# Chapter 7

# The research design

*"It is a good morning exercise for a research scientist to discard a pet hypothesis every day before breakfast. It keeps him young."*

Konrad Lorenz, "On Agression" ch. 2 (1963, trans. 1966)

# 7.1 Introduction

This chapter is the first of three in which the research which was undertaken is described. In the road map of the thesis (Figure 1.1) these are grouped together as the case study. In this chapter, the intentions and planning of the research is described. Chapter 8 gives a summary of the findings from the quantitative data and Chapter 9 gives a detailed analysis of the team discussions during which the team members attempted to construct or reconstruct meaning.

As explained in Chapter 2, Section 2.9 and Section 2.10, when the research framework was used to identify the nature of the research and to decide on appropriate strategies and methodologies, this thesis reports on an anti-positivist research project consisting of a field study during which both qualitative and quantitative data was collected. Methodological pluralism was considered to be necessary considering the multidisciplinary nature of the research. The research is clearly intersubjective in terms of the assumptions and beliefs about the nature of social science and this view affects both the way in which the research was planned and the way in which the data obtained was analysed. The research was both empirical and non-empirical (refer to Chapter 2, Section 2.9.1) and took the form of action research using questionnaires, recordings of the task-oriented discussions of the student teams, interviews and documentation to capture the data which is both text and recorded speech. The researcher was predominantly involved in participant observation. The type of methodology used relied on cooperation and understanding of the research was expected to emerge. This perspective can clearly not be value free.

The anti-positivist nature of the research is evident in the fact that there were no control groups of students. Students were allowed to decide for themselves which study option they wished to follow so that their studies were in no way compromised (this is discussed in more detail in subsection 7.6.9.2). Therefore, although the research is described as being empirical in part it was not in the form of a controlled experiment.

This chapter sets out the research design, looking specifically at what the research proposed to investigate, where the research took place, the relationship between the learning theory and the research, who participated in the research and why the research was undertaken as is necessary when case studies are done [Walsham, 1995]. The chapter also looks at proposals that were developed as to how the research question could be answered and how the research was actually carried out.

## 7.2                                     Research Question

This research involved action research, during which a critical, interpretive investigation was undertaken in order to determine whether e-mail can be used successfully by university students working together within culturally homogeneous teams, on tasks and projects which require them to share meaning groups. During the process, not only is there a need to understand what the other team members mean (reconstructing meaning), but also to build on and advance meaning further (constructing meaning).

## 7.3         The South African educational environment

The environment in which this study is being undertaken is an university in South Africa in the 21$^{st}$ century. South African society consists of many different cultures which are coming together for the first time as equals and this is equally true within the "traditionally white" universities in South Africa. Our multicultural society is unique, quite optimistic and in some respects growing in confidence. Trust between the various groups is generally stronger than most predicted it would be. The South African economy is, however, fragile and business confidence is no longer what it was in 1994. This society is indeed eager to get beyond its first tentative steps and stride out into the developed world but it is still a mixture of first and third world infrastructures, education and economy. There are immense gaps between the "haves" and "have nots" in terms of income, education and hence opportunities. The state and the private sector are attempting to redress inequalities but are meeting with mixed success. An enormous backlog exists in job creation and all aspects of providing acceptable standards of infrastructure to everyone.

Students at South African universities, from various backgrounds with respect to education, language, culture, politics and household composition are presently all being taught in much the same way, although there are student support programmes at some universities. Once the students join the main stream classes, however, the academic culture which is taken for granted in the discipline of Informatics (and Information Systems) is Western with an inheritance derived largely from the British and North American university cultures (and, to a lesser extent, German and other European cultures). Our degree structure parallels the British more closely than any other. These cultures, along with most others, are male dominated. The majority of text books used are written by citizens of the USA from an American point of view, and hence use examples from American business and assume familiarity with an American way of life. We have

a conflict, therefore, in that we have students from many different cultures but we adopt a predominantly American, male point of view. In addition, many, if not most South African students come from a distinctly authoritarian educational background, where not only is critical thinking never permitted, but in fact rote learning is frequently encouraged. Many students have very little confidence in their ability to form their own opinion let alone to defend it. We are faced, therefore, with the problem that students are not accustomed to relating what they learn to their own lifeworlds or using their own experience to judge the validity or applicability of what they learn. As explained in Chapter 3, Section 3.5.2.4, constructivist learning theory stresses that learners need to be actively involved in constructing meaning.

# 7.4                    Adoption of the Sociocultural model

The research question stated in Section 7.2 explains that this research involves teamwork and hence collaborative learning. Collaborative learning was discussed in Chapter 6 and, as was pointed out there, it is an example of constructivist learning. The research was carried out at a South African university where students have a wide variety of backgrounds. The sociocultural model of learning, as explained in Section 3.5.3 of Chapter 3, highlights two pertinent issues. Firstly, learning is a social activity that takes place when people interact and communicate with one another. Secondly learning takes place in a context and each student will have his own individual context reflecting his culture, history and environment. As pointed out in Chapter 6, there are fundamental differences between the ways in which different cultures see the world and these are likely to affect the ways in which the student will learn. Since this research was undertaken within the multicultural context of South African universities, a sociocultural model of learning seems appropriate and issues of culture will, therefore, be recognised as being significant.

> "*Socio-cultural theories of mediated learning suggest that what is learned will emerge from the relationship between human action and the social, cultural, institutional and historical contexts in which action occurs. This makes it essential for us to understand these contexts and activities before we begin to investigate issues of learning.*"
> [Sutherland et al, 2000]

Chapter 8 is devoted to an analysis of the quantitative data obtained. This analysis will help us to understand some aspects of the contexts within which the students who were involved in this research learn. In order to analyse it, the data is grouped according to home language (which is used as an indicator of cultural diversity).

Sociocultural learning "... *[c]onceives pedagogy as a partnership between learners and tutors with emphasis placed on tools which can stimulate and mediate thinking and the development of cognitive skills from within a 'social' context. These interactions via networking, might take place at a distance, leading to a virtual learning environment*." [Hartley, 1998]

Leidner and Jarvenpaa [1995] say that asynchronous communication, using networked computers and possibly groupware will support cognitive, constructivist, collaborative, and sociocultural learning models. The topic of this research is the use of e-mail by virtual teams and thus it coincides exactly with that described by Hartley, and Leidner and Jarvenpaa. Therefore, a sociocultural learning model seems to support the research.

A constructivist learning model requires learner-centred instruction and this implies that it the learner should be encouraged to use a learning strategy that suits his own learning style. This research required students to think about how they learn most effectively. They were encouraged to do so by being required to choose between the study options offered. The research accommodated different learning styles by providing three different study options,. After the collaborative teamwork was complete, the students were encouraged to reflect on the experience, the good and bad aspects of the study choice they had selected and whether that particular option did in fact suit their style of learning. Hence, students had to identify their preferred learning style, use it and then reflect on the choice and subsequent learning experience.

The proposed research contributes to the research challenges proposed by Leidner and Jarvenpaa [1995] namely, "*Research is needed on technology applications to promote sociocultural learning* " which is elaborated as research that aims "*... to immerse students in the content of the material, yet enabling them to communicate and contribute their own ideas and values based upon their own culture.*"; "*Research is needed on the added value of technology to the learning models*"; and also "*Research is needed on the influence of moderating variables on the learning models and their technological enhancements.*"

The study options proposed for this research, and explained in Section 7.6.2, were appropriate in a sociocultural model of learning, particularly as the various teams were encouraged to select one of the eleven official languages of South Africa, or any other language that they were all fluent in, as their language for communication within the group. It was hoped that a conscious effort to avoid cultural and social biases would result in more interesting outcomes.

## 7.5  What type of course is suited to virtual teams?

This research focusses on only one of the Internet teaching strategies, namely the use of computer-supported collaborative work in the form of virtual teams. Many examples of the use of online discussion groups, or virtual teams, quoted in articles, are at post-graduate level. One common reason for this is simply logistical convenience but this is not the only reason. Leidner and Jarvenpaa [1995] refer to studies by Hiltz and Singer, both of which were published in 1988, that "collaborative learning in a virtual space " is more effective than classroom learning for "mature, motivated learners" but less effective where the learners are less mature or less motivated. As will be seen from the summary of research reviewed during this study, given in Table 7.1, virtual teams have been studied for relatively small, post-graduate groups of students on a number of occasions. South African examples have also been noted, such as, the M Ed at the University of Pretoria (see Section 9.7); the use of Learning Space for groupwork by students studying towards a Masters in Business Leadership though distance education at The University of South Africa's Graduate School of Business Leadership [Hoosen, 2002]; and the PDIM offered as a postgraduate diploma by the Rand Afrikaans University [Van Brakel, 1999]. The research completed for this thesis differs in a very important way from all the other reports in that it was used to determine the viability of collaborative teamwork via e-mail for a much larger group (one thousand six hundred students) at a much more junior level and hence involving considerably less mature students.

There does not seem to be any research which focussed specifically on which educational level can use virtual teamwork most effectively. As noted above, reports of the research done in 1988 by Hiltz and Singer advise using this type of activity for more senior students. A more recent paper by Hiltz and Wellman [1997], indicates that the New Jersey Institute of Technology uses various online learning activities for all courses. Seely Brown and Duguid [1996], however, emphasise the importance of the way education socialises students and makes them familiar with the community of practice of the discipline they are studying. They refer to the experiences of Dan Huttenlocher, professor of Computer Science at Cornell University of using online news groups in undergraduate teaching as evidence that the Net is not useful for forming communities. They conclude that such discussions would be more useful at postgraduate level as older students are already very familiar with the patterns of university work and behaviour.

In the research being reported on here, a decision was made to experiment with virtual teamwork in a course where lecturing seemed to be rather unproductive, where the students were perceived to be particularly passive and where the lecturer had to work really hard not to fall into the "fork-lift" or objectivist mode of instruction, in which there is simply a transfer of

knowledge from the expert to the learner. Introductory Information Systems courses are not the only ones to exhibit these characteristics. They are frequently encountered in most other disciplines and are not limited to first year courses. Passerini and Granger [1999] use extensive multimedia in a technology-enabled classroom to present an equivalent course at The George Washington University and the justification for this investment in resources is likely to be very similar the concerns offered above.

The reason for proposing to use more collaborative work in this type of course, rather than to try to enhance the teaching as Passerini and Granger have done, is that in these classes the information is in fact available in the prescribed book. Lecturing, even that incorporating multimedia, adds very little beyond this. The lecturer can discuss or show videos of examples from more familiar, local organisations and this can help to address the problem identified earlier concerning the students' inability to relate to the subject but the volume of work to be covered usually reduces the opportunity to do this to a very superficial form of name dropping. It is easier and cheaper to set team assignments that make the student think about the course content and relate it to his own environment using examples which he and his team have devised.

We cannot get away from the need to be realistic and class size is certainly an issue. First year Information Systems classes are amongst the largest in our universities. Well over a thousand students may be registered. This is far larger than the class sizes reported in the research reviewed in Table 7.1 which averaged 62 students. (Hiltz and Wellman [1997] imply that they have used virtual teams for large classes but do not specify what they consider a large class to be.) There are practical considerations regarding teamwork in such large classes. It might be difficult for a lecturer, or lecturers, to cope with a hundred (or more) teams, each having four to seven members. Very careful administrative procedures need to be set up, with a careful choice of project topics and evaluation criteria.

The warnings of other authorities need to be heeded.

> "*Only students who are highly motivated, emotionally mature, and possessing a spirit of intellectual adventure are able to benefit to the full extent from such an independent, unstructured form of learning.*" [Warf et al, 1999]

There is a benefit which makes it worth trying to overcome the recognised obstacles. Large classes offer the most attractive possibilities of saving scarce resources, by moving at least partially towards a telematic option. Currently there is an enormous waste of resources as the largest lecture halls are reserved for these very large numbers of students, classes are repeated because the lecture rooms cannot accommodate them all in one class and within a month or two the lecture halls are only half full. This experience is supported by Maki and colleagues [2000]

who note a big drop out rate amongst first years and Papaspyrou and colleagues [1999] who state that attendance figures for a Software Engineering course at their university in Greece decrease steadily to less than 50%, as lectures are not compulsory. There are important advantages to keeping class sizes small, particularly for first year students [Clifton, 1999]. These include developing bonds between the student and lecturer which will ensure greater commitment from both parties and facilitate an exchange of knowledge. This goal (small class size) is almost impossible to achieve in courses such as Informatics 1 and the use of teamwork exercises compensates to some extent for this.

The review of research into the use of e-mail for online collaboration in tertiary education institutions, reported over the last five years, provided in Table 7.1, is by no means complete and cannot be considered to be unbiased. It would be nearly impossible to collect and analyse all relevant research. This collection can only be seen as a sample, which was collected because it was considered potentially interesting and relevant. The academic subject areas selected as the context within which these reported projects occurred cannot be said to be indicative of how appropriate or common they are. No research was found that attempted to determine where this teaching strategy was most appropriate but Rada [1998] reports that, " *A content analysis across many universities and disciplines of what they are doing on the Web (Rada, 1996), found that the only discernable pattern was that high technology disciplines were more inclined to use the Web in education than less technological disciplines."* One highly regarded researcher can influence others to build on research in the same subject domain.

Hence, we would not be justified in drawing a conclusion about the suitability of Psychology or Geography above Mathematics or English for this type of collaborative work, even though the collection of research referred to below might include noticeably more projects in one subject area than another. As can be seen from  Table 7.1, however, Information Systems and related subjects are represented quite well in the reported research.

**Table 7.1 Summary of research reports on Distance Collaborative Learning**

| Course | Number of students | Level | Tool | Activity | Ref |
|---|---|---|---|---|---|
| Various MBA courses, M Sc courses, B A (Information Management) Business Engineering | 7 projects each with two universities, max in a project 125 students (varied from 18 to 28 for Masters level courses, 25 to 39 for Business Engineering and 104 for the BA course) | Mostly post-graduate but at least one BA course | eRoom and Group-Systems | Global teams, electronic brainstorming, voting, categorising ideas, shared report writing. | Vogel, et al, 2001 |
| Cognitive Psychology | 20 | post-graduate | FirstClass | Asynchronous, discussion on assigned readings. | Hara et al, 2000 |
| Educational Psychology | 12 (2x6) | M Sc | FirstClass | Collaboration to conduct a literature review and write a paper. | Tolmie and Boyle, 2000 |
| Nursing | 96 in 7 courses | graduate students | WWW, COW plus others | Conferencing on the Web (COW) | Ryan et al, 1999 |
| MBA (MIS) | 120 | post-graduate (average age 28.1) | desktop video conferencing, ISDN link | Synchronous, collaborative telelearning with local and distant groups. | Alavi M, 1995 |
| MBA (MIS) | 127 | post-graduate (average age 28.1) | VisionQuest | GDSS collaborative decision making | Alavi M, 1994 |

| | | | | | |
|---|---|---|---|---|---|
| Introductory Psychology | large (max 25 x 4 - actual between 59 and 93; max 50 x 2 - actual 82) | introductory | WWW | Mastery quizzes, individual, interactive, exercises, weekly laboratory meetings. | Maki et al, 2000 |
| Geography | 5 faculty, 16 students | mixed | www, e-mail (Caucus) and Lotus Notes | International groupwork, find information on web, assess and share information, critical evaluation. | Warf et al, 1999 |
| Psycho-social Science module | 124 but only 47 (38%) completed questionnaires | 1st year | discussion list | Required to discuss material presented in class, self-chosen small groups. | Seale and Cann, 2000 |
| Fundamentals of Computing | 110 logged on (class size not given) | post foundation | FirstClass | Unstructured discussion. | Wilson and Whitelock, 1998 |
| Business schools | 30 (5 x6) | under-graduate | Business Strategy game | Global, but the members of each teams are together at one place. | Doyle and Brown, 2000 |
| Various | small groups 4 - 8 or medium 20-30, 7 masters students | from unaccredited to Masters | First Class, Lotus Notes, WebCT | Asynchronous online discussion, does not seem to have been task based. | Hammond, 2000 |
| Library Information Systems | 60 (5-7 in a group) | | FirstClass | Guest lecturers. General discussion of course content, project work with students active in determining the type of project and its work plan. Collaborative projects | Kochtanek and Hein, 2000 |

| | | | | | |
|---|---|---|---|---|---|
| Personal Identity and Community in Cyber space | 20 | undergraduate | | weekly journals, discussed key themes, group project. | Chester and Gwynne, 1998 |
| Computer Science | 140 | undergraduate | Virtual Classroom | Case studies done by groups or individuals and face-to-face or as distributed collaborative work. | Benbunan-Fich and Hiltz, 1999 |
| MIS | 34 | under-graduate | e-mail | Distributed teams, division of labour and transferring files using ftp. | Lind, 1996 |
| Different courses | | | WebCT | Various | Morss D A, 1999 |
| Digital Signal Processing | | senior-level under-graduate | students publish on web | Distributed teaming, various institutions, projects. | Orsak, 1999 |
| Introductory course in Software Engineering | 61 | ninth semester | web-based discussion forum and web-based courseware | Project plus enhanced course material. | Papaspyrou et al, 1999 |
| Nursing | 10 of the 30 in the class did the collaborative work | post-registration nursing degree programme, distance education | e-mail and a form of computer conferencing (news group) | Posted nursing logs and commented on each others logs. | Naidu and Oliver, 1999 |

| Software Engineering course | 95 | 3rd year | e-mail | Team project, software development. | E Vance Wilson, 2000 |
|---|---|---|---|---|---|
| Information Systems (CSCW and Software Engineering course) | 48 | M Sc and third year | BSCW (asynchronous) | Online threaded discussion on guided topics throughout the course, two hour long synchronous discussion for a collaborative SE task which required brainstorming, prioritising and diagramming. | Ishaya and Macaulay, 1999 |
| Geography | about 24 | | e-mail, web, video-conferencing and telephone | Distributed teams, create web based research report | Hurley, Proctor and Ford, 1999 |
| Average | 62 | | | | |

# 7.6                                              Research plan

## 7.6.1 Introduction

The research compares the way in which students undertake teamwork in different contexts and use different communications media to work on assigned activities. The research subjects were first year Information Systems students who were studying a course whose content is given in full in the prescribed book. The course has, over many years and a variety of different lecturers, been poorly attended by students, indicating that the students themselves believe that self study is a feasible option. Nevertheless, the results obtained in examinations have been disappointing, indicating that the students do not succeed in learning (appropriating) the material which the lecturers expect them to understand. The course has a very high student enrollment (approximately one thousand six hundred students) placing a burden on the resources of the university, but, since lectures are so poorly attended, the resources committed are wasted. Teamwork was introduced as an integral part of the course just prior to, and independent of, this research. It worked very well. This research built on that option and also made use of the existing infrastructure provided for the"telematic courses" offered by the university.

At the time this research was done, the university concerned had already made a large investment in web-based education by providing hardware (servers), software (WebCT) and technical assistance to teaching departments in order to allow them to place course content on the university's web site. The teaching department within which this research was conducted had already decided to replace after-hours lectures for the part-time students with telematic teaching. The repetition of the course during the second semester, which was largely but not exclusively taken by students who had previously failed the course, was also only available as a telematic option. Abbreviated lecture notes, quizzes and administrative instructions were already available on the web as study material for these students.

This research, therefore, explored the viability of using a telematic, computer-supported collaborative work model for assigned collaborative work (required class assignments) being done by first year, Informatics students. It also compared the effectiveness of this option with one where the same assignments were done as face-to-face collaborative teamwork.

## 7.6.2 Description of study options

The research offered students a choice between three different study scenarios/ environments.

a.    Students could choose to attend **lectures** during which the content of the course would be covered and the class would be expected to: Participate in discussions; Work on assignments in teams during scheduled lecture periods; Take class tests. (Note: Lectures cannot be made obligatory and the university does not exclude anyone from examinations.) In the discussion that follows, this group will be called the class teams.

b.    Alternatively, students could choose to study from a prescribed book which covers the course material completely, work on assignments in a **face-to-face** group, attend a contact session once every three weeks and take one or more class test. The activity of the face-to-face group was monitored. These students were free to attend normal lectures as well if they chose to as no one can be excluded from lectures. In the discussion that follows, this group will be called the face-to-face teams.

c.    Finally, students could choose to study from a prescribed book which covers the course material completely work on assignments in a **virtual** group, which were suppose to communicate only via e-mai, attend a contact session once every three weeks and take one or more class test. The activity of the virtual group was monitored. These students were free to attend normal lectures as well if they chose to, as no one can be excluded from lectures. In the discussion that follows, this group will be called the virtual teams.

Options b and c involve **independent** teamwork, as it took place at a place and time controlled by the team, and hence, when speaking of these two groups together they will be referred to as the independent teams.

## 7.6.3 Incentives to participate in the Virtual Team option

There should be a clear need to use the technology (one of the principles of success proposed by Tolmie and Boyle [2000]) or the already familiar status quo will be too attractive. Students and staff are reported by many researchers to be conservative [Dewhurst et al, 2000; Kochtanek & Hein, 2000; Leidner & Jarvenpaa, 1995]. A lack of incentive has been the reason identified by various writers for disappointing use of web-based material [Karuppan, 2001; Wilson & Whitelock, 1998]. Incentives have been provided in various ways by different educators. Marks may be awarded for work that has to be done online [Ishaya & Macaulay, 1999]. Hara et al [2000] allocated slightly over 10% of the final grade to the online activity and, as all the students participated in this project, they were all expected to do this work. In the case reported by Maki et al [2000], the use of the online study material was not compulsory, but the students  were

rewarded if they did use it, as questions were embedded in online study material and marks were awarded if these were answered correctly. These students could add to their course credits by completing further on-line activities, such as quizzes and often needed to obtain only very few additional points in the final examination [Maki et al, 2000].

It is clear that students do not in general do optional work. On the other hand, making participation in online conferencing compulsory may be counter productive. It may not suit the student's learning style (perceived or actual) and this teacher-centred approach is in conflict with the learner-centred philosophy already judged appropriate for virtual teamwork. Being forced to participate could cause resistance to the idea and hence have consequences entirely opposite to those intended. Seale and Cann [2000] say that it is important for the students and tutors to negotiate the use of technology and clarify expectations and that making it compulsory to work online contradicts this spirit of cooperation.

It was for these reasons, along with those indicated in Section 7.6.9 on ethical considerations, that the decision was made not to have additional rules or artificial incentives to make the virtual team option appealing, but rather to allow students to decide on a study option purely on the grounds of their own learning style and convenience. This turned out to have major consequences as far as the research was concerned as will be seen in the discussion in Section 7.7.3.

## 7.6.4 Assignments

The assignments set as teamwork should:
• provide sufficient scope for a group effort to be meaningful but be within the capabilities of the average student and even below average students in the class;
• be relevant to the subject matter prescribed for the period for which the project runs;
• allow for individual views of the topic;
• require serious thought.

It is important that there is clarity about the task [Tolmie & Boyle, 2000]. The description provided to the students in writing was considered to be sufficiently detailed. The assignment was, however, only provided in English. This decision was made after consultation with the lecturers, who believed that this was appropriate. All previous assignments had been in the form of references to exercises in the prescribed book which is only available in English and hence the problem statement had also only been in English. Some students subsequently said that they had struggled to understand the questions (refer to Table 7.2).

Hiltz and Wellman [1997] propose collaborative tasks in which students are asked to prepare written summaries of the prescribed material, identify key concepts, construct exam questions (presumably including model answers) and answer each others' questions.

The two tasks which were set as teamwork for the first year Informatics course are given in the exact form in which they were given to the students in Appendix C. Assignment 01 was an application of a concept and technique, which were given in the text book, to an environment which all students were familiar with. Assignment 02 required the students to design an unusual new application of a Management Information System, a Decision Support System or an Expert System for an imaginary scenario characteristic of their own environment. This would illustrate aspects of the subject being studied. The projects were expected to be original and require creativity while also requiring the student to devise concrete examples which would illustrate concepts. The researcher also expected that they would offer students the opportunity to relate the concepts to their own lifeworlds.

## 7.6.5 Evaluation of the students' assignments

Constructivism requires the process to be evaluated as well as the product [Hurley et al, 1999]. Therefore, ideally students should be evaluated on how well they worked together. The team members can assess each other's contributions to the task and these marks can be combined with those of the lecturer. (Orsak & Etter [1999] note that these evaluations tended to be biassed. It is indeed difficult to obtain reliable assessments of participation.) In the case being discussed here, a single copy of the assignment was handed in by the team as hard (printed) copy and all assignments were marked by a single teaching assistant using a model solution and a marking schedule provided by the researcher. This teaching assistant did not know which study option a particular team had selected. This ensured that no possible bias could exist. The mark awarded was the final mark for the assignment and every member of the team received the same mark. Marking was checked by the researcher on a random basis and appeared to be reliable.

Students who did assignments in class were all required to be present whenever the group met. This meant they all had to be present when the assignment was handed in and this was strictly enforced.

## 7.6.6 Infrastructure

The students who decided to use the virtual teams option had unlimited access to the facilities provided by WebCT in the university's computer laboratories ("the Informatorium"). They had to be registered on WebCT and needed to have a password allowing access. Information

regarding this research, but also general course information, was available on the WebCT site for the course. This included the research information brochure, schedule of activities for the course, the requirements (problem statements) of the assignments, a brief outline of each chapter of the prescribed book which was to be covered in the course and a self test in the form of multiple choice questions for each chapter. The most important resource, as far as the research was concerned, was the facility for discussion groups on WebCT. A private discussion group was set up for each team. The researcher was a member of each of these. A public discussion group, which all the "virtual" students could access, was also available. Many students had their own private e-mail accounts as well and, as will be reported in Chapter 9, many preferred not to use WebCT's discussion facility but to use e-mail per se.

The researcher had privileged access to the WebCT module site. This meant that she could access statistics regarding how often each student had accessed the site and when. Marks were not held on WebCT but the department held a complete record of all of the marks separately in a database to which the researcher had access.

Students who had not elected to be in virtual teams were not given access to WebCT but had access to the separate module home page. Students had to get the rather complex password that allowed access to this home page from a lecturer. This site only contained copies of the transparencies used during lectures and announcements such as dates and venues of tests.

Students who did the teamwork as face-to-face teams, outside lecture times, had to book and collect a digital audio recorder from the researcher in order to record the discussion.

Prior to students submitting their Informed Consent forms, where they indicated which of the study options they favoured, the researcher had very little idea as to how many students would choose any option. She made arrangements to cope with ten percent of the students choosing the virtual option and ten percent the independent face-to-face option. As it happened far fewer students made use of these options.

## 7.6.7 Social structures and team structure

The optimal size of teams in a collaborative work group is generally accepted to be between four and seven or eight [Skyrme, 1998; 1997]. Online news groups, however, may include thousands of members. The use of e-mail in education may follow either the news group approach or the team approach. Hammond [2000] has found that the more structured the forum, the deeper the discussion. This indicates that teams focussing on a specific task are more likely to get into a meaningful discussion than those in news groups where the subject of discussion is ill-defined.

There are a number of factors which should be taken into account when making a choice between smaller or larger teams. Work load is reduced if team size is reduced as there are fewer messages to read and probably fewer separate arguments to keep track of [Hara et al, 2000]. Smaller groups heighten the personal profile (or personal recognition) of the individual and, as a result, have a positive effect on student behaviour and commitment [Hiltz & Wellman, 1997]. This is equally true in classroom lecturing. In very large classes there is less chance that disruptive or sleeping individuals will be identified. Large class sizes (defined as more than thirty students) may discourage student participation, as some students are shy to ask or answer questions in front of a large audience [Leidner & Jarvenpaa, 1995]. Alternatively, it can be argued that introverts are more likely to participate in a discussion where they consider themselves to be unknown [Leidner & Jarvenpaa, 1995]. On the other hand, as was explained in Chapter 6, team members need to trust one another when they undertake a joint task. Hence, the individual must make contributions to the task that can be attributed to him and the feeling of belonging (and being recognised) encourages commitment and further contributions. In addition, smaller teams can encourage more active involvement and more commitment, partly because absence or non-participation becomes more obvious. In this research, students were required to work in teams consisting of between four and seven members.

The composition of the team is the next important issue. Individuals are often allocated to teams so that there is a balance of skills and each team member plays a specific role in the team. The achievement levels of students can also be used to decide which team they should be in. Teams with members of mixed ability are often recommended, as the higher achievers can assist fellow students who find the subject difficult and an improvement in standard overall can result. Sometimes the composition of the team is not one of the factors in the research, or cannot easily be controlled and students are randomly placed in teams as was the case with those used by Lind [1996] and Vance Wilson [2000]. Teams may be allowed to select their own members because this is simplest, or this might be done deliberately as already established familiarity and friendships between team members has been identified as a success factor [Seale & Cann, 2000; Tolmie & Boyle, 2000]. Team composition might require each member to come from a geographically distinct site to ensure offline communication was minimised [Warf et al, 1999].

Thomas [2000: 84] (referring to O'Malley [1995]) says that Piaget advises that team members should be at an equivalent level of understanding but differ in their specific understanding or approaches to a problem so as to be able to learn from this difference. As is the case with Habermas' concept of ideal speech, it is necessary for the learners to recognise the need to use rational argument in order to justify their own points of view intend to reach consensus and allow each team member to put forward his view and to pay the same amount of attention to the different views.

In this research, teams were allowed to select their own members. This was done for several reasons.

1.    The intention was to encourage the formation of culturally homogeneous teams.
2.    The need for trust within a team was recognised as a success factor [Tolmie & Boyle, 2000] and, as trust develops over time, it was believed that team members who already knew each other would work together best.
3.    The large number of students made it extremely difficult to evaluate individuals in any way in order to allocate roles or balance team membership.
4.    The learner-centred philosophy suggests allowing students to decide who they would like to work with. Giving students this responsibility also removes the ethical dilemma of possibly forcing a student into a team to his disadvantage.

The team construction supports the belief that this teaching intervention was sociocultural in nature (see Table 7.2).

**Table 7.2: Team construction according to the sociocultural approach [Kaptelinin, 1999]**

| How is the team constructed | |
| --- | --- |
| 1.    Size | Four to seven members |
| 2.    Composition.<br>•    Will team members have a homogeneous culture?<br>•    Are team members of similar status?<br>•    Do team members have special complementary qualifications?<br>•    Who selects team members?<br>•    Do team members already know each other? | This is the intention.<br><br>Yes, all undergraduates, mostly first years.<br>No<br>The team themselves<br>Ideally yes, in practice not necessarily. |

## 7.6.8 Procedures and rules

The procedures and rules were spelled out in the research information brochure and again during an introductory lecture, so that students had the opportunity to ask questions. The overall philosophy was to have as few rules as possible but nevertheless to have procedures in place that would improve the chances of success in a project that was recognised to be complex (a very large number of immature students, three lecturers and a variety of study options) and hence risky. This is appropriate for action research. Contradictions and areas of conflict or differences of opinion are actively sought and hence there is a certain amount of risk in bringing

previously unacknowledged grievances and power struggles into the open. This type of research is, therefore, low on control.

In Questionnaire 4 (question 4.1.1), slightly more than 80% of the students said that they had understood the purpose of the research and slightly more than 85% said they understood the study options (question 4.1.2) that they were offered. However, only 63% of students completed the first questionnaire in which they had to select a study option, and a small percentage did not seem to understand them well (as their answers to other questions in the questionnaire indicated confusion).

There were three lecturers whom the students could approach during the day for answers to any questions. The researcher had an office on campus for the entire period that the research was being conducted and was accessible from 8:00 to 16:00 five days a week, although students were encouraged to contact her only in the afternoons.

## 7.6.9 Cooperative research methodology

In the research framework (Figure 2.7) it was noted that the appropriate methodology for this research was cooperative. Several groups were recognised as being role players and their interests had to be balanced (see Figure 7.1). This is in line with the critical and emancipatory aspects of the research. This is also characteristic of action research during which the researcher and role players from within the organisation collaborate (refer to Chapter 2, Section 2.6.2).
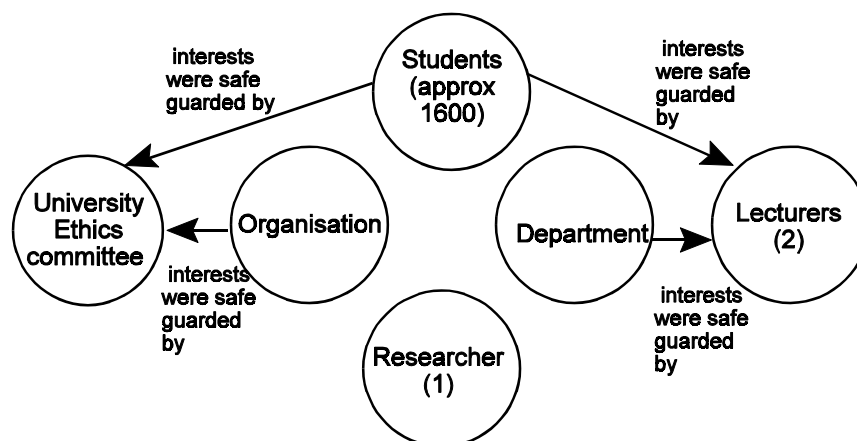


**Figure 7.1: Role players in the research**

### 7.6.9.1 The Department of Informatics

The impact of the research on the resources of the department, the relationship of members of the department to one another and the relationships of lecturers and students had to be considered. This was addressed by consulting those staff members who would be affected. The original proposals were adjusted in the light of input from the head of the department and lecturers for the course. This had a significant impact on the research but was considered to be necessary. Details of the changes made and how these affected the research are given in Section 7.7.3. In fact the initial response to the proposed research was one of serious concern when the researcher described her intentions to the module head and the second lecturer and compromises were necessary to obtain their cooperation. Thereafter they were unreserved in their support. This is an example of the choice of a compromise rather than an unadulterated emancipatory or critical approach to action research. After the research was completed, further interviews were held with the head of department and head of the course. These will be discussed in Chapter 9.

### 7.6.9.2 The students

It was very important to consider whether the research was likely to disadvantage specific groups of students. The most important way of ensuring that the student's academic outcomes were in no way compromised was by giving them the option as to whether to continue studying exactly as usual, or to make use of one of the other two options. They were offered a choice between participating in a virtual team or in a co-present team (meeting face to face). In all other respects all teams operated according to the same rules. The option of attending conventional lectures according to the existing lecture schedule or studying from the text book was also offered, although presenting all the scheduled lectures meant that there would be no reduction in work for the lecturers. (One of the long term goals was to reduce the number of duplicated lectures given, should a significant number of students indicate that they did not want to attend lectures.) In order to ensure that students were not disadvantaged by factors beyond their control, they were allowed to change from one study option to another at specific points in the course. The student response regarding the effect of the research obtained immediately after it was completed (question 4.2.3 in Questionnaire 4) was as follows: 21.11% said the research helped them, 29.62% were uncertain whether it had affected them in any way, 30.77% said it had not affected them at all, and 9.9% said it was disruptive. Comments that were considered to be similar were classified as belonging to the same group and a representative comment was used to identify the group. Personal judgement is used here and this is an example of the fact that the research is not value free. The groups of comments concerning the effect of the

research are given in Table 7.3 [2]. The rank assigned is an indication as to how frequently comments of this sort were encountered but there is no claim that it is a completely accurate count as this data collection was not verified by an independent person.

**Table 7.3: Comments from students regarding the effect of the research**
**(Comment part of Question 2.3 in Questionnaire 4)**

| Good points | Rank | Bad points | Rank |
|---|---|---|---|
| Assignment improved understanding of concepts | 110 | Assignments were too time consuming | 52 |
| forced me to study | 15 | Timing of the research was inopportune (coincided with test week) | 17 |
| Challenging assignment | 9 | Confusing | 15 |
| Stimulating | 9 | Did not enjoy teamwork | 10 |
| Good assignment | 8 | Bad assignment | 7 |
| Made class smaller | 4 | Assignments not translated | 6 |
| Introduced other study options | 2 | | |
| Introduced problem solving in the course | 2 | | |
| Expanded general knowledge | 2 | | |
| Provided an opportunity to be creative | 1 | | |
| Allowed students to make an input to teaching | 1 | | |

### 7.6.9.3    The university

The researcher was required to get the permission of the university's ethics committee before students could be asked to participate in the research. This was duly done. The committee was agreeable to the research provided that the students were informed in person and given the opportunity to ask questions. They did query the arrangement that students would get marks for submitting the final questionnaire but, since this in fact contributed a very small amount to the year mark and it had been approved by the head of the department, agreement was obtained.

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[2]a) Dennis and Valacich [2001] say at least two separate individuals, whose inter-rate reliability has been assessed, must be used to do this type of coding. In this research this was not feasible.

b) These comments were optional and unsolicited in that the question simply allowed any comment to be appended

c) Only a small percentage of students made any comment

## 7.6.10    Lecturer involvement with the independent teams

Reports of various virtual team exercises [Wilson & Whitelock, 1998] indicate that a facilitator is required to sort out technical questions. Research reports indicate that problems with technology are common and often result in a number of students having delayed or inadequate access. This has a significant effect on their attitude and confuses research outcomes to a serious extent. Active involvement of a lecturer with each team, mediating in the case of discord and participating in content creation can also be considered. On the other hand this can inhibit the team members who are more likely to participate freely if they are not noticeably under a spotlight. (This issue of high or low student profile was discussed in Section 7.6.7.) Seale and Cann [2000] advise that the lecturer should take a more active role and lead by example but do so very sensitively so as not to dominate or inhibit the students.

Various strategies or policies are possible. One is to make it clear that teams can ask for feedback and help by addressing a request to the lecturer but the lecturer will not snoop, nor will he intervene unless the majority of team members request help. A second policy is to allow individual team members to ask for help. Since occasional contact lectures are arranged, open discussion and feedback between the lecturers and the entire class could also be used to provide the encouragement, feedback and discipline that is needed. Another possibility is to require progress reports in the form of standard checklists to be submitted at set times. In order for there to be a basis for comparison between virtual teams and co-present teams, co-present teams may be required to make complete tape recordings of their sessions and make these available to the researcher.

In their research, Hara et al [2000] say that the lecturer limited his input to the virtual discussions to providing encouragement only and did not actively participate in the debate, as he did not want to influence the direction the discussion took. This research required students to discuss assigned readings and one of the students was assigned the role of starter who initiated the discussion. The research was one of few that have analysed the actual content of online discussions and it determined that the questions posed by the starter are one of the main factors in influencing how much interactivity will occur. They also note that encouraging informal communication does not seem to improve interaction. This implies that a task-oriented online discussion ceases to focus on personal relationships. The ability to edit and reflect on a written message rather than a verbal one becomes valuable. The richness of the discussion is now in terms of cognitive content rather than emotional content.

A role similar to that of a starter could be taken by a lecturer or discussion moderator [Kochtanek & Hein, 2000; Seale & Cann, 2000] but, where an assignment is set, the assignment questions can substitute for those of the starter.

Noticeable activity attracts more activity, so, by seeding the discussion with encouraging, stimulating or helpful messages, particularly when there seems to be insufficient activity, the lecturer may be able to help it to achieve critical momentum [Kochtanek & Hein, 2000; Tolmie & Boyle, 2000; Wilson & Whitelock, 1998]. Conferencing leaders must entice others to participate, negotiate the construction of meaning by encouraging discourse (rather than allowing disagreements simply to be dropped), suggest ways of reaching consensus, help maintain focus and manage the discussion by providing summaries. The leader needs to try to overcome shyness and feelings of inadequacy among team members. This is difficult and time-consuming. Frequent faculty input is needed to keep focus [Warf et al, 1999]. Ideally the role evolves into that of facilitator.

Where large numbers of teams are involved, the need to monitor all the communication, let alone participate in it, can place a heavy burden on the lecturing staff. (This was noted in Table 5.2 in Chapter 5 and will also be discussed further in Chapter 9.)

In this research, teams were allowed to nominate the language that would be used for all internal, team communication. Therefore, it was possible that the lecturer would not be able to follow these discussions. In addition, there were a number of independent face-to-face teams who might be meeting off campus or at the same time as other teams. The lecturer did not participate personally in the discussions of these face-to-face teams, but they were recorded on digital or analogue audio media.

In order to minimise the differences between the virtual and face-to-face teams, the researcher planned to play a minimal role in the discussions of the teams. There was no intention to assist in content creation or to participate in the actual discussions. This position was maintained. Each virtual team was welcomed in one message and asked for a progress report in a second message. The researcher tried to encourage the virtual teams to get going and, as they did almost no online discussion, tried to reiterate that this had been the intention. She was also involved in negotiations concerning membership of some of the virtual teams. This was not foreseen, but became necessary as the number of potential member was very small and they were unable to persuade their friends to join them in virtual teams or else did not know their classmates. Other semi-administrative functions concerning access to WebCT, the submission of the assignments electronically and an exchange with one team regarding nettiquette, were handled by e-mail. Further details will be discussed in Chapter 9.

## 7.6.11    Contact sessions

Students who choose to study independently were required to attend occasional lectures or contact sessions (See Section 7.6.2). The intention was that these students would not attend the regular, scheduled lectures. One of the subsidiary goals of the research was to identify meaningful activities for these sessions. Originally the students were told that these sessions would be held after normal lectures, that is after 17:30 but this was found to be too inconvenient for the students. The way in which contact sessions were used during the research is described in Section 7.8.3.

Maki and colleagues [2000] suggested that all students should submit two questions concerning course material, via e-mail, to be discussed during a contact session. Onay [1999] says that these sessions should be used for discussion of assignments and case studies or that guest lecturers could be invited to give presentations. He stressed that the lectures should not duplicate material covered online. This is in line with the recommendation that there has to be a real reason to use the technology.

The sessions were primarily expected to be used to:
•      Set up teams.
•      Give instructions how to use WebCT. (In hindsight these should have been arranged to take place in the computer laboratory for a practical demonstration.)
•      Explain that the virtual teams were expected to work on the assignments together and construct meaning jointly. (This process might have been understood better if a simulation or prototype discussion was demonstrated.)
•      Discuss techniques for working in teams and nettiquette. (Additional material regarding teamwork should form an essential part of the course and should be examined, as students pay little attention to topics that are optional.)

## 7.6.12    Conclusion

The proposed instructional model was designed to be used in courses with very large numbers of students (at least one hundred) where the content of the course is largely factual and lectures are poorly attended. An Introductory course for Information Systems was identified as a typical example of such a course. Teamwork had already been introduced into the course prior to this research as a means of improving student participation and this worked well. In this research the context for the collaborative work was extended by offering three different possibilities, one of which included computer support in the form of WebCT discussion groups. The students were permitted to choose between working in a virtual team, a co-present (independent face-to-face)

team or doing teamwork during class. This was an entirely free choice with absolutely no attempt being made to influence it in any way whatsoever. The virtual teams were encouraged to nominate a language of communication and the intention was to encourage the students to seek input from their own cultures. Students participating in the teams were instructed on simple strategies for enhancing trust within the team and achieving results as a team. Teams selected their own team members but were restricted in size to between four and seven members. A simple assessment policy was developed which involved an independent person marking assignments.

Role players who would be affected by the research were identified as in action research more than one opinion or point of view is sought, partly to uncover problems and partly to validate conclusions. The interests of the different groups were not always compatible and channels were created which would ensure that these various groups always had a voice and could prevent their own interests from being seriously affected in a negative way. This was done by collecting information using questionnaires, conducting interviews and being present and available for the period during which the research was conducted.

# 7.7                    Preparation for the research

## 7.7.1 Questionnaires

The four questionnaires were compiled in English and translated into Afrikaans so that both languages in which tuition is offered at this university were catered for. Copies of the questionnaires are provided in Appendix B.

## 7.7.2 Cross reference to research questions

A series of research questions was drawn up at the start of the research. Some of these were not in fact genuine research questions as they could be answered during the literature survey. A complete list as it was originally created, together with the expected source of information, is included in Appendix D. The questionnaires were validated by cross referencing the questions in the various questionnaires with the research questions. This ensured that information was collected regarding all the questions and also that data was relevant to the proposed research. The number of questions in the questionnaires that could be linked to a research question was calculated. Some questions could be linked to more than one research question as will be seen. The cross references table indicating the associations between questions in the questionnaires

and research questions is included in Appendix D. Dennis and Valacich [2001] say that if questionnaires are used to collect data, there should be at least three questions which contribute to measuring each dependent variable. Although no formal method, such as Cronbach Alpha, was used to do this, the idea here is along the same lines. It seemed that all the research questions were covered sufficiently.

## 7.7.3 Modifications made as a result of input from the department

The initial research proposal was modified as a result of concerns raised by the two lecturers who were in charge of the first year course on Informatics. The major changes are as follows.

- Only the second section of the course would be affected by the research. This was done in order to limit the scope of the research, permit first year students to become familiar with the university, lectures and lecturing staff and to make contact with other students before the research began. The only negative effect was that there was less time for the team members to get to know each other as a team.

- All students could attend any of the lectures, although virtual teams and those doing teamwork face-to-face, but not in class (independent teams), were told that they did not *have* to attend class. This was always the intention but it was now emphasised more. It was expected that most students who did independent teamwork would not attend normal lectures and that those who did teamwork in class would be required to attend all classes. In other words, originally there was a link between independent study and independent organisation of teamwork. The independent teams were expected to study according to a learning model that was much closer to the telematic model offered to after-hours and repeating students. As, according to the university rules, attendance of lectures is not compulsory, it was considered inappropriate to try to coerce the class-based teams to attend lectures and eventually there was absolutely no link between attendance of lectures and the option a student chose for teamwork. This considerably reduced the incentive to work as an independent team and resulted in one of the basic dimensions of the original research being weakened to an extent that the options became difficult to differentiate.

- All students were required to do the assignments in teams. Initially it was the intention that students attending class would do assignments as individuals. This would have increased the marking and was vetoed by the module head. This also resulted in the incentives to work independently being reduced considerably, removed one of the discernable differences between learning style options and reduced the options available to the students. A number of students complained about this (See Table 7.2 option 'Did not enjoy teamwork') as they wanted to do assignments as individuals and not in a team. In response to question 1.13 of Questionnaire 1, as to whether they enjoy doing teamwork, 253 students said that they sometimes enjoy it, 40 indicated no preference,

but 40 said they did not like teamwork and hence would choose not to do it. This group makes up only 7.7% of all the students who answered the question and, had this option been allowed as a sub-option within class-based study, it would not have increased marking too much. It does, however, mean that these students would not have the opportunity to learn how to work well in teams. In response to question 1.14 of Questionnaire 1, as to whether their results had been satisfactory when they had done teamwork previously, only 26 students said no (yes - 274, sometimes - 244).

Only one minor change was made after consulting the Ethics committee, namely, the student was asked to sign the Informed Consent form himself and not, as originally envisaged, a parent or guardian.

# 7.8                             Research process

## 7.8.1 Introduction

In action research it is difficult to separate the process and outcomes completely as the process is fluid and needs to be adapted in response to interim results. It is for this reason that some aspects of the research process, particularly those that evolved during the research, will be discussed in Chapter 9 when the interpretation of the team discourse is done.  However, in many respects the research process proceeded according to the plans explained in Section 7.6 and nothing further needs to be said about these aspects. This section explains those activities that need further explanation and can be described separately from the analysis of outcomes. In some cases, such as the actual mechanisms for collecting data, these processes were clearly research- oriented and not closely intertwined with the normal collaborative learning processes.

## 7.8.2 Selection of study options

The reasons for undertaking this research and the implications for students of choosing any one of the teamwork options were explained to the students who would be affected in detail, during an obligatory lecture before the research began. All students registering for the course received a pamphlet which repeated this information (this is reproduced in Appendix A). The ways in which teams would be required to operate, how they would be monitored, how marks would be allocated and how potential grievances would be handled were also discussed in this lecture. A lecture on cooperative work and specific ways of working effectively in a virtual team was also given prior to the teamwork.

Students were given one week in which to decide which option they wanted to use. All students were required to fill in a questionnaire (Questionnaire 1 is given in Appendix B) in which the reasons for making a choice were identified. The study option could be changed but this was supposed to be done only immediately after an assignment had been submitted and before work on the next one started. Students were asked to ensure that the researcher was properly informed in writing of such a decision. Students who elected to work in teams were required to register the names of their team members so that arrangements for monitoring the team activities could be made.

## 7.8.3 Contact sessions

In this research contact sessions were difficult to arrange. Students were reluctant to attend classes later than the usual lecture times but additional venues were difficult to obtain during the normal lecturing day. In addition, those students who did not want to attend lectures and hence opted for the independent study options were the ones who were supposed to attend these contact lectures. However, they were the ones who had indicated by their choice of study option that this was something they did not find convenient. Attendance at these sessions was therefore understandably very poor. Contact sessions were arranged to take place during scheduled lecture times for the course and occasionally had to "time share" with the activities of the class so that the independent student group did not have the undivided attention of the researcher.

## 7.8.4 Data collection

There were a number of forms of data that were collected.
• Questionnaires,
• Recordings of discussions between team members of face-to-face teams,
• E-mails exchanged between members of virtual teams,
• Recordings of interviews with the lecturers involved with the course,
• Recordings of interviews with other lecturers in this department and the head of department,
• Recordings of interviews with lecturers with an interest in Telematic education in other departments, some of whom were at another university,
• Recordings of interviews with students who had taken the course, and
• Students' marks for all assignments, tests and examinations.

### 7.8.4.1 Questionnaires

The first set of information was obtained from the Informed Consent form which was attached to the Information Brochure. Questionnaire 1 was handed out to the students before the research began and Questionnaire 4 was handed out after it was completed. There were three versions of Questionnaire 4. The first applied to students who elected to study by attending lectures and doing teamwork during class. The second was for the independent face-to-face teams and the third was for virtual teams. Questionnaire 2 was required in order to register who was in a particular team for the virtual and independent face-to-face teams. Questionnaire 3 was supposed to be completed if a student decided to change from one study option to another. The majority of questions in the questionnaires were structured and hence the responses could be collected as quantitative data. This was entered into Excel spreadsheets. The responses to the various open questions were classified, as explained in Subsection 7.6.9.2. The counts made of the responses in each of these categories is not entirely accurate[3]. Most of this data is reported on in Chapter 8. Occasionally references to the findings have been included elsewhere as considered appropriate. For example, the responses as to the students' perceptions as to the effect of this research is referred to in Section 7.6.9.2.

### 7.8.4.2 Recordings of team discussions

Two digital recorders were acquired and independent face-to-face teams were asked to book them and record their discussions. Some students simply recorded their discussions on analogue audio cassette recorders. This data was all converted to WAV format and stored on a number of CDROMs. The digital recorders were ideal for the purpose as the data could be downloaded to a computer hard disk in a matter of seconds even though the files were large. The compression of the audio files was very good in comparison with WAV format (exactly one quarter as large). Up to four hours of voice recordings could be held on the flash memory of the recorder. Unfortunately this format was not MP3 as the researcher had understood it would be from the marketing information for the equipment and hence these files could not be played other than on the Creative Nomad equipment. This was why they were converted to WAV. As

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[3]This data collection process cannot be considered to be accurate as new categories of responses were added as they were encountered and also because allocating remarks to a category is a subjective exercise. Had it been considered very important it would have been necessary to repeat the exercise once the set of categories had been finalised and it might even have been necessary to have the entire data collection process duplicated by a second data capturer. As there were so many questionnaires, and since this data was not considered to be of such great significance, this was not done. Therefore, this data provides only an impression of the responses. This is an example of research data that it either neither quantitative nor qualitative or is both.

the analogue recordings were captured as WAV files by the audio software used, all recordings were eventually in the same format, which was good.

The decision to allow these groups to record their discussions without the researcher being present was made after some thought. It meant that the role of the researcher as a participant observer was eliminated. It also meant that the research is dependent on recordings where it was sometimes difficult to hear what was said, are extremely difficult to transcribe and which might be edited by the research subjects by erasing sections. Walsham [1995] discusses all of these issues. The decision made here was based on the fact that if a much older lecturer was present at the team discussions, it might have had an inhibiting effect and the lecturer might take over the role of teacher within the discussions. In addition there were logistical difficulties, as more than one team might wish to meet at a time. In this research, no problems of confidentiality were encountered [Walsham, 1995].

### 7.8.4.3 E-mails and WebCT discussions

These are self-documenting and permanent so they need no additional data capturing.

### 7.8.4.4 Interviews

The digital recorders were used to record all the different interviews.

### 7.8.4.5 Marks obtained from student records

These were obtained as Excel files and could be merged with the Excel spreadsheets containing the quantitative questionnaire data.

# 7.9 Additional interviews

Additional interviews were conducted with lecturers and students after the research was completed. This was considered to be necessary because so few students elected to take the virtual teams option and because those who did work using e-mail communication did not exhibit any interaction that could be considered to be discourse. Two different sets of interviews were carried out with lecturing staff. The first was with lecturing staff in the Department of Informatics after the main research effort was completed and the quantitative data was analysed, in order to discuss the findings and get their opinions as to the validity of these results, as well as to give the feedback regarding a process that had also affected them. These interviews are referred to in Chapter 8. A second set of interviews was undertaken with a larger and less closely involved

group of lecturers and students as it was felt that not all of the research objectives had been achieved. These interviews were intended to get information concerning their own experience with virtual teamwork and computer-mediated communication as a means of sharing meaning. These interviews will be discussed in more detail in Chapter 9.

## 7.10 The theoretical elements used

Chapters 2 to 6 discussed a wide range of theory. The choice of research paradigm for the empirical work was discussed in Section 2.9 and was derived from the research frameworks presented in that chapter (particularly Tables 2.4, 2.5 and 2.6). The theory of communicative action [Habermas, 1984] will be used extensively in analysing the type of communicative action demonstrated by the team members in the virtual teams and this will be used to show evidence of one-side rationality. Concepts of information richness and communicative coherence with respect to e-mail, which were covered in Chapter 5, will be extended by investigating the levels of information carried in the e-mail messages. In doing so reference will also be made back to the classification of types of information derived in Chapter 3. Chapter 4 was devoted to studying aspects of modernity and radicalised modernity in accordance with Giddens' work. Globalisation is not referred to directly in the analysis, but the co-presence of the face-to-face teams is contrasted with the dispersed nature of the virtual teams, also the synchronised nature of the communication of the face-to-face teams is compared with the delayed communication by virtual teams, and finally the role that the length of the prior relationship and how this affects trust (discussed initially in Chapter 6) are all essential elements of the empirical work.

## 7.11 Conclusion

The goal of this research is to provide a genuine example of constructivist learning, within a sociocultural model and provide sufficient flexibility so as to accommodate a number of different learning styles. It is believed that this research design achieves these objectives.

A set structure for the research was prepared according to the guidelines identified in Chapter 2 as appropriate for an intersubjective or social view of the nature of social science This structure *inter alia* attempted to see the issues within context and to identify all the role players and address their needs, as well as to find ways to address conflicts arising between them.

However, action research is a learning process in which theory and action are combined. It is common for the original research plan to be adjusted during the period in which it is carried out

as action research requires a combination of generating change and generating knowledge. In action research, the researcher, together with participants from the host organisation, proposes changes and tries them out. It is a learning process in which theory and action are combined. Complexity and uncertainty are inevitable and acceptable.

The actual research thus differed in some respects from the research design particularly with regard to the duration of the research and the number of students who participated in the virtual groups. With regards to most other aspects of the research, such as the data collection and analysis, the research did not deviate significantly from the original research design.