.*" [Popkewitz, 1998, p.549].

As learners can only interpret information in the light of their own experiences, what and how that interpretation takes place will be, to a certain extent, individualistic [Jonassen, 1991]. Knowledge acquisition is a recursive practice where new knowledge is combined with existing knowledge to create new cognitive structures. Knowledge can also be created by reflecting on old knowledge [Ben-Ari, 1998]. Constructivism impresses on us the need to understand more about individuals and how they learn [Gruender, 1996]. The implication of this is that learners need to actively engage in the construction of their own knowledge and that we need to test that this construction is taking place correctly. Learners also need the time to reflect on their own understanding of problems [Savery & Duffy, 1995].

Some radical constructivists take this idea of constructing knowledge to the extreme and insist that, as knowledge is local to an individual, it cannot be taught or found in books and other materials. They claim that there can be no shared reality or shared understanding of language [Magadla, 1995]. This has been challenged and does not

seem to be the current view of most education researchers [Gruender, 1996; Reigeluth, 1991]. Reigeluth [1991] argues that there are many types of skills that need to be learnt and that conventional teaching methods are probably fine for some of them.

The Cognitive Flexibility Theory, an extension to the constructivist theory, takes this construction of knowledge a step further. Spiro, Feltovich, Jacobson & Coulson [1991] claim that, in ill-structured domains, the student cannot merely use his or her pre-existing knowledge, but must be flexible about using that knowledge. The prior knowledge itself must be reconstructed. Instead of retrieving from memory an item that tells the person how to act, the person needs to bring together knowledge from a variety of memories and adjust these to suit the new problem to be solved.

5.1.3.2 Misconceptions

As learners use their previously held beliefs and knowledge to understand any new concepts, this can also mean that they use their previously held incorrect knowledge and misunderstand what is being taught. This is especially true in the sciences where many misconceptions or alternative conceptions have been identified [Dufresne et al., 1996]. Even when two people have a discussion and think they understand each other, there is the chance that they do not perceive the same reality [Duffy & Jonassen, 1991].

When learning science, for example, students often have a "private understanding" or "*naive model*" of how things work [Perkins, 1991]. The concepts of speed, velocity, acceleration and force, for example, are concepts that have different meanings in everyday life to the meanings that scientists have for them. This can cause difficulties for students learning physics.

5.1.3.3 Social interaction

Although learners construct their own knowledge, their interaction with others will also influence their learning according to social constructivists. Radical constructivists have

a problem with the idea that learning can take place by internalizing from the social to the internal cognitive realm. The social constructivists borrow from the work of Vygotsky to allow for this process of internalization [Cobb, 1994].

Cognition has a social nature and the community that we live in will have an influence on the knowledge that is constructed [Dufresne et al., 1996]. This is true for scientific education too where knowledge is often stated in terms of symbols and constructs that have been agreed upon by the scientific community to interpret nature [Magadla, 1995].

Social interaction can promote learning. The learner can explain his or her own understanding and receive feedback from others. This process forces learners to clarify their own understanding when explaining it to others. Learning in groups often involves gaining group consensus, which means that learners must convince one another of the right approach or learn from each other that their approach has flaws [Stacey, 1998].

We must encourage students, not only to be problem solvers, but also to make sure that others accept their solutions. They should be able to have an argument with others and defend their ideas while being flexible enough to change their ideas if others can prove their ideas to be better. Collaborative groups are important because they allow students to test their understanding and examine the understanding of others. This, in turn, will allow them to get a deeper understanding of what they are studying [Savery & Duffy, 1995].

5.1.3.4 Implications for teaching and learning

The main implication of the constructivist view of learning for teaching is that teaching should be aimed at helping the students create within themselves the constructs they need, how to learn these constructs and how to explain these to others [Gruender, 1996]. We should also enable students to learn by connecting the new knowledge to their previous experience and knowledge. Social constructivism promotes the idea that this activity should include interaction with other people as we learn better when we work with

others.

Gravett [1995, p.34] suggests that when constructing courses, we should not only look at the content of the course but also "*the principles, key concepts, scientific thought processes and how they interrelate, support and illuminate one another*".

Constructivism does not tell one how to teach. It does, however imply that students should be exposed to learning opportunities that enable them to [Brooks & Brooks, 1993; Dufresne et al, 1996; Swan & Hughes, 1993; Jonassen, 1991; Savery & Duffy, 1995]:

- examine their own ideas;
- participate actively in their learning;
- change from remembering and reciting information to learning independently using critical thinking skills;
- engage in writing, talking, describing, explaining and reflecting;
- realise the purpose of the learning activity;
- develop ownership of the problem or task;
- work in an environment that closely matches the one that they will need to function in later;
- determine the extent to which new experiences make sense in the light of their own ideas;
- consider alternative explanations; and
- evaluate the usefulness of a number of perspectives.

This means that lecturing is likely to be less effective than the more active approaches to learning. Methods of teaching that encourage students to think about what they are doing and make strong connections between their new knowledge and existing knowledge are likely to increase the amount of learning that takes place [Selden, 1996]. Students can be emotionally attached to their own ideas (even if they are misconceptions) and will not give them up easily. It can, therefore, take some effort to challenge students into revising their ideas. Feedback from others is important in this process [Ben-Ari, 1998].

Students actively construct their own frameworks. They could also have their own preferred learning style - some may prefer writing, others talking, reading or listening. Having multiple learning methods and active learning strategies will provide an environment where the students can have some flexibility in constructing their own knowledge according to the learning style that best suits them [Abraham, 1995/1996].

Constructivism implies that students should develop metacognitive skills. This means that they need to think about the way that they think. Metacognitive training will help students develop the skills they need to construct connections and apply strategies for better achievement [Mevarech, 1996].

Social constructivism implies that the activities should be ones which include interaction with other people. This enables the students to learn from others as well as realizing any problems that they may have with their own ideas [Stacey, 1998]. Social constructivism recognises that the students interaction with others can help them to internalize what is to be learnt. The use of small groups, co-operative work, case studies in groups and discussion teaching can all stimulate learning in the social constructivist classroom [Abraham, 1995/1996].

The Cognitive Flexibility Theory, which is an adaptation of the constructive theory, adds another factor to the way that we should teach. Spiro et al. [1991] claim that when teaching and learning the same material should be covered at different times, for different purposes and from different conceptual perspectives. This will enable students to understand the material and be able to use it in different contexts and integrate the material with other material to solve complex problems.

5.2 COLLABORATIVE AND CO-OPERATIVE LEARNING

One of the important lessons to be learnt from the constructivist approach is that active student involvement is necessary for learning. What lecturers tend to do, however, is lecture. While instructing, lecturers fail to determine if the misconceptions students have,

are interfering with their ability to understand the current work being taught. Students should be challenged with the gaps, flaws or discrepancies in their existing knowledge in order to help them change the way that they perceive and learn something new [Gravett, 1995]. This could be done effectively using various types of collaborative work where students must defend their own ideas and listen to others.

Learning can occur in an individualistic, competitive or collaborative situation [Johnson & Johnson, 1986]. In an individualistic learning situation the students' goals are independent and the achievement of one student is unrelated to the achievement of other students. In a competitive learning situation the students' goal achievements are negatively correlated in that when one student achieves his or her goal then others will fail. In co-operative learning situations there is interdependence between the goals of the students. Students work together and perceive that they can only reach their goals if the others in their group also achieve.

5.2.1 What are collaborative and co-operative learning?

Roschelle and Teasley [1995, p.70] differentiate between collaboration and co-operation in the following manner. They define collaboration as "*a co-ordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem*". They say that co-operative work "*is accomplished by the division of labour among participants*", and that it is *"an activity where each person is responsible for a portion of the problem solving"*. Co-operative work would thus seem to be a special form of collaborative work.

Co-operative learning is the instructional use of small groups where students work together to maximise their own and each other's learning [Johnson, Johnson & Smith, 1991]. Hilke [quoted in de Villiers, 1995, p.12] says that "*Co-operative learning is an organisational structure in which a group of students pursue academic goals through collaborative efforts. Students work together in small groups, draw on each other's strengths, and assist each other in completing the task. The method encourages*

supportive relationships, good communication skills and higher-level thinking abilities."

Co-operative and collaborative learning give the individual opportunities to learn by expressing their own ideas and exploring those of others in a group. It is not about competing but rather about using the diverse resources of the group to deepen understanding, sharpen judgement and extend knowledge [McConnell, 1994].

When students collaborate, they share the process of constructing knowledge. This enables the students to think about and elaborate on their own ideas and those of others in the group. The student's fellow group members become collaborators rather than competitors in the learning situation [Strommen, 1992].

5.2.2 Essential features of effective co-operative learning

Co-operative learning is not just another name for group work. Simply placing students in groups and telling them to work together will not mean that they know how to co-operate or that they will co-operate.

Johnson, Johnson and Smith [1991] say that there are five basic principles that should be followed in a co-operative learning situation. These are positive interdependence, face-to-face promotive interaction, individual accountability, social skills and group processing. These five principles are described below:

5.2.2.1 Positive interdependence

Positive interdependence is achieved when each member of the group perceives that he or she cannot succeed unless the other members also succeed and that collaboration is necessary in order to complete the task. The work of the different team members must be beneficial to the other team members. Sharing resources, providing mutual support and encouragement and celebrating joint successes is important to the group. Team members must rely on one another to achieve the goal [Felder & Brent, 1994].

5.2.2.2 Face-to-face promotive interaction

Some or all of the work must be done interactively with group members giving feedback, challenging one another's reasoning and teaching and encouraging one another [Felder & Brent, 1994]. Individuals must encourage and facilitate each other's efforts to achieve, complete tasks and reach the goals of the group [Johnson, Johnson & Smith, 1991].

Promotive interaction is characterised by individuals who [Johnson, Johnson & Smith, 1991, p.30] "*provide each other with efficient and effective assistance; exchange needed resources such as information and materials; provide each other with feedback to improve their subsequent performance of their assigned tasks and responsibilities; challenge each other's conclusions and reasoning to promote higher-quality decision making and greater insight into the problems being considered; advocate the exertion of effort to achieve mutual goals; influence each other's efforts to achieve the group's goals; are motivated to strive for mutual benefit; acting in trusting and trustworthy ways; and exhibit a moderate level of arousal characterised by low anxiety and stress.*"

Note that negative interdependence will result in students obstructing each other's learning and discouraging each other's efforts to learn.

5.2.2.3 Individual accountability

There are two aspects to individual accountability. One is that the performance of the student needs to be individually assessed and the second that each member of the group must be held responsibly by the other members for contributing his or her fair share of the work [Johnson, Johnson & Smith, 1991].

One of the problems of conventional group work is that of "social loafing" whereby some students sit back and allow the rest of the group to do the work [Abrami, Chambers,

Poulsen, de Simone, d'Appollania & Howden, 1995]. This can affect the motivation of the rest of the students in the group. This type of problem is most likely to occur when it is difficult to identify each member's contribution or when members do not feel that they are responsible for the final outcome.

5.2.2.4 Social skills

Social skills are the fourth essential element for co-operative learning groups according to Johnson, Johnson and Smith [1991]. This aspect involves using the appropriate interpersonal or social skills at the proper time. Students must get to know and trust each other, communicate accurately and unambiguously, support one another and resolve conflicts constructively. Students must be encouraged to develop and practise trust-building, decision-making, communication and conflict management skills [Felder & Brent, 1994]. The skills of co-operation are essential for the workplace today [Hamm & Adams, 1992].

These skills are not ones that students can be expected to have instinctively, which means that they may have to be taught to the students if they are to be effective.

5.2.2.5 Group processing

Group processing is defined by Johnson, Johnson and Smith [1991, p.22] as "*reflecting on a group session to describe what actions of the members were helpful and unhelpful and to decide what actions to continue or change*". This will help to clarify and improve the effectiveness of the collaboration. Felder and Brent [1994] support this by saying that team members must set up group goals, assess how they are achieving as a team and identify changes that they need to make to become more effective.

This process can help maintain good working relations among the group members, help the students learn co-operative skills, ensure that members receive feedback on their participation, ensure that students think on the metacognitive level as well as the

cognitive and provide a means to celebrate the success of the group.

5.2.3 Advantages of co-operative learning

Co-operative learning has two main outcomes [Schmuck, 1985; Nijhof & Kommers, 1985]:

- The first outcome is that students learn by co-operating. The students' academic performance is improved as they co-operate with one another.
- The second outcome is that students learn to co-operate. The students learn to work as a team and learn the skills necessary for working with other people.

5.2.3.1 The effect on academic achievement

There are many studies that report on an improvement in students' academic achievement after working in co-operative groups. Johnson and Johnson [1990] investigated 323 studies conducted during the previous 30 years. They did a meta-analysis of the results of these studies and found that the average of the student learning by co-operative learning was two-thirds of a standard deviation above those learning in a competitive environment and three-quarters of a standard deviation above those learning in an individualistic environment. This positive effect on academic achievement has been found in high-, medium- and low-ability students.

Kagan, Zahn, Widaman, Schwarzwald and Tyrrell [1985] report on three major studies done in America that show that minority students (Mexican-Americans and African-Americans), suffer academically in traditional classroom situations. They found, however, that the minority students showed dramatically greater gains academically in the co-operative classroom as compared to the traditional. Knight and Bohlmeyer [1990] suggest that this could be attributed to the fact that these children see the reward structure of co-operative learning as being more consistent with their own co-operative values than the reward structures of a traditional classroom.

One of the suggestions made is that co-operative learning motivates the students to take a more active role in their learning. Learners are able to take control of their own learning within the social context of the co-operative learning group [McConnell, 1994]. By discussion, students can validate their own ideas, gain multiple perspectives of the solution and engage in conflict resolution with others. Students who work together experience this as fun which is a further motivating factor [Hamm & Adams, 1992]. Sharan and Shaulov [1990] studied students' motivation specifically and found that co-operative learning increases students' interest in learning tasks and that their motivation was improved.

Co-operative learning enables students, through discussion, to bring different perspectives to the designing of solutions and should help students to consider more options and issues. Students are encouraged to exchange views with others and become more aware of alternatives [Parsons & Drew, 1996]. This process also helps students to clarify their ideas and develops their critical thinking skills [McConnell, 1994]. Controversy among the group members demands that they reach a higher level of understanding [Knight & Bohlmeyer, 1990].

The process of students teaching one another could also be a factor that promotes the higher academic achievement [Hamm & Adams, 1992]. If a person wants to ensure understanding then he or she can try teaching that to someone else. Through the process of teaching, explaining and defending one's solution a greater understanding develops.

Two essential skills for being an effective thinker can be developed in co-operative groups according to Davidson and Worsham [1992]. These are the skill of good question formulation and the skills of formulating significant problems.

The problems that can be handled by a group can be done in greater depth and be more complex than the problems solved by individuals. Groups are generally able to come to a better solution or design than someone working on his or her own [Parsons & Drew,

1996]. Many students are leaving tertiary institutions with passive knowledge, i.e. they are able to produce facts on demand, but they are unable to understand the concepts and principles which enable them to apply their knowledge in real life [Gravett, 1995]. Co-operative learning tries to address this problem.

Felder and Brent [1994, p.2-3], in an ERIC report, summarize by saying that, relative to students who are taught using lecturer-centred lectures and individual assignments, students taught using co-operative methods exhibit: "*higher academic achievement, greater persistence through graduation, better higher-level reasoning and critical thinking skills, deeper understanding of learned material, more on-task behaviour and less disruptive behaviour in class*".

5.2.3.2 The effect on social relations

Co-operation is an essential skill in most jobs today [Hamm & Adams, 1992]. This is especially true in the field of Information Technology where software developers have to work in teams with users to create effective systems. The skills of working in teams, group dynamic skills, communication skills and consensus finding skills are important in the work place and need to be developed in IS students as discussed in Chapter 3.

Co-operative learning helps to develop the student's interpersonal skills and qualities and makes them better team members. Meyer [1993] claims that group work promotes a "humane and democratic attitude" on the part of students. The students learn to work together and can both give and receive help. This builds more supportive relationships between students in the class [Felder & Brent, 1994]. Support from peers can also help to reduce dropout rates [Stacey, 1998].

Co-operative learning techniques put heterogeneous groups of students together. Students from different sexes, races and cultural backgrounds all work together towards a common goal. Slavin [1985] reports that, in 14 studies of co-operative learning and inter-group relations, all but two found a positive affect on group relations and interracial

relations. This is supported by the studies of Johnson and Johnson [1985] who say that they have found evidence that co-operative learning promotes greater interpersonal attraction and more positive relationships among students who work in co-operative learning environments than those that work in individualistic or competitive environments. Johnson and Johnson also reviewed the work of 98 other studies and found that these results were supported even when students came from heterogeneous backgrounds. Hamm and Adams [1992] say that co-operating with people who are different from oneself increases respect for diversity.

Co-operative learning tries to accommodate individual differences in the learning process. In co-operative learning "*individual differences are exploited to promote learning*" [Antil, Jenkins, Wayne, & Vadasy, 1998, p.420].

English second language students are provided with opportunities to practise their English within the co-operative learning groups. Abrami et al. [1995] suggest that the students should be grouped together in homogeneous language groups when discussing complex concepts to allow them to explore these in their own language. They should be expected to report back in English, however, thus encouraging them to transfer their knowledge into their new language. Including them in heterogeneous groups with other students has the advantage of allowing them to improve their English skills during the entire co-operative learning experience, however. No references that this has been studied in South Africa have been found in the literature, so it remains an interesting point to research.

Students who have problems academically are often moved to bridging classes or other classes out of the mainstream. Slavin [1985] studied co-operation between mainstream and non-mainstreamed students and found that co-operative learning improved the students' acceptance of one another and also improved the self-esteem of the non-mainstreamed students. An enhanced self-esteem has been found to be significant in almost every study on co-operative learning where it has been measured [Slavin, 1985].

Cohen, Lotan and Catanzarite [1990] add that co-operative learning also helped students to view other students differently. They measured how students perceive the status of other students and found evidence that co-operative learning helped improve students' perceptions of the abilities of low-status students.

Felder and Brent [1994] claim that recent research has shown that co-operative learning lowers the levels of stress and anxiety in students. Mutual support is important in achieving this. The experience of being part of a caring group can foster a feeling of belonging, which helps reduce dropout rates and lowers anxiety [Solomon, Watson, Shaps, Battistich & Solomon, 1990].

5.2.4 Problems with group work

Research has shown that although there are many advantages to working in groups, there are also several associated problems. Some of these will be described below.

Some people are perceived to do most of the work while others are able to relax and depend on the "good" students in their group. The less able team member leave it to others to do the work, thus creating a "free rider" effect. The more able team member who is doing all the work feels like a "sucker" [Johnson & Johnson, 1990]. Abrami, et al. [1995] call this "social loafing". This can be particularly problematic, according to Abrami et al., when students share a grade equally regardless of the amount of effort put in by an individual. The co-operative learning methods described above do try to overcome this by forcing individual accountability or dividing the work in such a way that the students are forced to become expert in their individual section of the work [Slavin, 1985]. The students need to be convinced that they must change from listener, observer and note taker to active problem solver, contributor and discussant [Daigle, Doran & Pardue, 1996].

Some students are merely shy and do not participate in a group for this reason. Some students feel that being put in the public eye is a position of risk [Daigle, Doran &

Pardue, 1996]. Others might dominate the group and, even if the others would like to contribute, those students takes over. The dominant student is often egocentric and refuses to consider the perspectives of others in the group. This usually leads to inferior group problem solving [Johnson, Johnson & Smith, 1991]. The high-achiever may resent or belittle the efforts of the low achiever. Co-operative learning methods try to overcome this by having students become experts at a particular area or by evaluating in such a way that the individual and team scores are used [Slavin, 1985].

Some students have self-oriented needs and this can interfere with the work of the group as a whole [Johnson & Johnson, 1990]. Students with high-level abilities complain about being held back by their slower team mates [Felder & Brent, 1994]. Students may then decide to divide the labour dysfunctionally, for example, one might decide that he or she is the "thinker" and the other person is the "typist" [Johnson & Johnson, 1990]. Another dysfunctional way that tertiary students sometimes divide up work is when one member might do all the work for one project and the other for another. This situation will clearly be counterproductive [Anderson, Reder and Simon, 1996].

There can be problems if students are expected to do group work outside of class time. A great deal of time can be spent with trying to get everyone together for meetings especially if some students are not motivated [Parsons & Drew, 1996]. Even if the meetings take place during class time, some students' attendance of class is not of the best. Students will need to make the shift between attending class through personal choice to attending because it is expected by the group [Daigle, Doran & Pardue, 1996].

It can be difficult for students from heterogeneous cultural groups to communicate freely with one another and get to know one another. This is especially true if there are students from different language backgrounds in the group [de Villiers & Grobler, 1995].

Another problem can occur if the decision making of a group is destructive rather than constructive. This can occur if students do not listen to one another, do not know how to reach consensus or are unable to voice their point of view [King & King, 1998].

Internal pressures within the group may force the members to conform, even if they think differently, without true consensus being reached. Group members try to get concurrence within the group and work to get quick compromises and avoid disagreement, rather than to get the best solution [Johnson, Johnson & Smith, 1991].

The lecturer must be sure that the task given to a group is one that allows the students to arrive at well-argued decisions. There should be scope for students of varying levels of abilities to participate in the group and still feel at ease [Meyer, 1993]. The way that the groups are put together should allow the students to express their own ideas and arguments, but should also enable the student to listen and recognise that others may differ from themselves. Students should not be allowed to stop thinking while others are participating [Solomon et. al., 1990].

Another problem is that the group is often more social than productive. In tutorial classes where the students are asked to divide into groups and discuss problems, we often find that they discuss other topics unrelated to the classroom activity. Lecturers have a problem with monitoring the groups and noticing problems within the groups. They often intervene too quickly or fail to intervene when it is necessary [Solomon et. al., 1990].

Co-operative learning methods have been devised to help reduce some of these problems but they must be implemented correctly. The following section describes how the lecturer can implement effective co-operative learning.

5.2.5 Implementing effective co-operative learning

The co-operative classroom is a complex one and one that requires considerable redesigning on the part of the lecturer. The different features of the classroom environment are also integrated and they affect one another, for example, the teacher's leadership style, the structure of the learning task and the student's social skills will all influence the process [Hertz-Lazarowitz & Shachar, 1990].

This section tries to describe some of the factors that should be considered in order to use co-operative learning methods effectively.

5.2.5.1 Specifying the instructional objectives

Two types of instructional objectives need to be defined for the lesson. The first is the academic objective and the second is the social skills objective [Johnson, Johnson & Smith, 1991; Reynolds, 1994]. The academic objective must be appropriate for the level of skill of the students and will, to a large extent, determine the co-operative learning method, the learning material and the task structure that is chosen. The social skill's objective must indicate to the students what particular group skills will be emphasised during the lesson. The students must be aware of both of these objectives and they should be explained clearly to them.

In order to structure positive interdependence the lecturer should also communicate the goal of the individual and the goal of the group. This will help to foster individual accountability and group cohesion.

The context of the work should also be explained to the students so that they understand how the group activities link with the other parts of the course and with what happens in industry [Reynolds, 1994].

5.2.5.2 Prepare students for group work

Johnson and Johnson [1990] suggest that placing students who are socially unskilled into a group and telling them to co-operate will not work. Students have to be taught the interpersonal and small group skills needed for co-operation.

Thorley and Gregory [1994] suggest that students who are asked to do group work with inadequate training may find the group activity negative. This will then reduce the learning.

Students must be made aware of the importance of prosocial behaviour in the classroom and in the workplace. Factors like being fair, considering others, being helpful and having social responsibility should be highlighted [Solomon, et. al., 1990]. Social skills for group work like co-operation, sharing, negotiation and conflict management need to be taught and practised. The students must learn that their group will be successful through negotiated consensus rather than capitulation on their part [Sullivan, 1992].

Jaques [1991] provides some interactive training exercises that help with team building, thus enabling them to learn to know and trust one another, to not take each other for granted, to become aware of their own effect on the group and to foster an environment where group skills can be practised.

Some of the specific skills that students can be made aware of are [Hamm & Adams, 1992; Cohen, Lotan and Catanzarite, 1990]:

- Encouraging others to talk;
- responding to the ideas of others;
- giving others a chance to take part;
- listening to others;
- rotating tasks;
- showing appreciation;
- criticising an idea and not a person;
- decision making through consensus rather than compromise;
- empathising and encouraging; and
- helping others without giving the answer.

Effective constructive decision-making skills are important in co-operative learning groups. Students must learn the skills of decision making by consensus. This would involve learning to respect one another's opinions, learning to listen to one another, make one's own point of view known, be assertive and being able to evaluate what is being said before reacting [King & King, 1998].

Students must understand the concept of active learning whereby no one knows all the answers and students are encouraged and must encourage one another. It is also important that students understand that doing the work for someone else is not helping that person to learn. There must be intellectual sharing in order to help the other person to gain a greater understanding [Hamm & Adams, 1992].

5.2.5.3 Arranging the room

"*It is in the physical arrangement of chairs that many of the most basic yet influential problems in group discussion can occur. Who sits where and at what distance from whom will affect the social roles and relationships pursued by members*" [Jaques, 1991, p.119]. He goes on to say that the chairs of the group should be arranged in such a way that everyone is evenly spaced, no-one has a special position and everyone is able to have eye contact with everyone else.

This is not always possible, however, especially in tertiary institutions that often have large classrooms with fixed desks and chairs. It is difficult for co-operative learning to take place when students sit in rows facing the teacher. Johnson, Johnson and Smith [1991] have given some ideas for having pairs of students work together which could work in this situation, but generally it is better if the desks can be moved to facilitate group work [Hamm & Adams, 1992].

Desks need to be pushed together to allow the students to face one another and work collaboratively on the task. The students should be able to see all the relevant task material, converse with each other without raising their voices and have eye contact with one another. The lecturer should also have clear access to every group [Johnson, Johnson & Smith, 1991].

5.2.5.4 Deciding on group composition

One of the factors that should be considered is the size of the group. The type of

interaction that is possible will be influenced by the size of the group [Jaques, 1991]. The smaller the size, the greater the likelihood that relationships of trust and sharing will be fostered. The smaller size may, however, have a detrimental effect on the amount of variety that one finds in the group and this may reduce the amount of discussion. As the group size increases the opportunities for each member to contribute diminishes and this often means that the low-ability students contribute much less. Individual accountability will be higher in a smaller group.

Johnson, Johnson and Smith [1991] add that the shorter the amount of time available, the smaller the group should be. Group sizes for co-operative learning are generally between 2 and 6 members. Jaques [1991] suggests that 6 is an optimal number that allows students to register their feelings within the group, allows for a fluid leadership and does not need formal structuring. A group size larger than this requires some allocation of roles and more formal structuring.

Another factor that must be considered when deciding on group composition is whether the group should be heterogeneous or homogeneous with respect to member's ability. Some studies have shown that having students of high-, medium- and low- achievement in the same learning group is best as it fosters a wider perspective on the material and this, in turn, increases the quality of reasoning used by the group. Homogeneous groups can be used to master specific skills, however [Johnson, Johnson & Smith, 1991].

Students often want to choose who they want to work with but this has been found not to be very successful as the groups are often homogeneous [Johnson, Johnson & Smith, 1991].

Robson [1994] suggests that developing a working group requires more than just choosing the right group and introducing the members to one another. Groups should learn and practise group skills within the groups. They should also evaluate the way in which they work as a group. These factors are discussed later.

5.2.5.5 Structuring the task

The task must be explained to the students so that they have a clear understanding of the objectives, what needs to be done, procedures that they need to follow and social skills they are expected to demonstrate [Johnson, Johnson & Smith, 1991].

Positive interdependence must be structured into the task and the reward system, to make sure that the group takes responsibility for each member of their group. The task should also be such that each member must be individually accountable. They should have to do individual tests or be responsible for a particular part of a project [Johnson, Johnson & Smith, 1991].

The task must be structured in such a way that the students perceive that multiple abilities and strengths are needed to achieve success [Cohen, Lotan & Catanzarite, 1990]. This is especially true if we want to enhance the status of students who are seen by their fellow students as being of low status.

The students can then be assigned roles within the task or roles within the group. The following assignments could be made [Johnson, Johnson & Smith, 1991]:

- A summariser can be used to restate the group's major conclusions;
- a checker who ensures that everyone can explain how the group arrived at an answer;
- an accuracy coach who corrects mistakes in other members' explanations;
- an elaborator who relates what is currently being learnt to previous material;
- a recorder who writes down the group's decisions;
- an encourager who ensures that all members contribute; and
- an observer who keeps track of how well everyone is co-operating.

5.2.5.6 Planning instructional materials

The learning materials should be rich and varied so that students with different types of

skills can make different contributions [Cohen, Lotan & Catanzarite, 1990].

If the students have the co-operative skills and are mature and experienced, then the teacher need not arrange the materials in any specific way. If, however, the students are not skilled, the lecturer may want to arrange the materials to promote the idea that the project is a group project and not individual. This can be done by, for example [Johnson, Johnson & Smith, 1991]:

- Giving only one copy of the material to the group so that the students have to work together to be successful;
- giving different materials to the different group members who then have to teach one another or put their pieces together like a jigsaw as in one of the co-operative learning methods called the Jigsaw method; or
- arranging competitions between groups where it is to the group's advantage to make sure that each person in their group knows all the work.

5.2.5.7 Monitoring and intervening

Co-operative learning allows the students to validate their own ideas and this frees the teacher to move about, work with small groups and interact in a more personal way with the students [Hamm & Adams, 1992].

The constructivist classroom is one where the teacher tries to get some insight into how each student understands the work. The teacher should not, therefore, sit back and relax when the students start to work but should be trying to see what the students do and do not understand [Johnson, Johnson & Smith, 1991]. They should also check to see what problems the students are having working in a co-operative way and should assist if necessary. More effective methods of working together can be suggested to groups having problems.

Lecturers should not intervene with groups who are working effectively but should help groups to clarify instructions and even teach skills to a group if that is necessary.

Lecturers should change from an authoritarian way of telling the students when they are right or wrong to rather question the students by asking things like "What are you doing?", "Why are you doing it?" or "How will it help you?" [Johnson, Johnson & Smith, 1991].

The groups should be made aware of their own cognition and group processing by being invited by the lecturer to think about what they are doing. Students should also be made aware of their growth in these areas [Costa & O'Leary, 1992].

Students should be expected to help one another and not to expect help from the teacher until they have tried to help each other [Solomon et. al., 1990]. Teachers are often inclined to intervene too soon or give too much direction to the students and this should be guarded against. The students may have new ideas on the topic being discussed and the teacher will have to be comfortable with sometimes having to say "I don't know" or "Let's find out" [Hamm & Adams, 1992].

One must expect that the noise level in the classroom will rise and authoritarian methods of discipline will not work if the students must be responsible for their own learning. Teachers will have to tolerate this [Hamm & Adams, 1992].

5.2.5.8 Evaluating learning

McConnell [1994] reports on two views on rewarding co-operative learning. Some feel that extrinsic rewards are necessary to motivate students to learn while others suggest that intrinsic motivation, provided by the personal involvement of the students in the co-operative tasks, is sufficient to produce high achievement.

Most authors agree that evaluation should be based both on the activities of the group and the individual in order to promote group interdependence and individual accountability [Johnson, Johnson & Smith, 1991; Knight & Bohlmeyer, 1990; Hamm & Adams, 1992]. Individual accountability can be accomplished by:

- Having group rewards based on the grades achieved by individuals in tests;
- having individual students make presentations of the group project or part of that project; and
- providing incentives for students to work together when learning new material but testing them individually.

McConnell [1994] suggests that as students are playing a major role in their own learning, they should also play a role in evaluating their own work and the work of their team mates. He maintains that the skills of self-assessment are important and should be fostered in students. Students could also be involved in determining the criteria upon which their work and the work of others will be judged. In programming classes students could be used to do walkthroughs of one another's programs and would be jointly responsible for the quality of that program.

Social interaction should also be rewarded and evaluated.

5.2.5.9 Evaluating the group process interaction

The groups can only become more effective if they are able to reflect on how well they are functioning. They should use some time at the end of each group session to describe what actions were helpful and unhelpful and decide what should continue and what should change [Johnson & Johnson, 1990].

The evaluation techniques that are used should also afford individuals the chance to reflect on their own behaviour as well as that of the rest of the group [Jaques, 1991]. Diaries can be used where the students are asked to record ideas about their ideas, concepts, group activities and what they have learnt.

In order to make sure that this takes place properly, lecturers should [Johnson, Johnson and Smith, 1991]:

- Make time at the end of each session for the groups to process how effective they

were at working together;

- observe the groups himself or herself in order to comment if necessary;
- get the groups to describe what actions were helpful and those that were unhelpful in completing the group's work; and
- let the groups decide what behaviours they should change or continue.

5.2.6 Circles of learning co-operative learning method

Various methods of organising co-operative learning in the classroom have been researched. Examples of these include the Jigsaw method, co-op co-op, student teams-achievement divisions (STAD) and group investigation. The circles of learning method was chosen for this study as some of its characteristics were already present in the JAD groups. It has also been described as being effective for the learning of group skills [Slavin, Sharan, Kagan, Hertz Lazarowitz, Webb & Schmuck, 1985]. This method will be described in detail in this section. In Case Study 2, reported in Chapter 8, it will be shown how this method was adapted for use with the JAD techniques in the classroom.

The circles of learning method, developed by Johnson and Johnson, has the students working together as a group to complete a group product. They are required to share ideas, help one another and make sure that all members are involved and understand the group's answers.

Eighteen steps have been identified for implementation of this method although some of the steps are optional [Knight & Bohlmeyer, 1990, p.2-3]:

- Clearly specify instructional objectives.
- Limit the group size to no more that six with smaller size groups for students that are new to co-operative learning to ensure that everyone will participate.
- Structure groups so that they are heterogeneous with respect to ability, sex and culture. Homogeneous groups can be used sometimes in order to master specific skills.
- Arrange groups in circles to facilitate communication.

- Use instructional materials that will promote interdependence among students.
- Assign roles to ensure interdependence. One could assign a summariser-checker to summarise the lesson and quiz group members; an encourager to encourage everyone to participate; a recorder to write down group decisions and an observer to make sure that the group collaborates.
- Explain the academic task.
- Structure positive goal interdependence by having the group produce a single product or by providing group rewards based on the individual performances of the different group members.
- Structure individual accountability for learning by giving individual tests or expecting the individual to explain the work to others.
- Structure inter-group co-operation.
- Explain the criteria for success. Explain how the individual grades work and how one can earn points for one's group.
- Specify desired behaviours. These might include: Using people's names, taking turns, making sure each person understands and agrees with the group's answer.
- Monitor students' behaviour, continually looking for problems with the task or with the collaborative effort.
- Provide task assistance. At times the teacher will need to intervene, clarify instructions, encourage discussions or even teach.
- Intervene in order to teach collaborative skills of effective communication, building a trusting environment and managing controversy.
- Provide closure to the lesson with summaries by students and teacher.
- Evaluate the students' work. Group or individualist incentives can be used although there should be some group incentive.
- Assess group functioning through ongoing observation and discussion of the group process.

The circles of learning co-operative learning method allows the students to work together in a structured manner to achieve a common goal. Students learn, not only about the topic they are studying, but also about working together and co-operatively with the other

members of their group.

5.3 SUMMARY

This chapter firstly answered the question: "*What is the social constructivist learning theory?*" There are many learning theories. The three learning theories discussed in this thesis, namely, the Sociocognitive Learning Theory, the Sociocultural Learning Theory and the Social Constructivist Learning Theory all agree that learning is promoted when students work with one another. The three learning theories may structure the learning process or the group interaction differently, but they all agree that social interaction improves learning.

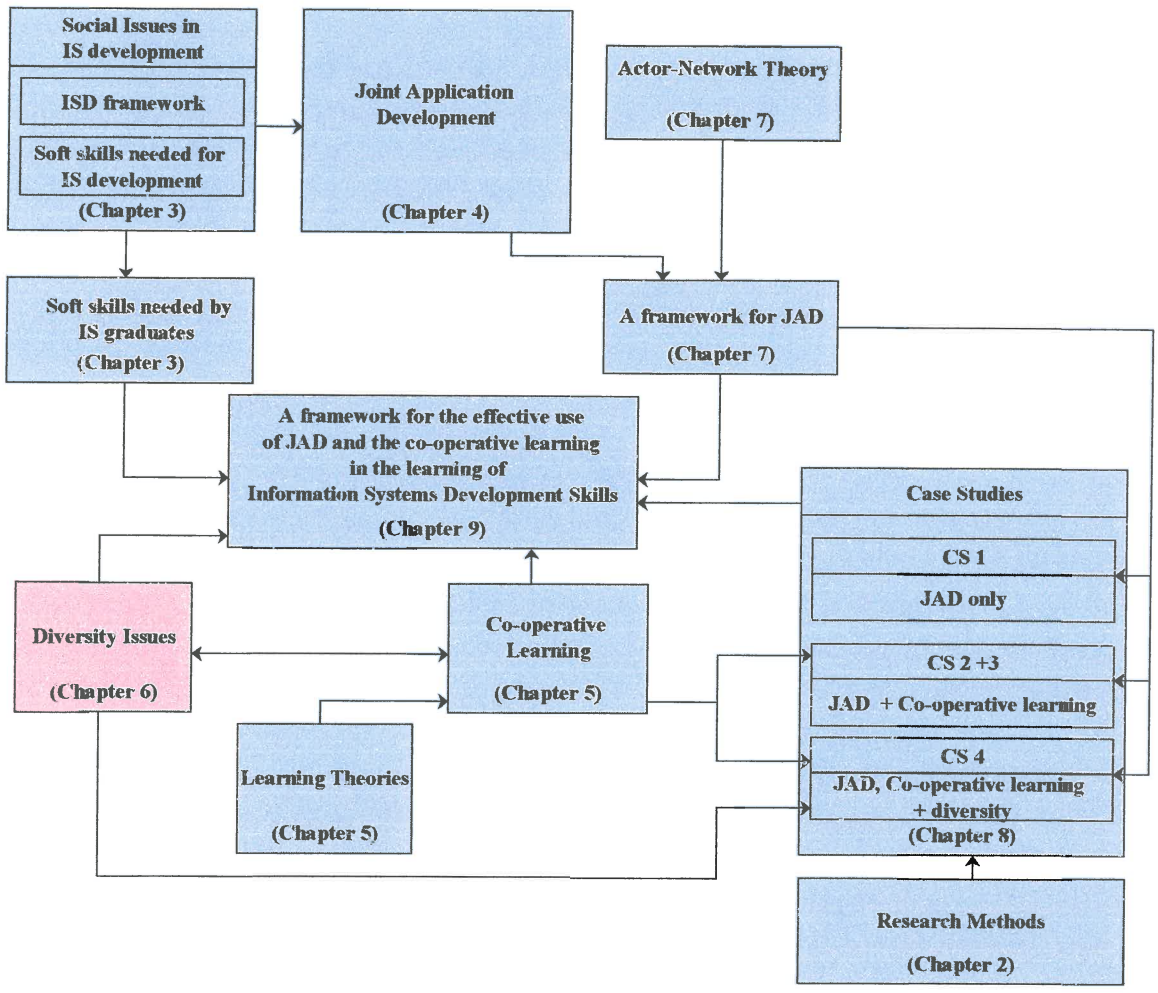
The chapter then went on to answer the question: "*What is co-operative learning?*" Co-operative learning provides a way of structuring the group work so that learning can be better facilitated. The students' and lecturers' roles are well defined so that the learning process can be effective.

Co-operative and collaborative learning are important to help students learn academically and socially. Merely putting students into groups and telling them to co-operate is not sufficient, however. Activities must be carefully planned in order to achieve the maximum benefit to the student, both in learning the material and learning the social skills.

In Chapter 8, this thesis will look at how the techniques of co-operative learning were combined with those of JAD in order to promote effective learning in the classroom.

Chapter 6

Diversity in the classroom



Chapter 6

Diversity in the classroom

During the research period of this study, it became evident that the diversity of the students played a major role in their experiences within the classroom and within the JAD groups. It was, therefore, decided that methods of dealing with diversity need to be explored and studied in order to enhance the learning experiences of the entire class.

South Africa has a rich multicultural society. This is shown by the country's 11 official languages. Diversity is not only language or culture, however, and this will be explored in this chapter.

This chapter looks at what diversity is, diversity in South Africa, the problems that diversity brings with it and the methods that people have devised in order to overcome those problems. The chapter will specifically look at the problems and diversity issues involved with group work in order to apply these within the JAD groups.

6.1 WHAT IS MEANT BY DIVERSITY?

Students come to tertiary institutions with a wide range of experiences and backgrounds [Koger, 1995]. Dimensions of diversity include those aspects with which we are born, for example, intelligence, gender, race, age, physical abilities and sexual orientation. A second dimension of diversity that affects us are those diverse aspects that we acquire and these include language, education, religious beliefs, culture, social class, geographic location, income, work background and marital status [Appelbaum, Shapiro & Elbaz, 1998; Lynn, 1998; Goduka, 1998].

Learners also have different learning styles, psychological dispositions and needs, together with diverse intelligence. Some students learn well in groups while others prefer to work individually. Some need quiet in order to concentrate while others prefer working in an environment where there is noise and movement. Some students need structure and support while they study, while others are more independent and prefer to learn in their own way. Some students learn best in an informal environment while others prefer the more formal classroom. Some students prefer a lecturer who deals with them personally while others prefer to be left on their own. All of these learning styles reflect diversity that the lecturer must deal with in the classroom [Goduka, 1998]. Culture can affect learning styles. Cultural factors like how a particular culture exercises control over their children and even physical factors like nutrition can affect how students learn.

Each learner has unique gifts and unique needs that should be taken into consideration when developing learning environments, curriculum material and instructional strategies [Goduka, 1998].

One must be careful of seeing diversity only as a problem. Diversity can be a positive force. A diverse group brings a wide spectrum of backgrounds, interests, points of view and ways of doing things into any interaction. This encourages creativity and brings fresh perspectives which leads to better decision making [Appelbaum, Shapiro & Elbaz, 1998].

6.2 DIVERSITY IN SOUTH AFRICAN TERTIARY EDUCATION

South Africa is a country of diversity with the challenge of overcoming the legacy of apartheid. Apartheid created a division between the haves and the have-nots. This chasm is also evident in education where apartheid created an educational system that was unequal and rewarded whites while disadvantaging the blacks in the country [McMillan-Lonesome, 1996].

The diverse student populations coming into tertiary education are often seen as a

problem in South Africa [Goduka, 1996a; Starfield, 1996]. Students from different backgrounds, with very divergent educational standards, come into tertiary education and are all given the same work and expected to understand it in the same way. Tertiary institutions continue to teach the same curricula in the same way as they did when they had a predominantly white, male student body.

While black students are a majority at the Port Elizabeth Technikon, where most of this research has been done, they are in the minority in the fields of technology and in particular in Information Technology. This can partly be attributed to the students' schooling where students are not encouraged to do subjects like Mathematics.

English is seen as a major symbol for success and power in South Africa [Goduka, 1998]. The apartheid policy of South Africa's previous government used language policies in education to try to dominate culturally and politically. This came to a head in 1976 when Afrikaans was imposed as a mandatory language for the medium of instruction in African schools and was the trigger for the struggle and mass protests that occurred from that date. Under the new constitution the importance of affirming and validating cultural and linguistic diversity is recognised. Eleven official languages are recognised but English is used for communication in official documents and remains the dominant language for tertiary education in South Africa. Tertiary institutions are now faced with students trying to cope with tertiary education in their second or even their third language. Creating classrooms and group discussions where these people have an equal opportunity of understanding and participating with their English counterparts, is a challenge for South African lecturers [Goduka, 1998]. In the Eastern Cape, where this research took place, there are three main languages used, namely English, Xhosa and Afrikaans.

Students have often been taught by rote learning and learning only from the text book during their secondary schooling. They find it difficult to work without a text book or to engage in free enquiry and discussion [Ruth, 1996]. Many of the students from disadvantaged backgrounds, find it difficult to ask questions in class or to participate in

classroom discussions especially when the whole class is present. Some are afraid that their language skills are not adequate or that their questions may be seen as naive by the other students in the class.

Many of the students coming into the tertiary institutions in South Africa are inadequately prepared for the new role that they must play. They are often first generation students whose parents have high expectations of them, thus putting them under a lot of pressure. Apartheid education was designed to promote an authoritarian way of teaching and students were taught not to question [Ruth, 1996]. Current teachers, brought up with this method of teaching, continue to teach in this way. This authoritarian school system means that students are afraid, especially at first year level, to interact with their lecturers [Winschiers, 1997].

Students' attitudes can also be a problem. Students see it as the staff members' role to provide them with answers to questions and to make sure that they pass [Sanders, 1992]. They are thus reluctant to do assignments which require them to find information or solve problems that have not previously been done by their lecturers.

While ill-prepared students are a problem, the diversity of students should not be seen as a problem but rather as an opportunity according to Goduka[1996b]. She states that the problem occurs when we try to change our diverse student population to all be the same. Diversity should be integrated into the curriculum and learning environments allowing each student to be different and understanding those differences.

The Xhosas use the concept of "*ubuntu*" to describe humanness. This ethos is based on collectivism and is core to Africans, Asians and Native-Americans, among others. Goduka [1996c] describes the following sentiment in Xhosa "*Umntu ngumntu ngabantu*" or, in English, *"I am we; I am because we are; We are because I am."* as being indicative of the philosophical thought of Africans who work well in collective, pluralistic processes rather than the more individualist, one-dimensional processes of the Western cultures. She goes on to say that neither of these attitudes are better than the other, but

that understanding the difference will enable us to adapt our classrooms to the needs of different students.

6.3 PROBLEMS ASSOCIATED WITH DIVERSITY

Ignoring the diversity in our classrooms can help to make students feel marginalised and can increase the domination process within tertiary institutions [Sanchez & Fried, 1997].

6.3.1 Problems of stereotyping and prejudice

People need to have a sense of belonging. Belonging to a group helps with feelings of social integration, a sense of security and commitment, a reassurance of our worth, self esteem and gives an opportunity to get guidance from the group [Cushner, McClelland & Safford, 1992]. Social identity is part of how people identify themselves. Being part of a group leads to dividing the world into in-groups and out-groups where other people are perceived as either being from one's own group or belonging to the other group. [Baron & Byrne, 1991] Aspects that are used to determine groups include race, age, sex and culture. Members of the out-group are seen as homogeneous and not as individuals. This leads to stereotyping and prejudice [Visser, Cleaver & Schoeman, 1999].

In order to simplify the world, people tend to organise information into categories that make sense to them. Categorisation can also lead to stereotyping [Cushner, McClelland & Safford, 1992]. Stereotyping suggests that all people of a particular group possess specific traits or characteristics. If someone has acquired a stereotyped framework, then they will tend to notice information and facts to fit that framework and will disregard information to the contrary [Baron & Byrne, 1991]. The stereotype is thus self-confirming.

Prejudice is an "*antipathy based on a faulty and inflexible generalisation.*" [Towson, 1985, p.266]. This means that a person who is prejudiced has negative feelings towards

another person based on their faulty ideas of that person on the basis of that person belonging to a specific group. Discrimination takes this a step further, where this prejudice is turned into negative action towards those people [Baron & Byrne, 1991].

A problem that people experience is that they have a tendency to be ethnocentric. This implies that they make judgements based on their own standards and then apply these to others. These judgements can often be prejudicial [Cushner, McClelland & Safford, 1992].

6.3.2 Problems associated with diversity of language

Students who have English as their second or third language and who must participate in an English classroom will be at a serious disadvantage to their English counterparts [Goduka, 1998]. At tertiary level students are, not only expected to participate in English, but also to participate using the language and terminology of their chosen subject area. This can cause added problems for a student with English as a second language who may not realise that, for example, a term in one subject area may have a different meaning to one in another subject area [Starfield, 1996].

The students who is studying in a second or third language will take more time to process information and will be easily intimidated by being asked to read or write in that language [Wood, 1998]. English second language students can experience problems reading texts. Their language skills are inadequate to cope with the complexity of the texts and the academic language that is used in those texts. This leads to a lack of confidence in their own abilities, a lack of self esteem as well as a misunderstanding of the material.

The problem is exacerbated as the students will often not admit to the fact that they do not understand as they are afraid that they will embarrass themselves in front of the other students [Lőtter, 1998].

The lecturer should also guard against letting his or her face take on a pained expression of concentration when listening to an English Second Language student. While this may be done in order to listen carefully, it may discourage further participation on the part of the student [Lou, 1994].

6.3.3 Problems associated with diversity of culture

Culture "*refers to those idealised cognitive models that form one's world view and that are shared among members of a particular group typically, although not always, a group sharing a common language. These models, derived from shared experience are strongly constitutive of one's understanding of oneself and one's relations with others, and are schematic mental representations of typical situations, persons, actions and objects.*" [Wood, 1998, p88]. Culture can thus be thought of as the "*systems of thought within which people interpret, assess and explain their life world.*" [Bitzer & Venter, 1996, p16].

As people from different cultures communicate, they bring with them their cultural knowledge and background. This causes them to speak from their cultural perspective and interpret the communication of others from this perspective [Moahloli & Phooko, 1998].

Mistrust and miscommunication between diverse cultural groups can be a major source of conflict according to Appelbaum, Shapiro and Elbaz [1998]. Miscommunication can be caused by misperception. People tend to perceive what they expect to perceive and that means that they are selective, consistent and inaccurate. Misinterpretation is another way in which people miscommunicate. This occurs when we try to categorize what another person is saying by our own standards and perspectives. A further source of miscommunication occurs when we misevaluate what is being done by using our own culture as a standard of measurement by which we judge everything else.

An example of cultural communication problems is given by Cushner, McClelland and

Safford [1992]. They describe how children of African or Mexican descent are taught to show respect by avoiding eye contact, while American children are taught to look a person in the eye when being reprimanded. The American teacher can interpret the child's response as being disrespectful. This problem is also evident in South Africa, where the Xhosa children are taught to avoid eye contact to show respect and those of Western origin expect children to keep eye contact.

Another problem in multicultural education is that academics often have little understanding of the cultural heritage of the students. This means that they are unable to imagine the mental models that the students are forming as a result of their lecture [Wood, 1998]. Although the student from a disadvantaged background may have a rich experience of life, this experience does not seem to count for much in the academic environment.

As mentioned before, many of the African, Asian and Latin-American cultures tend to be based on collectivism, while the European or Western cultures are more individualistic [Goduka, 1996c]. In an individualistic culture the person will be primarily concerned with his or her own needs and those of his or her immediate family. Privacy is valued [Terblanche, 1996]. People belonging to more collective cultural groups tend to play down their own individual emotions and needs to go along with the needs of the group. The people from these type of cultures tend to rely on their own group to see to their needs. This has an effect on communication, for example. A person from an individualistic culture will be inclined to use direct and explicit language and will rely on direct linear logical patterns of reasoning. Someone from a collective culture would be more inclined to use indirect verbal interaction and would use more spiral-type reasoning methods. The individualistic cultures tend to deal with conflict through confrontation, where as collective cultures try to be more passive and accommodating [Terblanche, 1996]. These communication patterns between the different cultural groups can cause problems in heterogeneous classrooms and heterogeneous groups.

Problems can also occur if some members of the class are egocentric and individualistic

as is often the case with students who have been brought up in a Western culture [Graves & Graves, 1985].

Some cultures do not encourage children to ask questions or participate in conversations with adults or teachers. This can cause students to feel very apprehensive about participating in class or group discussions [Tomić, 1996].

6.3.4 Problems associated with diversity of gender

Gender is another source of diversity that brings problems to the classroom. Gallos [1995] reports on studies of women studying at Harvard. These were successful women who had been accepted at an elite university and yet it was found that the women still had more self-doubt and questions about their capabilities and intellectual competence than their male counterparts. Research has shown that men talk more than women in a group and that they interrupt women more often than women interrupt them [Rosser, 1998].

Most women need support and confirmation in order to grow intellectually. Relationships and caring are seen as essential for women according to Gallos [1995]. Group work is a more positive learning method for women than for men [Rosser, 1998].

Gender can be an issue when allocating roles within a group. Females often have the social skills necessary for managing the group, while the males may have better technical skills [Rosser, 1998]. In some cultures, females have a difficult time asserting themselves when there are males in the group and some males have difficulty in working with female leaders. Men might also see women as being good secretaries, for example, and put them into this role. This can lead to conflict.

Another source of gender bias is due to the lecturers themselves. Research has shown that teachers are more likely to interact with white male students than with women and men of colour [Lou, 1994]. This is often not a conscious act on the part of the teacher.

6.4 METHODS OF DEALING WITH DIVERSITY

Diversity can be an enhancement to learning rather than a hindrance if it is integrated into the classroom process in an effective way. Students need to learn to work in a multicultural workforce and their classroom experiences can help them to develop the social, cognitive and communication skills necessary to do this [Lynn, 1998]. Teaching students in a multicultural classroom to be able to practise their profession in multicultural settings is crucial according to Sanchez and Fried [1997].

Frederick [1995, p.83] maintains that a "*genuine 'intercultural' education only begins to happen when students of different cultures, classes, ethnicities, ages, sex and learning styles interact with each other*".

The challenge in dealing with diversity is to preserve the identity of each group while taking into account the identity of each of the other groups [Moahloli & Phooko, 1998]. In order to achieve this lecturers need to be honest, open and flexible in their classrooms [Koger, 1995]. The lecturer plays a major role in empowering or disempowering the students in the classroom and can be a major determinant of how well the diverse students learn and perform in class [Sfeir-Younis, 1993].

Lecturers will also need to acknowledge that there is a problem and should be open and flexible to ideas on how to deal with the problem [Sanchez & Fried, 1997].

6.4.1 Affirming diversity

Affirming diversity does not mean "*tolerance, acceptance, patronization, benevolence or compassion*" as this would assume that one comes from a place of superiority. "*Affirming diversity means to acknowledge, validate, respect and be sensitive to the diverse nature of humankind.*" [Goduka, 1996a, p.30]. The diversity of students' learning and participation styles should be affirmed. "*The rejection of a student's cultural way of knowing and participating is tantamount to the rejection of the student.*" [deVoogd, 1998,

p.354].

Lecturers should recognise diversity within their classrooms but should not assume that individuals from one particular group have a particular learning style [Lőtter, 1998]. While it may be true that cultural factors can affect learning style, Goduka [1998] maintains that lecturers should be careful of fostering stereotypes. This could lead to a misunderstanding of a learner's learning style which in turn could lead to a lecturer underestimating a person's intellectual potential and cognitive abilities.

The use of separate academic support programmes where students are taught academic skills in isolation has not been a good strategy. Wood [1998] suggests that development activities need to take place within the academic departments rather than in isolation. It has been found that students have difficulty transferring the knowledge learnt from one context to another. This puts an added burden on the lecturer who may need to give additional material or create case studies that are more appropriate to their diverse student body [Wood, 1998].

Lecturers should try to use examples, analogies and materials from diverse students experiences in order to help them to connect with their prior understandings [Frederick, 1995]. Moahloli and Phooko [1998] suggest that this implies that students should try to contextualise new information in terms of the different students' real-life experiences. These ideas are supported by Gallos [1995] who studied gender issues and found that classrooms should try to draw on experiences that both men and women can relate to. According to him, successful women should be well represented in examples, case studies and illustrations. The same might be said for any other group within the classroom.

6.4.2 Develop a student-centred approach

Dealing with diversity implies that one needs a strong student-centred approach rather than an approach where the lecturer is the source of power in the classroom [Tomić,

1996]. In order to do this lecturers will need to have a strong sense of their own cultural identity. Lynn [1998] supports this, saying that lecturers need to be open and flexible to the needs of students. In order to do this they need to be competent facilitators of learning rather than acting as the expert or authority in the classroom.

The lecturer must be prepared to change his or her role for the different students in the classroom. At times the lecturer will be a teacher, at times a coach, a cheerleader, a promoter, a mentor or guide. Lecturers need to develop the skill of discerning the needs of a student and adjusting their response accordingly [Lou, 1994].

Lecturers should offer support without interference in order to create self-directing, resourceful learners [Tomić, 1997]. Lecturers who try to control student thinking and behaviour, will fail to help students to reach their full potential [Sanchez & Fried, 1997]. Students should not be labelled as trouble makers if they question the inequalities that exist in the classroom or tertiary institution.

Lecturers should develop the ability to listen and to become skilful at cross-cultural communication in order to support students from different cultures [Moahloli & Phooko, 1998]. Sanchez and Fried [1997] maintain that it is essential for lecturers to try to get both the dominant and the non-dominant class members to take part in discussions in a way that is non-threatening.

Lynn [1998] maintains that the challenge lies in creating a class that encourages students and the lecturer to see one another as individuals while still recognising that these individuals belong to a culture with specific norms, values and beliefs. Student-centred discussions should be encouraged. Students must be required to interact with one another both in and out of the classroom and mutual tasks should be assigned that require the students to work together. The JAD sessions discussed in the following chapter were a way to achieve this.

Diversity must be accepted as the basis for the promise of equality for all [Khotseng,

1996].

6.4.3 Dealing with communication issues

When communicating with others, an openness is needed. It is important to try to perceive a situation from another person's point of view. *"No view of the world can claim exclusive validity for itself. Every interpretation reaches its limits in the view of another person. A new complexity in the experience of the world comes about in which the other person's view must always be kept in mind as a possibility."* [Wulf, 1998, p.16].

Cushner, McClelland and Safford [1992] suggest some specific skills that one should try to address in intercultural communication:

- display respect for one another;
- respond non-judgementally to the other person;
- recognise that the other person is an individual - don't stereotype them;
- have empathy with the other person;
- build a relationship;
- interact with the other person - don't dominate them or be passive; and
- be able to adjust to new situations.

Starfield [1996] recognises the problem of students not just having a problem with English but also having a problem with dealing with the English associated with a particular subject area. She suggests that curricula need to be changed in order to make them more sensitive to the needs of people who are not of, what she terms, the *"dominant cultural group"*. Lecturers need to be more explicit in assignments throughout the semester in order to make it clear to students what is required so that students can learn how to deal with the terminology and assessment methods of the subject concerned in English. This will help them to learn the language that is used for reasoning, thinking and debating in that subject area.

Wood [1998] suggests that opportunities should be given within the classroom for

students to communicate in their own language or to explain to one another concepts that they may have misunderstood in English.

A problem that lecturers often have in the multi-language classroom, is that they do not learn the names of the students or that they cannot pronounce those names. In order to make all the students feel accepted in the class, the lecturers should make a concerted effort to learn and pronounce the names of all the students in the class [Bitzer & Venter, 1996]. This will also enable one to call on all the students in the class to participate, rather than leaving some out whose names cannot be pronounced.

Sanchez and Fried [1997, p.30] say "*students may become experts in the 'techno' sphere but be unable to move beyond it. We must spend at least as much time helping students to learn the language of critique and understanding as we do in helping them learn the language of bits, bytes and statistics.*" The challenge is to integrate the techno-intellectualism with the humanistic intellectualism in order to empower people.

6.4.4 Changing students' attitudes

Frederick [1995] suggests that students should be made aware of the complexities of the diversities within the classroom. They should become aware of what makes them like others and what makes them different. The lecturer must encourage students to be respectful of one another. The ideal would be to have an environment where every student feels comfortable with his or her own perspectives and biases and knows how to express these without offending others [Lou, 1994].

There are various psychological theories that help people to recognise that they are prejudiced or using stereotypes. Two of these that have been suggested should be in any programme that tries to address the problem, will be described briefly below [Baron & Byrne, 1991; Visser, Cleaver & Schoeman, 1999]:

Contact theory

Contact theory maintains that contact between different groups can decrease prejudice as the different groups get to know one another. As people realise their similarities with others and discover their misconceptions caused by stereotyping, they will decrease their idea that the "out-group" is homogeneous. There is a problem, however, as it has been shown that the contact should take place between people of similar social and economic status in order for change to occur. Contact theory also supports the idea that the contact should occur within an informal setting where the group is required to work towards a common goal [Baron & Byrne, 1991]. The former would be difficult to achieve in South Africa where economic and social differences are so wide. Research in South Africa has shown that contact between groups in a particular research project has led to a decline in prejudice in the white group with the blacks becoming more aware of their social identity [Visser, Cleaver & Schoeman, 1999]. Small groups and co-operative learning groups are an ideal way to promote contact but they need to be structured to achieve this [Sharan, Russell, Hertz-Lazarowitz, Bejarano, Raviv & Sharan, 1985].

Studies in other countries have shown that generally co-operative groups do not have this equal-status condition of contact theory. They have, however, been shown to be effective in helping students from different groups to like one another. This could be due to the students being required to participate in an equal and interdependent manner in co-operative groups according to Towson [1985]. It could also be that, although the students like each other more, this does not mean that their respect for one another has increased. Towson [1985] goes on to suggest, that maybe the goal of co-operative learning groups should not be universal love and brotherhood, but should rather be social integration without overt conflict, where group members can trust and listen to each other sufficiently well to complete the task.

Social identity theory

Social identity theory maintains that a person will strive to establish and maintain a

positive self identity and that this identity will have both a social and a personal component. People go through a categorization process in determining the groups that they belong to. This then leads to an "us" and "them" recognition. Students should be allowed to keep their individual identity but they should also be encouraged to self-disclosure in order to get to know other groups better and understand them better [Miller & Harrington, 1990]. One must, however, be careful of making in- and out-group categories more salient to the students. Visser, Cleaver and Schoeman [1999] suggest that any intervention programme should try to use as a basis both contact theory and social identity theory.

Guidelines for making diverse students feel safe in the classroom

It is important that each student feels safe within the classroom. Students should feel comfortable to listen to new information and other people's points of view as well as share their own feelings and ask questions [Koger, 1995]. Some guidelines for both students and lecturers to achieve this include:

- Make sure that the class understands that everyone should respect one another and that people should never attack other classmates or ridicule them. Listening without interrupting is one way in which respect is shown.
- Discuss with students the problem of prejudice and stereotyping. Encourage people to recognise that we all grow up with assumptions about other groups and that, while this is natural, everyone should try to acknowledge it and change to deal with it. Use experiences of being stereotyped or unfairly treated in order to help develop empathy with others.
- Lecturers should focus on the positive aspects of the different groups in the class and not just the negative. Students will feel more secure and less likely to defend themselves than if they are being attacked for being prejudiced [Visser, Cleaver & Schoeman, 1999].
- Koger [1998] suggests using examples from our own lives in order to examine the problems and how these have been overcome.
- Encourage students to share their feelings and experiences of discrimination.

Acknowledge all students' pain and unjust treatment.

- Challenge students assumptions, biases or stereotypes.
- Discuss differences in styles of communication and conflict. While some may see an exchange as an exciting argument, another might see it as an attack, for example.
- Make distinctions between the way people behave and the people themselves. Encourage students to be responsible for change rather than just feel guilty.
- Help students to develop the skills that they need for empowerment. This includes empowering students to become change agents within their economic, social and cultural systems [Sanchez & Fried, 1997].

Some authors suggest that it is useful to have special classes for students to learn about each others cultures [Bodibe, 1997]. One must be careful that this does not turn into a "*tourist*" view of the culture where stereotypes and generalisations about the culture are made worse rather than better. Goduka [1996c] suggests that one needs to have activities that foster critical thinking about prejudice, racism and try to affirm unity and diversity in the curriculum rather than just "*visiting*" other cultures. This needs to be an ongoing process. Towson [1985] proposes that students should be taught to see behaviour in terms of the other person and by their norms and values. Miller and Harrington [1990] argue against having students having discussions about their similarities and differences. They say that any group labelling will create boundaries and that building bridges between groups does not occur by making groups aware of in- and out-groups.

Allport [referred to in Nieto, 1992] found that indirect approaches worked best. The most effective programs fostered contact among students, led to a sense of equality in social status, avoided being artificial and enjoyed the support of the community. He suggests that action is more important than just giving the student information and that multicultural programs should be natural and meaningful to the students.

Not only students' attitudes to other people need to be addressed, but also students'

attitudes to themselves. Low self-esteem is likely to undermine a student's ability to interact with others as well as his or her academic performance [Schmuck & Schmuck, 1988].

Teamwork and projects in teams whose members are diverse, should be encouraged in order to enhance intergroup unity with the classroom [Bekker & Minnaar, 1996]. Methods of dealing with diverse groups in the classroom will be described next.

6.5 DIVERSITY IN GROUPS IN THE CLASSROOM

Some proponents of group work see it as a means of assimilating the minority group into the more dominant group. One of the aims of the group work, according to assimilationists is to foster ethnic integration. Another view of group work is that it should be used to advocate intercultural co-operation in schools by cultivating equal coexistence and mutual respect for students from different cultural groups. This is termed pluralism [Sharan, 1985].

In order to cater for diversity, the lecturer must make sure that different learning styles are catered for. This means that the process of learning in the classroom should allow for different learning styles. One method of doing this is to include more active learning activities and more group work. Group work helps to find new ways of generating knowledge and the diverse students' conceptions of reality are integrated [Sfeir-Younis, 1993].

Graves and Graves [1985] suggest that one should have getting-acquainted activities and develop events that promote unity and a feeling of group identity. Diversity can be acknowledged by providing opportunities for people to learn and understand about other students' cultural background and family. Students should become aware of their own and other's goals and try to match these to the goals of the group.

6.5.1 Dividing the students into groups

Rosser [1998] warns against allowing students to form their own groups or using the counting method to divide students into groups. She says that these methods may be suitable for students who are mature and have high self esteem, but they fail to enhance learning for the more vulnerable student. When students choose their own groups, they tend to choose people who are like themselves. They do not get a chance to mix with others and learn to know them better. Having the lecturer choose the groups allows the lecturer to take gender, race, abilities and experience into account. Mixed ability groups help to ensure that each group progresses successfully [Rosser, 1998].

Rosser [1998] further suggests that the size of the group should be related to the task. It may be appropriate to work in two's for a laboratory experiment or on a computer, but larger groups can be used for more complex projects.

Lőtter [1998] maintains that group work can be used to put people with homogeneous languages together so that they can explain concepts to one another in their own language. She also suggests that students should be required to participate in activities where they are encouraged to speak English in order to improve their English skills. This would suggest that students should have opportunities to work both within their language groups and separate from them.

Miller and Harrington [1990] argue against having students placed into groups according to the ratios that reflect the composition of the class. They say that if the class is 25% black and 50% male and one makes sure that in every group of four, there is one black student and two males and two females, one makes the in- and out-groups salient. This means that it becomes evident to the students that one is trying to do this. They suggest that assignment based on a students abilities or skills or random assignment is preferable.

Nieto [1992] suggests that practices that create homogeneous groups with respect to

academic ability or language might aggravate prejudice and interethnic hostility. She supports the idea of integrated, heterogeneous groups that allow interaction between diverse students.

Research has shown that it can be harmful to minority students to be placed on their own in a group [Rosser, 1998]. One minority student in a group can lead to that student feeling left out and dropping out of the course or group. The groups should thus have more than one person from any minority, whether it be racial or gender minority. This will lead to less feelings of isolation and fewer student dropping out.

In groups where roles are assigned, one must be careful not to assign roles along stereotypical lines, for example, by assigning a female to be the secretary every time. These roles should be rotated or should be assigned randomly [Miller & Harrington, 1990].

Groups can be more effective if they are able to work together over a long period of time in order to promote group cohesion [Johns, 1994].

6.5.2 Dealing with cultural differences in groups

There can be problems in trying to introduce group work and co-operative learning into a classroom if the students come from a background or culture where they are not expected to ask questions and participate in class [Tomić, 1996]. Students are apprehensive about working in teams, giving presentations and other learning methods where they are required to work with other class members. Tomić [1996] suggests that we need to explain to students the rationale for each activity and describe what the learning objectives are in order to reduce that apprehension.

The co-operative learning literature suggests that students be taught about group dynamics and group functioning [Johnson, Johnson & Smith, 1991]. Miller and Harrington [1990] suggest that, while teaching these skills, one should directly link them

to the team's task goals. The teams must understand that, in order to achieve, they need to work together. They suggest that it is these skills that should be emphasised and that this will lead to better multicultural links and reduced category salience.

In order to achieve pluralism, whereby students recognise each other as being different, but work effectively with one another and without feelings of being left out, Towson [1985] suggests that free and regular association of the students from different cultural groups is necessary. The groups should be given a set of goals whereby positive relations are necessary to achieve those goals.

6.5.3 Functioning of the diverse group

As mentioned in the co-operative learning literature, the task should be structured so that everyone needs to participate in order to complete the assignment. Self-interest on the part of the students with individualistic tendencies forces them to co-operate within the group [Rosser, 1998]. The students must be given a task that is relevant and that they need to solve together. The task need not necessarily have one correct answer but should be central to the concepts, content and assessment criteria for the class [Johns, 1994].

Contact theory suggests that students should get to know one another and each group should cultivate its own sense of identity [Sharan, 1985]. This does not mean that the group should strive for uniformity, but that the group should work towards a common goal and recognise what each student can bring to the group. The group should share authority and control. The group as a whole should decide on the norms for the group. Leadership roles should be rotated in order to give students with perceived lower status a chance to show what they can achieve [Graves & Graves, 1985].

This is supported by Rosser [1998]. She maintains that females bring certain characteristics to the role of leader and males another. She suggests that roles be rotated in order for all students to learn and that students should monitor the roles that

each of their group members play in order to ensure that everyone learns from the experience.

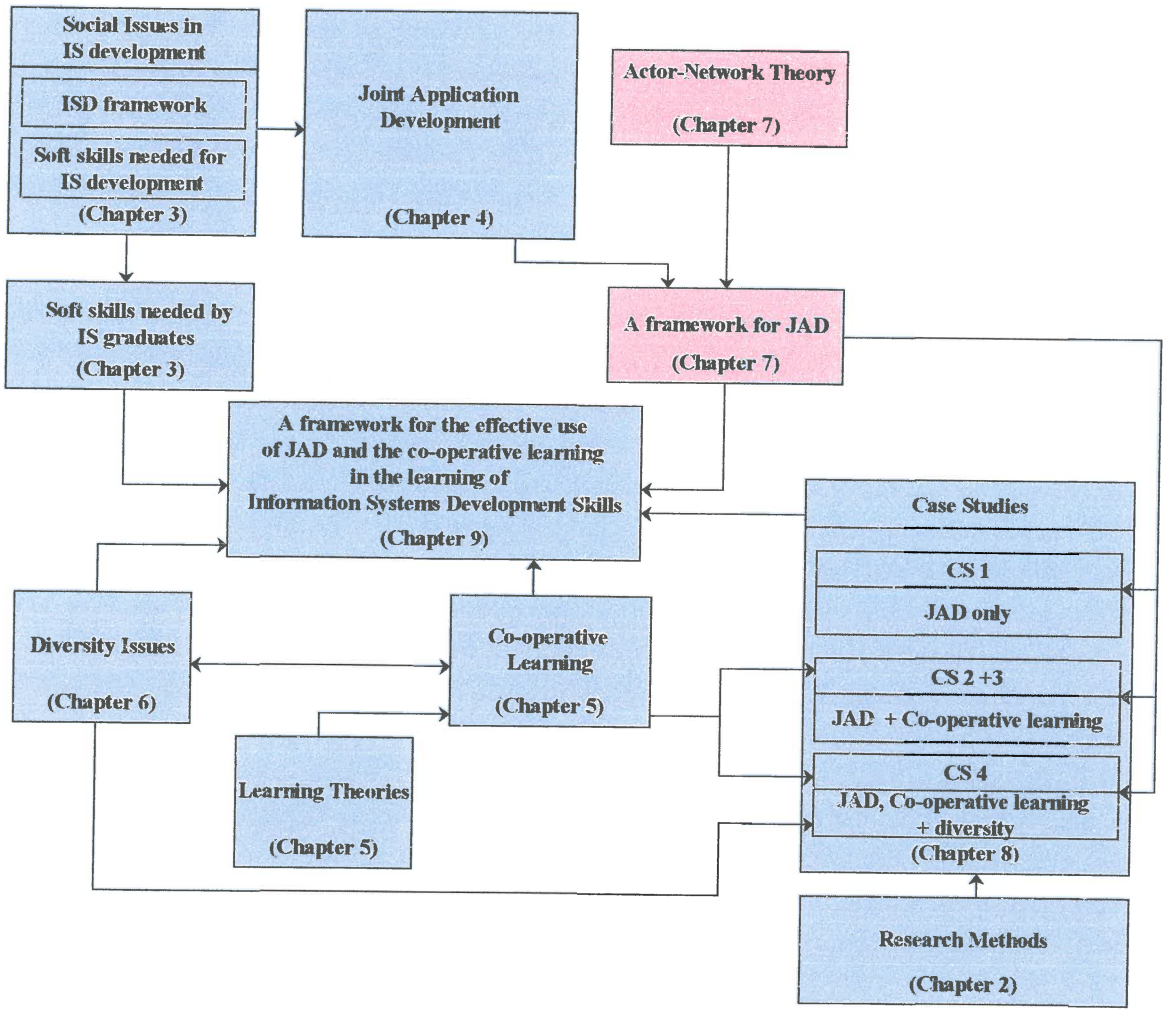
6.6 CONCLUSION

Chapter 6 dealt with the questions: "*What is meant by diversity?*", "*How does a diverse student population affect the classroom?*" and "*How should one deal with diverse students in the classroom and in groups?*" Dealing with diversity is a complex issue and it would be impossible to try to solve all the problems in one part of the curricula or in one class. The challenges and the opportunities offered by the diverse student populations need to be built into all the curricula of an institution in order to be effective. Students, staff and curricula need to be prepared for working in a diverse world.

The issue of diversity was seen to be important during the second and third case studies for this research. Some of the concepts presented in this chapter were added to the framework during Case Study Four. The new framework is presented in Chapter 8, together with the fourth case study where some of these issues were tried out.

Chapter 7

An actor-network framework for the use of JAD



Chapter 7

An actor-network framework for the use of JAD

Computing is now *"intricately tangled up with various streams within the social sciences"* according to Hull [1997, p.214]. Social theory is mainly concerned with illuminating the "*concrete processes of social life"* [Giddens, 1984, p.xxvii]. This means that social scientists have a role to play in the analysis of computing. Social scientists see ISD as an example of human activity that deals with design and with the discovery and elaboration of alternatives that meet some set design goals or standards [Hirscheim et al., 1996].

ISD also deals with changing conditions and changes in social behaviour brought about by the outcomes of the design. Hirschheim et al. [1996] suggest that this means that conceptual frameworks of ISD should be anchored in social action theories. These theories help to clarify the *"conditions, means, contents, constraints and objectives of human behaviour"* that have been organised socially [Hirschheim et al., 1996, p.8]. This is supported by Orlikowski and Robey [1991], who suggest that the underlying theories from sociology and organisational theory will help us to develop coherent theoretical frameworks for ISD.

Social action theories can assist in looking at how humans behave during the development of an Information System and can help us to relate theory and practice [Hirschheim et al., 1996]. In this study we will use the actor-network theory to study the process of JAD in industry and then to develop a framework of how JAD can be used effectively within the classroom.

Actor-network theory was chosen because it allows a researcher to analyse a complex social setting involving both human and non-human actors. An actor network can be used to model a dynamic and complex set of relationships between the actors. This makes it particularly applicable for the study of the JAD in industry as well as for the study of the complex interaction of students, lecturer, environment, methodology and other factors in the classroom.

This chapter first describes actor-network theory and its applicability to IS research. The theory is then applied to study the JAD process in industry. Chapter 8 then develops an actor-network model of the situation where JAD and co-operative learning are used in the classroom.

7.1 ACTOR-NETWORK THEORY

The roots of actor-network theory (ANT) are found in the sociology of science. It has, however, started to be used by IS researchers as it enables one to analyse the complex social, technical and organisational relationships that occur when information systems are designed, developed and applied [Walsham, 1996]. Knowledge is seen, by actor-network theorists, as a social product rather than something that a scientist generated in his or her own mind. This knowledge is seen as a product of a network of heterogeneous materials rather than an individual inspiration [Law, 1992].

One of the basic questions that actor-network theory tries to answer is how a diverse group of actors can reach agreement at all and how social order ever establishes a degree of structure and stability [Monteiro & Hanseth, 1995]. ANT investigates "*the links between identity and power and the techniques by which these links are mediated to produce sociotechnical change*" [Michael, 1996, p59]. ANT thus tries to determine the processes whereby relatively stable networks are created and maintained or why such networks fail to establish themselves [Walsham & Sahay, 1999].

The term actor-network theory is relatively new although the theory was started about two decades ago [Latour, 1999]. Some of the main contributors to the theory were Callon, Law and Latour. Callon [1986] described the sociology of translation in his ground-breaking article in 1986. It was only later that others gave the theory the name actor-network theory [Law, 1999]. The name has been criticised by all three of the authors [Callon, 1999; Law, 1999; Latour, 1999]. Law and Latour argue that the term actor-network leaves out the concept of translation which is one of the main ideas behind the theory. Latour [1999] maintains that it was never meant to be a theory at all but was rather a method of learning from the actors in a situation without imposing on them an *a priori* world-building capacity. The idea was to enable one to find the procedures that help actors in their world-building capacity. Law [1999] says that one cannot convert ANT into a set of rules, a creed or something with fixed attributes. In his opinion, only dead theories can reflect in detail what has gone before.

This section tries to describe some of the principles and characteristics of this theory. The theory is then applied by depicting a JAD workshop.

7.1.1 Principles of ANT

Callon [1986] determined three methodological principles for studying a social situation. These are the principle of agnosticism; the principle of generalized symmetry and the principle of free association. These principles are only the beginning of the theory because as Law [1997] says, ANT is a set of diverse practises rather than a set of principles.

- **Principle of generalized agnosticism**

The principle of generalized agnosticism maintains that the observer must abstain from censoring the actors in the situation when they speak about themselves or the social environment. The observer must refrain from judging the way that the actors analyse

their society. No point of view is seen as being privileged and no-one's interpretation is censored. The observer should also not fix the identity of the actors if this is still being negotiated [Callon, 1986]. Michael [1996] suggests that the researcher must have an analytical impartiality to the actors involved in the situation.

- **Principle of generalized symmetry**

The observer must have a single vocabulary and method of describing and explaining both society and nature. This language should be chosen to be the best for his task and should be applied to the social, natural and the technical aspects of the situation [Callon, 1986]. The language should be abstract and neutral [Michael, 1996]. Humans and non-humans must be analysed with the same conceptual and terminological framework [Somerville, 1999]. This does not mean that humans and non-humans are the same, but rather that they are treated as being similar when being described or traced within the network. Both are seen as having an influence on the other actors in the network and the way in which they interact.

- **Principle of free association**

The principle of free association says that all *a priori* distinctions between natural and social events must be abandoned. There should be no boundary between the two and should be the result of analysis rather than the point of departure. The observer must follow the actors to determine the manner in which they define and associate the different elements of their world, whether it be social or natural [Callon, 1986].

7.1.2 The heterogeneous actor network

ANT maintains that social organisations are not made up solely of people. The theory refuses to privilege the human actors over material matters or technology. The human and non-human actors are seen as a dynamically interacting network and each part of

the network influences the other parts [Parkin, 1996]. The entities in the network take their form and acquire their attributes as a result of their interaction with other entities [Law, 1999].

The social is seen as "*nothing other than patterned networks of heterogeneous materials.*" [Law, 1992, p381]. Society needs the machines, animals, texts, money, architectures and other material things, together with the people, in order to function as it does. The nature of these heterogeneous elements could be technical, human, natural, political or anything else [Murdoch, 1998]. In the classroom, for example, it is not only the lecturer and students who create the society of the classroom, but it is also the overhead projector, the transparencies, the blackboard, desks, stationery and other material things. These things form part of the social and influence the way that we act and interact.

Humans and non-humans are seen within the same conceptual and terminological framework, as are micro- and macro-actors. Micro-actors are individuals, equipment etc. and macro-actors are institutions, corporations etc [Somerville, 1999].

This weaving together of the various elements ensures the durability of the relationships of that social situation. The heterogeneity of the networks allows them to be consolidated and preserved [Murdoch, 1998]. It is the mixing of the human and non-human that allows networks to endure and to remain stable.

An analogy of the interweaving of actors is given in Somerville [1999]. He points out that a cake has many different ingredients but it is impossible to take a slice of cake and observe the impact of one of those ingredients even though one cannot ignore the importance of each. Similarly, the social, technical and natural are intermingled in a single web in an actor network.

7.1.3 Actors in the actor network

An agent is not an actor just because he or she has a body and has certain knowledge, skills and values, according to Law [1992]. The agent is a social agent because of the patterned networks of heterogeneous relations of which they are a part. Law [1992] argues that thinking, acting, writing, loving, earning and all the other attributes that we associate with people are generally generated in networks with other humans or materials both within and beyond the body. The actor or agent is thus always in a network [Law, 1994]. A machine can also be seen as an actor in a network, in that it interacts with the technical materials, operators, users and repair people. It is not the actor's identity that is important but rather its agency, because what matters is not the natural state of the actor, but the actor's relationship to the other actors.

Murdoch [1998] says that, at certain times, a person will be a network - a composition of various entities - but at other times the human will be situated within a network as an entity within a network. This makes it very complicated, however. When we look at a television set, for example, we generally see a single, coherent object with relatively few parts. When that same television breaks down, however, it suddenly turns into a network of electronic components and the human interventions needed to repair it. In practice we cannot cope with seeing everything as a network and we simplify these networks into an actor and the action itself [Law, 1992].

ANT does not focus on an actor because it is human or because of its size, but because of the role that that actor plays in a particular network. Technology and humans are given the same explanatory status in the actor-network [Monteiro & Hanseth, 1995]. There have, however, been some critics of this. Murdoch [1998] suggests that if a human is classified, then they will react to this classification and seek to negotiate with others. Murdoch [1998] also notes that humans can act intentionally and this mobilises them to create new networks or change the one within which they are functioning. This creates a "looping effect". Ignoring this effect could inhibit our

understanding of how new networks are created from the complex interactions of others and how actors move from organisation and stratification to multiplicity and change [Murdoch, 1998]. Actor-network theory does not propose that this looping effect does not take place. They say rather that human actors and non-human actors are both affected by and affect the network.

ANT concentrates on how the networks and the elements of those networks co-evolve. Judgements about which entities will act, which will be intermediaries and how they are spatially composed are not made in advance [Murdoch, 1998]. Humans are not always actors, sometimes they are intermediaries within a network. An intermediary is anything that passes between actors which defines the relationship between them [Michael, 1996]. Machines are also sometimes a primary actor and at other times act as an intermediary [Murdoch, 1998]. Not making a prior distinction allows the analyst to keep his or her focus on the aim of the social arrangement regardless of whether the means of achieving this aim are technical or non-technical [Monteiro & Hanseth, 1995].

A network cannot be equated with a structure. The links and nodes in a network are flexible and cannot be guaranteed. They must be uncovered by the analyst [Law, 1997]. The nodes and links do not remain stable. They are a simplification of a complex situation where the influence and identity of the nodes and links may change as the network evolves [Parkin, 1994]. The emphasis in ANT is on the actor and goal-directed behaviour rather than on conformity to norms [Parkin, 1996].

"*The indeterminacy of the actor naturally entails a number of difficulties. ANT [actor-network theory] is so tolerant that it ends up presenting an actor which is an anonymous, ill-defined and indiscernible entity. Since everything is action, the ANT actor may, alternately and indiscriminately, be a power which enrolls and dominates or, by contrast, an agent with no initiative which allows itself to be enrolled.*" [Callon, 1999, p182]. Callon [1999] goes on to say that actor-network theory has often been criticized for this tendency to make an actor someone who is constantly seeking for power and

for increasing his, her or its influence. An actor gets entangled in the links and relationships of the networks to which he, she or it belongs. This creates the possibility of a diversity of actors and actions which can only be understood in the relation of the actor to both the humans and non-humans in the network.

7.1.4 Translation

Translation is one of the key factors in ANT. It is the method by which one follows actors through their construction and deconstruction of nature and society [Callon, 1986].

Actor-networks are a dynamic and complex set of relationships between the actor nodes in the network [Parkin, 1994]. Actor-network theory does not see that there can be a fixed social structure. It assumes that social structure is a verb rather than a noun. It is a process that can change, that is never complete or final [Law, 1992].

It is this characteristic that causes Latour [1999] to comment that the word network is problematic. He says that when the word was first used, it meant a flexible network which was modified by a series of translations or transformations, but that, with the advent of the world wide web, it has come to mean transport without change or deformation.

Actor-networks can be seen as a means of acting upon a space. Translation is seen as the process of negotiation, representation and displacement that establishes relationships between the actors [Murdoch, 1998]. These phenomena are redefined so that they behave in accordance with the requirements of the network.

"*Translation is the mechanism by which the social and natural worlds progressively take form. The result is a situation in which certain entities control others. Understanding what sociologists generally call power relationships means describing the way in which*

actors are defined, associated and simultaneously obliged to remain faithful to their alliances. The repertoire of translation is not only designed to give a symmetrical and tolerant description of a complex process which constantly mixes together a variety of social and natural entities. It also permits an explanation of how a few obtain the right to express and represent the many silent actors of the social and natural worlds that they have mobilised." [Callon, 1986, p.224]

Translation is a slow mobilisation of the actors across time. This is often done by offering new interpretations and interests to the actors in order to make each indispensable within the network. The idea is to enrol all the heterogeneous actors of the network to willingly participate, believe and disseminate the common goal. This involves an element of control over the actors according to Latour [1987]. The idea is to promote convergence of these heterogeneous actors within the network in order to attain a network which is stable and durable [Michael, 1996]. Callon [1986] describes an obligatory passage point. This is the point that all the actors must reach in order to be bound together and converge to form the stable network. This is depicted in Figure 7.1.

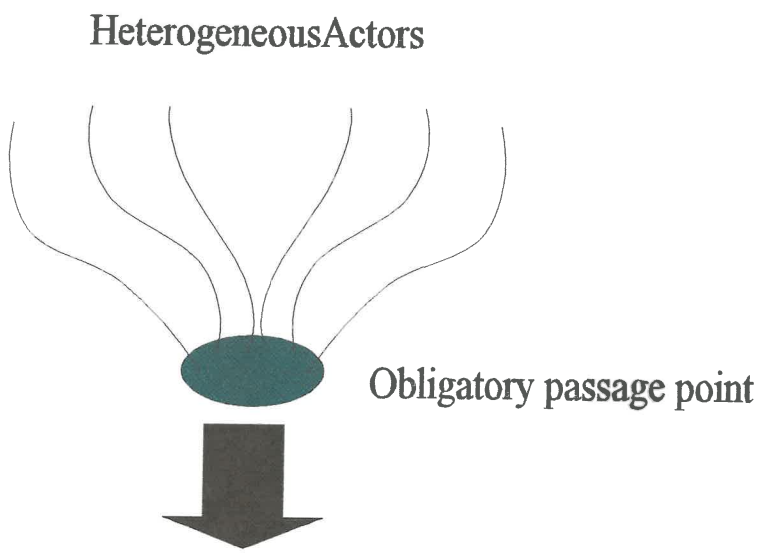


Figure 7.1: Convergence process [Adapted from Latour, 1987]

Some methods by which translation takes place will be described below:

- **Problematization**

Problematization involves identifying the actors in a network and defining their identities in such a way that they are indispensable within the network [Callon, 1986]. All actors are identified, whether they be human or non-human. Each actor's goals are identified.

Problematization describes how the different actors must adjust and the movements and detours that each must accept in order to define an obligatory passage point, which is what binds the different actors together [Callon, 1986].

- **Intressement**

"*Intressement is the group of actions by which an entity attempts to impose and stabilise the identity of the other actors it defines through its problematization.*" [Callon, 1986, p207-208]. In order to do this the identity, goals and inclinations of each of the actors should be defined. This helps to determine the entities to be enrolled, to interrupt any potential competing associations and to construct a system of alliances [Callon, 1986]. The social structures are thus shaped and consolidated.

- **Enrolment**

Intressement does not necessarily lead to alliances and enrolment according to Callon [1986]. Enrolment is the method by which interrelated roles are defined and attributed to actors. These actors must accept the roles. Enrolment thus involves negotiations, seduction, consensus seeking, physical violence and any other method used by the various actors to give others their role. Note that human and non-human actors all need to be enrolled into the actor-network.

The actor nodes are able to define the situation in terms that are favourable to them. They can also enrol the other actors in the network to their point of view and control their reactions by doing this. The actors thus become centres of translation as they control the network, at least temporarily, by channelling, selecting and monitoring the flow of interaction within the network [Parkin, 1996]. The role of the actor nodes can change their identity and their influence within the network over time [Parkin, 1994]. A powerful actor node can define the situation to suit itself, enrol the other actors to his or her point of view and control their reactions to what happens. This actor then becomes a centre of translation or centre of ordering and controls the network temporarily by channelling, selecting and monitoring the processes within the network [Parkin, 1996].

There is usually not only one source of power within the network. Power is generated in a distributed manner and the effects of power can be contested and resisted [Law, 1992]. Lee and Stenner [1999] say that actor-networks are de-centred. They explain this by saying that ANT does not reject the idea of centres of control, but rather shows how control can be temporarily centred but can change. Power is seen as an outcome and not a cause as it does not matter how much power actors have, they can only obtain power by the actions of others. This means that it is always necessary to say who is acting, why it is necessary to act together and how collective responsibility is allocated [Michael, 1996].

- **Irreversibility**

This process of translation can be perfectly accomplished, only if the network is stabilised and the actors in the network work in unison. The network then becomes predictable and standardised [Murdoch, 1998]. The network then becomes a black box which resembles a cohesive, organised whole [Latour, 1987].

The organisation, alignment and coordination within the network need to be made

invisible in order to achieve this black box status and assure the durability of the network [Michael, 1996]. The more interrelationships there are and the more associations there are between the heterogeneous actors, the more tightly coupled the network will be and the more difficult it will be to break [Michael, 1996]. The links and relations cannot hold by themselves, however, and must be constantly maintained by the other links and nodes in the network [Law, 1997]. Any standards that are used in the situation are actors within the network and become one element of the network linked to a number of other elements which may be human or technical [Monteiro & Hanseth, 1995].

When the translations between the elements of the actor-network are made durable, they can resist assaults from outside the network and the network is irreversible. This means that it cannot go back to a point where the translations that happened are undone although there may be subsequent translations that change the state of the network in a different direction [Monteiro & Hanseth, 1995]. Walsham and Sahay [1999] say that "*the degree of irreversibility of a particular element of a network depends on the extent to which it is subsequently impossible to go back to a point where alternative possibilities exist and the extent to which the particular frozen element shapes and determines subsequent inscriptions.*" Note that although the network may be considered stable, the situation can be contested at any time and the network will further evolve and change [Walsham, 1996].

- **Dissidence**

A network is rarely stable for long and is continually changing by bringing in new actors or changing the relationships between actors [Somerville, 1999]. The network can be changed after dissidence, betrayals and controversies. This can be caused by fluctuations in the identity and characteristics of the actors. Dissidence brings into question some of the gains of the previous stages as the identities, roles, displacements and spokesmen are challenged or refused [Callon, 1986].

The networks could be made up of provisional and divergent links between the actors and intermediaries and this means that the various components of the network are continually renegotiating with one another and the network changes all the time [Murdoch, 1998].

7.1.5 An example of using ANT to study group decision making

As an example, Parkin [1994; 1996] describes the translation that can take place within an actor-network for group decision making. Figure 7.2 shows the process variables

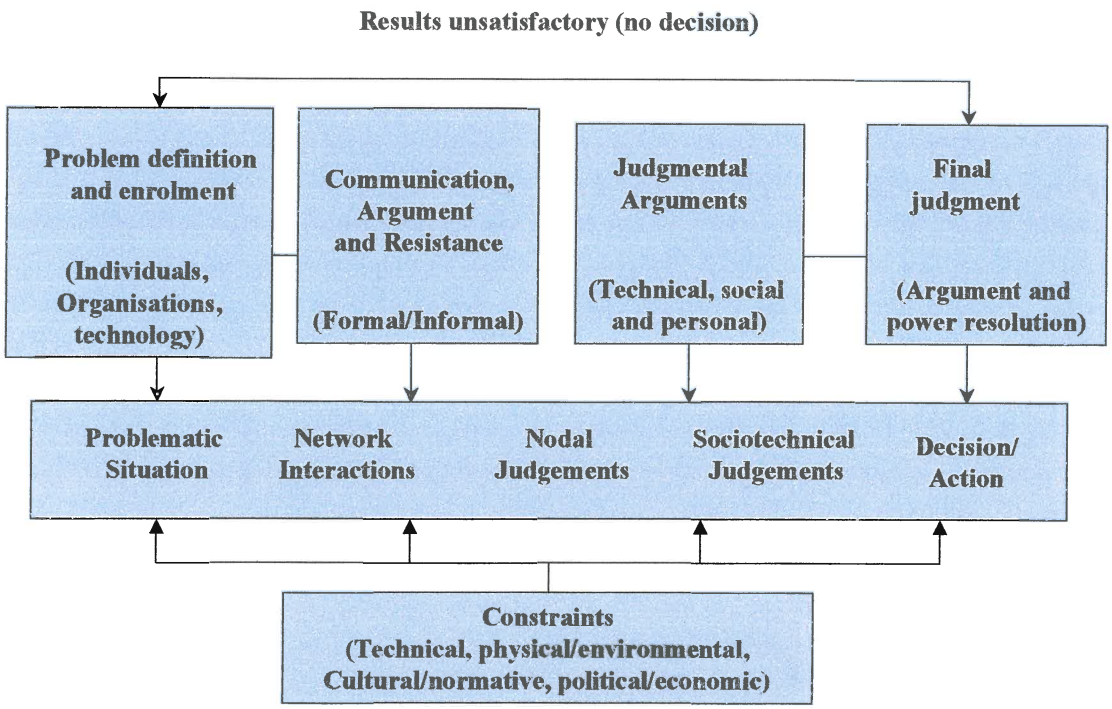


Figure 7.2: Actor-network group decisions - process variables [Parkin, 1996, p.260]

for making group decisions in an actor-network framework. When conceptualising the group decision making using ANT, one should define the actors that take part in that decision making and then show the process of translation that takes place. In the case of group decision making, the actors are considered, by Parkin, to be human agents with technology, politics, culture and economics acting as constraints. Parkin [1996] has bracketed the non-human actors into one node which he has called constraints. This is not in line with ANT which sees the human and non-human actors as equally important. Parkin [1996] defends this by arguing that he has done this as the process of decision making is essentially human and that technology does not have the same power of agency in decision making as humans. Another problem with bracketing these aspects and calling them constraints is that sometimes these factors would act as enabling actors rather than constraints.

The process of translation is described below:

- When working in a group, the actors in the group will try to define the place of the other actors in the network in relation to theirs. This is problematization. Each actor will have his or her own idea of what the decision should be and will see this as the obligatory passage point for the group.
- Enrolment then follows where the actors try to enrol the other actors to their point of view. The other actors will then challenge this. A powerful actor may try to force his or her view on others but will be challenged by the others in the group. Power is what makes a decision possible and necessary when there are no absolute guidelines, according to Parkin [1994]. Manipulation may be needed to maintain control over the other actors in the network, but this is an ongoing process in which different actors take part at different times.
- Communication, argument and resistance are then used to generate the data that is needed for decision making and to develop dialogue within the group. Groups or individuals who resist the arguments of the others may resist or drop out of the network. Those fully enrolled may accept the problem definition of the powerful actor but others may not. This leads to argument which may lead to

redefining the problem [Parkin, 1996].

- Judgmental arguments then occur through this dialogue and the different people's points of view. These judgements are then expressed in the form of arguments for or against some position. Argument can also help to determine how well an idea would be accepted by others. Parkin [1996, p.261] states that *"it is the role of the judgmental arguments to demonstrate how close any particular judgment is to the dominant social values of the actor-network and therefore how much coercive power (and reaction) will be generated by the resulting action."* Judgements are often based on the individual actor's own interests and are legitimised using a selective set of technical and social cues.
- Final judgment then occurs and this is a process whereby the best fit is found between the judgmental arguments (one or more) and the needs of the situation. The dominant social values of the group will help to find this best fit.

This process of enrolment tries to include in the final decision, as many actors as possible in order to reduce the social reaction against the decision.

7.1.6 Concluding remarks on ANT

In ANT, human agents, organisations, material objects, political agendas and other non-human aspects are all treated as actors which interact in the social situation. Law [1992] suggests that if we want to answer "how" questions about structure, power and organisation, then we need to explore all social effects, no matter what their form.

Action is seen as the establishment of links within the network [Murdoch, 1998]. The network is dynamic and involves a process of translation as the actors act and react within the network. Translation is seen as the process of problematization, enrolment, negotiation, representation and displacement that establishes relationships between the actors.

Monteiro and Hanseth [1995] criticise the actor-network theory for its inability to deal with institutions. They say that it cannot deal properly with the idea that institutions show actions at the same time as actions shape institutions. This is one of the main ideas behind structuration theory. Somerville [1999], on the other hand, sees ANT as an ideal way to study organisations as he suggests that it challenges the notion of an organisation being fixed and having an invisible boundary around it. ANT helps us to incorporate all the elements inside and outside the organisation that are part of the organisation's activity.

ANT allows for concrete and specific descriptions of IS situations and the interplay between IT and organisations and a theory like structuration theory is unable to supply this. Monteiro and Hanseth [1995] suggest that actor-network theory offers us a means of being more specific and that it is the more promising theory for the present.

ANT has been shown to be well suited to projects where the technical and non-technical are both actors in the situation and where negotiation, redefining and appropriation of interests are used [Monteiro & Hanseth, 1995]. ANT will thus enable us to build a theoretical framework for JAD and to see how that framework must be modified to work effectively in the learning situation in the classroom. The next section modifies Parkin's ANT network model to develop a framework for the social situation of the JAD workshop, as it was described in Chapter 4.

7.2 AN ACTOR-NETWORK FRAMEWORK FOR THE JAD WORKSHOP

The JAD workshop can be seen as a relatively small network that acts within the larger network of the organisation. It may only be a valid network for a short period of time and many of its actors will have roles to play within other networks within the organisation.

7.2.1 The actors in the JAD workshop

A diagram depicting the actors in a JAD workshop is given in Figure 7.3. The actors are both human and non-human as shown in the diagram. All of these actors interact with each other and influence the development of the network.

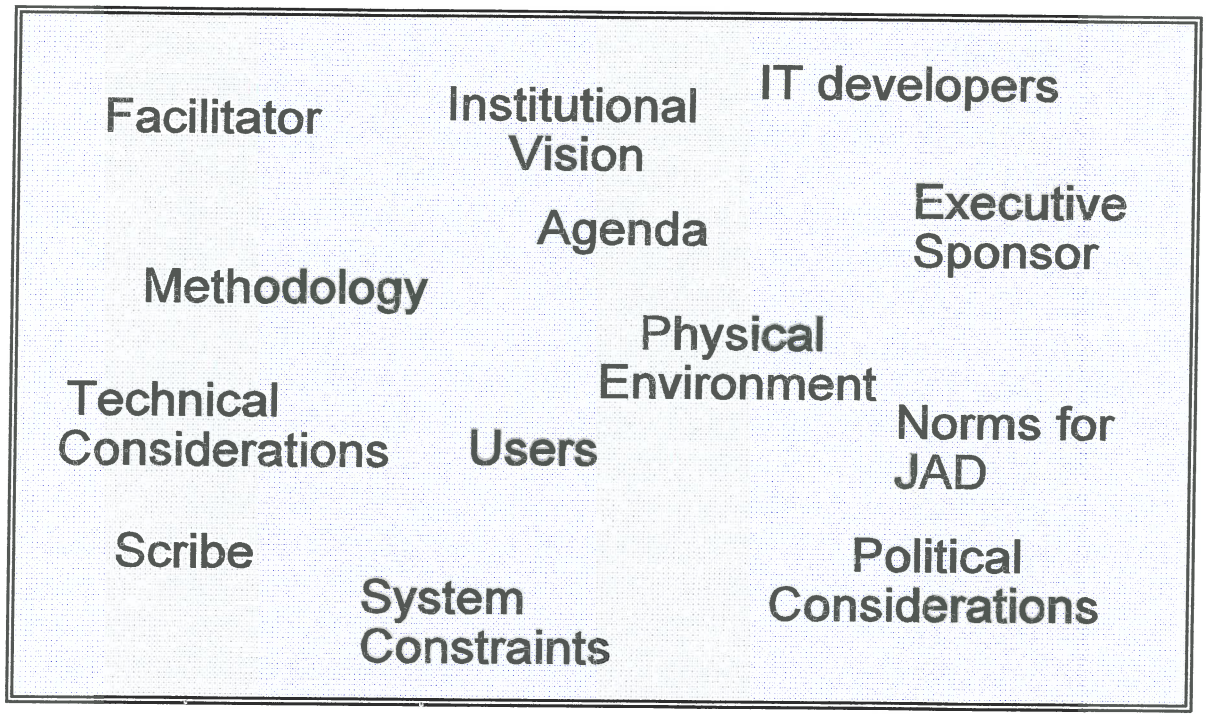


Figure 7.3: The actors in the JAD workshop

The JAD workshop involves **users** from the various departments which have a stake in the development of the IS. These users may be managers or operational staff. The users are thus actors in the JAD workshop actor-network. Each individual user may have his or her own ideas and they will have varying backgrounds which means that they will see things in different ways. Parkin [1996] says that each person in a group that is trying to make a decision, will select different cues and will put different weights to those cues. We perceive "facts" differently and this is why we come up with different judgments. This would be particularly true when taking into account the different users and the IT staff that come together for a JAD session and have to make decisions

together. The inter-departmental **politics** and any conflict between managers and operational staff can also be seen as actors in the actor-network.

The **executive sponsor** is another important actor in the JAD workshop. He or she will play an important part in making sure that the correct people and facilities are made available in order to make the JAD sessions a success. He will also make sure that the actors in the JAD workshop take cognisance of the **institutional vision** which may influence their deliberations.

The next group of actors in the actor-network are the **IT developers**. They will also have their own agendas and there may be some political tension between the IT developers and users which would be another form of an actor in the actor network.

The **facilitator** and **scribe** are both actors. The facilitator can help to play an enabling role in getting the group to come to a decision. If the facilitator is biassed or incompetent, his or her role could be dysfunctional. The scribe is there to record the decisions being made.

The **physical environment** is another actor in the actor-network. We could regard this as one actor, or we could say that it is made up of the white boards, overhead projectors, computers, projection equipment, tables and chairs and other parts of the environment. For the purposes of our formulation, we will use the method of simplification to make this into one node and call it the physical environment node.

Another actor in the JAD workshop would be the **methodology** or modelling technique being used. These will be simplified into an actor called methodology or technique. The methodology may use certain modelling techniques, which may need to be explained and accepted by the other actors within the network. There may be **technical considerations,** like the computer configuration upon which the resulting system will run, which will be another actor in the network as it will affect the actions of

the actors and the decisions that are made.

The **constraints of the system** being developed is another actor. It will influence all the discussions as well as the agenda for the workshop. The JAD facilitator will set up the **agenda** for the JAD workshop. He or she will also discuss with the participants the **norms** or rules that should be applied in the workshop. These will all influence how the decision making occurs.

7.2.2 Translation in the JAD process

Figure 7.4 shows the processes that occur in JAD. Before the workshop, the JAD

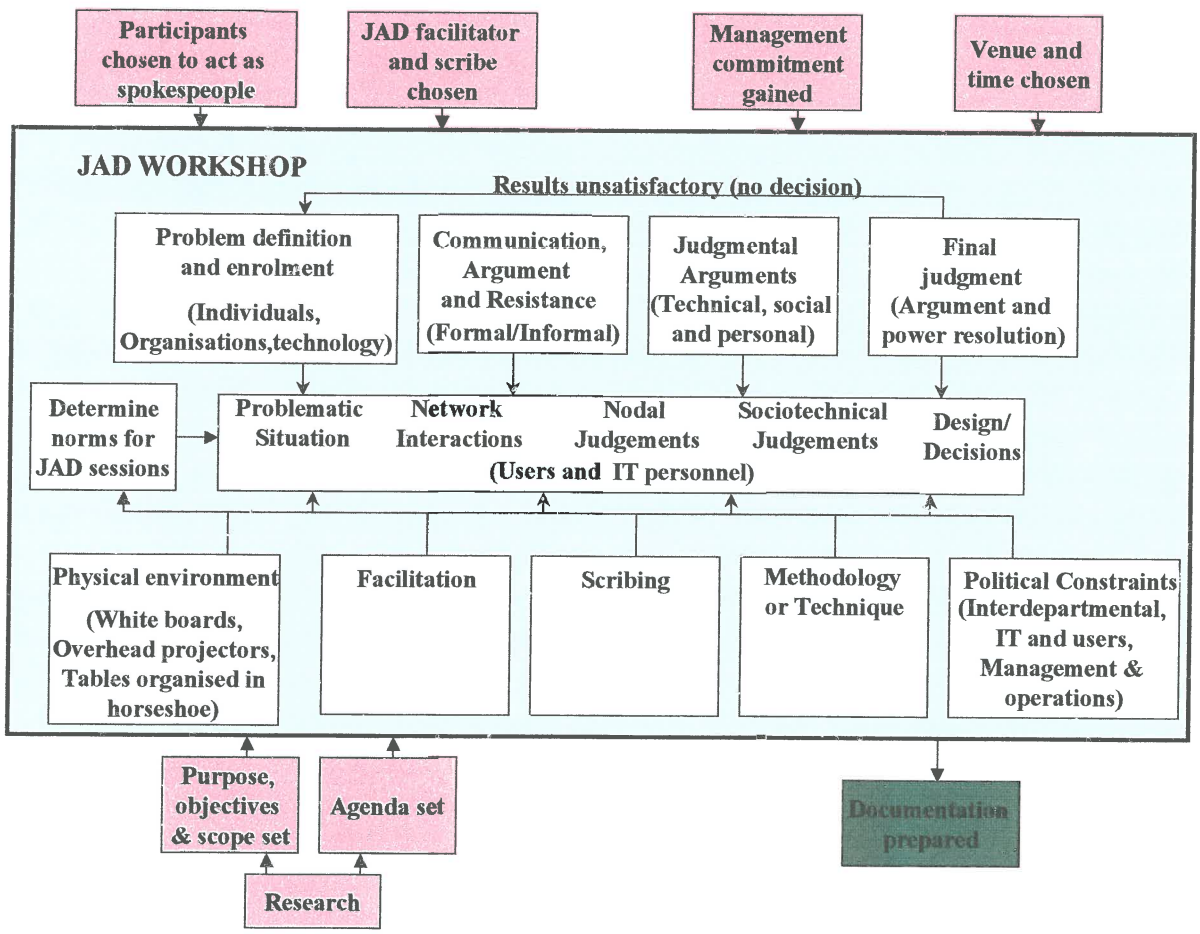


Figure 7.4: An actor-network framework for the use of JAD in industry

facilitator, a scribe and the participants are chosen. Management commitment must be gained. The facilitator, possibly with some of the IT personnel, does some research into the area which helps to determine the purpose, objectives and scope of the JAD session and to set an agenda. The venue and time are also determined. These are all shown in pink in the Figure 7.4.

The processes of translation for the JAD workshop itself are similar to those used by Parkin [1994; 1996] as what happens in a JAD session is essentially a process of group decision making. It is for this reason that the framework in Figure 7.2 has been used as a basis for drawing up the actor-network for the JAD workshop as shown in turquoise in Figure 7.4.

The process of problematization might start before the workshop itself even begins when the various user departments and IT department choose the participants in the workshop, who will act as their spokes-people in the definition of the system. Each of these people will come to the workshop with their own ideas of what the problem is and how the proposed computer system should look in order to solve that problem.

The facilitator will also have his or her own idea of what the problem is. The facilitator might begin the process by trying to define the problem. Any of the users and IT people in the workshop could add to this process. In order to make all these diverse actors part of the JAD network, they need to agree on the goal of their session. This will then be an obligatory passage point that will bind them in the network.

The place of the methodology or technique that will be used to define the system must be determined and the other actors must be convinced of its use in achieving the goal. The norms and methods of JAD must also be described and serve as actors within the network.

The process of enrolment then starts where each of the actors tries to get other people

to see their views. This helps to define the situation. A powerful actor within the group or the facilitator may end up enrolling everyone to his or her point of view, but it is more likely that there will be tension, as not everyone will agree on the proposed solution.

A process of communication, argument and resistance follows. In a JAD workshop this would be structured and controlled by the facilitator. The various actors would interact and explain their views. This would lead to judgmental arguments. Each actor will then make their his or her judgements and will express these to the other members of the network as judgmental arguments. The centre of control may change from the facilitator to any actor within the network at any time.

These possibly competing and contradictory arguments must then be used to come to a final judgment. Some of the alternatives may be discarded due to their infeasibility or some other reason. A perfect fit between an argument and the needs of the community would be ideal but is very unlikely. It is more likely that the group will need to find the best fit that they can between an argument, or set of arguments, and the needs of the organisation. In a JAD session, this may result in a design for a database or the design of the functions needed for the new system being built.

Note that these processes do not necessarily happen in order, but rather form a network whereby the actors may go back and forth between problem definition and enrolment, communication, argument and resistance and making judgments.

After the workshop, the scribe is involved in the preparation of the documentation and the validation thereof. This is shown in green in Figure 7.4.

7.3 CONCLUSION

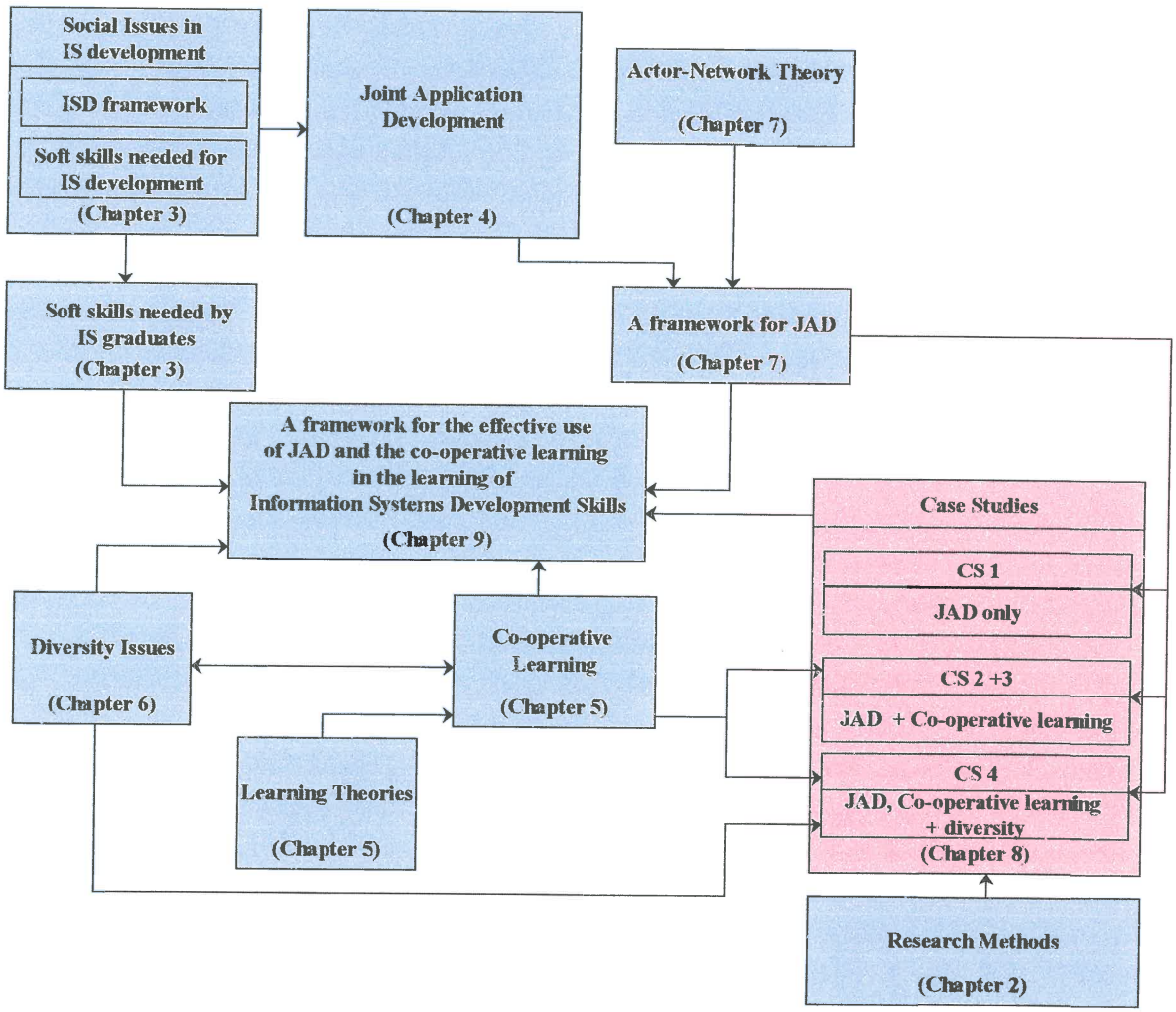
This chapter has answered the questions: "*What is actor-network theory?*" and "*How can we model JAD in industry using actor-network theory?*" Actor-network theory sees

both humans and non-humans as actors within the social network. Each element of the network affects and is affected by the other elements of the network, whether they be human or non-human. The network is continually changing as translation occurs and the actors and their interactions change.

Parkin's [1994; 1996] framework for decision making in a group was chosen as the basis for building a framework for a JAD workshop as shown in Figure 7.4 and with the actors defined in Figure 7.3. This framework will be developed during the rest of this study to describe how JAD can be used effectively within the classroom.

Chapter 8

Using JAD and co-operative learning in the classroom



Chapter 8

Using JAD and co-operative learning in the classroom

Joint Application Development (JAD) workshops had been introduced into the Port Elizabeth Technikon as a learning method as early as 1995. Initially they had been introduced to give the students a feel for how a JAD session was run, but later they were used more extensively as lecturers felt that they helped the students to learn the modelling techniques practised in the sessions. This was just a feeling that the lecturers had, however, and it had never been researched.

The students worked in groups at white boards that were placed around the classroom. The students role-played the various players in the JAD workshops, for example the facilitator or the scribe, while modelling systems using various techniques like entity-relationship (ER) diagrams, function structure diagrams or object-oriented techniques.

This chapter describes the progressive development of the framework for the use of JAD and co-operative learning techniques using four case studies to test the application of the framework. Table 8.1 gives some information about the four case studies. The first case study was a pilot study, carried out at the Port Elizabeth Technikon, that studied the use of the JAD techniques alone in the classroom. Problems with students' participation and the formation of "cliques" within the groups led to the use of co-operative learning techniques in the next case study. The second case study, also at Port Elizabeth Technikon, was one of the two main case studies where various data collection methods were used to determine the students' experiences of using the JAD techniques together with the techniques of co-operative learning. The third case study, at Border Technikon, was done in order to determine if the problems experienced by the Xhosa-speaking

students in the diverse cultural classroom at the Port Elizabeth Technikon, were also experienced in a more homogeneous environment. As the Xhosa speakers did not experience these problems, ideas for helping students work in the diverse cultural environment, were then introduced into the framework and tested in the last case study. The fourth case study was the second of the two main case studies and, once again, a variety of data collection methods were used to get a more complete picture of the students' experiences.

	Institution	Student group	No. of students in class	No. of students answering main questionnaire	Main language groups
Case Study 1	Port Elizabeth Technikon	Information Systems 2	90	75	English, Xhosa, Afrikaans
Case Study 2	Port Elizabeth Technikon	Information Systems 2	113	97	English, Xhosa, Afrikaans
Case Study 3	Border Technikon	Information Systems 3	80	61	Xhosa
Case Study 4	Port Elizabeth Technikon	Second years - mostly doing IS2	129	117	English, Xhosa, Afrikaans

Table 8.1: Overview of Case Studies

Throughout the case studies the grammar of students' comments quoted has not been changed. Most of the results can be found in Appendix B. The discussion of the results is found in this chapter, together with descriptions of the methods used for each case study and a formulation of the framework. The framework was set out before Case Study 1,2 and 4. It was not modified between Case Studies 2 and 3 as the aim of Case Study 3 was to determine if the methods used in the previous case study worked in the same way in the culturally homogeneous groups at Border Technikon as they had in the culturally heterogeneous groups at the Port Elizabeth Technikon.

8.1 USING JAD IN THE CLASSROOM: CASE STUDY 1

This case study was carried out as a pilot study in 1998 using the Information Systems II class at the Port Elizabeth Technikon. Although the technique had been used for three years prior to this, it had never been studied to see if it was effective or not.

This section gives a description of how the technique was used. The framework is presented and then the results of the study are discussed. These are looked at critically in order to determine what problems were found and offer suggestions as to how these problems can be overcome. The cyclic pattern of reflection, decision, action and experience described in Figure 2.2 for the critical theory is thus used as described in Figure 1.1.

8.1.1 Preparatory sessions - Case Study 1

The students were given preparatory sessions on the use of JAD in industry and the roles played by the facilitator, scribe, users and developers. They were also given some training on the running of meetings, setting up an agenda and keeping minutes.

8.1.2 Running the JAD sessions in the classroom - Case Study 1

8.1.2.1 The nature of the material used

The students were given a scenario for a system for which they had to do the function structure diagrams and the ER diagrams. The scenarios were written in such a way that the students had to determine for themselves what part of the scenario would help them build the functions and what they needed for the data.

The scenarios were from one to two pages long and all the students were given the same material. They were supplied with this material in the previous week and expected to

read it before the class. Appendix C.1 has an example of the type of exercise given to the students.

8.1.2.2 The layout of the classroom

The groups worked in a classroom where each group could be assigned to a board. The classroom had five boards around the sides and desks and chairs that could be moved. The students sat in a horseshoe facing the board with the facilitator (one of the students) standing at the board and recording the design as given to him by the other students in the group. The modelling of the system was the output that was recorded on the board. A diagram showing the layout of the classroom is shown in Figure 8.1. The student

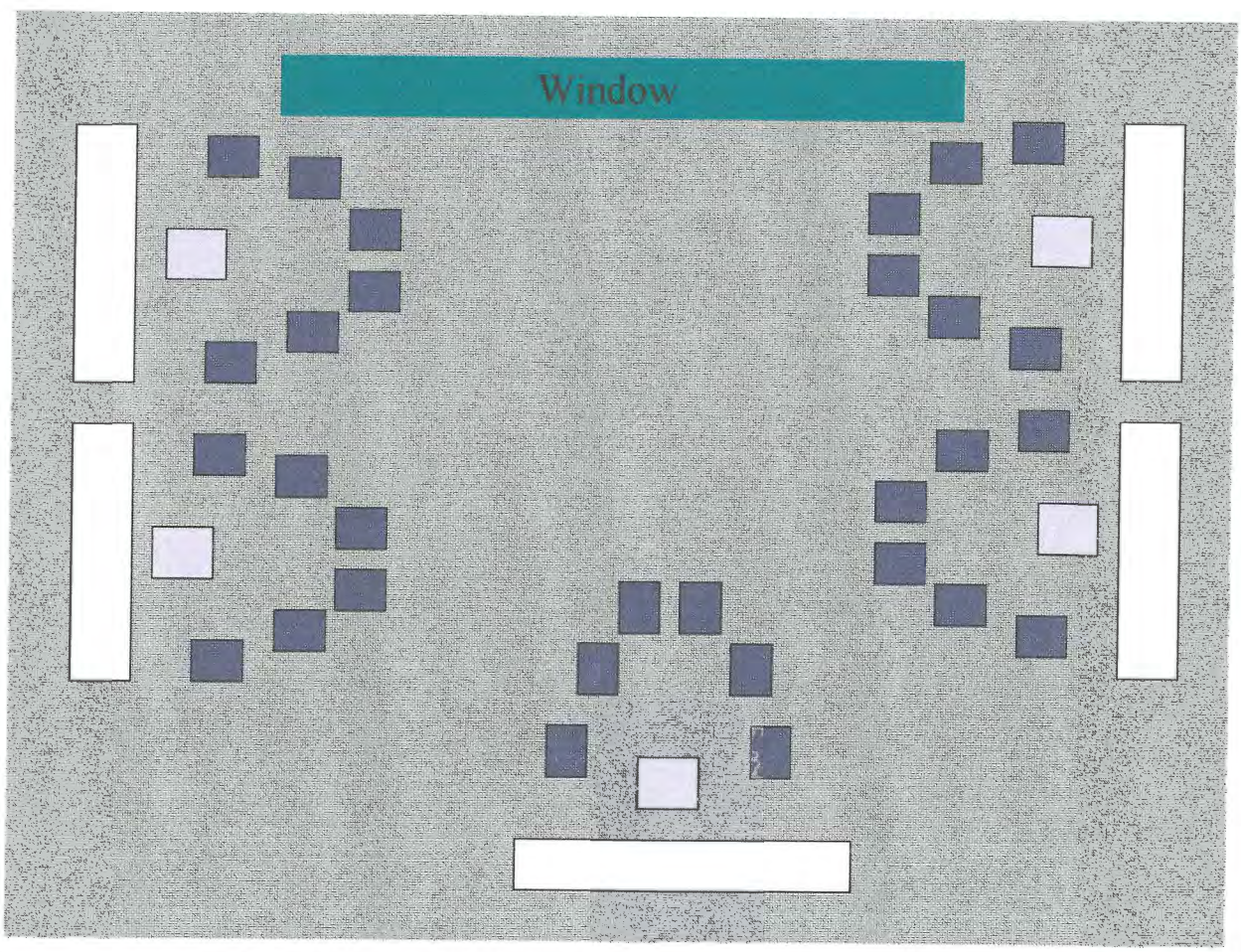


Figure 8.1: Layout of the classroom

facilitator is depicted as purple block with the other students as blue blocks.

8.1.2.3 The composition of the groups

There were five groups, one for each white board available in the classroom. The groups were made up of between six and eight students. The groups were not assigned by the lecturer. The students would form groups as they came into the classroom. This meant that many of the groups were made up of friends with a few late arrivals being added to the group by the lecturer. As will be seen from the results of the student survey, this caused problems within the groups.

8.1.2.4 The JAD process

The students were given the exercise and were required to model both the functions and the data for the system. One of the students was made the facilitator and another the scribe, with the rest acting as users or IT developers. These tasks were rotated so that all the students should have had a chance to be the facilitator and scribe. The facilitator's main task was to make sure that all the students participated, that none dominated and that the group stayed working on the topic. The facilitator was supposed to keep everyone working towards the objective. If there was conflict, the facilitator had to help the group to get to a consensus and negotiate a solution. The students were taught a little about facilitation skills before being asked to do this in class.

The task of the lecturer was not to solve problems or negotiate when there was a conflict but rather to make sure that the JAD facilitator was doing his or her job. The lecturer also checked the results of the design, discussing any problems with the group as a whole. Only in exceptional circumstances would the lecturer get involved in solving the problem with the students. This usually happened when the students were going round in circles without being able to come to any result.

8.1.2.5 Assessment

No marks were given to the group. The lecturer went through the solution with the group and discussed any problems with them. The students did not evaluate their group's processing. The students were evaluated on their knowledge of function structure diagrams and ER diagrams during tests and examinations administered at a later stage.

8.1.3 Original framework for the use of JAD in the classroom

Firstly, the actors within the framework are firstly determined. These actors are both human and non-human. Figure 8.2 gives an indication of these actors.

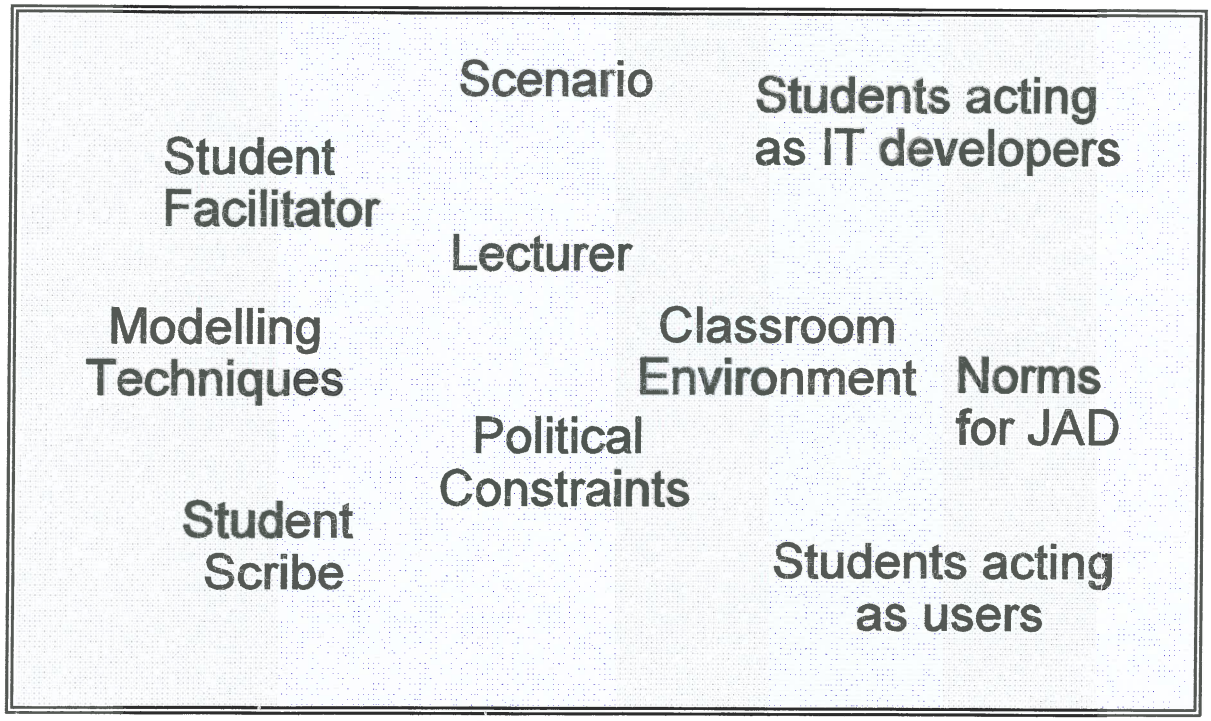


Figure 8.2: Actors in the learning environment network

The **students** act as **facilitators, scribes, users** and **IT developers** in the classroom. The role of the student facilitator and scribe was rotated. The **lecturer** gave the students a **scenario** which they were required to model using the **modelling techniques** that had been taught to them. The lecturer also moderated the groups as they worked in the

classroom. The **classroom environment** was set up to be conducive to holding multiple JAD sessions with a white board for each group, and desks and chairs that could be moved to form the horseshoe-shaped groups. The lecturer determined **norms** for the JAD session. The last actor was the **diversity** that existed in the classroom. This diversity was multi-cultural, multi-lingual, multi-gender and from students with different academic abilities.

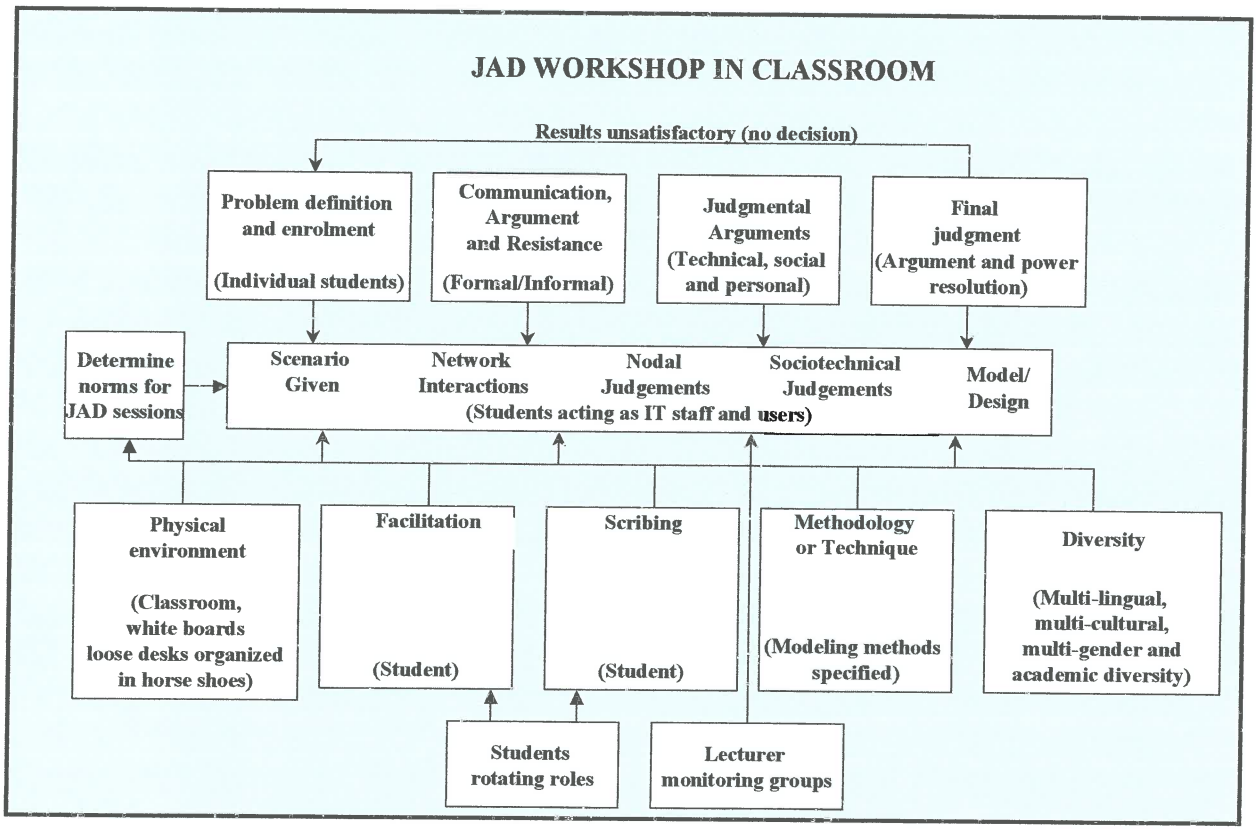


Figure 8.3: The JAD workshop in the classroom

Figure 7.4 for the use of JAD in industry was modified to show its use in the classroom. This is shown in Figure 8.3. The students were involved in the communication, facilitation, scribing, decision making and modelling of the system. In this Case Study, the lecturer defined the norms and gave the students the scenario. They then had to go

through the process of deciding as a group what the design for this scenario would be using the techniques of JAD. As with the JAD workshop in industry this was a process of problem definition, enrolment, communication, argument, judgemental arguments and final judgement.

The students rotated the roles of facilitator, scribe, users and IT personnel. The physical environment of the classroom with its multiple groups, whiteboards, desks etc played an important role in the effective use of JAD in the classroom. The methodologies or techniques used and the political constraints, like the diversity within the classroom, played a role in the way in which the decision making took place. The lecturer was also involved in monitoring the groups. Essentially the method remains a group decision-making process, however, with the model being the end result.

The entire framework will not only consist of what happens in the workshop in the classroom, however. Figure 8.4 shows the additional factors that occur before the JAD sessions and the learning that should take place. These are shown in purple in the figure.

The composition of the groups is an important input into what happens in the JAD sessions in the classroom. In the first case study, the groups were formed by the students themselves as they entered the classroom with late comers added to the groups by the lecturer. The composition of the group is thus an input into the learning environment. Additional to the model are also the pre-skills that the students were taught. The students were given some instruction in JAD facilitation and running meetings.

Output from the process is also shown in terms of the learning that it was hoped would occur. The learning involves the learning of the modelling techniques, together with the JAD, group, interpersonal and communication skills. These are some of the skills needed for being able to work in the sense-making and argumentation orientations for

IS development. As these skills are learnt, they will in turn, affect the way in which further workshops are run and decisions are made, which is why these skills are depicted as both input and output to the workshop activity.

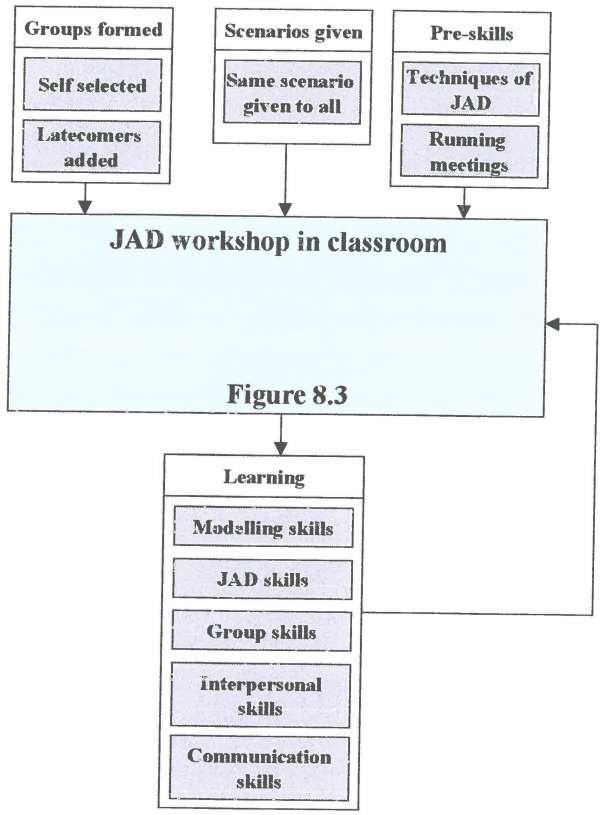


Figure 8.4: A framework for the use of JAD in the classroom

8.1.4 An overview of the results of the pilot case study

The students were given a questionnaire with both open and closed questions. The questionnaire can be found in Appendix A.1. There were 90 students in the class with 75 of them completing the questionnaire. The qualitative results will not add up to 75 as some students put more than one answer per question and others put no answers. The answers from the open-ended questions were categorized to help gain insight into the answers provided by the students.

Most of the quantitative results are compared to the other case studies and can be found in tables in Appendix B.5. The students' answers to the open-ended questions were categorised and the categories with the number answering in each category can be found in Appendix B.1. A discussion of the results is given here.

The class was made up of students following either a business- or a technically-oriented stream. The business stream made up 77,3% of the students, with 22,7% from the technical stream. The students were predominantly from the three language groups found in the Eastern Cape in South Africa, namely English (44%), Afrikaans (36%) and Xhosa (14,7%). Other African languages made up the remaining 5,3%. These results can be found in Table B.7. Although the students were not asked their gender in this questionnaire, the Technical class was all male and the Business class fairly evenly mixed with respect to gender. The Technical class was also predominantly white with the Business class being more mixed. (Questions on these aspects were asked in the questionnaires in the following years but were not asked in the pilot study questionnaire.)

The students were asked how they were allocated to groups and how they would prefer to be allocated to groups. Most of the students (58,7%) said that they were sometimes allocated to a group and at other times chose their own. Most of them seemed to prefer this method (53,3%). Another 22,7% said that they chose their own groups and a slightly higher percentage of 32% said that they preferred this method. There were 17,3% who said that they were always placed into a group with 14,7% saying that they preferred this method. An informal method of assigning people to groups had been used during this case study. As the students came into the class, they were able to form groups with their friends at the different boards. The late arrivals were then placed into the smaller groups as they arrived. As we will see later, this method seemed to cause some problems with friends forming "cliques" and others feeling left out. Although a great number of students prefer to be able to choose their own groups, it is felt that putting them into groups may be more effective.

Most of the groups seemed to be fairly heterogeneous with respect to gender, race, academic ability and language. As the Technical class had been all male (100%) and predominately white, there was little opportunity for them to be in heterogeneous groups with respect to these factors. The rest of the students were in heterogeneous groups, however.

8.1.4.1 Working in groups

The students were asked various questions about how they experienced working in a group. Table B.8 in Appendix B.5 gives an indication of these questions and the percentages of students that answered in each category. The answers to the open-ended parts of these questions can be found in Appendix B.1.1.

There were 24,3% of the students who felt that they enjoyed working in the groups all the time. Most of the students (68,9%) enjoyed it most of the time with 6,8% enjoying it seldom. According to their answers in the open-ended questions, they particular enjoyed hearing other people's ideas, interacting with other people, working as a team, arguing, debating and reasoning with one another, working with people that they would not normally work with and taking part. There were also a couple of negative comments made by individuals like: "*Do not have attend boring lectures*" and "*I did not have to work as much*".

Some of the problems experienced were individuals who did not contribute and others who tried to dominate the group. There were also problems between the different language groups. As the groups formed themselves initially and then had additional members added to them later, they were often initially formed by students from one language group, for example, Afrikaans. The students who were added at a later stage might then be English or Xhosa and when the group would speak Afrikaans, which the Xhosa speakers could not understand, they would naturally take exception to this. This caused some major friction within the groups which the lecturer had to diffuse. As one

of the students, commenting on what they disliked about working in groups, said: "*It was always difficult for me because we were forming our own groups, so if you don't have those friends who know you, you struggle a lot.*" Another individual commented that he or she had the problem of "*forcing myself to take part as I am shy*".

Most of the students felt that they were able to have their say most of the time (66,2%), although only 28,4% felt that they were always able to have their say, as shown in Table B.8. They felt that the student facilitators did try to accommodate everyone and that everyone was able to have his or her opinions taken into consideration. Some of the facilitators had some problems with controlling the group and only asking certain individuals questions, however, as indicated in the answers to the open-ended questions given in Appendix B.1.1.

While a large percentage of the students felt that they were always (21,6%) or most of the time (68,9%) able to contribute to the group themselves, only 6,7% felt that all the group members were contributing to the group all the time. There were 61,3% who felt that the others contributed most of the time with 26,7% feeling that others seldom contributed. As shown in Appendix B.1.1 a large number of the students said that while most of the students contributed, there were usually some who did not. They attributed this to shyness, laziness and to some people knowing more than others. A few students said that they worked well together. Quite a few students felt that their own opinions were listened to and taken notice of. Some said that they were able to discuss if they had a difference of opinion. There were also a few students who felt that they could not take part because they were too shy or did not understand the work sufficiently. Two participants complained that they tried to take part but others did not take notice of their contribution.

Although we had hoped that the facilitator would be able to handle most of the problems mentioned by the students, this did not seem to always be the case. More training might be needed and further monitoring by the lecturer in order to overcome these problems.

It would also seem that the students did not feel the need to explain to other students who were slower than themselves.

There were 54,7% of the students who felt that they were always accepted as group members, with 38,7% feeling that they were accepted most of the time and 6,7% feeling that they were seldom accepted. Most of the comments made by the students were positive although two students did mention that the other students formed cliques and did not accept them. This problem could once again be attributed to the way in which the groups were formed.

It was interesting to note some of the individual comments that students had. The comments ranged from "*Most times we were in a group with friends - felt I could contribute as a member*" to "*The groups were made according to friends, I have few friends*" or "*Some students 'click' and doesn't always accept you*". Other comments were, on the positive side, "*Everyone was equal and no-one discriminated against the other. Any input was discussed*" and on the negative side, "*Some members showed that they felt they could do a better job than you by their body language.*"

There was definitely room for improvement in the results for this section. It would seem that the informal method of forming groups was not effective. The students also needed to learn more about how to work together.

8.1.4.2 Learning in groups

Table B.9 in Appendix B.5.3 shows the results for the students' perceptions of their learning. The results for the open-ended questions can be found in Appendix B.1.2.

Eighty-eight percent of the students felt that the techniques always (32%) or most of the time (56%) were useful for helping them to learn. There were 9,3% who felt that it was seldom useful and 2,7% who felt that it was never useful. The 2,7% who felt that it was

never useful clarified their answers in the open-ended questions by noting that they already knew the work so they did not learn anything more. The students commented on how the techniques helped them to think and understand the work better and how it helped to hear other people's opinions. They said that working practically helped them to remember and learn and that it helped them in tests and exams. An example of one of the student's comments is: "*It made one think and also consider another's point of view. The solution was seen thru different angles.*"

8.1.4.3 Facilitation and language

Table B.10 in Appendix B.5.4 gives the quantitative results for the questions and Appendix B.1.3 the categorisations of the answers to the open-ended questions. Although many of the students seldom enjoyed being the facilitator (20,6%) or never enjoyed being the facilitator (5,9%), there were many who enjoyed it most of the time (54,4%) or always (19,1%). They said that they liked being in control and getting people to work together towards a solution but did not like it when the members of their group did not co-operate. They also disliked losing control of the group or when people would take over the discussion. Some students mentioned that they had never been the facilitator. Methods needed to be introduced to make sure that all students were given this opportunity.

The students were also asked about communicating in their home language while being the facilitator. Only 35,7% of the students were always able to use their home language, 18,6% were able to use their home language most of the time, 18,6% were seldom able to use their home language and 27,1% were never able to use their home language. The answers to the open-ended questions showed that the students were quite positive about English being used as the language of the group as this was what everyone could understand. A few did mention that it was more difficult for them to get their point across in English than it would have been in their home language. One of the students commented that there were no words for some of the terms in their home language.

Another suggested that the students be asked to speak simple English so that they could all understand.

8.1.4.4 Use of JAD

The students were asked to comment on whether they thought the techniques they used would be useful in industry. This question is included in this section as it shows if the students were able to decide if what they were learning is applicable and if they had seen the relevance of it. There were 39,7% of the students who thought the techniques would be very useful, 55,9% thought they would be somewhat useful, 2,9% thought they would be seldom used and 1,5% thought they would never be used. Many students mentioned that it was useful for Systems Analysis and Design, with some of those insinuating that it would only be useful for that. Some mentioned that they did not know what happened in industry. It would seem that some work needs to be done in order to show the students the relevance of this for later work although most of the students did see that it would be relevant. A great many of the Technical students thought that it would not really be relevant in their line of work. This perception needs to be revised.

The students seemed to have a good idea as to why the method of JAD was used in the classroom. They mentioned that it helped them to get used to what happens in industry, helped them to work in groups, improve communication and understand better what they were learning. A number also mentioned that it forces them to participate. All of these had been aims of using JAD within the classroom.

The students had been put into a classroom without boards at the start of the semester and thus worked in conventional groups rather than in the JAD method. They were asked "*At the beginning of the semester, there was only one white board in the classroom and how had to work in normal groups, which method do you prefer?*" Most of the students (82,2%) enjoyed working on the boards. There were 15,1% who had no preference and 2,7% who preferred conventional group work.

8.1.5 Reflections on Case Study 1

While the results of the questionnaire were reasonably positive, improvements were needed to solve some of the problems described by the students. As mentioned by Johnson, Johnson and Smith [1991], students do not just co-operate because they are put in a group and told to do so. The essential features for co-operation should be fostered using the techniques of co-operative learning discussed in Chapter 5.

Most of the difficulties seemed to be with the students not participating and with conflict due to differences in the students' knowledge, language and culture. These problems have been addressed in many research projects in co-operative learning.

Some of the problems that the students pointed out could be linked back to inadequate training on how to work effectively in groups. Other aspects could be directly attributed to the informal method of composing the groups which caused some people to feel left out of the group interaction. The scenarios given were also not created to promote co-operation among the students.

This ends the first cycle as shown in purple in Figure 1.1. The method for using JAD in the classroom was planned, the theoretical framework developed, the case study done and the results evaluated in order to determine problems and reflect on them.

In order to address these problems, co-operative learning techniques were combined with the JAD techniques and tested to see if they did improve the situation and reduce the problems experienced by the students.

8.2 USING JAD AND CO-OPERATIVE LEARNING TECHNIQUES : CASE STUDY 2

This section describes how the techniques of co-operative learning were combined with

the JAD techniques in order to promote effective learning of group and modelling techniques. The section first describes the methods used, then gives the framework and lastly the results of the second case study and reflects on the results. Appendix B.2 contains the categorisations of the open-ended questions for this case study and Appendix B.5 contains some of the quantitative results which were compared with the other case studies. This teaching method was described in Thomas and de Villiers [2000] and the results of the first and second case studies in Thomas [1999].

Case Study 2 was done in April - May 1999 in the Information Systems II class at Port Elizabeth Technikon. There were 113 students in the class with 87 completing the main questionnaire. The students were divided into three classes with a maximum of 42 students in one class. The composition of the student body will be discussed with the results of the questionnaire. The students for this case study are considered to be similar enough to compare with those from Case Study 1 and comparisons are made during the discussion of the main questionnaire. These results are found in Appendix B.5. It must be recognised, however, that no two classes are the same and that comparisons of this nature can be dangerous.

8.2.1 Preparatory group skills awareness - Case Study 2

Co-operative learning literature stresses that just placing students in groups and expecting them to co-operate will not be effective. Johnson, Johnson and Smith [1991] among others, stress the need for students to be given some training in the group skills that they will need to promote co-operation.

This skills training was done over three 1 ½ hour sessions prior to the running of the JAD sessions. A fourth week, specifically on the skills needed for JAD, was also included. A brief summary of each of the preparatory lessons is given here.

The students were given lessons on communication skills, with a focus on those skills

that are needed to communicate between users and IT personnel. Different types of communication methods were used and the need for modelling techniques and two-way communication was emphasized. The importance of making notes during communication was also demonstrated.

This workshop is explained in a little detail here to give an example of the type of activity that one can do in order to allow the students to actively participate while learning these skills. It also shows how one can adapt exercises so that they are IT-oriented so that the students see their relevance. The original exercise can be found in Pfeiffer and Jones [1981, p.69-74].

The students are divided into small groups and each group is given the same set of K-nex ® sticks and connectors to use. K-nex is a building toy that has sticks of different lengths and connectors that allow you to connect those sticks in different ways. Very complicated 3-D models can be built with the toy. One of the groups is sent outside and asked to build a model. This usually takes about 15 minutes, so one should have some other activity for those inside to do in this time.

The group outside is termed the "users". The groups inside are the "developers". The groups inside send one person each out to the "users". The users cover up their model and must then explain to the "developers" how to build their model. Different communication techniques are used. For example, the first time, the "developers" are not allowed to ask questions or to use pen and paper. The next time people may talk, but still do not use any writing equipment. Later they may use pen and paper and still later the "users" may draw them a model so that they can see what is done. In the last phase, one or two "users" are assigned to each "development" group to help them to build the model.

A discussion is then held on the different problems that were experienced. The "users" normally accuse the "developers" of not listening properly and they have

a problem because they have to repeat themselves over and over again. The problems of the "developers" are also discussed. These usually include the "users" not being clear and they get accused of trying to lead them astray. The different communication techniques are discussed as well as the problems associated with each. These communication problems are then related back to the IS world. One should leave at least 15 minutes at the end of the class for this discussion, otherwise the students just see it as a big game and while they may enjoy it, they will not see the relevance.

The students were also taught how to run problem-solving meetings during the second session. The students were shown a video on how to make meetings more effective. They were then given an exercise to allow them to practise problem solving and decision making strategies within a meeting. The art of reaching consensus rather than compromise was emphasized.

In the third session, the students were given a lecture on group dynamics, group decision making and group cohesion. They, themselves, then determined group norms for their groups and for the class.

Lastly, the JAD process was described to the students giving them background on the participants and how to make the JAD sessions effective. This formed part of their curriculum. Lecturers acted as difficult users to role-play some of the problems that could be experienced and to give some ideas as to how those problems could be overcome.

8.2.2 Running the JAD sessions - Case Study 2

8.2.2.1 The nature of the material used

The modelling techniques that were used in the JAD sessions during the second case

study were the drawing of Use-Case and ERD models. The students were given the scenarios the week before and were expected to read them before the next class. The material was divided into various sections and given to different students, for example, in the Library assignment found in Appendix C.2 all the students were given the general information with one student being given the information for the front desk, another for ordering of books and a third for the finance part. The giving of the different information to the different students was in accordance with the advice from co-operative learning literature that this is one method of promoting participation and individual accountability within the group. Appendix C.3 gives an example of the grocery store. In this example, some students worked in the stores and others at the tills and were given different information. They were also given the information using different terminology. This was done in order to show the students how factors like terminology can cause problems within a JAD session.

8.2.2.2 The composition of the groups

The students were very carefully assigned to groups for this case study. The students were asked to fill in questionnaires that covered their knowledge of some of the business areas that could possibly be done in the JAD sessions, for example, library, grocery store, restaurant, health club, free clinic, etc. (See Appendix A.7.) The questionnaire contained questions, which asked them if they had worked in that type of business, knew it well, knew it slightly or did not know anything about it at all. They were also asked to fill in their mark for the previous year for Information Systems I as well as their gender, home language and language of preference for group work. Almost all of the students chose English as their language of choice for group work and it was decided for this case study to keep the students in heterogeneous groups with respect to language so that they would be "forced" to work in English.

The lecturer then divided the students into five groups per class, that is, one for each board that was available in the classroom. The lecturer tried to get a good mix in terms

of the business areas, gender, language and academic ability. The group sizes varied, depending on the number of students in the class, with a minimum of six and maximum of nine students being assigned to a group.

8.2.2.3 Layout of the classroom

The layout of the classroom did not change from 1998 although there was at least one of the classes that had many more students in it. This meant that the groups were larger and the classroom more noisy.

8.2.2.4 The JAD process

The method of running the sessions was approximately the same as it was in the previous case study. The lecturer was more involved in pointing out where there were problems in the group interaction, however. The co-operative learning literature suggests that the lecturer should, not only monitor the product being produced by the groups, but should also monitor the group interactions.

8.2.2.5 Assessment

Assessment was done on the group processing as well as on the modelling techniques.

The groups assessed themselves during the first and last JAD sessions by means of a questionnaire where they had to answer questions about their group processing. The questionnaire can be found in Appendix A.5. After the first questionnaire was handed in, the lecturer set up a summary of the answers for each group. This was used as a discussion document at the start of the second JAD session. They were made aware of any problems that they themselves had identified, for example, if they were interrupting one another too much. They were also made aware of their strengths. This questionnaire was also handed out after the last JAD session. An overview of the

analysis of the two questionnaires can be found in Section 8.2.6.

An independent observer was used for some of the sessions. She helped to evaluate the class as a whole as well as evaluating individual groups. Her comments have been integrated into the discussion that follows.

The students were also asked to give a buddy rating of each other during the last JAD session. This was used as a practical mark for the students. The buddy rating form can be found in Appendix A.6. The students tended to give one another rather high marks, however.

The students had been given a test that included Use-Cases and ERDs before they started the JAD sessions. They were still busy learning about ERDs at the time of the pre-test so the ERD in the exam was quite different in standard than the test. The results of the pre- and post-test evaluations of the Use-Cases can be found in Section 8.2.7. The examination was done individually and helped to promote individual accountability.

8.2.3 The circles of learning co-operative learning method as applied to JAD

The circles of learning co-operative learning method was described in Section 5.2.6. Eighteen steps were identified for the implementation of circles of learning. Some of the steps were considered optional. Each of these eighteen steps will be listed in Table 8.2, together with an indication of how the step is catered for when combining the methods of JAD with the methods of co-operative learning.

As one can see from the table, this method did try to keep close to the circles of learning method as possible. Slight variations were necessary to try to keep the method as close to the industry methods of JAD while incorporating the co-operative learning techniques.

Recommended steps	Implementation in JAD
Clearly specify instructional objectives.	This is done by giving the students the objectives of learning the modelling techniques as well as the objectives of learning to work with other people in small groups.
Limit the group size to no more that six with smaller size groups for students that are new to co-operative learning to ensure that everyone will participate.	Although the group sizes in the JAD sessions were sometimes eight or nine people, the use of the white boards and the roles that were played within the session allowed for easier communication and participation.
Structure groups so that they are heterogeneous with respect to ability, sex and culture. Homogeneous groups can be used sometimes in order to master specific skills.	Heterogeneous groups were used in the JAD sessions.
Arrange groups in circles to facilitate communication.	The groups were arranged in a horse shoe with the white board at the front. This facilitated good communication with the written work being done on the white board.
Use instructional materials that will promote interdependence among students.	The instructional materials (scenarios) were divided among the students so that different students were given the details of a part of the system to be modelled. This was done to promote positive interdependence among the students.
Assign roles to ensure interdependence. One could assign a summariser-checker to summarise the lesson and quiz group members; an encourager to encourage everyone to participate; a recorder to write down group decisions and an observer to make sure that the group collaborates.	The students were given the roles of facilitator and scribe. Other students played the roles of users and IT personnel. The facilitator can be likened to the encourager and the scribe to the recorder. A summariser-checker was not needed as the lecturer played that role and an observer was not used for the second and third case studies.
Explain the academic task.	The task was explained to the students.
Structure positive goal interdependence by having the group produce a single product or by providing group rewards based on the individual performances of the different group members.	The group was required to model the Use Case models and the ER models on the board for the scenarios given. No rewards were given for this.
Structure individual accountability for learning by giving individual tests or expecting the individual to explain the work to others.	The students were only tested individually at a later stage although the students' group processing was evaluated by their fellow team members.
Structure inter-group co-operation.	This was not done. Each group worked on their own.
Explain the criteria for success. Explain how the individual grades work and how one can earn points for one's group.	Criteria for success were determined by the group effort as well as in the individual's participation in the group. This was explained to the students.

Recommended steps	Implementation in JAD
Specify desired behaviours. These might include: Using people's names, taking turns, making sure each person understands and agrees with the group's answer.	The desired behaviours were those that were expected for a JAD session in industry. These included making sure that people agreed, listening with respect to others and other behaviours that would be desired in group behaviour.
Monitor students' behaviour continually looking for problems with the task or with the collaborative effort.	The lecturer did this.
Provide task assistance. At times the teacher will need to intervene, clarify instructions, encourage discussions or even teach.	This was done to a certain extent although the lecturer tried to keep her intervention to a minimum.
Intervene in order to teach collaborative skills of effective communication, building a trusting environment and managing controversy.	When problems in collaboration were seen, these were pointed out to the students. They were reminded of what they had previously learnt.
Provide closure to the lesson with summaries by students and teacher.	This was not done as a class although the lecturer did it individually with each group.
Evaluate the students' work. Group or individualist incentives can be used although there should be some group incentive.	The lecturer evaluated the models of the groups and discussed any problems with the group.
Assess group functioning through ongoing observation and discussion of the group process.	The groups assessed their own group functioning using a questionnaire and the lecturer discussed any problems that they had with them.

Table 8.2: Circles of learning method and JAD method

One of the advantages of the circles of learning method is that it caters for students learning about group dynamics and learning to work co-operatively which is one of the aspects that we wanted to achieve with the use of JAD.

8.2.4 A framework for the use of JAD and co-operative learning in the classroom

The framework was modified to include the co-operative learning methods. Figure 8.5 shows the new framework. Boxes with changes have been coloured in purple.

The groups were formed by the lecturer rather than the students choosing their own. The groups were also made heterogeneous. The whole scenario was no longer given to all

the students, but the scenario was split among the students. The principles of co-operative learning as well as the rules for the circles of learning co-operative method were adhered to.

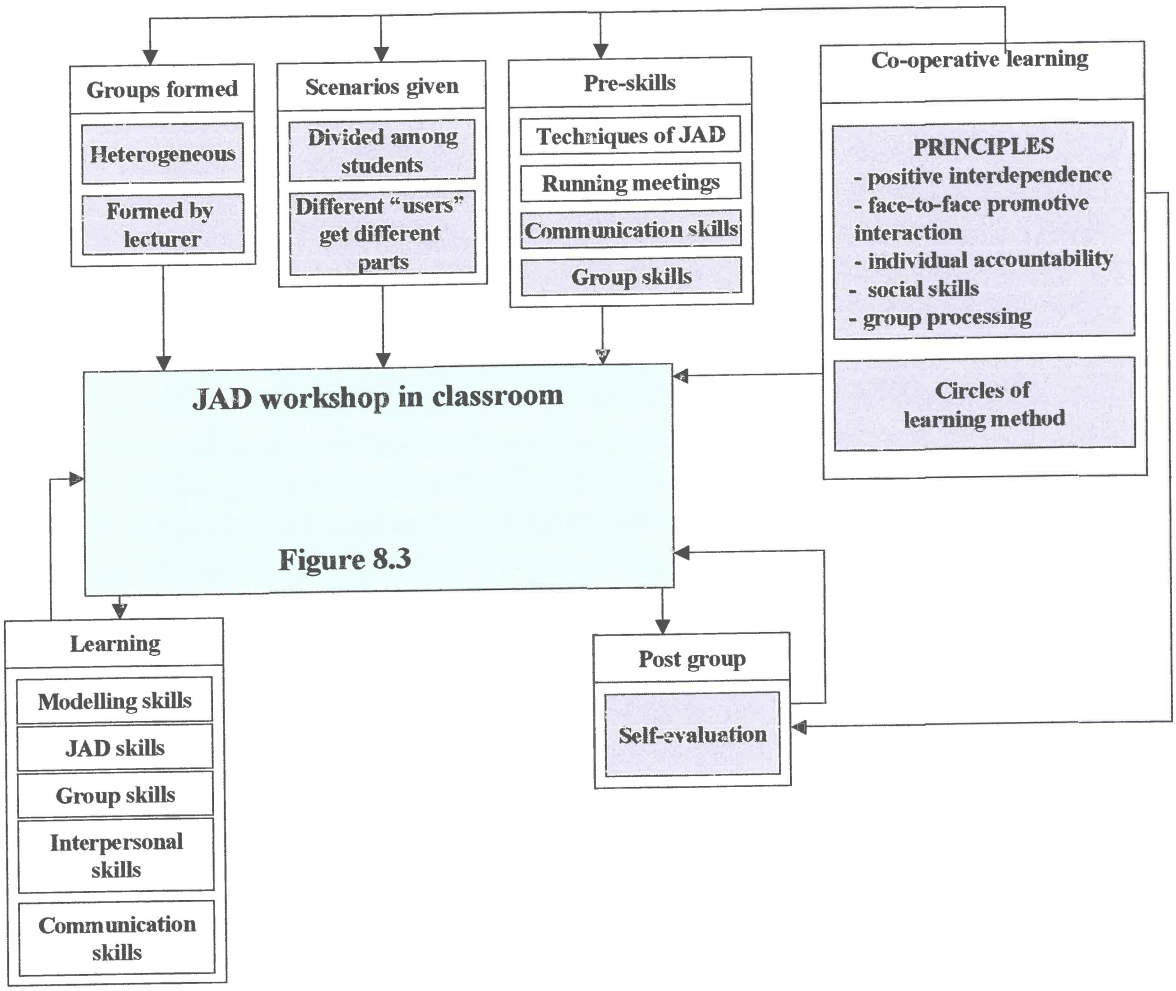


Figure 8.5: A revised framework for the use of JAD and co-operative learning in the classroom

The students' pre-skills training was also modified, including more workshops on communication and group skills. Students set up their own norms for group work rather than have these dictated to them by the lecturer.

Each group evaluated their group processing after the JAD workshop and these results were used to help them learn and modify their group behaviour.

8.2.5 An overview of the results of Case Study 2

Appendix B.2 contains the categorisation of the students' open-ended questions for this case study. Appendix B.5 gives tables showing the quantitative results and their comparison with the other case studies.

The students were from two streams with 66,6% from the business stream and 33,3% from the technically-oriented stream. The students were once again mainly from the three language groups in the Eastern Cape, namely English (57,5%), Afrikaans (26,4%) and Xhosa (13,8%). Other language groups made up the remaining 2,3%. The students were predominately male (69%) with only 31% females overall. The technical class was 93% male but the business class was more mixed with 57% males and 43% females. These results can be found in Table B.7.

Whites made up the majority of the students during this case study (66,3%) with 16,3% Africans, 12,8% Coloured and 4,6% Asian. The business class had a more mixed composition with 61,4% Whites, 19,3% African, 15,8% Coloured and 3,5% Asian. Whites still dominated the class by 61% to 39%, however.

8.2.5.1 Working in groups

Table B.8 compares the quantitative results of the four case studies with respect to working in groups. The categorisation of the open-ended questions can be found in B.2.1.1. As pointed out previously, one must be careful making comparisons between the two groups. Although they were both Port Elizabeth Technikon student groups doing Information Systems II, they cannot be seen as being equal in every respect.

The students' enjoyment of the group work was very similar to Case Study 1 with 25,2% enjoying it all of the time and 64,4% enjoying it most of the time. The students' comments on why they enjoyed it were also very similar, with the students mentioning interacting with other people, hearing other people's ideas, working as a team, finding a good solution together, facilitation, debating, arguing and reasoning with one another, and meeting and working with other people that they would not normally work with as being reasons for their enjoyment. One of the more interesting comments made by an individual was the following: "*I got to know a lot of people and found out it was not so bad working in groups as I had thought.*"

Once again "people who did not contribute" was number one on their list of dislikes along with people not taking their ideas into consideration and people who dominated the group.

As mentioned above some of the students disliked not having their ideas taken into consideration. On further analysis it was discovered that eight of the ten students who answered this were Xhosa speaking students with two being English speaking. The problem of the Xhosa speakers being left out of the groups was also noticed by the observer in the classroom. One of the groups that she noticed this phenomenon was in a group that had an African student who was a very high achiever. Despite this, the student's input was not sought by his fellow students. It is, perhaps, best summarized by one of the white, English-speaking, female students, who in her answer to the question on why she thought JAD was used in the classroom, said the following: "*I think that JAD is a brilliant method of educating. If the members participated it would be beneficial. South Africa still has serious racial problems and language barriers. It is sad that students can't even do mock JAD without racial conflict.*" There did not seem to be the language problems of the previous case study and there was no open racial conflict. There did, however, still seem to be a problem with students perceiving other students as being of lower status than themselves. It also seemed that sometimes the Xhosa speakers felt shy to participate in the group. This could be because of language

difficulties or feelings of low self-esteem. This aspect would need to be addressed in later studies.

There was quite an increase from the first Case Study in those who felt that they could always have their say - from 28,4% to 40,7%. It would seem that significant improvement has been achieved in this area. One must, however, be careful about saying this as the question in the first case study said "When you were a member of the group and not the JAD facilitator, did you feel that the facilitators gave you a chance to have your say *when you wanted to?*" One of the students in that case study mentioned that they felt that you could not expect to always have your say at the time when you wanted to - which is correct. The question was thus modified and could have been responsible for some of the change. There was also a larger number of students who said "seldom". If you take the never and seldom together, however, one finds a shift from 5,4% to 8,1%, which is not really that large. Many students commented that everyone was able to have their opinions taken into consideration and that the facilitators tried to accommodate everyone. Six people commented that their ideas were sometimes ignored, whereas only two people had mentioned this in the previous case study. A smaller number than previous years commented on the problems that facilitators had. One student felt that "*There must be respect within the session and this needs to be enforced by the facilitator.*"

The students were asked about their own and others' contribution to the groups and here we find a huge improvement from the previous case study. The percentage of people who felt that they themselves always contributed rose from 21,6% to 44,7%. It would seem that the co-operative learning techniques have been effective in this area. There was a slight drop in the number of people who felt that they seldom contributed - from 9,5% to 7,1%. There were also many more positive comments in the open-ended section of the question with 55 people making positive comments compared to the 22 of the previous year. The most common comment was that their input was listened to and taken notice of. Students also mentioned that if they differed on some point then they

could say so. Some still felt too shy or insecure about their knowledge to participate, however.

In the previous case study, 32% of the students felt that other people contributed seldom (26,7%) or never (5,3%). This dropped to only 16,3% feeling that other people contributed seldom and 0% never, which was a great improvement. There was also quite a big improvement in those who felt that other people always contributed - from 6,7% to 17,4%. It would seem that the techniques of co-operative learning have helped to improve the students ability to co-operate and participate. The positive comments in the open-ended part of the question increased from six in the previous case study to 27 in this one, although the problem of people not contributing was still very prominent with 40 students mentioning it. There was much greater variety in the reasons that students gave for non-participation during the second case study as compared to the first. Some attributed it to shyness, others to laziness, the problem of other people dominating, people having their own conversations or people not feeling part of the group. Two students also mentioned the problem of minorities feeling intimidated. As mentioned before, the observer found that the Xhosa-speaking students did not participate very much within the sessions.

There were 71% of the students who felt that they were always accepted in their group, 22,1% felt that they were accepted most of the time with 5,8% feeling accepted only seldom and 1,2% feeling that they were never accepted. This was very satisfying and shows a fostering of group cohesion which is very important. On the whole the students felt more accepted within the groups. The feelings of always being accepted rose from 54% to 71% using the new methods. The forming of well-defined groups and the teaching of group skills does seem to have improved the group cohesion and feeling of belonging that the students have. Students commented that the atmosphere was friendly and that people listened to them. There were, however, still some students who felt that their ideas were ignored or that they were the odd one out.

On the whole, the comments made were very positive. One of the interesting comments made by a student was "*We were a well combined group. Found it easy to feel accepted. We took time to get to know each other in the beginning of our first JAD session.*" Group cohesion needs to be fostered more carefully in the groups. Asking the groups to give themselves a name and to learn each other's names can help.

Another comment that made one think that maybe it was not only the Black students who had been having problems was the following: "*Being blonde and female, I was treated as the secretary by our 'superior' male members.*" The observer had noticed the opposite problem in one of the groups where there were three dominant females who tended to ignore the male members of their group.

8.2.5.2 Learning in groups

The questionnaire for this case study contained questions which asked the students more specific questions about their learning. They were asked about their perceived learning in general, as well as their group skills of acting in a group, interacting with others and speaking in front of others. The results cannot be compared with the previous case study as the answers for the learning in general were changed and the other questions had not been asked at all. The results are compared to Case Studies 3 and 4 in Table B.9 and categorisation the of the open-ended questions can be found in Appendix B.2.1.2.

Overall 60,5% of the students felt that they had learnt a lot during the JAD sessions with 32,5% feeling that it helped them a little. The remainder either felt that they already knew the techniques (3,5%) or that they had not learnt anything (3,5%). Almost all of the comments made were positive ones with the most being how it helped them to hear the opinions of others and how it helped them to learn about ERDs, Use Cases and JAD. Five students mentioned that working practically helped them to think better.

It was surprising that only 18,6% of the students felt that they were already confident about how to act within a group. This shows how much need there is for this type of activity. There were 48,8% who felt that the JAD sessions had helped them a lot, with 26,7% feeling that it helped them a little. The remainder (5,8%) felt that it had not helped them at all. The students felt that they were less intimidated. One student mentioned that "*It made me realize that anyone can speak their mind no matter who he/she is*". Another interesting comment was the student who mentioned that she loved being in control and it made her realise that she sometimes needed to contain her enthusiasm in order to let other people have a turn. Another student said: "*Why would JAD help? Confidence comes from within oneself.*"

There were 26,7% who felt that they already interacted well with other people. Another 36% felt that it improved their interaction a lot and 31,5% felt that it improved a little. The other 5,8% felt that it did not help at all. Students mentioned how they had learnt to listen to other people and give them a chance, how they had learnt to get many people's ideas and come to a decision and how they had learnt to speak freely in front of others. One person felt that it only helped them a little because if they did not respect someone then they would not interact with them. This was a little disappointing as the point was stressed that in working in groups in industry one will need to be able to work with all types of people - even if one does not "respect" them.

Many of the students commented that they felt that they were more confident to speak in front of people than they had been before. There were 46,5% who felt that it helped them a lot, 26,7% who felt that it helped them a little and 4,7% who felt that it did not help them at all. The rest (22,1%) felt that they already had this skill. One of the students commented: "*It was a wake-up call for me to actually see what talking in front of people was all about.*" Another said that: "*Although I am not so shy, JAD improved my self-esteem so I am more confident now.*"

8.2.5.3 Facilitation and language

The students were asked about how they enjoyed being the facilitator as well as their experiences of using English when facilitating. These two questions were asked in the previous case study and a comparative table is given in Table B.10.

Most of the students fell in the category of enjoying being facilitator most of the time (65,1%). There were 19,8% who felt that it was enjoyable all the time, 11,6% who felt that it was seldom enjoyable and 3,5% who felt that it was not at all enjoyable. The figure for those who enjoyed it a lot is almost the same as for the previous year. There was a shift from those who seldom or never enjoyed it to those who enjoyed it most of the time with that figure rising from 54,4% to 65,1%.

The students enjoyed having control and getting people to work together to get a solution. They also enjoyed structuring the ideas of others to get a good solution. Less people than the previous year commented negatively on people who did not participate, but some still felt unable to control the group and that people did not listen to them. The noise level was mentioned by four people. There were more students in each class, which led to bigger groups and a noisier classroom than in previous years. The students were given some instruction on listening skills, not talking while others were talking and not interrupting until a person had finished their thought. They do get quite enthusiastic, however, and find it hard to keep to these rules. It is difficult to determine how to get around this problem besides by trying to enforce the rule of only one person speaking at a time. One does not want to stifle the students' enthusiasm too much.

One student mentioned that they disliked the fact that they had to think a lot. This is not considered a negative comment by the lecturers!

There was a large increase this year in the number of students whose home language was English (57,5% from only 44% in the previous year). This led to a situation where

55,3% of the students said that they were always able to communicate in their home language. The percentage of students never able to communicate in their home language was 30,6% with 8,2% saying they were able to communicate in their home language most of the time and 5,9% saying they were seldom able to communicate in their home language. These latter two percentages should have been 0% if instructions had been followed as the work should have been done in English only. It seems like some of the groups in the Technical stream, which had a large number of Afrikaans speakers, did switch to Afrikaans at times. One of the students complained about this saying that the people would sometimes swop to Afrikaans which he did not understand.

Using English does seem to be a positive move, however. The lecturer tried to make sure that the groups were heterogeneous with respect to language. The lecturer perceived that there was less conflict between the language groups than there had been in previous years.

8.2.5.4 Use of JAD

The students felt that the techniques that they had learnt would be very useful (57,5%), somewhat useful (36,8%) or seldom useful (5,8%) in industry. Table B.11 shows the differences between these values from the previous year.

It is interesting to see that there was a huge difference from the previous year. It is difficult to speculate as to what made the difference. One of the factors that came out in the open-ended questions that may have influenced the answer to this question was that the students were more aware of the group skills and how they are used in industry. This led them to make comments on the usefulness of the group skills learned rather than the modelling techniques only. They mentioned how it helped them to develop their listening, communication and group skills that would be useful in industry. The students also mentioned that it was useful for systems analysis and design and that it would help them to actively involve the users.

One of the students made the following statement which possibly sums up what the lecturer was trying to achieve: *"From the examples done in class you gain a good understanding of techniques and when you understand the techniques, you realize the usefulness of those techniques."*

The students were once again asked why they felt that the JAD techniques had been used in the classroom. The students mentioned that it helped them to get used to what happens in industry, taught them to work in groups, helped them to understand what they were learning, gave them JAD skills, helped them to interact with others, improved their communication skills and helped them gain confidence in themselves. More students made positive comments, especially about the group skills, than in the previous case study. This is probably because these skills were emphasized and because they had to evaluate themselves with respect to those skills.

The JAD method of learning was chosen as a method of choice by 76,2% of the students, with 8,3% feeling that they would rather do more traditional group work and 15,5% feeling that they would rather learn individually. It was interesting to note that some of the students got together in classrooms before exams and worked in the JAD method while learning for exams.

8.2.6 An overview of group questionnaire and observation results - Case study 2

The groups had been asked to evaluate their functioning as a group after the first and third (last) JAD session. The table with the results is given in Table B.1 in Appendix B.2.2 of the thesis. An independent observer was also asked to fill in the questionnaire for the groups that she observed during the third JAD session. She also commented on each of the groups she observed. These results can be found in Table B.2 in Appendix B.2.2. A more detailed version of the observer's comments can also be found in Appendix B.2.2.

As the students were only involved in three JAD sessions and were tested after the first one and after the third, no really significant improvements were expected. There were, however, significant shifts in seven of the variables. These rows have been shaded in Table B.1. It would seem that the group members were better at making sure that the objectives were clear to everyone, that the groups were more sensitive to one another's feelings and that they were better at handling conflict. The groups also seemed to be able to structure the lesson more effectively and finish in time. The students also perceived an improvement in their facilitation skills, their ability to ask questions in order to clarify points and their ability to make sense of what the group was telling them. There were no other significant changes.

The observer observed four groups and found problems with some of the students trying to dominate in three of the groups. She also found problems with the participation of the African members of the three of the groups. In two of these groups, she found that the African student did not participate themselves, although one of the students was an A-aggregate student, and with the third she found that the African student was not treated as being of equal status although he did try to participate. One of the groups that she observed also had problems with the female members dominating and the males sitting back and only participating every now and then. Details can be found in Appendix B.2.2.

8.2.7 Assessment of students learning - Case Study 2

The students were given a test of their knowledge of Use Cases before the JAD sessions were held and the examination question served as a post-test. The three Information Systems II lecturers were satisfied that the questions were of the same standard. This was not done for the ER diagrams although more time was spent on these as the question in the examination was much more difficult than that of the test.

It must be remembered that no effort was made to stop the students from doing any extra studying of their own as this was felt to be unethical and not in line with the attempt to

study the topic in context. The results from the t-test are given in Table B.3 in Appendix B.2.3. It is debatable as to whether these statistical results can be considered to be relevant, even though the p-value was highly significant (p = 2.86E-09), as no effort was made to stop the students learning from any other method. The graph for the regression analysis is given in Figure B.1 in Appendix B.2.3 and also shows a significant improvement in the marks. The black line is drawn to show where the dots would be situated if the students achieved the same marks in the pre- and post-tests. Those above the black line improved their marks and those below the black line did worse in the post test than the pre-test.

A cross-tabulation of the students' results, as shown in Table 8.3, is also interesting. This table shows the students' results during the pre-test and their corresponding results in the post-test. The table shows that 3 students had between 0 and 49% in the pre-test and stayed between 0 and 49%. Two of the students with between 0 and 49% went up to the 50-64% range and another 2 went up to the 65-79% range. There were 17 students who moved from the 65 to 74% range to the 80 to 100% range and 13 students who moved from the 50 to 64% range to the 80 to 100% range.

	POST-TEST				
PRE-TEST	0-49%	50-64%	65-79%	80-100%	Total
0-49%	3	2	2	0	7
50-64%	2	4	9	13	28
65-79%	0	2	19	17	38
80-100%	0	0	8	32	40
Total	5	8	38	62	113

Table 8.3: Cross-tabulation of pre- and post-test results - Case Study 2

In total 43 student improved their mark categories and 12 dropped. (Eight of those 12 dropping from the 80 to 100 % category to the 65 to 74% category.) It would seem that the method is especially effective for those students whose grades were in the middle categories.

8.2.8 Reflections on Case Study 2

There would seem to be an improvement in the students' participation when comparing this case study to the previous one. Group cohesion also seems to have improved with students feeling more accepted within their groups. The teaching of group skills before the time seems to have been effective in allowing students to be aware of what should happen in groups, how to come to decisions in groups and various other aspects of group dynamics. The division of the material also seems to have been effective in making students more accountable and "forcing" students who may otherwise have been quiet, to participate.

Another positive aspect was that the groups were more heterogeneous and this seemed to help solve the problem of students feeling like there were "cliques" within the groups and that they were left out. There were, however, still problems with perceptions of low status of some of the minority groups with eight of the thirteen Xhosa speakers saying that they did not like it when their contributions were ignored. It is possible that the students should be made more aware of their tendencies towards bias and stereotyping.

The JAD groups also seemed to be effective in helping the students to learn, although as no control groups were present, it is difficult to make that statement with any certainty. The increase in the marks was seen to be highly significant when analysed statistically.

The group activity questionnaires from after the first and third sessions, seemed to indicate that there was some improvement over the three weeks in the way that the groups operated. One of the aspects that needs to be looked at, however, is the tendency of some students to dominate within the groups. One of the roles that Johnson, Johnson and Smith [1991] suggest for group learning is that of an observer who observes the group and indicates if they find any problems in the group processing. It may be a good idea to try using a student observer in the next case study.

This ended the second cycle of the research although the framework and method were not changed before doing Case Study 3. It was decided to do a third case study using almost exclusively Xhosa-speaking students at the Border Technikon, another tertiary institution in the Eastern Cape. This would enable us to see if the problems were from the Xhosa-speakers culture, or whether the problems they experienced were caused by the heterogeneous nature of the groups.

8.3 USING JAD AND CO-OPERATIVE LEARNING: CASE STUDY 3

The third case study was done during the second semester of 1999 at the Border Technikon. The Border Technikon has its main campus in Pottsdam, with satellite campuses, situated in East London and Bisho. Border Technikon was set up during the apartheid era as a Technikon for Africans only. The Bisho and Pottsdam campuses are situated in what was then the Ciskei. Although the Technikon is now accepting students from all culture groups, the student population remains almost exclusively black. Most of these students come from schools in disadvantaged areas and their exposure to technology has been limited. Information Technology is taught at the Main campus and the East London campus. The study was done with the Third year IT students as JAD was part of their syllabus and their lecturers felt that they would be able to handle the questions at that level.

The framework was not modified between the second and third case studies although the method did have to be changed a little due to the researcher only being there for a week and not knowing the students. The students were also only given the questionnaire on the group interaction at the end of the first session and the main questionnaire at the end of the second. This was due to time constraints. The group questionnaire was thus used to help the students determine what problems they were having as a group, rather than as an analysis tool. On overview of the results of the research through to the third case study was presented in Thomas and de Villiers [2000b].

8.3.1 Preparatory group skills awareness - Case Study 3

The researcher went to Border Technikon for one week to work with the students. During this time two classes were held with each group, each class being approximately 2 hours long. The students had covered lectures on meetings and how to set up meetings in the previous year and one of the Border Technikon lecturers did the lesson on Group Dynamics and setting up group norms with the students before the time.

The first lecture included a half hour lecture on the JAD process, JAD participants and facilitating a JAD session. The students then went directly into the JAD session.

8.3.2 Running the JAD sessions - Case Study 3

8.3.2.1 The nature of the material used

The material used was the same as for the Port Elizabeth Technikon students. Only two scenarios were used, one in each session. The students were given the material and given different roles to play in the session as had been done for Case Study 2.

8.3.2.2 The composition of the groups

As the author did not know the students, the method used to divide them into groups was fairly simple. The group in Pottsdam, for example, needed to be divided into seven groups with approximately seven students in a group. The lecturer counted the students from 1 to 7 and put all the 1's into a group, all the 2's into a group etc. This split people who were sitting near each other in order to prevent "cliques" being formed. The groups seemed to be fairly heterogeneous with respect to their abilities. There were many more females than males which meant that some of the groups was almost exclusively female. As almost all of the students were Xhosa speaking, getting the different languages into the different groups was not an issue.

8.3.2.3 Layout of the classroom

There were seven groups in Pottsdam and four groups in East London. Two of the groups used the white boards that were across the front of the classroom and the others used flipchart boards or used flipchart paper that had been stuck to the walls of the classroom. The students did not seem to have too much of a problem using the paper although they usually had to do a rewrite at least once during the session.

8.3.2.4 The JAD process

The method used was the same as for Case Study 2.

8.3.2.5 Assessment

The groups assessed themselves after the first session using the questionnaire in Appendix A.5. This questionnaire was also used by the observer who sat in the classes in East London. The lecturer went through the questionnaire after the first session and prepared a feedback sheet for the students on what they could improve in the following session.

The lecturer went through each groups' solution at the end of the session but no marks were allocated for the solution. Their knowledge of JAD and of ER diagrams would be evaluated in the examination.

8.3.3 An overview of results of the main questionnaire - Case study 3

The students were given a questionnaire with both open and closed questions. The questionnaire was an adaption of the one used in Case Study 2 and can be found in Appendix A.3. In total 61 students completed the questionnaire. The qualitative results from the open-ended questions are given in detail along with the qualitative results in

Appendix B.3. Where students' exact words are used, there may be some grammar errors as English was often the students' second or third language.

There were 22 students at the East London campus (36,1%) and 39 at the Main campus (63,9%) who filled in the questionnaire. The students were mostly Xhosa speakers (91,8%) with a further 4,9% speaking other African languages and only 3,3% speaking English. There were many more females than males in the classes with 78,7% females and 21,3% males. The students were all African (96,8%) except for one coloured student (1,6%) and one Asian student (1,6%) at the East London campus. The results are tabulated in Table B.7.

8.3.3.1 Working in groups

The students were asked the same questions about working in groups as the students in Case Study 2 had been asked. Overall the students were extremely positive about doing the group work in the form of the JAD sessions. The students at Border Technikon cannot be considered to be the same as those from Port Elizabeth Technikon, as they have different backgrounds in terms of their schooling and their tertiary experiences. Although the students were asked to answer the questions truthfully, it must be considered that the students, were perhaps more inclined to answer in a positive way as the lecturer was visiting their campus. The atmosphere in the classroom was very good, however and it seemed as if most, if not all, of the students were participating and enjoying the experience.

Table B.8 gives some indication of the percentages from the four case studies with respect to the students' group experiences.

Most of the students (61,4%) felt that they always enjoyed working in the JAD groups, with 29,8% enjoying it most of the time, 7% enjoying it seldom and 1,8% never enjoying it. Students mentioned how it helped them to hear other people's ideas and to interact

with other people. They also said that it helped them understand better and get a better solution. Three people mentioned that it helped them to have someone criticize their ideas, which is a comment that had not been made by the students at Port Elizabeth. This idea that they found it useful having someone pointing out where they went wrong was expressed in some of the answers to other questions too. A comment of interest by an individual was the person who said: "*I was able to participate which is something that I am not used to.*"

Although some of the students mentioned that they disliked it when people did not contribute, this comment was only made by six students. Something that they also disliked was conflict. One person commented on the problem of people who just agreed with everything. This seems to have been a larger problem than in the previous case studies as will be seen by the answer to the question on the contribution of others. Another individual comment was from a student who said that he disliked it *"when the group proceeded when everyone did not understand."*

Seventy percent of the students felt that they were always able to have their say in their groups with 30% feeling that they were able to have their say most of the time. It would seem that the Xhosa speakers do not have a problem with having their say if they are in homogeneous groups with other Xhosa speakers. Only one person made a negative comment in this section and that person felt that some of the facilitators tried to dominate the session.

This is reflected in the students' answers about their own contribution to the groups. Sixty-five percent felt that they always contributed with the remainder (35%) feeling that they contributed most of the time. Even the students in the groups which had to use English as their language of communication did not have difficulties in getting everyone to participate. This would support the idea that it is the groups with students from heterogeneous cultures at the Port Elizabeth Technikon that are causing the problem and not their inherent Xhosa culture. Students said that the others took notice of their input and that their ideas were often used by the group. Some of the individual

comments are interesting. One student wrote: "*Everytime that comes discussions, I participate very much so that I can know my own mistakes and give my views to the group.*" Another commented: "*I had to support my ideas and did not undermine others intelligence so we were all equal.*", while yet another said: "*I actually felt good about myself because it is something that I am not used to.*"

The students also felt that the other members of the group were contributing. There were 55,2% who felt that other people always contributed against a maximum of 17,4% in the previous two case studies. The groups seemed to be able to get everyone to participate and contribute far better than had been the case in the previous case studies although six of the students again mentioned the problem of some people just agreeing to everything. Comments by individuals included: "*They had to (contribute). The session was very interesting for anyone to keep quiet.*" (Brackets provided.) Another said: "*When we were having a problem, for example, someone takes time to understand what we are saying, we tried all ways to make her understand.*"

A very high percentage of students felt that they were always accepted (88,3%) with the remainder feeling like they were mostly accepted (11,7%). The students felt that the others listened to them and that the atmosphere was friendly. There were quite a lot of interesting comments made by individuals. Some of the comments included: "*I felt shy initially but ultimately I felt free.*", "*I was not with my friends but after JAD we were all laughing and no one was classified as 'stupid'*", "*Nobody showed any disapproval*", "*I never felt inferior or stupid. I always felt my contribution was worthwhile*", "*Their faces meant it. There was not anyone who was shy or uncomfortable.*", "*Not once did I feel shy or lost.*" and one merely said "*Yes, yes, yes.*" It is interesting how many of these comments are about how they did not feel stupid or disapproved of. Perhaps the students' fear of appearing 'stupid' or 'inferior' is why they have difficulty contributing in the mixed groups.

8.3.3.2 Learning in groups

Table B.9 gives an indication of the quantitative results of the students' perceptions of what they had learnt during the third case study. The comments made by the students can be found in Appendix B.3.1.2.

An overwhelming 91,4% of the students felt that they had learnt a lot during the JAD sessions. Another 6,9% felt that they already knew the techniques with only 1,7% feeling that they had only learnt a little. These high percentages were also reflected in their feelings about how much they had learnt about being confident to act within a group. A very high percentage (82,1%) felt that they felt much more confident about how to act within a group, 14,3% felt that they already had this skill and another 3,6% felt that they had learnt a little. A number of students commented on how they initially felt shy but now feel that they can share their ideas. There were quite a few interesting individual comments. Some of these are listed here: "*Normally I do not contribute in class but this time I did.*", "*It is difficult to start talking among strangers but this helped me see that in order to do work, you must forget other things like what other people think.*", "*When I worked in groups before, I used to be shy or find that my ideas were not used because I would not say them out loud.*" and "*I am a shy person but today I learn that there's nothing one can do with shyness and be confident about yourself.*"

The percentage of people who felt that they had learnt a lot about interacting with others was 77,8%. Another 16,7% felt that they already had the skills, with 5,6% feeling that they had learnt a little.

There were 72,4% of the students who felt that they had learnt a lot about speaking in front of others from this exercise. Another 3,5% felt that they had learnt a little and 24,1% felt that they already had this skill. Once again the main comment made by the students was that they were shy but now felt more confident about speaking in front of people.

Some of the ways in which the students expressed this sentiment were quite interesting. One said: "*At first my voice was shaky and I spoke so fast, but in the end I was confident of what I was doing.*" Another found that it was "*Difficult at first but JAD allows you to ask other members so that the attention is not always on you.*" The third one put it in quite an interesting way. He/she said: "*I am usually afraid to be seen by those eyes looking at me but today I am not afraid of those eyes.*" This comment is interesting as Xhosas consider it respectful to look down when they talk to one another, unlike the European culture where it is considered a good communication medium to look someone in the eye.

8.3.3.3 Facilitation and language

The students enjoyed being the facilitator with 70,7% enjoying it all the time, 25,9% enjoying it mostly and 3,4% enjoying it seldom. The answers to the open-ended questions can be found in B.3.1.3 and the table with the quantitative results in Table B.10 in Appendix B.5. The students said that being the facilitator helped them to learn how to speak in front of others, that they liked having control and getting others to work together towards a solution. They also liked hearing other people's ideas. When asked what they disliked, nine people said "Nothing" and six said they disliked people who did not contribute. One person wrote that they disliked: "*Not being able to contribute yourself because you must give others a chance.*". Another put this in a different way, saying: *"Writing others views when I had my own right ones."* This is obviously a problem for the brighter student although it is usual for the student facilitator to give their opinions even if they are the facilitator.

The groups were informed that they should check what language everyone in their group understood and that they could use any language that was understood by all their group members. The answer on the board had to be in English, however. At the Main campus in Potsdam, most of the groups used Xhosa with a sprinkling of English. In East London, there were some students who did not understand Xhosa which meant that English was

used in some of the groups. They would sometimes switch to Xhosa to explain something to one another and would then switch back to English again later. The scenario was also given to them in English. This seemed to suit these students well as can be seen by their participation and feelings of acceptance in the group.

It was interesting to note the students' answers to this question as the perception of the lecturer had been that most of the groups at the Main campus were using Xhosa almost exclusively and that two of the four groups at the East London campus were also using Xhosa most of the time. The students would speak in Xhosa and would put in the English terminology for things like "entity" or for some of the terminology used in the scenario. They would, for example, use English for terms like "member" in the library. The observer confirmed this for the East London groups. Only 30,4% of the students felt that they could use their home language all the time, 35,7% felt that they used their home language mostly with 21,4% saying that they could seldom use their home language and 12,5% that they never used their home language. The 12,5% (7 students) and some of the 21,4% (12 students) could be accounted for by the two East London groups which had five to six students each.

After the quantitative question, the students were asked: "*If you were not able to communicate in your home language, mention the language that was used in your group and describe your experiences using that language.*"

Twenty-two of the students said that English was used in their group and 6 said that a mixture of Xhosa and English was used. Only six of the students commented on their having to use English and these said that it was good to use English as they would one day have to use it in industry and that it was an international language.

8.3.3.4 Use of JAD

The modelling techniques were felt to be useful in industry by 77% of the students and

somewhat useful by 21,3%. Only 1,7% felt that the techniques would seldom be of use to them in industry. The quantitative results are in Table B.11 and the comments can be found in Appendix B.3.1.4.

The students were also asked about the use of JAD in the classroom. They said, among other things, that it was used to improve their communication, help them gain confidence, help them to work in groups and to know what happens in industry.

The students were overwhelmingly in favour of using the JAD techniques for learning with 86% favouring JAD over conventional group work (7%) and working individually (7%).

8.3.4 Overview of group questionnaires and observations of the groups - Case Study 3

The group questionnaire was only administered at the end of the first day and was used to help the groups determine any problems that they had been having in their groups. It was also used by the observer who added her comments to the questionnaire. The table showing these results is in Table B.4 and the detail of the observer's comments can be found in Appendix B.3.2.

On the whole the groups seemed to work well together. One of the problem areas seemed to be that the groups were not sensitive to the feelings of the other members of the group. There also seemed to be a bit of a problem with the ability of the facilitator to take the discussions of the various group members and make sense of them on the board. The groups' ability to discuss differences and handle conflict also could be improved.

The observer found differences in every group. In the first group, the first facilitator tried to dominate the group and it took some time, and a change of facilitator, before the

group relaxed and were able to be productive. The second group was made up of some very strong personalities and the lecturer had to remind them a few times to listen to one another and respect one another's ideas. By the time the observer saw the group, they too had settled down and were working well together. They did not really support one another as a group, however. The observer found that the third group was very open and relaxed with each other and, although they had had a problem with handling of conflict during the first day, were able to overcome this on the second. The last group that the observer observed had a couple of students who were very quiet and, despite the best efforts of the facilitator, did not really contribute. There seems to have been quite a difference in the groups. It may be that the method of almost "randomly" assigning people to groups using the counting method did not get a very good balance in the groups.

8.3.5 Reflections on Case Study 3

The students worked very well together and were enthusiastic about the method. This is also indicated by the 86% who said that they preferred JAD over conventional group work or individual work. Although the classroom had not been set up for JAD sessions, the sessions were still successful. The students who had to use flip chart paper on the walls did not have too much difficulty and usually only needed one rewrite during a session. The lecturer was also able to monitor seven groups in one classroom which is quite difficult with conventional group work. The classroom itself was quite big so the groups were able to meet without influencing each other too much.

The results would tend to confirm the belief that the Xhosa-speaking students do not find difficulties in participating and getting involved in the group when they are among other Xhosa speakers - even when they are speaking in English. The problem seems to come from the diversity of the groups found in Port Elizabeth. This diversity seems to contribute to making the students shy to participate or causing some students to dominate the sessions more than others.

This ends the next cycle of the research and completes the pink block of the research approach given in Figure 1.1. The learning environment was planned and a theoretical framework developed before Case Study 2. This was then implemented in Case Study 2, the results studied and a further Case Study done and reflected upon.

It was felt that it was important to continue with heterogeneous groups in Port Elizabeth in order to give the students the experiences of working with students different from themselves. This meant that the problem of diversity and how to handle diversity within the classroom and for group work needed to be investigated.

8.4 IMPLEMENTING IDEAS FOR HANDLING DIVERSITY: CASE STUDY 4

Case Study 4 was done in 2000 at the Port Elizabeth Technikon with second year Information Technology students. During this case study some of the techniques for dealing with diversity in the classroom were investigated and incorporated into the learning environment. The results from the questionnaires can be found in Appendix B.4 and B.5.

Techniques for dealing with diversity and dealing with diversity in group work were discussed in Section 5.4 and Section 5.5 respectively. Many of these methods were already evident in the method of using JAD and co-operative learning used in the previous case studies but some ideas were found to enhance the method for the diverse classroom. Thomas and de Villiers [2000c] has been accepted for publication and describes some of these methods and their implementation within the JAD sessions.

8.4.1 Methods of dealing with diversity already in the learning environment

The JAD and co-operative learning environment offered an opportunity for students of different cultures, classes, ethnic groups, ages, sex and learning styles to interact with

one another. The students were given an indication of how they would need to practise their profession in a multicultural setting. The role and rationale for each activity, together with the learning objectives were discussed with the students.

The material for the case studies had been chosen to be appropriate to the diverse student body by using such diverse examples as a health club and a free clinic. Part of the material was given to the different students so that they were forced to co-operate with one another in order to get the end result.

Research has shown that contact with other groups reduces prejudice and stereotyping especially when it occurs in informal settings with people of the same social and economic status [Visser, Cleaver & Schoeman, 1999]. Getting groups of the same social and economic status is impossible in the learning situation at Port Elizabeth Technikon and one of the aims was to get the students to work with people who were different to themselves. Contact theory supports the idea of working in small groups that are structured to promote contact. This was done by combining the techniques of JAD with the co-operative learning techniques.

During the second case study, the lecturer had chosen the groups to be of mixed ability, gender, race and experience. The size of the group was also related to the task given and kept to less than nine. Further suggestions on the creation of groups were incorporated into the method and are discussed in the following section.

The students were the source of power in the classroom, acting as facilitators, scribes, users and IT personnel. They were able to work without excessive interference by the lecturer. The roles that were assigned to the students were rotated and were not based on stereotypes of gender or race. Each of the students had a chance to play the role of facilitator and act as the leader of the group.

Group skills and group function skills were also taught to the students during Case Studies 2 and 3. Workshops on communication, decision making and conflict handling

within groups were held. Each group set up its own norms for group functioning although the lecturer did monitor the groups.

Each of the aspects mentioned above had been suggested as methods of working with diverse students. The next section describes how the learning environment was further enhanced in order to enhance the learning experiences of the diverse student groups.

8.4.2 Modifications to the learning environment for catering for diversity

8.4.2.1 Assertiveness training

One of the problems found was that some students tend to be passive and do not participate, whilst others are aggressive and try to dominate the session. It was decided to give the students some insight into what it means to be assertive and techniques that they could use to improve their assertiveness.

An assertive person was defined as having respect for themselves as well as for others. The assertiveness training was done before any of the other workshops by the Student Counselling Department at the Port Elizabeth Technikon.

8.4.2.2 Multicultural skills training

There is some debate in the literature as to whether students should be given explicit instruction about one another's culture or not. Some authors [Bodibe, 1997; Koger, 1995] feel that students should be given such classes. Others like Goduka [1996] and Miller and Harrington [1990] argue that one should avoid a "tourist" view of another's culture as this makes students more aware of in- and out-group activities.

A middle road was chosen for this study. No specific instruction on different cultures was given, but while the students were doing their workshops on communications and group

processing, special problems caused by diversity were highlighted. Problems that the lecturer, herself, had experienced when trying to converse in a second language were described, for example. Another example of communication differences discussed was how the Xhosa- and English-speaking students use a different type of body language with regard to eye contact. The idea of respecting one another's viewpoint and listening with empathy to a speaker was emphasized. This was also emphasised in the assertiveness training, as acting assertively was seen as a means of improving communication and interaction with others.

The lecturer also made sure that examples and case studies used with the students in the entire course were more suited to the diverse student body. For example, most of her notes and examples used English, male names and some of these were modified to reflect Xhosa and Afrikaans names as well as names of females.

8.4.2.3 Determining the groups

The students were once again put into heterogeneous groups by the lecturer. These groups were heterogeneous with respect to their knowledge of the business areas and their academic abilities.

Although there is some literature to suggest that single language groups are more effective, there is some debate on the issue. As mentioned before, one of the aims was to get the students to work effectively with people who were different from themselves, so single language groups were inappropriate. It was decided, however to take the advice of Rosser [1998] who suggests that minority students should not be placed on their own in a group. She suggests making sure that there are at least two people of each minority in a group even if some groups then have no minority students. This was done and, although the groups were as heterogeneous as possible, no group had only one Xhosa, English or Afrikaans speaker or one female, even if this meant that some groups had no females or Xhosa speakers in their group.

8.4.2.4 Fostering group cohesion

Both the students and the lecturer often had problems learning the students' names. This was especially difficult with the Xhosa names as these contained clicks which are often difficult to pronounce. The students were given name tags to wear in the initial sessions and were asked to make sure that they all learnt one another's names, including the pronunciation. As name tags are quite common in JAD sessions, it was put to the students as a method that might be used in industry. In the later sessions they wrote their names on the board to make sure that they could remember them. This was unnecessary by the last session as they had learnt to know one another.

A group identity had been achieved to a large degree in the previous case studies. The only difference in this case study was that the group was asked to give themselves a name. This helped to promote initial discussion among the group as well as giving them identity as a group.

8.4.2.5 Monitoring the group activity

Rosser [1998] suggests that the students should monitor the roles that each of the group members plays. One of the roles suggested by Johnson, Johnson and Smith [1991] for a co-operative learning session, is the role of an observer. This role is not used in industry JAD sessions and was not used in the first three case studies. It was decided to let the scribe also act as a student observer to monitor the roles that the students play and the group activity during the fourth case study.

8.4.3 Framework for using JAD and co-operative learning with a diverse student population

The framework in Figure 8.5 was modified to model the changes made to cater for the

diverse student population and this is shown in Figure 8.6. These changes are shown by colouring in the boxes where modifications have taken place in purple.

The lecturer made sure that there were at least two students of a minority in a group, even if this meant that some groups did not have any minority members. Group cohesion was encouraged by letting the groups give themselves a group identity by choosing a

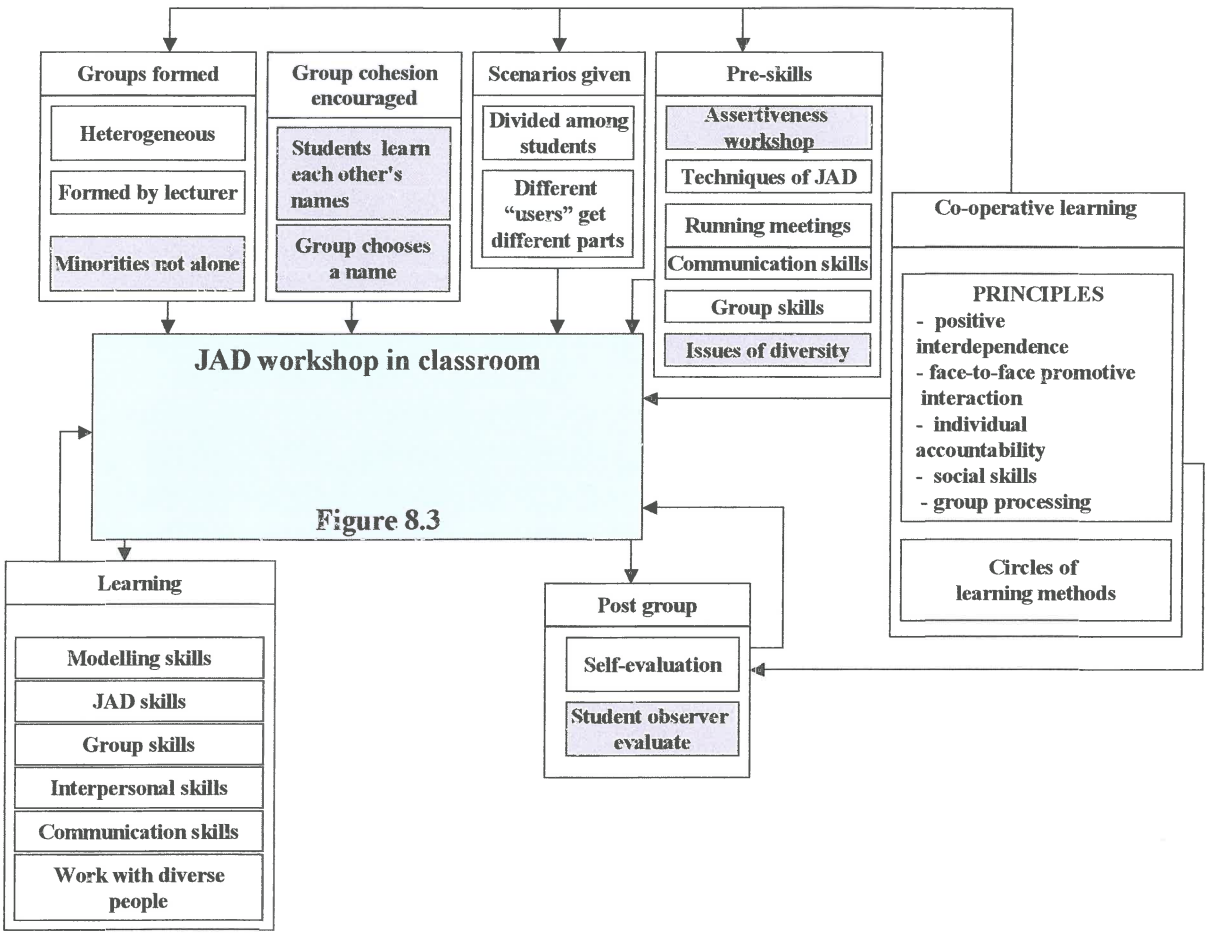


Figure 8.6: Framework for the use of JAD and co-operative learning in a classroom with diverse students

name for themselves. The students were given name tags and asked to learn each other's names during the first group session.

The scribe was also asked to play the role of observer for the group in order to help the group to monitor their own group processing.

Pre-skills training included the learning of how to be assertive rather than aggressive or passive. Issues of diversity and the influence of culture on communication, body language and other aspects were highlighted during the pre-skills training.

8.4.4 An overview of the results of Case Study 4

The students were divided into two streams, namely a Business-oriented stream (40,2%) and a Technically-oriented stream (59,8%). This was the first year that there had been more Technical students than Business students. The Business students were divided into two class groups and the Technical students were also divided into two class groups. The tables with the percentages for the composition of the groups can be found in Table B.7 in Appendix B.5.

The classes were once again made up of different language groups, namely English (44,4%), Afrikaans (30,8%) and Xhosa (21,4%). There were four students (3,4%) who came from other language groups and these were all languages spoken by Africans in South Africa, for example, South Sotho or Zulu. The spread of languages was more even than it had been in the previous years. There were many more speakers of Xhosa and other African languages than there had been in the past.

There were approximately twice as many males (66,7%) as females (33,3%) overall. The Business class was fairly evenly distributed - 53,2% males and 46,8% females, but the Technical class had 75,7% males and 24,3% females. There were more females in the classes than there had been in previous years, however.

The students came from all the race groups in the Eastern Cape region of South Africa. There were 26,1% who were African, 10,4% Coloureds, 60% White and 3,5% Asians. Although Whites formed the major composition of each class - 58,7% in the case of Business and 60,9% in the case of Technical, the black students together formed 41,3% of the Business class and 39,1% of the Technical class. The Technical class, in

particular, had many more black students than in previous years.

In previous years, the JAD sessions had been done as part of the Information Systems 2 (IS2) course. This meant that everyone who was doing the course had done the modelling techniques and were at more or less the same level. During 2000 the Technikon decided to add a module specifically for teaching the softer skills like communication and group skills needed by IT students. The course is called Business Skills. The JAD workshops were moved to this course.

This meant that, although there were many students who were busy with IS2 (78,6%), there were also a few who were not. Those busy with IS1 were students who had failed Information Systems 1 in the previous year. There were only 4,3% in this category. Those finished with IS2 (3,4%) had passed the course the previous year and were busy with Information Systems 3. The majority of those not doing IS2 fell into the last category (13,7%). They had finished IS1 but had not yet started IS2. The Technikon has an academic support program where students who do not quite have the grades to do the normal course, generally those coming from disadvantaged backgrounds, are given the opportunity to do the course over four years. In the first year, they do two of the main stream subjects, one of which is Information Systems I. They also do courses in Study Methods, Commercial Calculations and English. In their second year, the students do the new Business Skills module but do not do Information Systems 2 until the following year.

This difference in the students' knowledge of the modelling techniques was naturally a source of concern. The students do a very brief introduction to ER diagrams in their first year but have no knowledge of Use Case diagrams. The lecturer gave them one lecture on Use Case diagrams so that they at least knew what they were. No extra lessons were given on ER diagrams. Throughout the discussion of the open-ended questionnaires, one will see some of the comments made by these students about their learning and interaction, given this problem.

As mentioned before, the students were placed into heterogeneous groups but there was never fewer than two people of any minority in a group. This included the academic development students who were also placed with at least two of them to a group.

8.4.4.1 Working in groups

A comparison is done with the second case study and not the third, as the third case study was done at Border Technikon. This comparison allows us to look at the differences that took place at the Port Elizabeth Technikon between 1999 and 2000. Although Case Study 2 and Case Study 4 were done with second year students at the Port Elizabeth Technikon in consecutive years, the students cannot be considered equal in every respect, especially as some of the students were not doing Information Systems 2 in the year 2000. This should be kept in mind when discussing these results. The categorization of the answers to the open-ended questions can be found in Appendix B.4.1.1 and the quantitative results in the Table B.8 in Appendix B.5.

There were 26,5% of the students who always enjoyed the JAD sessions. Another 65% enjoyed it most of the time, giving a total of 91,5%. There were 8,5% of the students who seldom enjoyed the sessions. These values are not much different from those achieved in the first and second case studies.

The students mostly enjoyed hearing other people's ideas, working as a team and having the opportunity to share their ideas, interact with other people and working together to achieve the goal. Other factors mentioned were the friendliness, the debate with others and the way in which the JAD sessions improved their understanding.

There were many more positive comments than had been expressed in any of the previous case studies which was good to see. Some of the group members made interesting comments. One said that they enjoyed "*when we were all patient with one another and accepted each other as one.*" Another Afrikaans speaking student said that

they enjoyed "*working with different races, people with different backgrounds. I learnt a lot about the way people think and about them.*"

The main negative comments were about people who did not contribute, closely followed by those who took over and dominated the group and people who had private conversations.

In the previous year in Case Study 2, the second most used comment was that people did not take the person's ideas into consideration. This had been mentioned by 10 people, 8 of whom were Xhosa speakers and was one of the indications that there was a problem with the Xhosa speaking students in the diverse group. The number of students experiencing this problem in Case Study 4 went down to 4, and of those 1 was English, 1 was Afrikaans and 2 were Xhosa.

There was one Xhosa-speaking student who complained that "*some of the guys speaks only to their race group sometimes - not all the time.*" One of the students who was not doing IS2 experienced it differently, however, stating that "*I don't really know any of the second years so I felt a bit uncomfortable at first and was afraid to speak out but everyone was friendly and helpful*". The problem of some of the students not doing IS2 was obviously a difficulty for some of the students, however, as indicated by the three students who said that they disliked the fact that some students did not know the techniques.

Most of the students felt that they were always (52,1%) able to have their say or that they were mostly (44,4%) able to have their say. Only 2,6% felt that they were seldom able to have their say with 0,9% feeling that they were never able to have their say. There was a distinct improvement in this from Case Study 2. The people who felt that they were always able to have their say went up from 40,7% to 52,1%. If one considers that in Case Study 1, this figure had only been 28,4%, then there has been a very big improvement in this area. (Although the question was modified a bit between the first

and second case studies.) The people who felt like they seldom or never had their say, went down from 8,1% in the second case study to a 3,5% combined value in the fourth case study.

The students showed in the open-ended part of the question that they felt that everyone was able to have his or her opinions taken into consideration and that the facilitators tried to accommodate everyone and give them a chance to speak if they wanted to. Some of the facilitators still had difficulties, however. Some of those mentioned were difficulties in that they only listened to some of the people, were unable to control the group and allowed some to dominate.

There were no students who mentioned that their ideas were ignored, although one Xhosa-speaking student did mention that "*because my group members were so active, sometimes you just feel to hold back until the facilitator gives you a chance.*" One of the students who was not doing IS2 said: "*I did not have a lot to say, but they did listen to me and when I was wrong, they explained it to me what was wrong about what I said.*"

Almost all the students (96,5%) felt that they were always (49,5%) or most of the time (47%) able to contribute to the group. Only 3,5% felt that they were seldom able to contribute. There was a rise of 4,8% from the previous year in those who felt that they were always able to contribute. From the first case study to the fourth, the improvement was 27,9%, which seems to indicate that the adding of the co-operative learning methods and the diversity methods were successful in this aspect with the co-operative learning methods being most important. Those who seldom felt that they were able to contribute went down from 7,1% in 1999 to 3,5% in 2000.

Quite a lot of the students felt that people listened to their ideas and that these ideas were often used by their groups. Others said that they spoke when they thought it was necessary. The comments were generally positive. Two of the three people who said that they sometimes did not understand the work were students not doing IS2. One of the English-speaking, coloured students mentioned that he tried to contribute but was not

taken notice of. One of the brighter students said "*No offense to the rest of the group, but sometimes I know I'm right. Even after explaining, the decision is made and it is the wrong one.*"

Contributions by others did not improve much from 1999 to 2000. The people who said that they felt that others always contributed was 17,2% compared to 17,4% in the previous year. Those who felt that others contributed most of the time went up from 66,3% to 69,8% and those who felt that they seldom contributed went down from 16,3% to 12,9%. The question of improving this figure further and how to do this would have to be the topic of future research. The co-operative learning techniques did improve the figures from the first to the second case studies but the techniques for handling diversity did not seem to improve the figures much. As 18% of the students had not yet covered the modelling techniques used in the JAD sessions, one might have expected that this figure would have deteriorated in 2000, however. The fact that the figures stayed relatively constant would be cause for some hope that if all the students had been doing IS2, as they had in the past, that the figures would have improved. This is merely speculation, however.

Even more of the students than in previous years commented that some students did not contribute although most of the students did. There were ten students who felt that this was due to some knowing more than others. The fact that ten people mentioned that the problem of non-contribution was due to some people knowing more than others, compared to only one mentioning this in the previous year, would tend to lend credence to the idea that the fact that not all the students were doing IS2 influenced this result.

It was encouraging to note the students' responses to how they felt about being accepted in the group. There were 83,5% who felt that they were always accepted. This increased from 71% in 1999 and 54% in 1998. The remaining 16,5% felt that they were accepted most of the time. None of the students felt that they were seldom or never accepted. In 1999 these figures had been 5,8% for seldom and 1,2% for never. It would seem that the techniques implemented in 2000 for dealing with diversity were particularly

good for letting the students feel accepted within the groups.

This is also shown in the open-ended question results where students mentioned that the atmosphere was friendly and that people listened to them and treated them with respect.

It is interesting to note that there were no negative comments mentioned by more than one person. Some of the negative comments made by individuals were : "*Sometimes it felt like they knew that all your contributions meant nothing at all.*" Another said that some people are narrow-minded about taking suggestions. Some of the interesting comments on the positive side were: "*They accepted me just as I am, did not look for faults or anything.*", "*Nobody was marginalised and everyone spoke and joked about everything.*", *If I did not understand, they would explain to me.*", and "*The group was cool in that every idea was important and used to come to an answer.*".

There were hardly any negative comments and nobody felt that they seldom or never were accepted in the group. This would seem to indicate that a definite improvement had been made in this issue over the three years.

8.4.4.2 Learning in groups

The students were asked questions about whether they perceived that they had learnt through the JAD sessions. They were asked about their learning in general, the group skills learnt, whether they felt they had learnt to interact with others and whether they had learnt to speak in front of other people. The categorisation of the students' comments can be found in Appendix B.4.1.2 and the quantitative results in Table B.9. Table B.9 also contains the quantitative results for the learning across the other case studies for comparison purposes.

As can be seen from the table, the students' perceptions of their learning in general was fairly similar from 1999 to 2000. There was, however, an improvement in the students'

perceptions of their learning to act in groups and to interact with other people. The learning to speak in front of others did not change much either.

Most of the students (63,2%) felt that they learnt a lot. Another 29,8% felt that they learnt a little with 6,1% feeling that they already knew the techniques and 0,9% that they had not learnt anything. These figures changed very little from 1999 despite having students who did not know the techniques very well at all in the class. It is interesting to note that two of the people who said that they learnt only a little said that they already knew the techniques quite well and five said that they knew the techniques quite well but it helped them iron out some problems.

In the open-ended questions, the most common remark was that it helped them to think and understand the work better. Many also commented that it helped to hear other people's opinions and it taught them about group work.

One student mentioned that "*Everyone is forced to pay attention and can see what is being done clearly. If anyone is unsure of something it is usually explained to them".* Another said "*Anything I previously struggled with has been solved and I can now use the techniques that I learnt."* On the negative side, one student said: "*I think it would have helped a lot if I were not in an environment where people tended to ignore others."* Almost all of the comments were positive, however, with only two or three individuals making negative comments.

There were 21,4% who felt that they were already confident about how to act in a group. Those who felt that they learnt a lot amounted to 58,1% with 19,7% feeling that they had learnt a little and 0,9% (1 student) that they had learnt nothing.

The percentage of the students who felt that they had learnt a lot about how to act in a group increased by approximately 10% from 1999 to 2000. It is difficult to know if this can be attributed to the techniques that were implemented to cope with diversity. The idea of acting assertively and having respect for both themselves and their fellow

students was stressed more during 2000 than in previous years. There were seven students who commented that they felt part of the group. No students had said this in previous years. Perhaps the ideas used for helping with diversity helped the students to feel more comfortable, which in turn helped them learn how to act in the group. Both the lecturer and the independent observer felt that the groups' interaction improved over the three lessons.

The students' open-ended answers were similar to the previous year although the idea of feeling part of the group was more prominent in 2000. Students said they felt less intimidated and that although they were shy at first, they now felt more confident.

One student mentioned that *"I actually cared about my group towards the end."*. The idea of respect came through in the answer of another student who said *"A lot of it deals with respect for others and teamwork."*. One student who was obviously confident in their own abilities said: *"I learnt to listen to other people and not always consider what I'm saying right and I learnt to change my mind when their was a need for that."* Another less confident student said: *"You realize that what you think isn't always wrong but is sometimes right."*

It was encouraging to have someone say *"It made me believe in myself always."* Group work is important for IT professionals so it was good to have a student comment: *"I were not a person for working in groups. I hated it and now I am able to do so."*.

The answers to the question were particularly encouraging. The only negative comments were really neutral comments that came from the three students who felt that they were still not confident.

There were 49,6% who felt that they had learnt a lot about interacting with others. Another 27,8% felt that they had learnt a little with 20% feeling that they already knew how to interact and 2,6% feeling that they had not learnt anything.

Comparing this to the previous year, one once again sees that there was a fairly significant increase in this area. Those who felt that they had learnt a lot went from 36% in Case Study 2 to 49,6% in Case Study 4. These increases for the previous question and this one had not really been expected but it would seem that the techniques that helped the students to feel more comfortable working in their groups, also made them feel as if they had learnt more.

Students commented that they learnt to speak freely in front of people. Others said that they met new people and learnt to interact with them. Some mentioned that it taught them to listen to others. It is interesting to note that of the 32 students (27,8%) who said that they had only learnt a little, 11 mentioned that it was because they already knew how to interact with others.

The students' comments were generally positive and there were some interesting comments made by individuals: "*Once I started talking it was much better and it helped me feel confident.", "I usually like to walk alone but during the group sessions I adjusted and it was not so bad.", "I have learnt to be assertive and to question things that I am unsure of. I shall know how to approach a 'quiet' person".* A comment that sounded negative was "*I am generally a recluse (I keep myself to myself). No man is an island but if a man could be an island then it would be me."* Although this sounds negative, the student had marked the block that they had learnt a lot. The only two somewhat negative comments, from students who said that it did not help them at all, were*: "If a person does not know how to speak his mind by now they need a psychiatrist not a JAD session."* and "*Interaction with people comes with everyday social behaviour and cannot be learnt quickly".*

A number of the students mentioned how it helped them to have to interact with people of different races and cultures: *"It helped me understand how to interact with people of different races and cultures.", "I was able to interact with different people in a different language", "It removed my shyness especially to different cultural groups and gender" and "It was good to work with the opposite sex, different races and coming into contact*

with different backgrounds." The first two comments were made by White students and the last two by African students. Although a lot of group work is done at Port Elizabeth Technikon, generally the students are allowed to choose their own groups and they choose within their own language and cultural groups. The students seem to appreciate the opportunity to work with other groups.

The percentage of people who felt that they already knew how to speak in front of other people was 27,2%. Many of the students (42,1%) felt that they had learnt a lot with 29,8% feeling that they had learnt a little and 0,9% that they had learnt nothing. If one considers that those who felt that they already knew about speaking in front of people then the percentages stayed relatively constant from the one year to the next. A change of only about 3 to 4% occurred.

On the positive side, one of the individual comments was: "*I did not have the techniques to speak in front of people but now I can because of the JAD sessions".* On the negative side a student who had answered that they did not feel that it helped at all, said: "*When in a small group you quickly pick up if people are listening to you and value your opinion."*

8.4.4.3 Facilitation and language

The question asked in the case study about being the facilitator was the same as in the previous case studies, namely: How did you experience being the JAD facilitator? The students were then asked to comment on what they enjoyed the most and what they disliked the most about being the JAD facilitator. The results can be found in Appendix B.4.1.3 and Table B.10.

Generally the students seemed to enjoy facilitating all the time (28,7%) or most of the time (55,7%). Only 13,9% enjoyed it seldom and 1,7% did not enjoy it at all. It is interesting to note that there was a shift of 9% from those who enjoyed it most of the time in Case Study 2 to those who enjoyed it all the time in Case Study 4 as shown in Table

B.10.

Students said that they enjoyed having control and getting people to work together towards a solution. It was interesting to note that seven of the students expressed the sentiment that being the JAD facilitator made them feel more part of the group. This feeling had not been expressed in any of the previous case studies.

After the first JAD session, many of the students mentioned to the lecturer that facilitation was more difficult than they had thought. This is expressed by the student who said: "*It is not that easy to always keep people on the right track when standing in front and thinking about everything that must be done*". Other students commented on how the JAD facilitation had helped them to learn different skills: "*Teaches you to respect others and to treat others in a fair minded manner. Sometimes my opinions were not always right*" , "*I enjoyed it because I felt I had a lot to give, but also a lot to learn and I think they are important life skills*" and "*Helped me learn to keep quiet when I needed to listen and write. It was difficult but I enjoyed it.*".

On the negative side the students disliked people talking among themselves and people who did not co-operate. Others did not enjoy talking in front of other people. There were much fewer negative comments than positive.

The problem of the students talking among themselves or having private conversations had not even been mentioned in Case Study 2 and yet was one of the most common problems indicated in this case study. One of the steps that the lecturer took to improve this situation was to tell the students that they should make sure that they were not sitting next to their best friend in the group. In the lectures on JAD it had been mentioned that one should try to mix the users and the IT personnel for two reasons - one was to stop private conversations and another to stop the "us" and "them" mentality of the group. When the observer and lecturer noticed the increase in the private conversations in the groups, this "rule" was stipulated to the students and did seem to help the situation.

They were then asked to comment on their experiences if they were unable to communicate in their home language. The percentage of students speaking English as their home language had dropped from 57,4% in 1999 to 44,4% in 2000. This affected the results for this question as shown in Table B.10.

Only 39,1% were always able to use their home language. Another 13,9% were able to use it part of the time with 17,4% seldom able to use their home language and 29,6% never able to use their home language. There were two groups where that the lecturer noticed that English was not always used in their discussions. The one was a predominantly Xhosa-speaking group where all the students in the group said they understood Xhosa and the other was a group with a number of Afrikaans-speaking students. The latter group agreed among themselves that either English or Afrikaans could be used as they all understood both but some of them felt more comfortable using their home language.

8.4.4.5 Use of JAD

The students were asked about whether they thought the entity-relationship modelling techniques would be useful in industry, as well as why they thought that the JAD techniques had been introduced into the classroom. The question was slightly different from that used in Case Study 2 as it specified the entity-relationship techniques. This question was asked to try to determine if the JAD sessions helped them to see some of the relevance of what they were learning. The categorisation of the results can be found in Appendix B.4.1.4.

The students felt that the techniques would be very useful (53,5%) or somewhat useful (43,9%). Only 2,6% felt that they would seldom be useful with no students feeling that they would not be used at all. These figures did not differ very much from Case Study 2 in the previous year.

The students' comments were similar to the previous year although there were more comments on the modelling improving design of systems and databases.

The students were once again asked why they thought the techniques had been used in the classroom. The learning of how to work in groups was the most prominent idea, closely followed by the idea that it gets the students used to what happens in industry. The ideas of helping with communication and interaction with others was also prominent. There were eight students who felt that it was to get them to know one another better. Improvement of the students' design techniques, group decision making, leadership and confidence were also mentioned by quite a few students. These results were very similar to those of the previous case study although the interpersonal skills development came out more prominently.

One interesting comment made by a Xhosa-speaking male was "*JAD allowed me to speak well with people. It helped me to develop smiley faces in the classroom, thereby making the classroom atmosphere more comfortable.*"

The JAD method was chosen by 72,7% of the students as their preferred method of learning, with conventional group work being chosen by 13,6% of the students and individual work by another 13,6%. These results were fairly similar to what they had been in the previous year. This is only about a four percentage point shift from the students choosing JAD to choosing conventional group work.

8.4.5 Evaluation of group processing - Case Study 4

Appendix B.4.2 includes Table B.5 which gives an indication of the way that the students experienced working in groups after the first session and after the third. The observations of the observer are also given in this part of the appendix.

As there were only three sessions, no great differences were expected and the Mann-

Whitney showed that there was a statistically significant improvement in five of the questions. The first significant factor was in the dominant members being allowed to dominate the group (p-value = 0,038). This was interesting as in the previous year this aspect had actually been worse at time 3 than it was at time 1 (although not significantly so). Another factor that improved significantly was in the facilitator's ability to determine if the members of the group had reached consensus before moving on to the next point (p=0,030). It was good to note that the group members were also more sensitive to the feelings of the other members (p=0,049). As in the previous year the students' ability to structure the session and complete the task on time also improved significantly (p=0,022 and p=0,000 respectively). All the significant shifts of the means were in the right direction. The shifts in the wrong direction were all 0,1 or less.

An independent observer observed four groups during Case Study 4. The observer did not fill in the questionnaire as the previous observers had done, but rather wrote notes on his observations. Detail of the observer's comments can be found in Appendix B.4.2.

Some of the interesting observations that he made concerned the problem of the students, especially in the larger groups, holding private conversations. The groups would form smaller discussion groups instead of discussing the problem together. He found that the placement of the students within the groups affected this. After his observations, we moved the students so that friends did not sit next to one another. This was based on the idea from JAD sessions that you should split users and IT personnel so that they do not hold private conversations.

The observer was able to be in the sessions during the first and the last JAD sessions. He found that the group cohesion had improved and that the students seemed to be more focussed and task oriented. Participation by all was more of a problem in the first session than the last, but still remained a problem in one of the groups. Domination by some also seemed to improve.

8.4.6 Assessment of students' learning - Case Study 4

The students were given a pre-test on the use of use cases and ER diagrams and the examination served as a post-test. The students had completed ER diagrams before the pre-test as it was decided to use these to measure if learning had taken place rather than the use-case diagrams. The students tend to find ER diagrams fairly difficult as is shown by the pre-test average of 50,12%.

Once again, it must be remembered that no effort was made to stop the students from doing any extra studying as this was felt to be unethical and not in line with the attempt to study the method in context. This should be kept in mind when looking at these results. The lecturers felt that the examination question was a bit more difficult than the question that had been used in the pre-test.

As the students' marks could be matched between the pre and post-test, it was possible to do a t-test and a regression analysis of the marks. These results can be found in Appendix B.4.3 in Table B.6.

The scatter plot, shown in Figure B.2 shows that there was a general improvement in marks. The straight, red line shows the line for the regression analysis. The formula for the regression line is post-test% = 44,018 + 2,9639 * pre-test%. The correlation value is r=0,37943. It is possible that the correlation value is a little low (although still significant) because of the big increase in scores for students in the low range.

The black line shows where the students would have lain if their marks had stayed the same for the two tests. Those above the line improved their marks and those below the line did worse. As one can see, the method seems to have been more effective for those in the low to medium range, rather than those whose scores were high to start with. It was especially effective for those whose scores were very low.

This can also be seen in the cross-tabulation of pre and post test results given in Table 8.4. The 0-49% interval used in Case Study 2 was divided into two intervals in this case study as the students marks for the ER diagrams had been much worse than those for the Use Cases. For the same reason the top interval was changed to 75-100.

	POST-TEST					
PRE-TEST	0-29%	30-49%	50-64%	65-74%	75-100%	Total
0-29%	0	8	8	3	2	21
30-49%	1	5	12	5	1	24
50-64%	1	12	14	6	5	38
65-74%	0	1	3	1	5	10
75-100%	0	0	4	5	6	15
Total	2	26	41	20	19	108

Table 8.4: Cross-tabulation of pre- and post-test results - Case Study 4

There were 21 students in the 0-29% interval in the pre-test. All of these students improved their marks: 8 going to the 30-49% interval, 8 to the 50-64% interval, 3 to the 65-74% interval and 2 making it into the 75-100% interval. In the 30-49% pre-test group, one went down, 5 stayed in the same interval and 18 moved up. The improvement in marks does not look quite as good for the higher intervals. In the 50-64% interval, 13 went down, 14 stayed the same and 11 improved. There were 108 students in total. Of these 55 improved at least one interval, 26 stayed in the same interval and 28 went down in their marks. In this case study it seemed that the students who benefited most were those in the lowest ranges.

8.4.7 Reflections on Case Study 4

There did seem to be some improvement from Case Study 2 to Case Study 4. Students felt more accepted within the groups and felt that they were able to contribute more. There was also quite an improvement in their perceptions of what they had learnt about

working in groups and interacting with one another. This is perhaps as a result of their feeling more part of the group.

The assertiveness training also seemed to help and the idea of respecting one another and improving their own self-esteem came through in many of the answers to the open-ended questions.

It would seem from the observations made that a students' place within the group has a part to play in preventing private conversations and improving group cohesion. Students should be asked to make sure that they are not sitting next to their best friend in the group. The motivation given to the students for this was that in JAD workshops one should not have IT and users sitting next to each other in order to prevent private conversations and a feeling of "us" and "them".

Giving the students the role of observer as well as scribe did not work very well in the sessions. The student observers tended to be very positive about what was happening in the groups even though the lecturer and person acting as observer found that there were problems. Using the anonymous post-group self-evaluation questionnaires seemed to be more effective.

There is still some problem with trying to get everyone to contribute, although a large majority of the students said that everyone contributed always or most of the time. This did not seem to improve from Case Study 2 to Case Study 4. One reason for this might have been that some of students were not doing IS2 and it would seem that one should be thankful that the percentages did not go down. Another factor that could be looked at is the size of the group. The smaller groups seemed to encourage participation better than the larger ones.

8.5 CONCLUSION

Chapter 8 has addressed the questions: "*How should lecturers combine the methods of JAD and the methods of co-operative learning in their classrooms?*" and "*How should the framework be designed in order to promote the learning of group skills, interaction skills and modelling skills in a classroom with diverse students?*".

Bringing JAD techniques into the classroom has been an effective way of helping the students to learn about working in groups, interacting with others, speaking in front of small groups and learning the sense-making and argumentation skills needed by IS developers today.

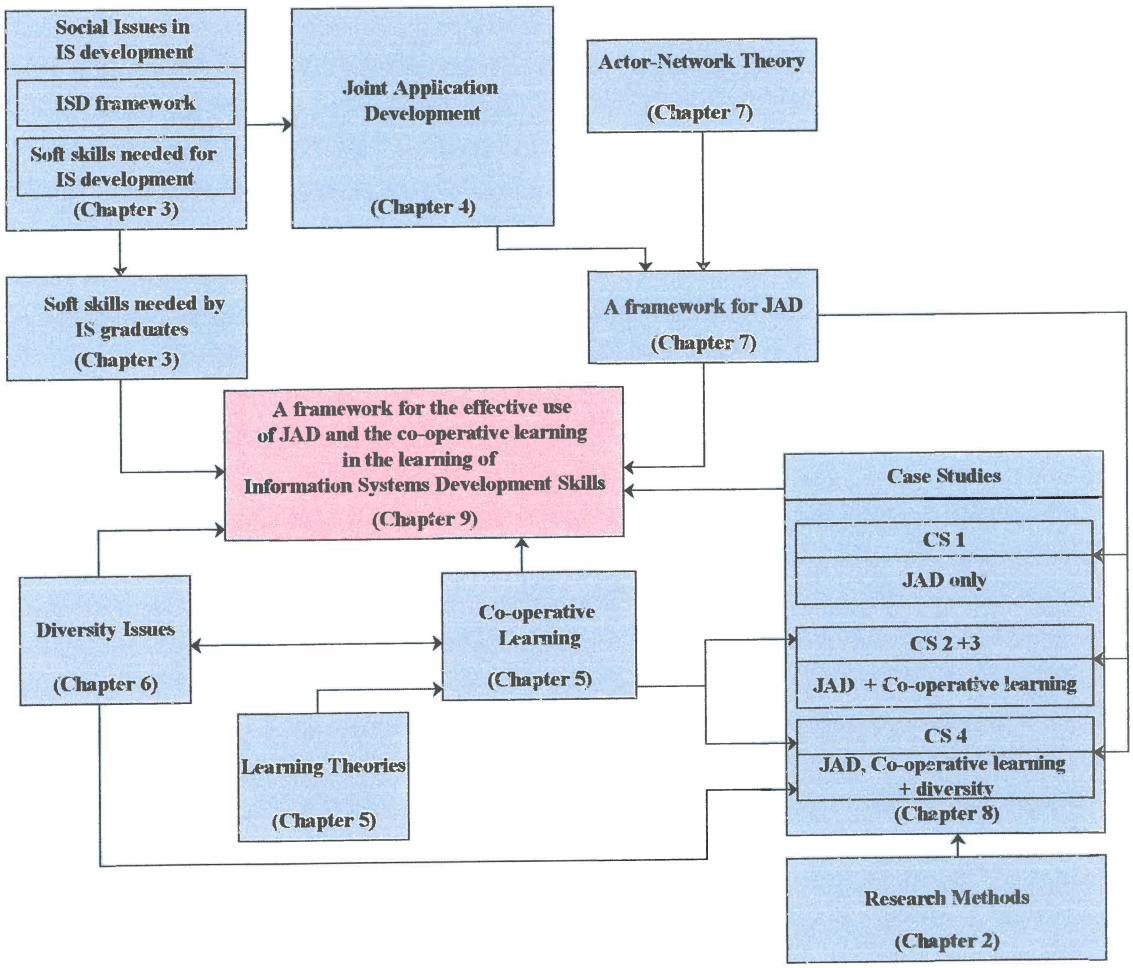
The JAD techniques were made more effective by incorporating the co-operative learning methods. Students need to be taught the skills of co-operation and team work. The groups should be formed by the lecturer rather than allowing them to form in a haphazard manner. The groups should be heterogeneous. The learning material should also be divided to promote positive interdependence and individual accountability. The groups should evaluate their own group processing.

In South Africa, at least, and possibly in other countries, the problem of diversity in the groups should not be overlooked. Some students are naturally shy and play a passive role in the groups while others tend to dominate. Assertiveness training should be added to help the students realise their problems and to help give them some techniques for overcoming those problems. The groups should be formed in such a way as to make sure that no-one feels left out. This can be done by making sure that minority students are not alone in a group and that students learn one another's names. The students should also be made aware of diversity issues in communication and group work.

The following chapter brings all of these issues together and presents the final framework for using JAD effectively in the classroom.

Chapter 9

A Framework for the use of JAD and co-operative learning methods in the classroom



Chapter 9

A Framework for the use of JAD and co-operative learning methods in the classroom

This chapter shows how the information from the literature studies and the case studies has been brought together to get the framework for the effective use of JAD in the classroom.

The framework for the teaching environment is presented first in Figure 9.1. The chapter then goes on to bring together the different factors that were considered in the building of that framework. The parts that each of these different factors played in the framework are depicted in different colours in the framework. The desired learning outcomes for the framework are described, followed by a discussion of how the JAD techniques were used within the classroom. The next section looks at the use of the circles of learning co-operative learning technique and how it was used in the development of the framework. The learning method is then compared to the learning guidelines that are suggested by the social constructivist learning theory. The way in which the diversity issue is handled in the framework is presented. Lastly, the method by which the framework for the learning environment was developed is described.

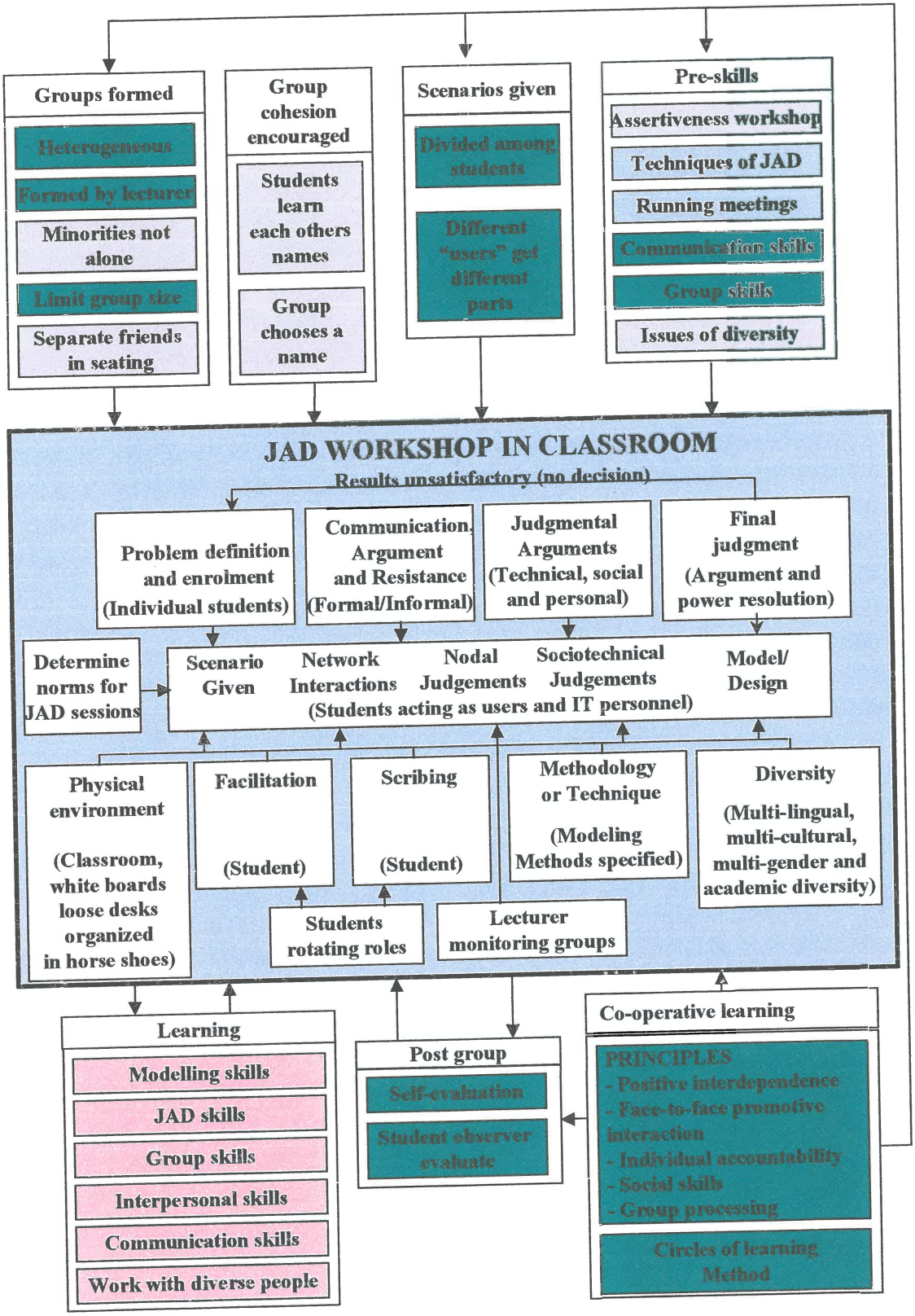


Figure 9.1: A framework for the use of JAD and co-operative learning in the classroom

9.1 DESIRED LEARNING OUTCOMES

Chapter 3 described a framework for IS development which led to a discussion of some of the skills that were needed by IS developers to work in the sense-making and argumentation orientations. A discussion followed of the need for tertiary institutions to foster these skills.

While no method can hope to develop all the social skills needed by an IS graduate, the learning environment, developed in this framework, tries to develop some of these skills while also helping students to develop their modelling skills.

The first skills that are developed through using the JAD activities in the classroom are the skills of modelling systems. These skills are needed by IS professionals and it was shown in Case Studies 2 and 4 that there is a significant improvement in the students' abilities in this regard. In the case studies the modelling skills were Use Case modelling and ER models but other modelling methods could have been used.

On the soft skills side, the workshops helped to develop the students JAD, group, interpersonal and communication skills as well as helping the students to learn to work with diverse people. These soft skills are considered to be important in the field of IS development especially as the field moves into the sense-making and argumentation orientations and away from the control orientations. The research showed that the students felt that they had improved in their ability to work in groups, interact with others and communicate with diverse people. These skills are shown in pink in the model in Figure 9.1.

9.2 THE USE OF JAD IN THE CLASSROOM

The JAD techniques used in industry, and described in Chapter 4, were modified for use in the classroom. The students were taught the techniques of JAD and how to run

meetings before the workshops started.

The students acted as the facilitators, scribes, users and IT personnel. They rotated these roles. A scenario was given to them by the lecturer and they had to use their group decision making skills to get to a final model or design for the scenario.

The classroom was converted into a location suitable for JAD to take place. Whiteboards were placed around the classroom and the students sat in their groups in the horseshoe-shape with the students facilitator at the board. A process of enrolment, communication, argument, evaluation and judgement then occurred until the final judgement was made by the students.

The JAD influences on the model are shown in light blue in Figure 9.1.

9.3 CO-OPERATIVE LEARNING METHODS

Co-operative learning methods were added from Case Study 2. Table 8.4 gives an indication of how the methods of the circles-of-learning co-operative learning method were adapted for use with the JAD workshops. These will not be repeated here.

The principles of positive interdependence, face-to-face interaction, individual accountability, group processing evaluation and skills learning should be adhered to. This implied that the following concepts be added to the framework:

- The students should be put into heterogeneous groups.
- The group size should be limited to six if possible, otherwise not more than eight.
- The students should be taught the skills needed for effective co-operation before the session. This led to the introduction of pre-skills workshops on communication and group dynamics being added to the model.
- The scenario should be divided so that different students have different parts of the information needed by the group.

- The students should monitor their own group processing and should change the way they interact if there are problems.
- The students should act the roles of facilitator, scribe, IT personnel and users as well as being observer. These roles should be rotated.

These concepts are depicted in turquoise in Figure 9.1.

9.4 SOCIAL CONSTRUCTIVIST LEARNING THEORY

The social constructivist theory of learning was described in Section 5.1.3. Constructivism emphasises the active role of learners in constructing their own knowledge. This knowledge will be constructed by building onto their existing knowledge and understanding. Misconceptions that are held by the students will hamper their understanding. Social interaction helps students to internalise from the social to the cognitive. As learners must explain their own understanding and receive feedback from others, it forces them to clarify their own thinking and confront their misconceptions.

This leads to several implications for learning environments that promote learning. The learning environment created for this study is evaluated according to these criteria, which were given in Section 5.1.3.4.

Criteria specified by social constructivist theory of learning	**How this was implemented in the learning environment**
Students should participate actively in their own learning.	Participation was encouraged and even insisted on in the JAD environment where one of the tasks of the facilitator was to stimulate participation.
Students should examine their own ideas.	Students would suggest their ideas to the group and would have to clarify them to others thus forcing them to examine their own ideas.
Students should learn independently using critical thinking skills rather than just remembering or reciting.	The students were learning in groups with their fellow students rather than having the lecturer do the exercises on the board.

Criteria specified by social constructivist theory of learning	How this was implemented in the learning environment
Students should engage in writing, talking, describing, explaining and reflecting.	These skills were all necessary in the JAD sessions as the students had to explain their thinking to others, write on the board and reflect on their own and other's thinking.
Social interaction must be encouraged to help students internalise their knowledge.	The students worked in groups and social interaction among the group members was encouraged.
Students should realise the purpose of the learning activity.	The purpose of working in groups and learning the JAD methods were explained to the students together with the purpose of the modelling techniques that they were learning.
The students should develop ownership of the problem or task.	The groups were encouraged to develop ownership of their models. They accepted responsibility for their answers as a group.
The students should work in an environment that closely matches the one that they will need to function in later.	JAD is a technique used in industry and it served as a motivation factor to the students to learn how to work in this environment in the classroom.
The students should determine the extent to which new experiences make sense in the light of their own ideas.	Students explained to one another and helped one another to understand why they made decisions as a group. This helped the students to make sense of the modelling methods.
The students should consider alternative explanations.	Hearing other people's ideas was considered to be very positive by the students in the JAD groups. This enabled them to consider alternative methods of modelling.
The students should learn how to evaluate a number of perspectives.	With the different students having their own ideas, students had to learn to evaluate those ideas in order to determine the best solution.
The cognitive flexibility theory which is an adaption of the constructivist theory suggests that the same material should be covered at different times, for different purposes and from different conceptual perspectives.	The modelling techniques had been taught to the students previously and this was an opportunity for them to see them again but in different circumstances.

Table 9.1: A comparison of suggestions from social constructivist learning theory and the learning environment developed

As the table suggests, the learning environment developed satisfies all the criteria for a good learning environment as suggested by the social constructivist theory of learning. This would suggest that the environment would promote learning.

9.5 WORKING WITH DIVERSE STUDENTS

The issue of diversity was explored in Chapter 6. From this various suggestions were incorporated into the framework and these are shown in purple in Figure 9.1.

In the formation of groups, it was determined that minorities should not be alone in a group. Sometimes friends would be in a group as a result of not dividing the minorities and this would lead to private conversations. Separating friends in the seating arrangements helped to alleviate this problem. Group cohesion should be encouraged by letting the students choose a name for their group and by learning one another's names. If there is sufficient time, a social event might be arranged for the group.

In the pre-skills workshops, it was decided to include a workshop on assertiveness to help the diverse students learn to respect themselves and other people. Issues of diversity were also included in the other workshops but not as a separate workshop.

9.6 BUILDING THE FRAMEWORK

The JAD sessions were seen as a type of group decision-making activity. Parkin's [1994; 1996] model for the group decision making was thus used as a basis for a framework for the use of JAD in industry. This was described in Chapter 7. This framework was then extended and modified for use in the classroom.

The actor-network theory recognises both human and non-humans as actors in a network. The actors for the learning environment were:

- Students acting in the roles of facilitator, scribe, users and IT personnel;

- the lecturer;
- the classroom environment consisting of the whiteboards, loose desks and chairs, and other classroom needs;
- the modelling techniques being used;
- the scenario given by the lecturer;
- the norms developed for the JAD sessions; and
- the political constraints caused by the diversity in the classroom.

The JAD workshop within the classroom was modelled using the model of how JAD was used in industry as a basis. The students' discussion and argument within the workshop was seen as a process of problem definition and enrolment after being given the scenario. Communication, argument and resistance followed as the students interacted with one another in the network. Various problems occurred during this process where students tried to dominate and others did not participate. Judgemental arguments and the final judgement followed where the students used their knowledge of the business areas and the methodologies and techniques to persuade the others in their group and make their final decisions about the model.

All of the above was influenced by the other aspects shown in the JAD Workshop box. The students rotated the roles of facilitator and scribe. The personality and ability of the facilitator, in particular, played an important role in the group's ability to reach consensus and model the system. The diversity of the students with respect to their culture, gender and academic ability was found to influence the classroom situation. The physical environment, with its white boards, loose desks and method of placing those desks also affected the communication and interaction of the groups. The lecturer monitored the groups interaction and their solution but did not get too involved in helping the groups to reach their decision unless problematic behaviour was encountered. The students were told what modelling techniques to use and the methodology to follow to solve the problem. They set up their own norms for the sessions, however.

9.7 THE EXPANDED FRAMEWORK

The research showed that there were many aspects that the lecturer should set in place before the workshop took place which influenced what happened in the classroom. Most of these have already been discussed in this chapter but an overview is given here. Figure 9.1 can be referred to during the discussion. Co-operative learning principles, in particular those of the circles-of-learning method, were used to adapt the process of JAD for use in the classroom. This influenced the way in which the groups were formed, the creation of the scenarios, the pre-skills training and the post group evaluations.

It was found to be best if the lecturer formed the groups. The groups were chosen to be heterogeneous with respect to language, gender, academic ability and knowledge of the different business areas that would be modelled in the JAD sessions. In order to make minorities in the classroom feel more comfortable, minorities were not placed alone in a group. Friends in the group were asked not to sit next to one another in order to reduce private conversations within the group. A group size of six was found to be ideal, but group sizes of eight were still manageable as the groups were structured.

Group cohesion was encouraged by letting the students choose a name for their group and by encouraging them to learn one another's names. This also helped the students to start their group interaction and learn to know one another. They were urged to learn how to pronounce one another's names in order to help each team member feel accepted within the group.

The lecturer provided the students with the scenario. Participation was encouraged by dividing the scenario among the students and giving different students the roles of the various users in the scenario.

Pre-skills training was found to be particularly useful. An assertiveness workshop allowed the students to learn about having respect for themselves and for others. The students also needed to learn the techniques of JAD and ways of running meetings and taking

minutes. Communication skills including aspects like active listening were considered important. Workshops on group skills and group decision making were held. Diversity issues were not addressed specifically, but were rather discussed during the other workshops, for example while discussing communication, different cultural issues relating to communication were mentioned and discussed. The groups were asked to evaluation their own group interaction and a student observer was used to evaluate and report on the group's interaction. Questionnaires were used for the groups evaluation of their own interaction.

The students perceived that they had improved their learning of the modelling skills while also learning about the group skills, interpersonal skills and communication skills that are so important in an IS developer. Many of them mentioned that they had learnt to work with diverse people. Their marks for the modelling improved from before the JAD sessions to afterwards as was shown by the pre- and post-tests in Case Studies 2 and 4. They obviously also learnt about how JAD sessions work, including the skills needed to facilitate a JAD group.

9.8 CONCLUSION

This chapter described how the different aspects of this study were brought together to get the framework described in Figure 9.1. It must be remembered that while these elements worked in the particular situation that was studied, it may be that with other actors, in other situations different results would be achieved.

The next chapter looks at the whole study and evaluates the research and its contribution. Ideas for future research areas are also presented.

Chapter 10

Evaluation and conclusions

The research for this study determined a method whereby the techniques of JAD could be effectively transferred into the classroom and combined with co-operative learning methods in order to help Information Systems students learn some of the interpersonal and group skills needed in industry, while also learning the modelling techniques. The research approach used was both interpretive and critical. A framework for the use of JAD and co-operative learning in the classroom was developed. A series of case studies was used to get a deep understanding of the students' experiences working in the JAD groups. This understanding was analysed critically and the framework was adapted between each case study.

This chapter firstly looks at how each of the research questions was answered. The chapter then evaluates the research done and tries to determine the contribution that the research has made. Some ideas for future research are presented as well as a conclusion.

10.1 ANSWERING OF THE RESEARCH QUESTIONS

In Chapter 1, a number of research questions were asked. This section will show how each of these questions has been addressed in this study.

10.1.1 What is.....?

A number of what is... questions were answered in this study in order to lay a foundation for the underlying structure of the problem.

- **What is involved in IS development?**

This question was answered in Chapter 3. Information Systems development was seen as a complex, social process that combines technical, business and interpersonal skills. Hirschheim, Klein and Lyytinen's [1996] framework for Information Systems development was presented to show the multiple dimensions of the development process.

- **What social skills are needed by the IS professional?**

This question was answered in Section 3.3. Communication and interpersonal skills were shown to be imperative for the IS professional as IS development moves into the sense-making and argumentation orientations of the IS development framework. This implies that these skills need to be developed within tertiary education and this was proposed in Section 3.4. The specific skills needed were defined by the IS Curriculum '97 [Davis et al., 1997].

- **What is JAD?**

JAD is an acronym for both Joint Application Development and Joint Application Design. This question was answered in Chapter 4. JAD is a method that uses a structured workshop to get all the stakeholders together in order to reach consensus on what a proposed system should do. A facilitator is used to control the meeting and a scribe to document decisions that are made. Group dynamics plays an important part in the running of JAD workshops.

- **What is the social constructivist learning theory?**

Section 5.1.3 described what the social constructivist learning theory is. Constructivism emphasizes that people learn by constructing their own knowledge and that this construction process will depend, to a large extent, on their prior knowledge. Social

constructivism recognises that there can be a collaborative construction of knowledge that occurs when groups of people interact as they hear other people's ideas and have to explain their own to others.

- **What is co-operative learning?**

Co-operative learning was defined in Section 5.2.1 and expanded on throughout Chapter 5. Co-operative learning occurs when students work in organised groups towards a common goal. The students should be dependent upon one another and yet still be individually accountable.

- **What is meant by diversity?**

Diversity of students includes a variety of aspects as shown in Chapter 6. Students can be diverse with respect to their intelligence, gender, culture, race, age, physical abilities and sexual orientation. They can also be diverse because of their learning style, religious beliefs, geographic location, income, work background or marital status. Each learner has unique gifts and unique needs and these should be taken into consideration when designing learning environments.

- **What is actor-network theory?**

Actor-network theory (ANT) was discussed in Chapter 7. ANT uses the same terminology and explanatory status for both human and non-human actors within a network. The network becomes stable as the actors interact and links are established within the network. This is done through a process of translation. ANT tries to answer the question of how a diverse group of actors can reach agreement at all and how social order ever establishes a degree of structure and stability. The main concern of ANT is how the elements of a network co-evolve.

10.1.2 Why .....?

- **Why should tertiary institutions help IS students develop interpersonal and group skills?**

Various research projects were mentioned in Section 3.3. These showed that industry required communication and interpersonal skills in Information Systems graduates. Many of these researchers found that these skills were considered more important than the technical skills that tertiary institutions tend to focus on. While some countries might have programmes in place to ensure that students learn these skills in primary and secondary education, this is not the case in South Africa, as was described in Chapter 6. This means that tertiary institutions must help students to develop these skills.

- **Why do people use JAD in industry?**

JAD is a technique that can be used very effectively within the sense-making and argumentation orientations of IS development in order to promote understanding and structured conflict resolution between team members. There does not seem to be much research on the effectiveness of JAD as it is used in industry. Section 4.3 gives some of the claims that advocates of JAD have for its effectiveness. Two research projects were also described in this section which showed under what circumstances JAD proved to be effective.

10.1.3 How does.....?

The How does..... question allows the researcher to determine how the problem has been manifested in real life.

- **How does JAD work in industry according to the literature?**

This question was answered in Chapter 4. Details were given of how the JAD teams

should be chosen and also how the JAD workshops should be run in order to work effectively in industry.

- **How does a diverse student population affect the classroom?**

This question was added during the research when it was determined that the issue of diversity of the student population could not be ignored - in South Africa at any event. The second case study showed that the Xhosa-speaking students tended to feel left out in their groups and therefore did not participate. This did not happen in the classroom with only Xhosa-speakers in Case Study 3. There were also a few problems with gender difficulties in the groups. The problems and opportunities offered by diversity were discussed in Chapter 6.

10.1.4 How should.....?

The answers to these questions allow the researcher to explain the new insights obtained during the research and the conclusions that can be drawn.

- **How can we model JAD in industry?**

Section 7.2 modelled the process of JAD in industry. The actors were identified and the processes described that enabled consensus to be reached within the JAD workshop.

- **How should one deal with diverse students in the classroom and in groups?**

This question was investigated in Chapter 6 of the dissertation. Group work is seen to be an effective way of promoting interaction between the diverse students. The groups need to be carefully chosen and monitored, however, in order to make sure that that interaction is effective. Some of the ideas were implemented during the case studies and their effectiveness was noted.

- **How should lecturers combine the methods of JAD and the methods of co-operative learning in their classrooms?**

Chapter 8 described how this question was investigated. Four case studies were done which showed how the JAD techniques and co-operative learning techniques could be used in the classroom. The circles-of-learning co-operative learning method was combined with the techniques of JAD. A framework was developed to describe the processes and actors that are involved in the classroom.

- **How should a framework be designed in order to promote the learning of group, interaction and modelling skills in a classroom with diverse students?**

The framework was developed in Chapter 8 and described again in Chapter 9. The case studies showed how the students' perceptions of their learning improved as the method was refined and the framework developed. Chapter 9 put all of this together to give a final version of the framework.

10.2 EVALUATION OF RESEARCH

This section evaluates the research according to Klein and Myers's [1999] seven principles for interpretive field studies as described briefly in Section 2.2.2.2. This is followed by an evaluation of the research according to its authenticity, plausibility and criticality as suggested by Walsham and Sahay [1999].

10.2.1 Evaluation according to seven principles of interpretive field studies

Klein and Myers [1999] describe seven principles for interpretive field study research using case studies or ethnographic research. These principles are interdependent and should be used as a guide, but researchers themselves must decide how the principles should be applied.

- **Principle of hermeneutic circle**

This principle suggests that human understanding is only achieved by moving in a cyclical fashion between the interdependent meanings of the parts and the whole. The complex whole is understood from the shared meanings of the parts and their interrelationships.

The researcher firstly looked at the different skills that were needed by an IS developer. The JAD process was also investigated to see how it could be used in the classroom. This was then used to determine a framework for using JAD within the classroom, thus getting a more holistic, interrelated view from these parts.

The students' experiences were then sought and the details of their experiences helped to determine what problems were experienced. This led to the incorporation of co-operative learning techniques with the JAD techniques. Once again specific changes were made which were then built into the framework and into the classroom practice. The parts studied were thus once again built into a whole.

A second case study was done which led us to believe that the issue of diversity was causing problems in the classroom. This was substantiated by the third case study in a classroom without cultural diversity. The issue of diversity was then studied and adjustments made to the framework and the classroom practice, thus once again going from the parts to the whole. This integrated framework was then tested again in the fourth case study and the students' individual experiences sought. This led to a deeper understanding and the framework showing this is found in Chapter 9.

- **Principle of contextualisation**

This principle requires that the researcher takes into account the social and historical background of the research setting. These contexts should be explored and discussed

rather than hidden.

This was done in great detail in this study. It is acknowledge that South Africa has some special problems in their post-apartheid era, that might not be applicable in other areas of the world. The context of the South African situation and the situation in the two tertiary institutions where this research was done, was described in detail so that the readers might decide for themselves whether the research would be applicable to them or not. The context and different types of students involved in each case study were also described.

- **Principles of interaction between the researchers and the subjects**

The principle of interaction requires critical reflection on how the research materials were constructed and what the interaction was between the researcher and the subjects. The results of the research may be partly as a result of the social interaction between the participants and the researcher. Both the participants and the researcher interpret as they interact. This relationship should thus be spelt out.

The researcher was also the students' lecturer. This meant that the researcher was closely involved with the research and the participants in the research. During the third case study the researcher visited the Border Technikon for one week and did not know the students very well but was still involved in the monitoring of the JAD sessions.

- **Principle of abstraction and generalisation**

Interpretive studies do not need to remain relevant only within a particular context. Theoretical abstractions and generalizations should be carefully related to the context-specific situation being studied. Giving rich insight helps readers to know if they can abstract and generalise to their situation. This enables the researcher to show how he or she arrived at the theoretical findings.

This is closely linked to the principle of contextualisation. Case study research has a weakness with regard to abstraction and generalisation, but Smith [1990] argues that logical inferencing can allow us to draw inferences based on systematic explanation or theoretical propositions.

This study used the case studies to get insight into the diverse students' experiences of the way in which the JAD and co-operative learning techniques were used in the classroom. Both quantitative and qualitative results were used to get the deep understanding of the situation. The studies were only done at two technikons in the Eastern Cape in South Africa, therefore it is difficult to say if the results obtained would be applicable in general.

The results of getting this deeper understanding were, however, compiled into a model which could be used by other people and adapted to their own situation. The framework models some of the factors that a person needs to consider when trying to implement JAD modelling techniques in a classroom with diverse students.

- **Principle of dialogical reasoning**

This principle suggests that the researcher must be sensitive to possible contradictions between the theoretical preconceptions and the actual findings. Any preconceptions or prejudices of the researcher should be confronted and related to the results achieved. Improved understanding of one stage of the research can be become a prejudice for the next. This should be spelt out in the research.

The researcher was involved in the process being researched. This means that her subjectivity was present from the creation of the research questions through to the development of the final framework. The researcher was convinced that it was important for students to learn the social skills needed for information systems development and this was supported by the literature. One could also consider that the problems that the observer noted with the culturally diverse students, could be a result of the observer and

the researcher's own cultural heritage in an apartheid South Africa. The observations were, however, substantiated by the answers to the open-ended questions of the students involved.

The dissertation shows clearly in Chapter 8, how the framework was developed and how the method was refined. The research results show why the framework was developed as it was.

- **Principle of multiple interpretations**

Human actions occur in social context and involve multiple agents. As the research is done, the researcher must be sensitive to the differences in interpretations among the participants. Conflicts due to power, economics and values may need to be analysed.

One of the factors that was of interest in this research was the experiences of the different actors within the research situation. When contradictions were found, the researcher tried to determine why this happened. Multiple viewpoints were needed to get a more complete picture of what was happening in the classroom. Students from different gender groups or racial groups sometimes experienced things in different ways. An example of this was in the second case study where eight Xhosa-speaking students said, in answer to one of the open-ended questions, that the other people in the group did not listen to them even though they tried to participate.

- **Principle of suspicion**

The researcher must be aware of possible biases and distortions in the stories told by the participants. The social world of belief of the participants may need to be understood in order to understand their experiences within the research situation.

Although the students could answer the questionnaires anonymously, one must consider that they might feel that they should answer positively in order to please the lecturer.

This was especially true in Case Study 3 where the results were very favourable. One might consider that as the lecturer was visiting Border Technikon, the students felt 'obliged' to answer in a positive way. Both the observer and the researcher felt that the atmosphere in the classroom was very positive, however.

The cultural differences among the students and the background of an apartheid South African did seem to influence the students' answers, however. An example is the student in the third case study who commented that they disliked being the JAD facilitator at first as he disliked all the eyes following him. As Xhosa speakers tend to look down in order to show respect, rather than looking someone in the eye, this remark was particularly interesting. The background of the students' secondary school experiences also played a role in their answers. Some of the students had never before been given an opportunity to act as the leader of a group or to interact with people of other cultures or gender. This came through in their answers to the questions.

10.2.2 Authenticity, plausibility and criticality

Walsham and Sahay (1999) suggest that researchers should show that their research is authentic, plausible and critical in order to prove the merit of the research. They base their criteria on the work of Golden-Biddle and Locke.

- **Authenticity**

Authenticity is shown by proving that the researcher has been there in the field. This has been done by the observations of the author as well as by the direct quoting of the students from their open-ended questionnaires. The place of the researcher in the research process and as lecturer has been described and her motivation in doing the research discussed.

The author also showed how the theory was developed by analysing the data from the four case studies. Personal biasses were also mentioned in the previous subsection.

- **Plausibility**

Plausibility is a way of ensuring the text makes sense to the reader as well as showing that the text offers something distinctive to the field. The first step in plausibility, according to Walsham and Sahay (1999), is in normalising unorthodox methodologies. Tables and graphs were used to show the quantitative findings of the case studies although most of the conclusions drawn were based on the reasons and comments made by the students in their open-ended questions. These comments were categorized in Appendix B and the discussion included direct comments from some of the students.

The actor-network theory was used to lend plausibility to the analysis of the interactions that took place within the classroom.

In order to be plausible, another factor that should be catered for is that of drafting the reader and the smoothing of the contestable. As the research was developed, the reader was brought into the written work by specifying when there might be cause for contention as to the interpretation of a particular aspect. An example of this was in the fourth case study where the students' perceptions of the contribution by others did not improve although other factors, like their own feelings of acceptance and contribution did. It was speculated at that stage that, as 18% of the students had not covered the work in Information Systems 2 with regard to the modelling techniques, that had influenced this result and that, if everyone had been doing Information Systems 2 as they had in the previous years, this result would have improved. This was substantiated by the fact that ten students commented that people did not participate because they did not know as much as the others. This was not presented as fact but was given as one possible interpretation of the results.

This research also offers something distinctive. The idea of combining the co-operative learning techniques and dealing with diversity with the JAD techniques in order to enhance the learning environment for all, is new. The group dynamics and group decision making issues involved in JAD help to motivate students to learn these methods

while working in a co-operative learning environment.

Walsham and Sahay (1999) suggest that the text should build dramatic anticipation through good writing. It is difficult for an author to determine if this has been done. The text in the literature study chapters, Chapters 3 to 7, builds up to the case studies and the development of the model presented in Chapters 8 and 9. The problems experienced in each of the case studies were then addressed in the development of the model in the subsequent case studies.

- **Criticality**

The research should stimulate the reader to reflect, according to Walsham and Sahay (1999). The researcher applied a critical action research approach to study the use of JAD and co-operative learning in the classroom. The research hopes to stimulate readers to reflect on how they can use active learning methods of all sorts to improve learning of both the technical and social skills needed by IS students. It also hopes that the reader would consider trying out the method of using JAD in the classroom to see if it would work in their circumstances.

Another aspect of stimulating criticality is imagining new possibilities. This would involve using metaphors and imagery to achieve this. Some new possibilities for further research are explored later in this chapter, but the imagery and metaphors implied by this dimension have probably not been achieved in this research.

10.3 CONTRIBUTION OF THE RESEARCH

Introna [1992] proposes a set of principles whereby contribution of research can be evaluated. The evaluation should assess whether progress has been made in the area in the light of the historical or traditional knowledge.

- **Does the theory raise problems previously not perceived, for example problems of increased depth, and does it display an ever-increasing fertility in suggesting new problems?**

There was no previous theory for incorporating JAD and co-operative learning techniques in the classroom. Methods of facilitating a JAD workshop in industry were available from the literature as were studies on co-operative learning methods. This research showed how these methods could be combined within the classroom to create a learning environment where the students learnt some of the social skills needed in IS development while also learning the modelling techniques. Inputs from computer science, education and psychology were used. The framework was developed by an iterative process as new problems were discovered and catered for in the learning environment.

New problems and ideas for further research are given later in this chapter.

- **Does the theory anticipate novel facts and auxiliary theories?**

The actor-network theory was used to analyse the learning environment. The social constructivist theory of learning was used to show that this type of environment should promote learning. The circles-of-learning co-operative learning method was adapted for use with the JAD techniques. Contact theory and social identity theory were used to help modify the environment for the diverse student population.

Many of the social skills needed to interact effectively in JAD sessions, are also those identified as being necessary for an IS graduate. The model specified some of these communication and interpersonal skills that need to be learnt by the students. Added to these skills were those associated with acting assertively and having respect for themselves and others. The JAD sessions then offered the students a chance to practise those skills.

It is important to promote active learning in IS students and it would be interesting to see if the model of the skills input into the JAD sessions would be relevant for other active learning situations.

- **Is the theory more precise in its assertions and in the facts it explains than previous theories?**

There were no previous theories for using JAD and co-operative learning in the classroom. The theory is more precise than previous theories of JAD, used in industry, or general co-operative learning theories.

- **Has the theory unified or connected various hitherto unrelated problems or concepts?**

The theory has unified concepts from computer science and information systems with theories from education and psychology. These concepts were tested and then used to propose a model for the effective combination of these theories in using JAD in the classroom.

- **Has the theory produced a new perspective on existing problems and thus created a new understanding of these existing problems?**

A new theoretical perspective for learning both social and modelling techniques using JAD and co-operative learning techniques was proposed in this research. Problems of promoting participation, developing interpersonal and communication skills and working with diverse students in the groups were addressed.

The groups should be chosen carefully and should be heterogeneous if one wants to promote the learning of working with different types of people. Minorities should not be alone in a group, however. The size and composition of the group plays an important part in the effectiveness of the group and the interaction within the group. Even the

position where the students sit in the group can hamper or promote group cohesion. Group cohesion should be further encouraged by letting the groups give themselves an identity by naming their group. They should also be encouraged to learn one another's names and the pronunciation thereof.

The model suggests that in order for students to work effectively in JAD groups, the students need to learn how to be assertive, how to communicate effectively, how to handle group dynamics, how to come to consensus within a group, how to work in a problem-solving meeting and how JAD workshops should be run. They should also be aware of cultural diversity and how it affects these issues.

The students should also be required to monitor their own group processing and to address any problems that they might have. As they learn more about working in groups this will affect their group processing and decision making ability within those groups. A student can also act as an observer of the group interaction and give feedback to the group as to how the members are interacting.

The students should not all be given the same material to model. The scenario should be divided into different parts with the students being given different parts. This will "force" them to participate as only they will have the information needed by the group.

Many of the above factors are as a result of applying the five principles of co-operative learning, namely promoting positive interdependence, face-to-face promotive interaction, individual accountability, practising and learning social skills and monitoring group processing. Some of the specific behaviours are suggested by the eighteen steps of the circles-of-learning co-operative learning method.

All of these factors lead into the workshop itself. This is seen as a complex network of actors, both human and non-human, that interact through problem definition, enrolment, communication, making judgements, facilitation, etc. in order to create a design for the scenario given by the lecturer. While the students are the controllers of the situation,

the lecturer must monitor and facilitate the process.

It is difficult to say if the ideas produced radically challenge any current conceptions. The theory suggests that:

- JAD techniques, with their strong emphasis on group dynamics, can be used effectively to promote learning within the classroom.
- The JAD techniques become more effective when combined with the techniques of co-operative learning, and in particular the circles-of-learning co-operative learning method.
- The students need to learn the social skills of assertiveness, communication, group dynamics, group decision making and handling both problem-solving and JAD meetings in order for the method to be effective.
- The needs of the diverse student groups need to be catered for in the method and this can be done through careful choice of students within groups. The groups should be heterogeneous in order to promote students learning to work with people who are different from themselves but minority students should not be alone in a group.

10.4 FUTURE RESEARCH

This section gives some ideas for future research that could flow from this project.

10.4.1. Applying the framework in different cultural environments

The framework was developed by solving problems using the experiences of Xhosa, English and Afrikaans students in the Eastern Cape in post-apartheid South Africa. One would probably find that students in different parts of the world and with diverse backgrounds would have varying experiences which would alter the model.

The co-operative learning literature has examples of studies where the results achieved in one country could not be replicated in another. Just the difference between what

happened at the Port Elizabeth Technikon and the Border Technikon would tend to suggest that this might be the case with this research as well.

10.4.2 Applying the framework in non-IS subjects

The techniques used in the JAD groups could be used in other subjects. At the Port Elizabeth Technikon, some of the lecturers have used it to help the students learn about program design in JAD-type groups. The greatest advantage of using JAD with computer science and IS students is that one can motivate the issues in group dynamics and group decision making from the point of view that these would be used in industry. If one used the method with students from other disciplines then that motivation might be lost. It would be interesting to see if, for example, engineering students could use it to learn about design issues.

10.4.3 Co-operative learning techniques in JAD in industry

There have been some problems with getting JAD to work effectively in industry. The question arises as to whether or not one could use some of the techniques of co-operative learning to improve the use of JAD in industry. The idea of organizations being "learning organisations" has become quite important lately [Janz, 1999]

JAD has not always proved to be as effective as one would have supposed that it could be in industry. This was discussed in Chapter 4. Studies by Purvis and Sambamurthy [1997] and by Davidson [1999] have shown that although JAD does have a positive effect overall, there are some instances where it is not effective.

Co-operative learning has been shown to improve work outcomes in self-directed teams [Janz, 1999]. In his study of self-directed teams, he found a greater positive correlation between co-operative learning and work outcomes than between autonomy and work outcomes. Co-operative learning within the teams improved job satisfaction, growth satisfaction, levels of motivation, self-perception of performance and perceptions of

performance from external people.

This also gives some support to the idea that if one could try to introduce some co-operative learning techniques into the JAD sessions that one would be able to improve them. Some suggestions as to how to do this are:

- The participants should be taught some group skills and JAD skills before they get into the sessions.
- The diversity of the participants should be recognised and it is possible that having more than one person from a department or from a particular minority group might help improve participation.
- The idea of positive interdependence should be there as the different members of the group will have different skills and knowledge. This needs to be explicitly pointed out to the members so that they realise their reliance on one another.
- The group as a whole should be made aware that they are responsible for what happens and that each member is accountable for the result. Group cohesion must be fostered within the group.
- The group should be encouraged to evaluate their sessions to see where their group processing was successful and where it could be improved.
- The idea that the group members are there to learn from one another as well as to give their input should be fostered as this will improve the learning environment.

10.5 CONCLUDING REMARKS

This chapter evaluated the research and its contribution. The research methods used were in line with an interpretive and critical approach. The theory was shown to have made a contribution to the area of IS education. Ideas for future research were described.

There is a need for learning methods that help students to develop the interpersonal and communication skills that they will need to work in an IS development arena in the

sense-making and argumentation orientations. As JAD facilitator, the students learn about taking leadership in a small group, facilitating and speaking in front of small groups of people. As group members and as facilitators, they learn about listening actively to other people, negotiating, being assertive, communicating in small groups, group decision making and reaching consensus, and working with people from diverse backgrounds. As scribe they learn about observation, taking notes and documenting events. These skills are all learnt and practised while also learning about modelling techniques which many students find difficult to master.

This research showed how the JAD methods needed to be adapted to help the students feel accepted in their groups, participate better and thus learn more effectively. This adaption was done using co-operative learning techniques and methods of dealing with diversity.

The challenge to IS educators is to find interesting and appropriate methods of developing these skills in IS students so that they can be productive and useful when they get into industry.

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Appendix A

Questionnaires

This appendix contains the questionnaires used in the different case studies. Four versions of the main questionnaire are given. The questionnaire used in Case Study 1 differed from the other three, but the other three were only slightly modified to deal with the changing situation.

The questionnaire on group processing can be found in Appendix A.5. This questionnaire is used by the groups themselves to determine if they have problems within the groups. It was also used for the research to see if the groups managed to improve their group processing over the weeks from the first JAD session to the last JAD session in Case Studies 2 and 4. In Case Study 3, it was only used to let the groups evaluate their own group processing at the end of the first JAD session. The observer also used the questionnaire in their evaluation of the groups for Case Studies 2 and 3. This evaluation is based on the work of Jaques [1991, pp179-180, p204].

The buddy rating form in Appendix A.6 was used to foster individual accountability within the groups during Case Studies 2 and 4. Each group member evaluated the other group members according to their participation, facilitation skills etc. This was used as part of the students grade for the course.

The last questionnaire in Appendix A.7 was the one used by the lecturer to create heterogeneous groups, with respect to language, academic ability and gender. The students knowledge of the business areas also helped to decide what groups they were in. It was used in Case Studies 2 and 4.

A.1 QUESTIONNAIRE ON YOUR EXPERIENCES WITH JAD - CASE STUDY 1

This questionnaire is being used to investigate your experiences of using JAD techniques within the classroom when learning modelling techniques. Please answer the questions based on your own experience and leave out questions that you do not want to answer rather than giving inaccurate responses. Place an X in the box provided. You do NOT need to put your name on the questionnaire.

1. In which class group are you?

Business	Technical

2. What is your home language?

English	Afrikaans	Xhosa	Other – please specify.....

3. Do you think that the modelling techniques that you have learnt this year will be useful in industry?

Very useful	Somewhat useful	Seldom useful	Not used at all

Why do you answer as you do?

.....

.....

4. How were you allocated to a group?

Chose my own group	Sometimes chose my own group and at other times was placed in a group	Was placed in a group.	Other – please specify..... ....

5. Which of the above methods of allocating you to a group would you prefer?

Chose my own group	Sometimes chose my own group and at other times was placed in a group	Was placed in a group.	Other – please specify..... ....

6. Did you find that the members of your group were generally the same as you with respect to:

Sex	Yes – Same	Mixed
Race	Yes – Same	Mixed
Academic ability	Yes – Same	Mixed
Language	Yes - Same	Mixed

7. How much did you enjoy working in groups?

Enjoyed it a lot	Enjoyed it most of the time	Did not enjoy it most of the time	Did not enjoy it at all

What did you enjoy the most?

……

……

……

What did you dislike the most?

……

……

……

8. How did you enjoy being the JAD facilitator?

Enjoyed it a lot	Enjoyed it most of the time	Did not enjoy it most of the time	Did not enjoy it at all

What did you enjoy the most?

……

……

What did you dislike the most?

……

……

9. When you were the JAD facilitator, were you able to communicate in your home language?

Always	Most of the time	Very seldom	Never

If English is not your home language, describe your experiences with using English in the JAD process both as a facilitator and as a member of the group.

……

……

10. When you were a member of the group and not the facilitator, did you feel that the facilitators gave you a chance to have your say when you wanted to.

Always	Most of the time	Very seldom	Never

Comment on your answer.

.....

.....

.....

11. Did you feel that you were able to contribute to the group?

Always	Most of the time	Very seldom	Never

Comment on your answer.

.....

.....

.....

12. Did you feel that all group members made contributions to the group?

Always	Most of the time	Very seldom	Never

Comment on your answer.

.....

.....

.....

13. Did you feel that you were accepted as a group member?

Always	Most of the time	Very seldom	Never

Comment on your answer.

.....

.....

.....

14. Do you feel that the JAD techniques used in the classroom are effective in helping you to learn?

Always	Most of the time	Very seldom	Never

Comment on your answer:

.....

.....

.....

15. At the beginning of the second semester there was only one white board in the classroom and you had to work in normal groups, which method did you prefer and why?

Working in groups with white boards	No preference for either method	Working in groups without boards

Why did you have that preference?

.....

.....

.....

16. Why do you think that JAD techniques were used in the classroom? You may mention more than one reason?

.....

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.....

.....

A.2 QUESTIONNAIRE ON YOUR EXPERIENCES WITH JAD - CASE STUDY 2

This questionnaire is being used to investigate your experiences of using JAD techniques within the classroom when learning modelling techniques. Please answer the questions based on your own experience and leave out questions that you do not want to answer rather than giving inaccurate responses. Place an X in the box provided. You do NOT need to put your name on the questionnaire.

1. In which class group are you?

Business	Technical

2. What is your home language?

English	Afrikaans	Xhosa	Other – please specify.....

3. What gender are you?

Male	Female

4. What race are you?

African	Coloured	White	Asian

5. Do you think that the modelling techniques that you have learnt this year will be useful in industry?

Very useful	Somewhat useful	Seldom useful	Not used at all

Why do you answer as you do?

. . . . . .

. . . . . .

6. How did you experience working in groups?

Enjoyed it a lot	Enjoyed it most of the time	Did not like it most of the time	Did not enjoy it at all

What did you enjoy the most?

. . . . . .

. . . . . .

What did you dislike the most?

. . . . . .

. . . . . .

7. How did you experience being the JAD facilitator?

Enjoyed it a lot	Enjoyed it most of the time	Did not enjoy it most of the time	Did not enjoy it at all

What did you enjoy the most?

.....

.....

What did you dislike the most?

.....

.....

8. When you were the JAD facilitator, were you able to communicate in your home language?

Always	Most of the time	Very seldom	Never

If English is not your home language, describe your experiences with using English in the JAD process both as a facilitator and as a member of the group.

.....

.....

9. When you were a member of the group and not the facilitator, did you feel that the facilitators gave you a chance to have your say?

Always	Most of the time	Very seldom	Never

Comment on your answer.

.....

.....

.....

10. Did you feel that you were able to contribute to the group?

Always	Most of the time	Very seldom	Never

Comment on your answer.

.....

.....

11. Did you feel that all group members made contributions to the group?

Always	Most of the time	Very seldom	Never

Comment on your answer.

. . . . . .

. . . . . .

. . . . . .

12. Did you feel that you were accepted as a group member?

Always	Most of the time	Very seldom	Never

Comment on your answer.

. . . . . .

. . . . . .

. . . . . .

13. What method of learning the modelling techniques do you prefer?

Working in groups using the JAD techniques	Working in groups on paper without using JAD	Working individually

Why did you have that preference?

. . . . . .

. . . . . .

14. Do you feel that the JAD techniques used in the classroom are effective in helping you to learn?

I already knew the techniques perfectly	It helped me a lot	It helped a little	It did not help at all

Comment on your answer:

. . . . . .

. . . . . .

15. Do you feel that the JAD technique has helped you to learn how to feel more confident about how to act within a group?

I was already confident	It helped me a lot	It helped a little	It did not help at all

Comment:

. . . . . .

. . . . . .

16. Do you feel that the JAD technique has helped you to learn to interact with other people?

I was already able to interact easily with other people	It helped me a lot	It helped a little	It did not help at all

Comment:

. . . . . .

. . . . . .

. . . . . .

17. Do you feel that the JAD technique has helped you to learn how to speak in front of small groups of people?

I was already able to speak easily in front of small groups of people	It helped me a lot	It helped a little	It did not help at all

Comment:

. . . . . .

. . . . . .

. . . . . .

18. Why do you think that JAD techniques were used in the classroom? You may mention more than one reason?

. . . . . .

. . . . . .

. . . . . .

A.3 QUESTIONNAIRE ON YOUR EXPERIENCES WITH JAD - CASE STUDY 3

This questionnaire is being used to investigate your experiences of using JAD techniques within the classroom when learning modelling techniques. Please answer the questions based on your own experience and leave out questions that you do not want to answer rather than giving inaccurate responses. Place an X in the box provided. You do NOT need to put your name on the questionnaire.

1. On which campus were you?

East London	Main

2. What is your home language?

English	Afrikaans	Xhosa	Other – please specify.....

3. What gender are you?

Male	Female

4. What race are you?

African	Coloured	White	Asian

5. Do you think that the entity-relationship modelling techniques that you have learnt this year will be useful in industry?

Very useful	Somewhat useful	Seldom useful	Not used at all

Why do you answer as you do?

.....

6. How did you experience working in groups?

Enjoyed it a lot	Enjoyed it most of the time	Did not like it most of the time	Did not enjoy it at all

What did you enjoy the most?

.....

.....

.....

What did you dislike the most?

.....

.....

7. How did you experience being the JAD facilitator?

Enjoyed it a lot	Enjoyed it most of the time	Did not enjoy it most of the time	Did not enjoy it at all

What did you enjoy the most?

. . . . . .

. . . . . .

What did you dislike the most?

. . . . . .

. . . . . .

8. When you were working in your JAD groups, were you able to communicate in your home language?

Always	Most of the time	Very seldom	Never

If English is not your home language, describe your experiences with using English in the JAD process both as a facilitator and as a member of the group.

. . . . . .

. . . . . .

9. When you were a member of the group and not the facilitator, did you feel that the facilitators gave you a chance to have your say?

Always	Most of the time	Very seldom	Never

Comment on your answer.

. . . . . .

. . . . . .

10. Did you feel that you were able to contribute to the group?

Always	Most of the time	Very seldom	Never

Comment on your answer.

. . . . . .

. . . . . .

11. Did you feel that all group members made contributions to the group?

Always	Most of the time	Very seldom	Never

Comment on your answer.

. . . . . .

. . . . . .

. . . . . .

12. Did you feel that you were accepted as a group member?

Always	Most of the time	Very seldom	Never

Comment on your answer.

. . . . . .

. . . . . .

. . . . . .

13. What method of learning the modelling techniques do you prefer?

Working in groups using the JAD techniques	Working in groups on paper without using JAD	Working individually

Why did you have that preference?

. . . . . .

. . . . . .

14. Do you feel that the JAD techniques used in the classroom are effective in helping you to learn?

I already knew the techniques perfectly	It helped me a lot	It helped a little	It did not help at all

Comment on your answer:

. . . . . .

. . . . . .

15. Do you feel that the JAD technique has helped you to learn how to feel more confident about how to act within a group?

I was already confident	It helped me a lot	It helped a little	It did not help at all

Comment:

. . . . . .

. . . . . .

16. Do you feel that the JAD technique has helped you to learn to interact with other people?

I was already able to interact easily with other people	It helped me a lot	It helped a little	It did not help at all

Comment:

. . . . . .

. . . . . .

. . . . . .

17. Do you feel that the JAD technique has helped you to learn how to speak in front of small groups of people?

I was already able to speak easily in front of small groups of people	It helped me a lot	It helped a little	It did not help at all

Comment:

. . . . . .

. . . . . .

. . . . . .

18. Why do you think that JAD techniques were used in the classroom? You may mention more than one reason?

. . . . . .

. . . . . .

A.4 QUESTIONNAIRE ON YOUR EXPERIENCES WITH JAD - CASE STUDY 4

This questionnaire is being used to investigate your experiences of using JAD techniques within the classroom when learning modelling techniques. Please answer the questions based on your own experience and leave out questions that you do not want to answer rather than giving inaccurate responses. Place an X in the box provided. You do NOT need to put your name on the questionnaire.

1. In which class group are you?

Business	Technical

2. What is your home language?

English	Afrikaans	Xhosa	Other – please specify.....

3. What gender are you?

Male	Female

4. What race are you?

African	Coloured	White	Asian

5. Are you:

Busy with IS2	Busy with IS1	Finished IS2	Finished IS1 but not yet busy with IS2

6. Do you think that the modelling techniques that you have learnt this year will be useful in industry?

Very useful	Somewhat useful	Seldom useful	Not used at all

Why do you answer as you do?

. . . . . .

7. How did you experience working in groups?

Enjoyed it a lot	Enjoyed it most of the time	Did not like it most of the time	Did not enjoy it at all

What did you enjoy the most?

. . . . . .

. . . . . .

What did you dislike the most?

. . . . . .

. . . . . .

8. How did you experience being the JAD facilitator?

Enjoyed it a lot	Enjoyed it most of the time	Did not enjoy it most of the time	Did not enjoy it at all

What did you enjoy the most?

. . . . . .

. . . . . .

What did you dislike the most?

. . . . . .

. . . . . .

9. When you were the JAD facilitator, were you able to communicate in your home language?

Always	Most of the time	Very seldom	Never

If English is not your home language, describe your experiences with using English in the JAD process both as a facilitator and as a member of the group.

. . . . . .

. . . . . .

10. When you were a member of the group and not the facilitator, did you feel that the facilitators gave you a chance to have your say?

Always	Most of the time	Very seldom	Never

Comment on your answer.

. . . . . .

. . . . . .

. . . . . .

11. Did you feel that you were able to contribute to the group?

Always	Most of the time	Very seldom	Never

Comment on your answer.

. . . . . .

. . . . . .

12. Did you feel that all group members made contributions to the group?

Always	Most of the time	Very seldom	Never

Comment on your answer.

. . . . . .

. . . . . .

. . . . . .

13. Did you feel that you were accepted as a group member?

Always	Most of the time	Very seldom	Never

Comment on your answer.

. . . . . .

. . . . . .

. . . . . .

14. What method of learning the modelling techniques do you prefer?

Working in groups using the JAD techniques	Working in groups on paper without using JAD	Working individually

Why did you have that preference?

. . . . . .

. . . . . .

15. Do you feel that the JAD techniques used in the classroom are effective in helping you to learn?

I already knew the techniques perfectly	It helped me a lot	It helped a little	It did not help at all

Comment on your answer:

. . . . . .

. . . . . .

16. Do you feel that the JAD technique has helped you to learn how to feel more confident about how to act within a group?

I was already confident	It helped me a lot	It helped a little	It did not help at all

Comment:

. . . . . .

. . . . . .

17. Do you feel that the JAD technique has helped you to learn to interact with other people?

I was already able to interact easily with other people	It helped me a lot	It helped a little	It did not help at all

Comment:

. . . . . .

. . . . . .

. . . . . .

18. Do you feel that the JAD technique has helped you to learn how to speak in front of small groups of people?

I was already able to speak easily in front of small groups of people	It helped me a lot	It helped a little	It did not help at all

Comment:

. . . . . .

. . . . . .

. . . . . .

19. Why do you think that JAD techniques were used in the classroom? You may mention more than one reason?

. . . . . .

. . . . . .

. . . . . .

A.5 GROUP EVALUATION

1. We made sure that everyone understood the objectives for the session at the start of the session.

Always	1	2	3	4	5	Never

2. The group members listened to and responded to the other members ideas and comments

Always	1	2	3	4	5	Never

3. The group members were all involved and participated in the discussion.

Always	1	2	3	4	5	Never

4. Dominant members were allowed to dominate the group

Always	1	2	3	4	5	Never

5. Group members involved themselves in private conversations thus disturbing the group

Always	1	2	3	4	5	Never

6. The atmosphere of the group was friendly and open

Always	1	2	3	4	5	Never

7. The group has been able to discuss differences between the ideas of the group members and does not avoid conflict

Always	1	2	3	4	5	Never

8. Discussions were held which were irrelevant to the topic

Always	1	2	3	4	5	Never

9. Group members supported one another

Always	1	2	3	4	5	Never

10. I was able to contribute to the group

Always	1	2	3	4	5	Never

11. The other team members contributed to the group

Always	1	2	3	4	5	Never

12. The facilitator determined if the members of the group had reached consensus before moving on to the next point.

Always	1	2	3	4	5	Never

13. Group members were sensitive to my feelings

Always	1	2	3	4	5	Never

14. The group members participated to the best of their ability

Always	1	2	3	4	5	Never

15. People pushed their own views without trying to explain them to the others

Always	1	2	3	4	5	Never

16. Group members were encouraged to ask questions

Always	1	2	3	4	5	Never

17. The group was able to structure the session

Always	1	2	3	4	5	Never

18. We checked on our progress and were able to complete the task in the allotted time

Always	1	2	3	4	5	Never

19. People constantly interrupted me and I was unable to make my point

Always	1	2	3	4	5	Never

20. The facilitator was able to take the discussions from the various group members and make sense of them on the board.

Always	1	2	3	4	5	Never

21. Anything that you would want to add that is positive about the way that your group interacted?

. . . . . .

. . . . . .

22. Anything that you would like to add that is negative about the way your group interacted?

. . . . . .

. . . . . .

A.6 BUDDY/ SELF RATING

Your name: . . . . . .
Class group: 2..... Group name: . . . . . .
Write a number from 1 to 5 in the column under the person's name. 1 means that the person does not exhibit this skill and 5 means that they are excellent in the particular skill. Please also rate yourself. Write the name of the person you are rating at the top of each column.

Name —>	S E L F							
MEMBER SKILLS								
Participates to the best of their ability								
Listens to the ideas of the other members of the group								
Presents their own ideas clearly and logically								
Is flexible and does not always want their own ideas to be used								
Has good ideas to contribute to the group								
Encourages the other group members								
Asks questions if they are not clear on something								
Does not try to dominate the other members of the group								
Values the other group members as people								
FACILITATION SKILLS								
Clear about what the goal and objectives are								
Able to control the session								
Made me feel part of the group								
Encouraged all team members to participate								
Knew the modelling techniques well enough to manage the sessions								

A.7 BUSINESS SKILLS - 2ND YEARS Group: .....

Name: .....

Home Language: English / Xhosa / Afrikaans / Other (please specify) .....

Language of group preference: English only / Afrikaans / Xhosa .....

Gender: Male / Female .....

Mark for Information Systems I: below 50/50-59 / 60 - 74 / 75 -100

Confidence to talk in front of others

Very difficult for me	1	2	3	4	5	No problem for me

For each of the following businesses indicate how well they are known to you:

Library

Do not know it at all	Seldom used	Used often	Have worked there

Health club

Do not know it at all	Seldom used	Used often	Have worked there

Free clinic in townships

Do not know it at all	Seldom used	Used often	Have worked there

Computer laboratories at the Technikon

Do not know it at all	Seldom used	Used often	Have worked there

Restaurant

Do not know it at all	Seldom used	Used often	Have worked there

Grocery Store (like Spar or Checkers)

Do not know it at all	Seldom used	Used often	Have worked there

Appendix B

Case Study Results

This appendix firstly gives the results for the four case studies that were carried out for this study. The answers to the open-ended questions were categorised and are presented here, together with the students' and the observers' observations of the interaction of the groups. The statistics associated with the students' learning of the modelling techniques are also given for Case Studies 2 and 4. The last section is a comparison of the quantitative results from the main questionnaire for the four case studies. Where the questionnaires were modified this is also discussed. The discussion of the results is found in Chapter 8.

B.1 RESULTS OF CASE STUDY 1

Case Study 1 was done as a pilot study. The students were given only one questionnaire with both open and closed questions. The questionnaire can be found in Appendix A.1. There were 90 students in the class with 75 of them completing the questionnaire. The qualitative results will not add up to 75 as some students put more than one answer per question and others put no answers. The answers from the open ended questions were categorized to help gain insight into the students' answers.

B.1.1 Working in groups - Case Study 1

How much did you enjoy working in groups? - Question 7.

When asked to explain what they enjoyed the most or disliked the most, some interesting comments were found. The numbers in brackets are the quantity of people who gave the answer or one that could be categorised as that answer.

- Hearing other people's ideas (26);
- Interacting with other people (18);
- Working as a team (10);
- Able to argue, debate and reason with one another (9);
- Meeting and working with people I would not normally work with (8);
- Enabled me to take part (7); and
- Helps us to understand better (3).

There were also factors that students disliked about the group process.

- People who did not contribute (19);
- People who took over and dominated the group (7);

- People chatting and getting no work done (3);
- The argument and chaos (3); and
- Language differences (3).

When you were a member of the group and not the JAD facilitator, did you feel that the facilitators gave you a chance to have your say when you wanted to? - Question 10.

The open-ended questionnaire results indicated why the students answered as they did:

- The facilitators TRIED to accommodate everyone (14);
- Everyone was able to have their opinions taken into consideration (13);
- Some of the facilitators had problems (10):
  - Some were unable to control the group (4);
  - Some only chose certain people to answer questions (3); and
  - Some were themselves too dominating (1).
- I made myself heard (3).

Did you feel that you were able to contribute to the group? - Question 11.

The students' answers were categorised into the following:

- My input was listened to and taken notice of (17);
- If we differed on some point then we could say so (5);
- Others would be quicker than me so I would not say anything (4);
- Sometimes I did not understand the work (4); and
- I did contribute but the others did not take notice of my contribution (2).

Did you feel that all group members made contributions to the group? - Question 12.

The students answered as follows in the open-ended part of the question:

- A large number of students said that most of the students contributed but there were usually some who did not (41):
  - Attributed this to shyness on the part of the students (10);
  - Attributed this to laziness on the part of the students (6); and
  - Attributed it to some people knowing more than others (3).
- Everyone worked well together (6); and
- We made sure that everyone participated by asking them questions (3).

Did you feel accepted as a group member? - Question 13.

The open-ended questions showed that students answered the way they did for the following reasons:

- The atmosphere was friendly (10);
- People listened to me (7);

- I was usually in a group with friends (5); and
- Some students formed clicks and did not accept others (2).

B.1.2 Learning in groups - Case Study 1

The students were asked only one question in this category in Case Study 1.

Do you feel that the JAD techniques used in the classroom are effective in helping you to learn? - Question 14.

The comments made by the students showed that they had insight into what we were trying to achieve:

- Helps me to think and understand the work better (16);
- Helped to hear other people's opinions (12);
- Working practically helped me to remember and learn (10); and
- Helps in tests and exams (5).

B.1.3 Facilitation and language - Case Study 1

The students were asked how they enjoyed being the facilitator and then were asked to describe what they enjoyed most or disliked most about it. They were also asked about their experiences with the different languages in the group.

How did you enjoy being the JAD facilitator? - Question 8

The reasons that the students enjoyed facilitation were shown in the qualitative results by the following answers:

- The feeling of being in control (21);
- Getting people to work together towards a solution (14);
- Helped me to learn to speak in public (5);
- Nothing (5); and
- I was never the facilitator (3).

The things that the students disliked were:

- People who did not co-operate (17);
- Feeling that they could not control the group (5);
- People who would take over the discussion (5);
- Speaking in front of people (4); and
- The responsibility (4).

When you were JAD facilitator were you able to communicate in your home language? - Question 9

The students were then asked to comment on their experiences if they were to use only English as the medium within the group – only second language English students were

asked to comment.

- No problem (21);
- English should be used as we can all understand it (6);
- Would be easier to use my own language (4);
- Sometimes difficult to get my point across in English (3); and
- Helps me to learn English (2).

B.1.4 Use of JAD - Case Study 1

The students were asked whether they thought the modelling techniques would be useful in industry and why they thought the method was used.

Do you think that the modelling techniques you have used this year will be useful in industry? - Question 2.

The open-ended questions showed the following:

- Useful for systems analysis and design (28). Some of these went on to say that it was not useful for everything, only for systems analysis and design;
- Helps us develop the skills we need for industry (7);
- I do not know what happens in industry (6);
- Systems are similar to those used in industry (3); and
- Industries all differ and change rapidly so will not always be useful (3).

Why do you think that JAD techniques were used in the classroom? - Question 16

Their answers were:

- Get us used to what happens in industry (25);
- Teaches us to work in groups (18);
- Helps us improve personally (15):
  - Communication improves (9).;
  - Leadership improves (3); and
  - Gain confidence in yourself (2).
- Helps us to understand what we are learning (13); and
- Forces us to participate (10);

B.2 RESULTS OF CASE STUDY 2

The data from this case study was collected using a main questionnaire, the group questionnaires given to the students to assess their group processing and by having an observer in the classroom. The observer was a colleague from Staff Development at the Port Elizabeth Technikon. The qualitative comments from the students' answers to the open-ended questions are presented first. The quantitative results can be found in the tables in Section B.5, where they are compared to Case Studies 1,3 and 4.

B.2.1 Main questionnaire results - Case Study 2

The students were given a questionnaire with both open and closed questions. The questionnaire can be found in Appendix A.2. There were 113 students in the class with 87 completing the questionnaire. The qualitative results will not add up to 87 as some of the students put more than one answer per question, while others did not answer the open-ended part at all. The questionnaire was fairly similar to that used the previous year but was modified by adding some questions.

B.2.1.1 Working in groups - Case Study 2

How did you experience working in a group? - Question 6

The open-ended questions were used to determine what the students had enjoyed most or disliked most about working in the JAD groups. The number in brackets refers to the number of people that gave an answer that could be categorised as that answer.

- Interacting with other people (20);
- Hearing other people's ideas (18);
- Working as a team (15);
- Getting a good solution together (9);
- Facilitating (8);
- Debating, arguing and reasoning with one another (8);
- Meeting and working with people that I would not normally work with (7);
- The laughs (2); and
- Enabled me to have my say (2);

There were also a number of things that people disliked about the group work:

- People who did not contribute (19);
- People not taking my ideas into consideration (10);
- People who take over and dominate the group (8);
- Takes a lot of time (5);
- Conflict (5);
- People chatting and getting no work done (4);
- Difficult to hear (4); and
- Being facilitator (3).

When you were a member of the group and not the JAD facilitator, did you feel that the facilitators gave you a chance to have your say? - Question 9

The open-ended questions were answered very similarly to the previous case study:

- Everyone was able to have their opinions taken into consideration (19);
- The facilitators tried to accommodate everyone (16);
- Some facilitators had problems (11);

- Some only chose certain people in the group (3);
- Some were unable to control the group (2);
- Some were too dominating (1);

- Some people thought that they were always right (6);
- Sometimes my ideas were ignored (6); and
- I only spoke if the facilitators asked me something (2).

Did you feel that you were able to contribute to the group? - Question 10

Some of the comments made by the students were:

- My input was listened to and taken notice of (32);
- If we differed on some point then we could say so (13);
- Other people would jump ahead and say something, then I would not say anything (4);
- I am shy and was not able to explain (4);
- Sometimes I did not understand the work (3); and
- I did contribute but was not taken notice of (2).

Did you feel that all group members made contributions to the group? - Question 11

The open-ended questions gave some insight into this question:

- Most contributed but there were usually some who did not (40);
  Attributed it to:
  - shyness (11);
  - laziness (3);
  - domination by some (3);
  - people having their own conversations (3);
  - minorities feeling intimidated (2);
  - people not becoming part of the group (2); or
  - some knowing more than others (1).
- Everyone worked well together (27).

Did you feel that you were accepted as a group member? - Question 13

The explanations given by the students in the open-ended part of the questionnaire were:

- The atmosphere was friendly (18);
- People listened to me (14);
- We treated each other equally (5);
- My ideas were ignored (4); and
- I was the odd one out (2).

B.2.1.2 Learning in groups - Case Study 2

Do you feel that the JAD techniques used in the classroom are effective in helping you to learn? - Question 14

In the open-ended questions the following answers were given to explain their answers:

- Helped me to hear other people's opinions (14);
- Helped me be more sure about how to use ERDs and/or Use Cases (12);
- Helped me learn about JAD (9);
- Some people who answered that they only learnt a little then specified that this was because they already knew most of it (5).;
- Working practically helped me think better (5);
- Getting more difficult problems helped me learn more (4);
- Helped me sort out some errors that I had been making (3);
- Helped me to revise for exams (2); and
- I learn in my own way (2).

Do you feel that the JAD techniques helped you to learn how to feel more confident about how to act within a group? - Question 15

Some of the comments made by the students included:

- I feel less intimidated about sharing my ideas (10);
- I am fairly confident so it only helped me a little (10);
- You learn how to interact with other people better (7);
- Showed me that I can work in groups (2); and
- It forced me to participate which was good (2).

Do you feel that the JAD technique has helped you to learn to interact with other people? - Question 16

Many students did not fill in this section but those who did said:

- It helped me to listen to other people and give them a fair chance (6);
- I learned how to get many people's ideas and come to a decision (6);
- I learnt to speak freely in front of other people (5);
- I still feel shy but it did help me communicate better (4); and
- I met new people and learnt to interact with them (2).

Do you feel that the JAD technique has helped you to learn how to speak in front of small groups of people? - Question 17

Some of the comments made were:

- I feel more confident about speaking in front of people than I was before (19);
- I like to talk in front of people (6);
- It helped me learn to speak in front of people I did not know well (4);
- Being with friends made it easier than it would be in industry (4); and

- I still can't talk in front of people (4).

B.2.1.3 Facilitation and language - Case Study 2

The students were asked about how they enjoyed being the facilitator as well as their experiences of using English when facilitating.

How did you experience being the JAD facilitator? - Question 7

The students were asked to comment on what they enjoyed most and what they disliked most about being the facilitator. On the positive side the answers could be categorized as follows:

- Having control (17);
- Getting people to work together towards a solution (12);
- Structuring the ideas of others to get a good solution (8);
- Drawing on the board (8);
- Arguing (5);
- Everything (4);
- Giving everyone a chance to participate (3);
- Helped me learnt to speak in public (3); and
- Nothing (2).

On the negative side, the following comments were received:

- People who did not participate (12);
- Feelings of not being able to control the group (9);
- People who did not listen (7);
- Nothing (6);
- Drawing the diagrams on the board (5);
- Noise (4);
- Speaking in front of people (4);
- Not understanding what people were trying to tell me (4); and
- Not understanding the techniques well myself (4).

When you were the JAD facilitator were you able to communicate in your home language? - Question 8

The open-ended questions yielded the following comments:

- No problem (22); and
- Sometimes it is difficult to get my point across in English (4).

B.2.1.4 Use of JAD - Case Study 2

There were two questions asked in this section. The first concerned the use of the modelling techniques in industry and the second concerned why they felt that the lecturer had chosen to use these techniques in class.

Do you think that the modelling techniques that you have learnt this year will be useful in industry? - Question 5

Some of the comments made by the students included:

- The techniques are useful for Systems Analysis and Design (25);
- Helps us develop some of the skills we need in industry (9);
- Good method of actively involving users (6);
- Teaches us listening and communication skills used in industry (5);
- Teaches us the group skills needed in industry (4);
- You teach it to us (2);
- Systems are similar to those used in industry (2); and
- We will not use everything that we learn in industry (2).

Why do you think that JAD techniques were used in the classroom? You may mention more than one reason. - Question 18

This was an open-ended question only. The students answers can be categorized as follows:

- Helps us get used to what happens in industry (32);
- Teaches us to work in groups (29);
- Helps us understand what we are learning (13);
- Gives us JAD skills (13);
- Teaches us to interact with other people (11);
- Helps us improve our communication skills (11);
- Helps us gain confidence in ourselves (11);
- Teaches us to respect others (3);
- Lets us get the opinions of others (3);
- We learn to know one another (2); and
- We see the importance of user input (2).

B.2.2 Group questionnaires - Case Study 2

The students were asked to evaluate their functioning as a group after the first JAD session and after the third (and last) JAD session. Table B.1 gives an indication of their response to the questions asked. The answers to the questions went from 1 to 5 with 1 meaning ALWAYS and 5 meaning NEVER. The column labelled shift wanted gives an indication of the direction in which one would have hoped that the mean would shift as some of the questions were asked with a positive bias and others with a negative one.

As the students answered the questionnaire anonymously, no comparison could be made on an individual level and the Mann Whitney test was used to determine if there was a significant shift in the two distributions. The Mann Whitney statistic is given by the symbol "U" and the associated normal value by the value "Z". A p-value less that 0.05 is considered to be significant.

	Valid N - Time 1	Mean - Time 1	Valid N - Time 3	Mean - Time 3	Shift in Mean	Shift wanted	U	Z	p-value
1. We made sure that everyone understood the objectives for the session at the start of the session	94	2.12	91	1.60	-0.52	-	3271	-2.981	0.0029
2. The group members listened to and responded to the other member's ideas and comments	93	1.71	91	1.68	-0.03	-	4227	-0.013	0.9890
3. The group members were all involved and participated in the discussion	94	2.03	91	1.95	-0.09	-	3998	-0.812	0.4168
4. Dominant members were allowed to dominate the group	93	3.67	91	3.62	-0.05	+	4106	-0.359	0.7193
5. Group members involved themselves in private conversations thus disturbing the group	94	3.78	91	3.82	0.05	+	4202	-0.213	0.8313
6. The atmosphere of the group was friendly and open	94	1.51	91	1.43	-0.08	-	4257	-0.065	0.9485
7. The group has been able to discuss differences between the ideas of the group members and does not avoid conflict	93	2.09	91	1.81	-0.27	-	3437	-2.329	0.0193
8. Discussions were held which were irrelevant to the topic	94	4.36	91	4.35	-0.01	-	4186	-0.282	0.7780
9. Group members supported one another	94	1.85	90	1.87	0.02	-	4177	-0.157	0.8753
10. I was able to contribute to the group	94	1.71	91	1.59	-0.12	-	4039	-0.720	0.4714
11. The other team members contributed to the group	94	1.80	91	1.58	-0.22	-	3763	-1.560	0.1188
12. The facilitator determined if the members of the group had reached consensus before moving on to the next point	93	2.12	91	1.90	-0.22	-	3225	-2.975	0.1473
13. Group members were sensitive to my feelings	92	2.43	91	1.97	-0.47	-	3220	-2.810	0.0050
14. The group members participated to the best of their ability	94	1.89	91	1.68	-0.21	-	3716	-1.673	0.0944

	Valid N - Time 1	Mean - Time 1	Valid N - Time 3	Mean - Time 3	Shift in Mean	Shift wanted	U	Z	p-value
15. People pushed their own views without trying to explain them to the others	94	3.94	91	3.92	-0.02	+	4221	-0.160	0.8753
16. Group members were encouraged to ask questions	94	2.49	91	2.05	-0.43	-	3239	-2.964	0.0030
17. The group was able to structure the session	94	2.32	91	1.91	-0.38	-	3288	-2.858	0.0043
18. We checked our progress and were able to complete the task in the allotted time	91	2.35	89	1.81	-0.54	-	3145	-2.722	0.0065
19. People constantly interrupted me and I was unable to make my point	94	4.04	91	4.19	0.14	+	3813	-1.362	0.1732
20. The facilitator was able to take the discussions from various group members and make sense of them on the board	94	2.09	90	1.64	-0.44	-	3225	-2.982	0.0029

Table B.1: Group processing at time 1 and time 3

Observations of group processing

Four of the groups were also evaluated by an independent observer who gave her impressions of the group processing according to the same questionnaire as the students. The observer was only able to spend about 10-15 minutes with each group. The observer also gave some open comments on the different groups which are discussed below. She was not able to give feedback on all the questions and those that were not answered have been left out of Table B.2.

The groups have been numbered from 1 to 4 and the column heading Self refers to the average that the students in the group gave themselves. The column labelled Obs refers to the value that the observer gave the group. This was done after Session 3.

Group 1 was observed to have 2 strong members who skewed the participation. The black group members were also not given an equal chance of participation and were not treated as being of equal status. The observer's comments are also backed up by the group's answers to the question on domination where the students' answers ranged from 1 through to 5 showing the different student's perspective on this. The observer's evaluation of this group and that of the students seemed to be fairly similar in most of the questions (within 1 point.) The only one's with a larger discrepancy being the one on domination and the one on the friendliness of the group where the students experienced the group as being more friendly than the observer felt they were.

Group 2 was observed to be very task oriented. The participation here was observed to be equal and the group members of equal status. The observer differed from the students evaluation of themselves by more than 1 point on a number of questions.

The students did not feel that they were as good at making sure objectives were understood as the observer felt they were. The fact that the observer felt that they did not hold discussions irrelevant to the topic but that the students felt that they sometimes did, is probably due to the students being aware of the observer and keeping to the topic when she was there. The observer felt that the students did encourage one another to ask questions. Looking at the individual student's responses to this, one finds a wide discrepancy for this question with the students answers ranging from 1 through to 5. The fact that the observer was only there for 10-15 minutes could explain why there is a difference between the way the students see their ability to structure the session and the way the observer saw this. The ability of the facilitator to put the discussion of the group on the board was also different but it would probably depend on who facilitated during the time that the observer was there.

Group 3 had 3 females who tended to dominate the group according to the observer. The white males would relax and watch and participate every now again. The black members did not participate at all. One of the black group members in this group was an A-aggregate student so it was disappointing to note that there was this problem in this group too.

	Group 1		Group 2		Group 3		Group 4	
	Self	Obs	Self	Obs	Self	Obs	Self	Obs
1. We made sure that everyone understood the objectives for the session at the start of the session	1.57	-	2.75	1	2	-	1	-
2. The group members listened to and responded to the other member's ideas and comments	1.86	2	2.00	1	2.00	2	1.57	3
3. The group members were all involved and participated in the discussion	1.86	2	1.75	1	2.67	5	1.86	3
4. Dominant members were allowed to dominate the group	3.14	2	4.75	5	3.67	1	3.29	1
5. Group members involved themselves in private conversations thus disturbing the group	4.00	4	5.00	5	3.83	3	4.00	5
6. The atmosphere of the group was friendly and open	1.43	3	2.00	1	1.83	3	1.14	3
7. The group has been able to discuss differences between the ideas of the group members and does not avoid conflict	1.57	2	1.75	1	2.67	3	1.71	4
8. Discussions were held which were irrelevant to the topic	4.43	5	3.75	5	4.00	5	4.57	5
9. Group members supported one another	2.00	2	1.75	2	2.33	2	1.00	3
10. I was able to contribute to the group	1.57	-	1.00	-	2.17	-	1.57	-
11. The other team members contributed to the group	1.43	2	1.00	1	2.00	3	1.00	3
12. The facilitator determined if the members of the group had reached consensus before moving on to the next point	2.00	2	2.25	2	2.67	2	1.29	2
13. Group members were sensitive to my feelings	2.29	-	1.75	-	2.50	-	1.00	-
14. The group members participated to the best of their ability	1.43	2	1.00	1	2.33	3	1.29	2
15. People pushed their own views without trying to explain them to the others	3.57	4	4.00	4	3.33	4	4.57	2

	Group 1		Group 2		Group 3		Group 4	
	Self	Obs	Self	Obs	Self	Obs	Self	Obs
16. Group members were encouraged to ask questions	2.00	2	2.50	1	2.33	2	1.43	2
17. The group was able to structure the session	2.14	1	3.25	1	2.33	3	1.57	2
18. We checked our progress and were able to complete the task in the allotted time	2.80	-	2.75	-	2.33	-	1.14	-
19. People constantly interrupted me and I was unable to make my point	3.57	-	4.50	-	3.50	-	4.86	-
20. The facilitator was able to take the discussions from various group members and make sense of them on the board	1.71	2	2.25	1	2.33	-	1.33	-

Table B.2: Observer versus self evaluation of group processing - Time 3

The group members did feel that there was some problem with their participation and put the value between 1 and 4 with an average of 2.67. The observer saw it as more of a problem and put the value at 5 ie never. The observer saw the problem of domination in this group with the 3 females dominating. It is possible that the students did not see it as a problem because there were 3 people involved. The group once again saw itself as being friendly although one student in the group gave the same value as the observer ie 3. In all other aspects, the students and the observer had similar views of the group (within 1 point.)

Group 4 enjoyed participation by all but did have one member who tried to dominate the group. The observer also felt that the black group member in this group was not treated as being of equal status although they did try to participate. The observer almost consistently put this group as worse than they saw themselves. This was true with respect to listening, participation, domination, friendliness, handling of conflict, support of one another, contribution and people pushing their views onto the group.

It is difficult to tell why this is true as the students in the group seemed to experience the group in a positive way. All the students except 1, for example, said that the group was ALWAYS friendly (1) and that one gave the group a 2. The group members themselves felt that the group supported them - all giving a 1 - but the observer felt that the group only deserved a 3 for this. No reason for this discrepancy could be found.

B.2.3 Assessment of students' learning - Case Study 2

The students were given a pre-test of their knowledge of use cases and the examination question served as a post-test. The three Information Systems II lecturers were satisfied that the questions were of the same standard. This was not done for the ER diagrams although more time was spent on these as the question in the examination was much more difficult than that of the test.

It must be remembered that no effort was made to stop the students from doing any extra studying of their own as this was felt to be unethical and not in line with the attempt to study the topic in context. Table B.3 shows the results of the t-test done for the dependent samples.

All the criteria for a t-test are satisfied and the p-value is extremely low which indicates that the difference between the mean for the pre-test and post-test cannot be attributed to chance. The p-value is much less than 0.05 which indicates that the difference between the means is very significant.

	Mean	Std Dev	N	Diff	Std Dev Diff	t	df	p-value
PRE%	70.265	15.038	113					
POST%	79.281	14.979	113	-9.016	14.846	-6.456	112	2.86E-09

Table B.3: T-test results for marks for Use-Cases

As one can see clearly from the graph in Figure B.1, there was a definite improvement in the marks of the students at all levels (except those who had exceptionally high marks). The red line shows the line for the regression analysis with the dotted line showing the line with 95% certainty. The formula for the red straight line is Post-Test % = 43.535 + 0.50874 * Pre-Test%. The correlation value r = 0.51078.

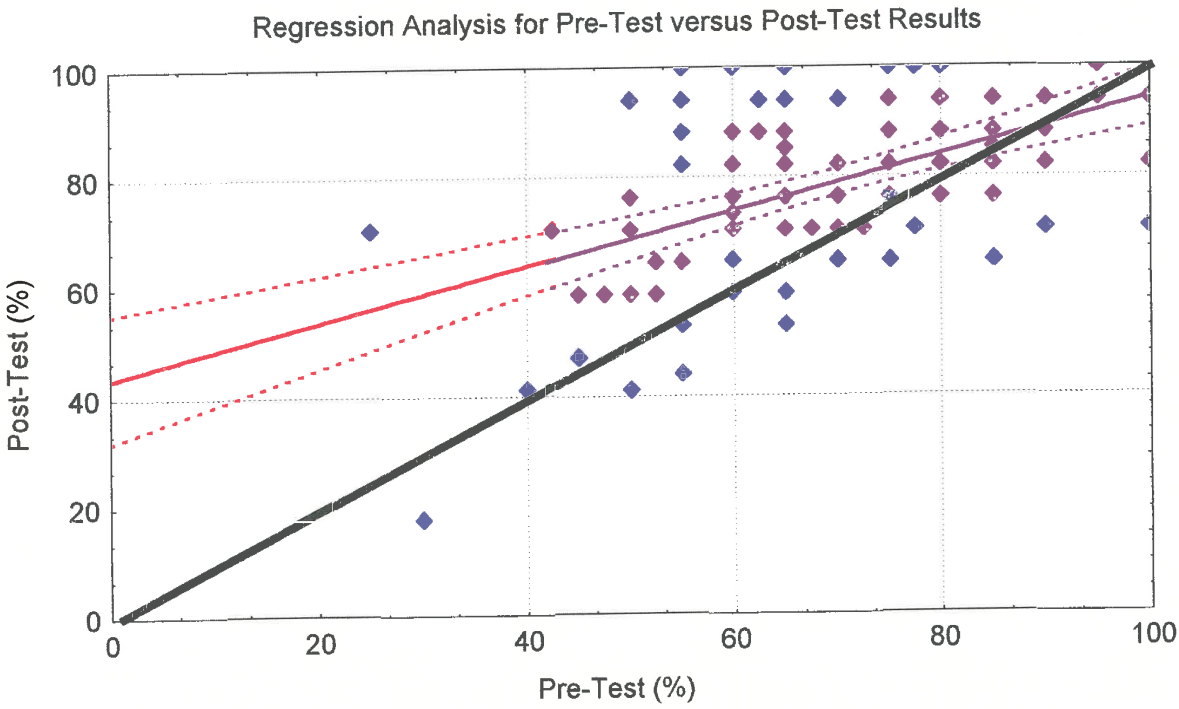

Figure B.1: Scatter plot showing pre- and post-test results - Case Study 2

B.3 RESULTS OF CASE STUDY 3

B.3.1 Main questionnaire results - Case Study 3

The students were given a questionnaire with both open and closed questions. The questionnaire was an adaption of the one used in Case Study 2 and 3 and can be found in Appendix A.3. In total 61 students completed the questionnaire. The qualitative results from the open-ended questions are given along with the qualitative results. Where students exact words are used, there may be some grammar errors as English was often the students' second or third language.

B.3.1.1 Working in groups

How did you experience working in groups? - Question 6

There were many reasons that the students gave to indicate what they enjoyed most about working in groups. The numbers in brackets indicate the number of students whose answers could be categorized as this answer:

- Hearing other people's ideas (22);
- Interacting with other people (11);
- Helped me to understand better (8);
- Getting a good solution (7);
- Being able to argue, debate or reason with one another (6);
- Helped me to have other people criticise my ideas (3); and
- Learnt how to control my emotions and behave in a group (2).

The students were also asked to comment on the thing that they disliked the most. On the negative side, some of the more common comments were:

- People who did not contribute (6);
- Conflict (6);
- People having private conversations (5);
- Nothing (5);
- People who try to dominate the group (4);
- I like working alone (4); and
- It takes a lot of time (2).

When you were a member of the group and not the facilitator, did you feel that the facilitators gave you a chance to have your say? - Question 9.

On the open-ended question many of the answers could be categorised as shown below:

- The facilitators tried to give everyone a chance (20);
- Facilitators tried to make sure that everyone participated (11);

- Everyone was able to have their opinions taken into consideration (5); and
- I made myself heard (2).

Did you feel that you were able to contribute to the group? - Question 10.

Some of the more common answers in the open-ended section were:
- My input was listened to and taken notice of (10);
- My ideas were often used by the group (7);
- If we differed on some point then we would say so (4);
- Facilitators got us all to participate (4); and
- I was able to have my say (2).

Did you feel that all group members made contributions to the group? - Question 11.

Categorising the answers from the open-ended questions gives the following:
- Everyone worked well together (17);
- Most contributed but there were some who did not (6);
  - attributed this to shyness (1)
  - attributed it to some knowing more than others (1)
- Some just agreed to everything (6); and
- We made sure that everyone participated by asking questions (3).

Did you feel that you were accepted as a group member? - Question 12.

Some of the students' answers could be categorized as follows:
- People listened to me (15);
- The atmosphere was friendly (10); and
- I asked a lot of questions (2).

B.3.1.2 Learning in groups - Case Study 3

The questions asked were the same as in the previous case study.

Do you feel that the JAD techniques used in the classroom are effective in helping you to learn? - Question 14

Some of the comments made by the students in the open-ended part include:
- Helped to hear the opinions of others (5);
- Helped me to learn about JAD (5);
- Helped me to learn about ERDs (4);
- Working practically helped me to think better (3); and
- Helped me learn to communicate with others (2).

Do you feel that the JAD technique has helped you to learn to feel more confident

about how to act within a group? - Question 15

Only three common comments could be categorised in the open-ended answers. These were:

- I was shy but now I feel that I can share my ideas (8);
- It forced me to participate which was good (2); and
- You learn how to interact with people better (2).

Do you feel that the JAD technique has helped you to learn to interact with other people? - Question 16

The answers were categorized as:

- It helped me learn to listen to other people and give them a chance (5);
- I learnt to speak freely in front of other people (3); and
- I learnt to relate to other people (3).

Do you feel that the JAD technique has helped you to learn how to speak in front of small groups of people? - Question 17

There were only two comments made by more than one person. These were:

- I was shy but now I feel more confident about speaking in front of people (13); or
- Helped me to speak English (2).

B.3.1.3 Facilitation and language - Case Study 3

How did you experience being JAD facilitator? - Question 7

The students were asked to comment on what they liked and disliked about being the JAD facilitator. On the positive side, some of the comments made could be categorized as:

- Helped me to learn how to speak in front of other people (14);
- Liked having control (9);
- Liked getting people to work together towards a solution (7);
- Liked hearing other people's ideas (6);
- Enjoyed getting people to understand (2); and
- Helped me to feel more confident (2).

On the negative side people disliked:

- Nothing (9);
- People who did not cooperate (6); and
- People taking over the discussion (3).

When you were working in your JAD groups, were you able to communicate in your home language? - Question 8

After the quantitative question, the students were asked: "*If you were not able to communicate in your home language, mention the language that was used in your group and describe your experiences using that language.*"

Twenty-two of the students said that English was used in their group and 6 said that a mixture of Xhosa and English was used. Only six of the students commented on their having to use English and these said:

- It is good to use English as we will have to one day in industry (3); and
- It is good to use English as it is an international language (2).

B.3.1.4 Use of JAD - Case Study 3

Do you think that the entity-relationship modelling techniques that you have learnt this year will be useful in industry? - Question 5

Some of the comments that were most common included:

- Helps to clarify what users need (10);
- Useful for the Systems Analysis and Design phases (7);
- Helps us to develop the skills we will need in industry (7); and
- Systems are similar to those used in industry (5).

Why do you think that JAD techniques were used in the classroom? You may mention more than one reason. - Question 18.

This section had no quantitative part as the students' thoughts were wanted. The most common reasons given were:

- Helps us improve personally (15) because:
  - Improves our communication (10);
  - Helps us gain confidence in ourselves (5);
- Teaches us to work in groups (14);
- Gets us used to what happens in industry (11);
- Helps us learn about JAD (5);
- Helps us to understand what we are learning (4);
- Helps us learn to work with different people (3);
- Teaches us to contribute ideas (3); and
- Forces us to participate (2).

What method of learning the entity-relationship modelling techniques do you prefer? - Question 13

Almost all the students chose the JAD method. Their comments were:

- JAD helps us to share ideas (14);
- JAD helps improve participation (4);
- With JAD others can help me (3);
- With JAD we all combine our answers to get a better solution (2);

- IT will help us when we get into industry (2); and
- It is faster not to use JAD (2).

B.3.2 Group questionnaires - Case Study 3

The group questionnaire was only administered at the end of the first day and was mostly used to help the students to determine what their problems were. The questionnaire consisted of 20 questions and 2 open-ended questions. The 20 questions could be answered with a value from 1 to 5 with 1 meaning always and 5 meaning never. Each group's answers to the questionnaires were integrated to give the students feedback on their group processing. The questionnaire can be found in Appendix A.3 and the Table with the results in Table B.4.

An observer sat in the groups in East London over the two days and evaluated the 4 groups in East London. She spent approximately 20 - 30 minutes with each group. The groups have been numbered from 1 to 4 and the column heading Self refers to the average that the students in the group gave themselves. The column labelled Obs refers to the value that the observer gave the group. Note that the observer's comments for Groups' 3 and 4 were done on the second day, whereas the students filled in the group questionnaire on the first day.

On the whole the groups seemed to work well together. One of the problem areas seemed to be that the groups were not sensitive to the feelings of the other members of the group. There was also a bit of a problem with the ability of the facilitator to take the discussions of the various group members and make sense of them on the board. Two aspects that could also be improved include the participation by everyone and the groups' ability to discuss differences and not avoid conflict. On the whole, the atmosphere in the class was very positive and the participation by the students seemed to be good.

Looking at the individual groups, where an observer was present, shows up some of the more detailed problems that the students experienced. The facilitator found that the first facilitator used in Group 1 had a fairly strong personality. He tended to write down his own solution rather than involve the group. The group was, however, quick to correct him if necessary. After the first 10 minutes, the group relaxed and each began to contribute. The person who had been JAD facilitator made better contributions when relegated to the role of team member. The observer found that the students were trying to establish a 'pecking order' at first which effected the openness and trust of the group. The group seemed to settle after a while and the group dynamics improved. The observer was there for the first part of the lesson - about half an hour. The students and the observer differ on their perceptions of the domination in the group. They also felt that the group was friendly and open (1.6) whereas the observer had not experienced it as such (4). The same difference is found in the group supporting one another where the group gave themselves an average of 1.6 and the observer felt that this was only worth a 3. This may be because the students filled in the form at the end

	Mean Day 1	Group 1		Group 2		Group 3		Group 4	
		Self	Obs	Self	Obs	Self	Obs	Self	Obs
1. We made sure that everyone understood the objectives for the session at the start of the session	1.5	1.8	3	1.8	-	1	4	2.8	-
2. The group members listened to and responded to the other member's ideas and comments	1.3	2	2	2	2	1	3	1.5	2
3. The group members were all involved and participated in the discussion	1.3	1.4	2	1.4	2	1	1	2.7	4
4. Dominant members were allowed to dominate the group	4.4	4.2	3	4.8	3	2.4	4	4.7	4
5. Group members involved themselves in private conversations thus disturbing the group	4.7	3.4	3	4.2	5	5	4	4.8	4
6. The atmosphere of the group was friendly and open	1.2	1.6	4	1.4	1	1	1	1.3	3
7. The group has been able to discuss differences between the ideas of the group members and does not avoid conflict	2.1	2	3	2	2	2.4	1	1.2	2
8. Discussions were held which were irrelevant to the topic	4.5	4.4	5	5	5	3.4	5	3.8	5
9. Group members supported one another	1.4	1.6	3	2.8	2	1	1	1.8	3
10. I was able to contribute to the group	1.1	1.2	-	1	-	1	-	1	-
11. The other team members contributed to the group	2.3	3	2	1.4	2	3.4	2	2.2	2
12. The facilitator determined if the members of the group had reached consensus before moving on to the next point	1.4	2	4	1	1	1.2	4	1.5	2
13. Group members were sensitive to my feelings	3.1	2.8	3	2.8	2	2.8	2	1.7	2
14. The group members participated to the best of their ability	1.2	2	1	1	1	1	1	1.5	4
15. People pushed their own views without trying to explain them to the others	4.6	4.4	4	4.6	4	4.6	4	4.5	4

	Mean Day 1	Group 1		Group 2		Group 3		Group 4	
		Self	Obs	Self	Obs	Self	Obs	Self	Obs
16. Group members were encouraged to ask questions	1.5	2	2	1	1	1	4	1.5	4
17. The group was able to structure the session	1.6	2.2	4	1.6	2	1.2	2	1.5	2
18. We checked our progress and were able to complete the task in the allotted time	2.0	2.4	-	2.6	-	1	-	2.5	-
19. People constantly interrupted me and I was unable to make my point	4.4	4	4	3.8	5	4.4	3	4.8	5
20. The facilitator was able to take the discussions from various group members and make sense of them on the board	2.5	2.8	2	2.3	2	2	4	1.5	1

Table B.4: Group processing evaluation - self and observer

of the hour and that the atmosphere had improved throughout the session. The lecturer had also noticed that the students in this group had a difficult time getting going but became more and more productive as time progressed. The observer felt that the facilitator almost never (4) determined that the group had reached consensus before moving to the next point, whereas the students felt that they almost always did this (2).

Group 2 was an interesting group. The group was made up of all girls, most of whom had very strong personalities and very definite ideas as to what should be done. During the first part of the JAD session, the lecturer had to interrupt them a few times to ask them to respect what each other was saying and to listen to one another. They were all talking at once and the facilitators were unable to control the session. The group improved, however, and by the time the observer got there, they were working quite effectively together. It was interesting to note that they gave themselves a rating of 4.8 for almost never allowing dominate members to dominate the group. The observer gave them a 3. It depends on what is meant by being allowed to dominate. Most of the members were trying to be dominant at first, but it is true that the others would not allow them to dominate as they, themselves, were also trying to dominate. One problem that this group had was their lack of support for one another. It is interesting to note that the students gave themselves a 3.8 average for the problem of being interrupted whereas the observer gave them a 5 ie. the observer never saw any problem. This could be an indication of the growth that took place in this group as the time progressed. At the start of the session, the lecturer would have said that the group deserved a 1 or 2 for this but they were really working well together towards the end.

The observer found Group 3 to be very open and relaxed with each other. They did not seem to feel threatened when other people disagreed with them and they worked well together as a team. She found, however, that the facilitators did not really guide or lead the discussion and that the only difference between the facilitators and the other group members was that the facilitator was writing on the board. The group themselves had felt after the first session that they had a problem with avoiding conflict (2,4) but this was not evident on the second day to the observer who gave them a 1 to say that they were always able to discuss their differences and did not avoid conflict. The team themselves felt that the facilitator determined if they had reached consensus before moving to the next point (1,2) and that the group was encouraged to ask questions (1). The observer felt that this was not the case and gave them 4 for each of these questions, meaning that they almost never were able to do this. There was also a difference of opinion about people interrupting one another and the facilitators ability to make sense of the discussions on the board.

The last group also did their self evaluation on day 1 and was observed on day 2. The observer found that the facilitators asked leading questions and encouraged group members to question and justify their decisions. She found that the facilitators tried to draw all the team members into the discussion. There were, however, two very quiet team members who did not contribute much despite the facilitators encouragement. This would account for the low score by both observer (4 - for question 3 and 14) and

themselves (2.7 for question 3 and 1.5 for question 14) for this aspect. From the observers comments, one would have expected that the group would score quite well on the fact of being encouraged to ask questions. This was not so, however, and the observer gave the group a 4 - meaning almost never - whereas the group gave themselves a 1.5. The group felt that they were friendly and open (1,3) but the observer felt that they were less so (3). This difference was also found in their supporting one another where they rated themselves with a 1,8 but the observer only gave them a 3. Another point where a difference was found was in whether they held discussions which were irrelevant to the topic. The students felt that they sometimes had a problem with this (3,8) whereas the observer did not find so (5). This could be because the students stopped having irrelevant discussions when the observer was there. Another explanation is that the students spoke Xhosa, which the observer could not understand.

B.4 RESULTS OF CASE STUDY 4

B.4.1 Main questionnaire results - Case Study 4

The students were asked the same questions as the previous year in Case Study 2. The questionnaire can be found in Appendix A.2. There were 129 students in the class and 117 completed the questionnaire.

B.4.1.1 Working in groups - Case Study 4

How did you experience working in a group? - Question 7

The open-ended questions were used to determine what the students enjoyed most and disliked the most about working in groups.

They enjoyed:
- Hearing other people's ideas (41);
- Working as a team (26);
- Enabled me to share my ideas (19);
- Interacting with other people (17);
- Working together to achieve our goal (16);
- The friendly people (11);
- Able to argue, debate and reason with one another (7);
- Helps us to understand better (7);
- Relaxed environment (3); and
- People listened to me (2).

There were also a lot of negative comments although not nearly as many as the positive. Students mentioned the following:
- People who did not contribute (18);
- People who take over and dominate the group (11);

- People having private conversations (7);
- Time consuming (5);
- Wandering off the topic (4);
- People not taking my ideas into consideration (4);
- Noise (3);
- People not knowing the techniques (3);
- Not doing IS2 meant that I did not know the techniques (2); and
- Being facilitator (2).

When you were a member of the group and not the facilitator, did you feel that the facilitators gave you a chance to have your say? - Question 10

The open-ended questions brought many responses:

- Everyone was able to have their opinions taken into consideration (30);
- Facilitators tried to accommodate everyone (14);
- I was given a chance to speak if I wanted to (14);
- Some of the facilitators had problems (13)
  - Only listened to some people (3);
  - Were unable to control the group (3);
  - Allowed some people to dominate (3);
  - Wanted to use their own ideas (2);
  - Allowed people to interrupt me (1);
  - Had no idea what to do (1);
- I gave my views, others gave theirs, we discussed and came to a decision (7);
- Facilitators asked questions to everyone (7);
- I was asked my opinion (2); and
- We worked well together (2).

Did you feel that you were able to contribute to the group? - Question 11

The students comments on this question were:

- My input was listened to and taken notice of (18);
- My ideas were often used by the group (13);
- I spoke when I thought it necessary (11);
- We used my ideas to discuss and come to a conclusion (9);
- Everyone's ideas were discussed and considered (9);
- I tried my best (4);
- I always gave my ideas (4);
- Sometimes I did not understand the work (3); and
- The group was friendly so it was easy to contribute (2).

Did you feel that all group members made contributions to the group? - Question 12

The open-ended questions show the following:

- Most contributed but there were some who did not (56)
  Attributed it to:
  - some knowing more than others (10);
  - shyness (4);
  - language differences (3);
  - laziness (1);
  - size of group (1);
- Everyone worked well together (25);
- Some people dominated (2);
- Some people had private conversations (2); and
- Everyone tried their best (2).

Did you feel accepted as a group member? - Question 13

This is also shown in the open-ended question results:
- The atmosphere was friendly (24);
- People listened to me (21);
- The group treated me with respect (11);
- Everyone was accepted (7);
- I did not feel left out (5); and
- Everyone was included (4).

B.4.1.2 Learning in groups - Case study 4

The students were asked questions about whether they perceived that they had learnt through the JAD sessions. They were asked about their learning in general, the group skills learnt, whether they felt they had learnt to interact with others and whether they had learnt to speak in front of other people.

Did you feel that the JAD techniques used in the classroom are effective in helping you to learn? - Question 15

The open-ended questions revealed the following:
- Helped me to think and understand the work better (22);
- Helped to hear other people's opinions (14);
- Teaches us about group work too (9);
- Helped me learn about JAD (5);
- Knew it quite well but it helped me iron out some problems (5);
- Helped me prepare for IS2 for next year (3);
- Working practically helped me to remember and learn (3);
- Already knew it quite well so only helped a little (2); and
- People in the group explained to the others (2).

Do you feel that the JAD techniques helped you to learn how to feel more confident about acting within a group? - Question 16

The students' open-ended answers were similar to the previous year although the idea of feeling part of the group was more prominent in 2000.

- I feel less intimidated about sharing my ideas (16);
- I was shy at first but am now more confident (7);
- I am fairly confident so it only helped me a little (7);
- I felt like I was part of the group (6);
- You learn how to interact with others better (3);
- Forced me to participate - which was good (3); and
- I am still not very confident (3).

Do you feel that the JAD technique has helped you to learn how to interact with other people? - Question 17

Some of the comments made by the students were:

- I learnt to speak freely in front of people (13);
- I already knew how so it only helped a little (11);
- I met new people and learnt to interact with them (7);
- It helped me to learnt to listen to other people and give them a chance (6);
- I learnt to get many people's ideas and come to a decision (3);
- Helped me learnt to interact in a more business-like way (3);
- Helped me learnt how to interact with a group (3); and
- I still feel shy but it did help me to communicate better (2).

Did you feel that the JAD technique has helped you to learn how to speak in front of small groups of people? - Question 18

The students comments in the open-ended questions were:

- I feel more confident about speaking in front of people than I was before (20);
- It was not a problem before so I only learnt a little (7);
- I like to talk in front of people (6);
- Being friends made it easier than it would have been in industry (4);
- I still can't talk in front of people (4);
- Helped me with my English fluency (3); and
- Helped me not to be afraid (2).

B.4.1.3 Facilitation and language - Case Study 4

The question asked in the case study about being the facilitator was the same as in the previous case studies, namely:

How did you experience being the JAD facilitator? - Question 8

The students were asked to comment on what they enjoyed the most and what they disliked the most about being the JAD facilitator.

In the open-ended questions the following answers were received:

- Liked having control (36);
- Getting people to work together towards a solution (24);
- Felt more part of the group (7);
- Listening to others (6);
- Writing on the board (6);
- People listened to me (5);
- Learnt a lot (3);
- Helped me to learn to speak in public (2); and
- Able to give ideas (2).

On the negative side the following comments were made:

- People talking among themselves (12);
- People who did not co-operate (12);
- Speaking in front of people (7);
- Not knowing the IS2 work (4);
- Trying to get people to participate (4);
- People not listening (4);
- Having to explain to people who did not understand (3);
- Noise (3);
- Settling arguments (2); and
- People taking over the discussion (2).

When you were working in your JAD groups, were you able to communicate in your home language? - Question 9

They were further asked to comment on their experiences if they were unable to communicate in their home language.

It is only in the open-ended questions that one can determine if there was a problem with the language use and the students answered:

- No problem (27);
- English should be used as we all understand it (11);
- Sometimes difficult to get my point across in English (5); and
- Helped me to learn more English (3).

B.4.1.4 Use of JAD - Case Study 4

The students were asked about whether they thought the entity-relationship modelling techniques would be useful in industry as well as why they thought that the JAD techniques had been introduced into the classroom. The first question was slightly different from that used in Case Study 2 as it specified the entity-relationship techniques.

Did you think that the entity-relationship modelling techniques that you have learnt this year will be useful in industry? - Question 6

The students comments were similar to the previous year:

- Modelling helps you to understand the system better (22);
- Helps design databases (15);
- Useful for systems analysis and design (12);
- Helps us layout requirements logically (6);
- I do not know what happens in industry (6);
- Things may be quite different in industry (4);
- Helps you to think before you start a system (4);
- Helps to determine relationships (4);
- Helps in discussion with others (3); and
- Not practical for industry (2).

Why do you think the JAD techniques were used in the classroom? You may mention more than one reason. - Question 19

This was only an open-ended question and the students answers could be categorised as follows:

- Teaches us to work in groups (37);
- Gets us used to what happens in industry (36);
- Helps us improve our communication skills (26);
- Helps us interact with others (16);
- To help us understand the design techniques (13);
- Helps us learn to make group decisions (9);
- Helps us get to know one another better (8);
- Out leadership improves (6); and
- You gain confidence in yourself (6).

B.4.2 Group questionnaires - Case Study 4

The students were once again given questionnaires to evaluate their functioning as a group at the end of the first and last sessions. The results from the first session were analysed by the lecturer and given back to them as feedback for the second session. This was to help them evaluate their group processing and to see where they needed to improve and what their strengths as a group were.

Table B.5 gives an indication of their responses at time 1 and time 3. The answers to the questions were from 1 to 5 with 1 meaning ALWAYS and 5 meaning NEVER. As some of the questions were asked in a way where ALWAYS was negative and NEVER was positive, the shift wanted column gives an indication of the direction of the shift that one would have wanted. The Mann-Whitney test was used to determine if there was a significant shift in the distributions as the results could not be done using matched pairs because the students filled the questionnaire in anonymously. A p-value of less

than 0,05 is considered significant. The Mann-Whitney statistic is given by the symbol "U" and the associated normal value by "Z".

Observations of group processing

An independent observer observed four of the groups. For Case Study 4, the observer did not fill in same questionnaire as the students but rather wrote his observations down in long hand. Some changes were made after the first session as a result of his observations and these will be noted here. These observations will be described here.

The groups will be called Group A, Group B, Group C and Group D.

Group A was a larger group of 9 students. The observer noted during the first session that the group tended to form smaller groups, some would speak through the facilitator and the others would hold private discussions. Sometimes even the facilitator would carry on a discussion with one group member and would allow the others to continue. He noted that the position of the group members - whether they were next to their friends or not - seemed to make this problem worse. A change in facilitator did improve things somewhat and more team members took part. Another problem was the position of the facilitator. The students had tended to put their desks quite close to the board and this meant that when the facilitator stood at the front of the group, he or she was still standing between the front people and would have his or her back to part of the group.

The lecturer acted on this information and in the following JAD session firstly made sure that the tables and chairs were correctly placed so that the facilitators could do their job without having their back to anyone. The lecturer also reminded the students of the instruction in JAD that users and IT people should be mixed in order to promote group cohesion and to prevent private conversation. This did seem to help the situation and could be included in the model for the effective use of JAD.

The observer found that the group still had some problems with personal discussions at the start of the session during the Time 3. He found that they became more task orientated and showed good group cohesion as the session progressed. The group as a whole seemed to be working together and taking part.

Group B also experienced the problem of the facilitator standing with his or her back to part of the group during the first session. The observer found that the facilitator seemed inaccessible and would look to one part of the group for input. There seemed to be one member who was seen as the leader and was consulted to make sure that he agreed before any decision was made. During the last session the observer found that the group members were all encouraged to participate and there was good group cohesion. One of the members was very quiet but did warm up as the session progressed. The observer said that the group seemed to be thinking in unison.

	Valid N - Time 1	Mean - Time 1	Valid N - Time 3	Mean - Time 3	Shift in Mean	Shift wanted	U	Z	p-value
1. We made sure that everyone understood the objectives for the session at the start of the session	109	2,06	120	1,89	-0,17	-	5811,5	1,45	0,124
2. The group members listened to and responded to the other member's ideas and comments	112	1,86	120	1,76	-0,10	-	6110,0	1,19	0,197
3. The group members were all involved and participated in the discussion	111	2,08	119	2,07	0,01	-	6566,5	0,08	0,937
4. Dominant members were allowed to dominate the group	111	3,50	117	3,86	0,36	'+'	5496,0	-2,00	-0,038
5. Group members involved themselves in private conversations thus disturbing the group	111	3,82	119	4,00	0,18	'+'	5871,0	-1,45	0,126
6. The atmosphere of the group was friendly and open	112	1,38	120	1,48	0,10	-	6454,0	-0,52	0,492
7. The group has been able to discuss differences between the ideas of the group members and does not avoid conflict	110	2,29	110	2,11	-0,18	-	5487,5	1,19	0,211
8. Discussions were held which were irrelevant to the topic	111	4,17	120	4,08	-0,09	'+'	6250,0	0,81	0,378
9. Group members supported one another	112	1,89	120	1,78	-0,11	-	5995,0	1,42	0,125
10. I was able to contribute to the group	112	1,57	120	1,58	0,01	-	6543,5	0,35	0,693
11. The other team members contributed to the group	112	1,71	120	1,74	0,04	'+'	6704,5	-0,03	0,973
12. The facilitator determined if the members of the group had reached consensus before moving on to the next point	112	2,26	120	1,98	-0,28	-	5664,0	2,07	0,03
13. Group members were sensitive to my feelings	110	2,32	119	2,00	-0,32	-	5604,5	1,88	0,049
14. The group members participated to the best of their ability	112	1,85	120	1,78	-0,07	-	6527,0	0,37	0,686

	Valid N - Time 1	Mean - Time 1	Valid N - Time 3	Mean - Time 3	Shift in Mean	Shift wanted	U	Z	p-value
15. People pushed their own views without trying to explain them to the others	112	3,83	120	3,97	0,14	'+'	6300,0	-0,82	0,388
16. Group members were encouraged to ask questions	110	2,26	120	2,13	-0,13	-	6082,0	1,03	0,283
17. The group was able to structure the session	111	2,22	120	1,93	-0,29	-	555,5	2,18	0,022
18. We checked our progress and were able to complete the task in the allotted time	111	2,48	120	1,73	-0,74	-	4142,5	4,96	0,000
19. People constantly interrupted me and I was unable to make my point	112	4,04	120	4,22	0,18	'+'	6230,0	-0,96	0,300
20. The facilitator was able to take the discussions from various group members and make sense of them on the board	112	2,01	120	2,03	0,02	-	6640,5	-0,16	0,869

Table B.5: Group processing at time 1 and time 3

Group C had two African students who were dominated by the overwhelming majority of White students in the group during the first session. During the second session the observer noted that there seemed to be two groups of students. The one group tended to participate actively and lead the session. The second group only sought clarification from the first group or validated what had been offered by them. The same members who had been reluctant to participate in the first session, only partook occasionally in the last.

The only comment the observer made about **Group D** during the first session was that there was some domination of the group by some of the members. He found that this had turned around during the second session. The minorities seemed to play a leading role. One of the females in particular made an excellent facilitator and was able to clarify what was happening to the others. When another facilitator took over there were still two members who tended to dominate the discussion and participation.

It would seem from these observations that there had been some improvement from the first to the third session. The groups were more cohesive and participation was improved but there was still a problem with the domination of some team members over others. Some of the groups did have students in them who were only doing IS1 and this might have exacerbated the situation.

B.4.3 Assessment of students' learning - Case Study 4

The students were given a pre-test on the use ER diagrams and the examination served as a post test. This year the students had covered the work on ER diagrams before the pre-test so it was possible to compare these results. The students tend to have more difficulty with ER diagrams than use-case diagrams - as shown by their average mark, which was only around 50% in the pre-test. More time is also spent doing ER diagrams than the use-case diagrams in the JAD sessions. The examination question was felt to be more difficult than the test question by the lecturers in Information Systems 2, but the marks improved anyway.

Once again, it must be remembered that no effort was made to stop the students from doing any extra studying as this was felt to be unethical and not in line with the attempt to study the method in context. This should be kept in mind when looking at these results.

As the students marks were known the values could be matched and it was possible to do a t-test and a regression analysis of the marks.

Table B.6 gives the results of the t-test done on the dependent samples.

	Mean	Std Dev	N	Diff	Std Dev Diff	t	df	p-value
PRE%	50,122	20,172	108					
POST%	58,873	15,757	108	-8,752	20,346	-4,470	107	1,95E05

Table B.6: T-test results for marks for Use-Cases

All the criteria for a t-test are satisfied and the p-value is once again extremely low (1,95E-05) - although not as low as the previous year. This indicates that the difference between the means of the pre- and post-test cannot be attributed to chance.

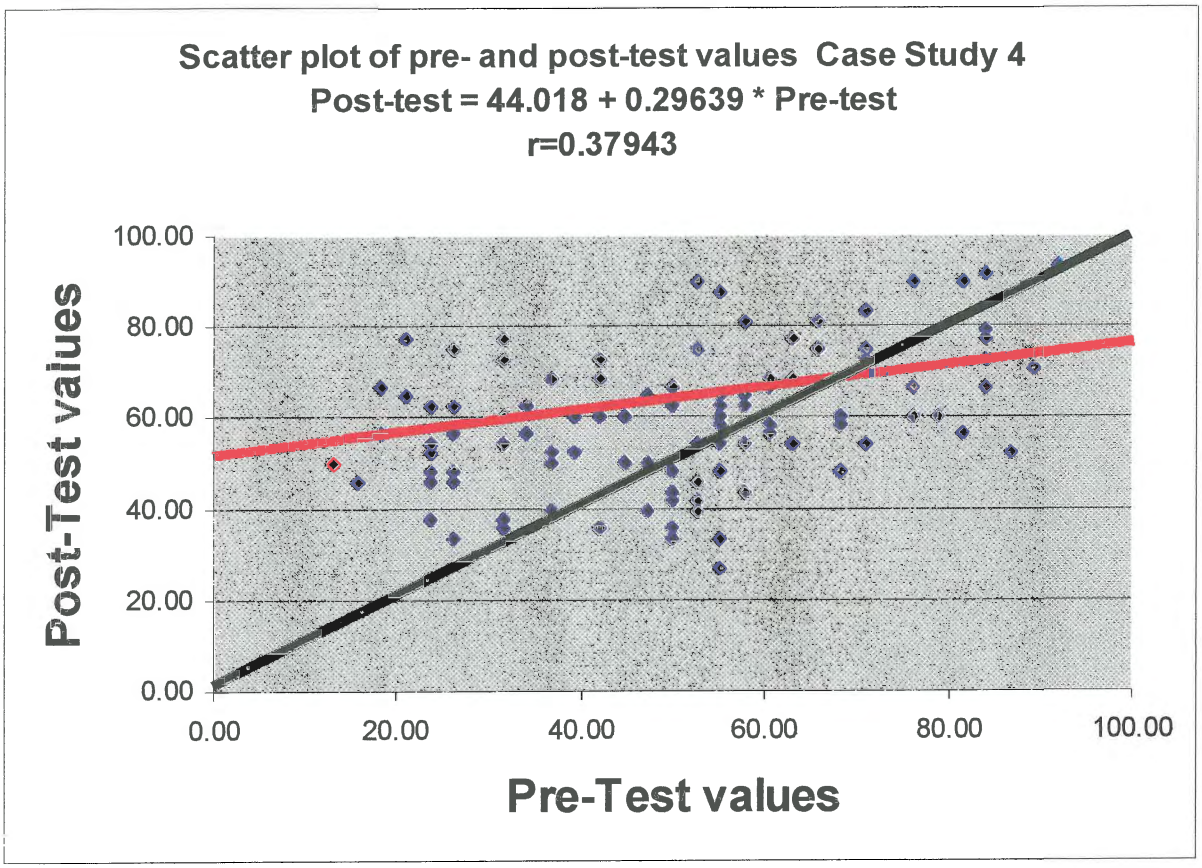

Figure B.2: Scatter Plot showing pre- and post-test results - Case Study 4

The scatter plot, shown in Figure B.2 shows that there was a general improvement in marks. The straight, red line shows the line for the regression analysis. The formula for the regression line is post-test% = 44,018 + 2,9639 * pre-test%. The correlation value is r=0,37943. The black line shows where the students would have lain if their marks had stayed the same for the two tests. Those above the line improved their marks and those below the line did worse. As one can see, the method seems to have been more effective for those in the low to medium range, rather than those whose

scores were high to start with. It was especially effective for those whose scores were very low.

This ends the discussion of the results of each of the individual case studies. Some of the quantitative results are available in Tables in Section B.5 where the four case studies results can be compared. There were some small differences in the questionnaires used and these are described with the tables.

B.5 TABLES OF COMPARATIVE RESULTS ACROSS CASE STUDIES

The following sections give some of the quantitative results for the four case studies.

B.5.1 Group composition - comparative

	In which classgroup are you?		What is your home language?		What gender are you?		What race are you?	
Case Study 1	Business	77,3%	English	44,0%				
	Technical	22,7%	Afrikaans	36,0%				
			Xhosa	14,7%				
			Other	5,3%				
Case Study 2	Business	66,6%	English	57,5%	Male	69,0%	African	16,3%
	Technical	33,3%	Afrikaans	26,4%	Female	31,0%	Coloured	12,8%
			Xhosa	13,8%			White	66,3%
			Other	2,3%			Asian	4,6%
Case Study 3	E.London	36,1%	English	3,3%	Male	21,3%	African	96,8%
	Pottsdam	63,9%	Afrikaans	0,0%	Female	78,7%	Coloured	1,6%
			Xhosa	91,8%			White	0,0%
			Other	4,9%			Asian	1,6%
Case Study 4	Business	40,2%	English	44,4%	Male	66,7%	African	26,1%
	Technical	59,8%	Afrikaans	30,8%	Female	33,3%	Coloured	10,4%
			Xhosa	21,4%			White	60%
			Other	3,4%			Asian	3,5%

Table B.7: Comparison of composition of students across four case studies

B.5.2 Experiences of working in groups - comparative

		Did you enjoy working in groups?	When you were a member of the group and not the facilitator, did you feel that the facilitators gave you a chance to have your say?	Did you feel that you were able to contribute to the group?	Did you feel that all group members made contributions to the group?	Did you feel that you were accepted as a group member?
Case Study 1	Always	24,3%	28,4%	21,6%	6,7%	54,7%
	Mostly	68,9%	66,2%	68,9%	61,3%	38,7%
	Seldom	6,8%	2,7%	9,5%	26,7%	6,7%
	Never	0,0%	2,7%	0,0%	5,3%	0,0%
Case Study 2	Always	25,2%	40,7%	44,7%	17,4%	71%
	Mostly	64,4%	51,2%	48,2%	66,3%	22,1%
	Seldom	9,2%	8,1%	7,1%	16,3%	5,8%
	Never	1,1%	0,0%	0,0%	0,0%	1,2%
Case Study 3	Always	61,4%	70%	65%	55,2%	88,3%
	Mostly	29,8%	30%	35%	41,4%	11,7%
	Seldom	7%	0,0%	0,0%	1,7%	0,0%
	Never	1,8%	0,0%	0,0%	1,7%	0,0%
Case Study 4	Always	26,5%	52,1%	49,5%	17,2%	83,5%
	Mostly	65%	44,4%	47,0%	69,8%	16,5%
	Seldom	8,5%	2,6%	3,5%	12,9%	0,0%
	Never	0,0%	0,9%	0,0%	0,0%	0,0%

Table B.8: Comparison of group experiences over the four case studies

Note that the first question changed from Case Study 1 to the rest. In Case Studies 2, 3 and 4, the question was 'How did you experience working in groups?' and the answers were 'Enjoyed it a lot, Mostly enjoyed it, Enjoyed it seldom, Never enjoyed it'. The sentiments were the same, however.

B.5.3 Learning in groups - comparative

		Do you feel that the JAD techniques used in the classroom are effective in helping you to learn?	Do you feel that the JAD technique has helped you to learn how to feel more confident about how to act within a group?	Do you feel that the JAD technique has helped you to learn to interact with people?	Do you feel that the JAD technique has helped you to learn how to speak in front of small groups of people?
Case Study 1	Always	32,0%			
	Most of time	56,0%			
	Very Seldom	9,3%			
	Never	2,7%			
Case Study 2	Knew already	3,5%	18,6%	26,7%	22,1%
	Helped a lot	60,5%	48,8%	36,0%	46,5%
	Helped a little	32,5%	26,7%	31,4%	26,7%
	No help at all	3,5%	5,8%	5,8%	4,7%
Case Study 3	Knew already	6,9%	14,3%	16,7%	24,1%
	Helped a lot	91,4%	82,1%	77,8%	72,4%
	Helped a little	1,7%	3,6%	5,6%	3,5%
	No help at all	0,0%	0,0%	0,0%	0,0%
Case Study 4	Knew already	6,1%	21,4%	20,0%	27,2%
	Helped a lot	63,2%	58,1%	49,6%	42,1%
	Helped a little	29,8%	19,7%	27,8%	29,8%
	No help at all	0,9%	2,6%	2,6%	0,9%

Table B.9: Comparison of learning in groups across the case studies

The students were asked various questions about their learning in groups. During the first case study, the were not given the option of saying that they already knew the skill and they were given four other options as indicated in Table B.7. Not all of the questions were asked in Case Study 1.

B.5.4 Facilitation and language - comparative

	How did you experience being the JAD facilitator?		When you were working in your JAD groups, were you able to communicate in your home language?	
Case Study 1	Enjoyed it a lot	19,1%	Always	35,7%
	Enjoyed it mostly	54,4%	Most of the time	18,6%
	Enjoyed it seldom	20,6%	Very seldom	18,6%
	Did not enjoy at all	5,9%	Never	27,1%
Case Study 2	Enjoyed it a lot	19,8%	Always	55,3%
	Enjoyed it mostly	65,1%	Most of the time	8,2%
	Not enjoy mostly	11,6%	Very seldom	5,9%
	Did not enjoy at all	3,5%	Never	30,6%
Case Study 3	Enjoyed it a lot	70,7%	Always	30,4%
	Enjoyed it mostly	25,9%	Most of the time	35,7%
	Not enjoy mostly	3,4%	Very seldom	21,4%
	Did not enjoy at all	0,0%	Never	12,5%
Case Study 4	Enjoyed it a lot	28,7%	Always	39,1%
	Enjoyed it mostly	55,7%	Most of the time	13,9%
	Not enjoy mostly	13,9%	Very seldom	17,4%
	Did not enjoy at all	1,7%	Never	29,6%

Table B.10: Facilitation and Language - comparison across the case studies

B.5.5 Use of JAD - comparative

	Do you think that the modelling techniques that you have learnt this year will be useful in industry?		What method of learning the modelling techniques do you prefer?	
Case Study 1	Very useful	39,7%	Working in groups on white board	82,2%
	Somewhat useful	55,9%	No preference	15,1%
	Seldom useful	2,9%	Working in groups without white board	2,7%
	Not used at all	1,5%		
Case Study 2	Very useful	57,5%	Working in groups using JAD techniques	76,2%
	Somewhat useful	36,8%	Working in groups on paper without using JAD	8,3%
	Seldom useful	5,7%	Working individually	15,5%
	Not used at all	0%		
Case Study 3	Very useful	77%	Working in groups using JAD techniques	86%
	Somewhat useful	21,3%	Working in groups on paper without using JAD	7%
	Seldom useful	1,7%	Working individually	7%
	Not used at all	0,0%		
Case Study 4	Very useful	53,5%	Working in groups using JAD techniques	72,8%
	Somewhat useful	43,9%	Working in groups on paper without using JAD	13,6%
	Seldom useful	2,6%	Working individually	13,6%
	Not used at all	0,0%		

Table B.11: Usefulness of JAD - comparison across the case studies

The question and answers on what method of learning they preferred was slightly different in Case Study 1 from the other case studies. The question was "*At the beginning of the semester, there was only one white board in the classroom and you had to work in normal groups, which method did you prefer?*"

Appendix C

JAD Exercises

C.1 JAD EXERCISE EXAMPLE - THE LIBRARY - CASE STUDY 1

The library has decided that the system that they are using is too problematic and wants to create an entirely new library system. You have been instructed to create a system for them and have done some initial work and determined the following - for today we will simplify the process and only look at a part of the library - namely the books. We will also assume that we are only dealing with ONE library instead of the three that actually exist.

The library contains many copies of books that are identified by an accession number. The accession number is unique for each copy. You may, however, have more than one copy of the same book. Each book is identified by an ISBN number that is unique for a book. The library might need the following information about a book:

Accession number of the copy of the book is : 99999
ISBN number of the book is : 1234-123-456
Title of the book is: XXXXXXXXXXXXXXXXXXXXX
Author/Authors of the book are: YYYYYYY and ZZZZZZZZZZ
Publisher of the book is : PPPPPPPPPPPPP
Place published is : SSSSSSSSSSSSSS
Year published is : 19XX

(Note that there could be two copies of the XXXXXXXXXXXXXXXXXXX book in the library and both will have the same ISBN number but different accession numbers.)

They also keep details of what subject the book is about, for example the book might be about DATABASES and OBJECT-ORIENTATION or any number of subjects.

The library keeps a list of distributers. Each publisher will only have ONE distributer in South Africa and when a book needs to be ordered then they order it from the appropriate distributer. A book can have a status of ON ORDER, ON SHELF or OUT.

The library has three types of members, staff members, student members and outside members. All are identified by a membership number. Staff members may take out 10 books for 3 months at a time, student members can take out 4 books for 2 weeks at a time and outside members can take out 2 books for 2 weeks at a time. We only keep record of the books that the members have out - NOT any history of who has taken out a book as we do not want to waste space.

We must have a record of when the book is due back and we send out notices to people whose books are overdue. If a book is overdue for more than 2 months and 2 notices have been sent out then we update the members account with the technikon so that they pay for the book - note that accounts are handled by another system and we only need a list of the problem cases and the price and name of the book which will then be handled by finances. No record of this need be kept in the library.

C.2 JAD EXERCISE EXAMPLE - THE LIBRARY

General

The Port Elizabeth Technikon library has three branches. These are the Main library, the College Campus library and the Saasveld library. Each branch of the library has many books, journals and media. (For the purposes of this exercise, we will ignore journals and media and only focus on the books.)

A book is identified by its ISBN number. Details of the book that are kept are the title of the book, the publisher of the book, the year of publication, the price and the author/s who wrote the book. Each copy of a book is identified by an accession number. The library can have more than one copy of a particular book. Each copy is assigned to a particular branch, ie. We might have 4 copies of the book 'Database Systems' in the library, one might be in Saasveld and the other 3 in the Main library. Each copy of the book has a status of IN or OUT depending on if someone has taken out the book or not. We also keep link the book to various subject areas that are used in the book, for example, the Database Systems book might be linked to the subject Databases and the subject Information Systems.

Library members may be staff members or students. Staff members may take out their books for 3 months and may take out a maximum of 20 books. Students may only take out a maximum of 6 books for 2 weeks at a time.

Front desk

At the beginning of the year, students and staff must register at the library. Their smart card is swiped and the details of their address, contact telephone numbers etc are entered. When a library member comes to take out a book, the computer should check that they do not have any overdue books and also that they will not exceed their limit. The record of their taking out the book should then be recorded on the database, together with the date when the book should be returned.

When the book is returned, the computer should check that the member does not have any fines or that the book is not late. The record of the member taking out the book should then be deleted from the database as we do not have the space to keep the records of all books taken out.

Finances

We should be able to get a printout of any library members whose books are overdue by more than a certain period of time. (We would like to enter the number of days. For example, we might want to sometimes get a list for everyone whose books are 7 days overdue, but may at other times want a list of everyone whose books are 28 days overdue.) Every week, we should be able to automatically generate letters to those whose books are overdue by more than two weeks. There should be three versions of the letter - which will be sent out at two weekly intervals for 8 weeks. The last version should warn the student that if the book is not returned within two weeks, that they will be charged for the book. (Ask the IT staff if it would be possible to keep the library members e-mail addresses if they have them and to generate e-mail letters instead of normal letters.)

If the book is more than 12 weeks overdue and the library member has been sent the three letters, then the finance department at the Technikon must get a notification of the amount of the book so that they can take the amount off the student's account or the staff member's salary and the member should be sent a last letter to this affect.

Ordering

When a staff member finds a book that they would like to have in the library, they fill in an order card. The order card has on it the details of the book like its title, publisher, year of publication, and authors. This information is entered into the computer, an accession number is allocated and the copy is given a status of ON ORDER. Each publisher has only one distributer in South Africa. An order for the book is placed with the distributer. Each order will be for one distributer but may contain order lines for many books.

When the book arrives, the I put all the accession information onto the book and add any information that might be needed into the database. This would also include the information on the subject areas of the books. The copy status is then changed to IN and the book is placed on the shelf.

C.3 JAD EXERCISE EXAMPLE - THE GROCERY STORE

General

The Pay-as-you-go Grocery Store is a medium size grocery store that would like to computerise its operations. It has computers for tills at the moment but this is not linked to its stock levels and they have a difficult time determining when they are going to run out of any item.

They also do not keep record of their credit card transactions at the moment and this

is causing them difficulties and they think it might be costing them money.

They would like to link the transactions at the tills, their stock taking and their ordering and buying of supplies within one computer system. They would also like to use the bar codes on the items. Instead of having to mark each item with a price and type in the price, they would like to scan in the bar code and use that for identification and to get the price.

The till

The customer comes to the till with their groceries and loads them out of the cart. We would like to be able to scan the items using a bar code reader. We should have the option of entering how many of a particular item a customer is buying without having to scan each one, however. There may also be items without bar codes, like bread, and these we would need to enter the code rather than scan.

The computer at the till add up the items and work out the amount that the person owes. It is often true that customers will see the result and then want to add items after the total has been displayed. This should also be catered for in the program.

The customer then decides to pay by credit card or cash. We do not accept cheques. If it is cash then the computer should work out the change. This should be given back to the customer. If they pay by credit card, then we should be able to swipe the card and have a direct link to the bank to check the credit details of the customer. The slip should be printed and signed by the customer. It would be a good idea if the computer can give the cashier some guidance as to what to do next, for example, say swipe card, get signature etc.

Stock

When we buy new stock we should be able to enter the details into the computer. The stock is normally put straight onto the shelves but sometimes must be stored in the warehouse. There should be three amounts, one that tells us what is on the shelves, one that says how much is in the warehouse and a third that tells us how much is on order. Each stock item will be identified by its bar code. (Those that do not have a bar code should have another code that can be stored in the same place.)

We must be able to transfer stock from the warehouse to the shelves. Each shelf should have an identifier, for example, aisle 3 - number 4 would be the 4th shelf in aisle 3. There can be more than one item on a particular shelf but we only keep a particular stock item in one place in the store.

When a customer buys something, the amount should be automatically subtracted from the amount of stock on the shelf. This will allow us to determine when the shelf needs

repacking. A list should be printed at the end of each day that gives us what items are low on the shelf and what items are low in total so that we can determine what needs to be reordered.

We only buy a particular stock item from one supplier but will often place an order for more than one stock item from that supplier at one time. We need to store the cost price of the stock item as well as the selling price of the item.