EVALUATING COMPUTER-BASED TEACHING AND LEARNING SITUATIONS: THEORETICAL APPROACHES TO TILT-E'S WORK

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This thesis is dedicated to the memory of my father, Dr Nigel Henderson.

Abstract

A methodology and a framework for evaluating computer-based learning was produced by the TLTP Teaching with Independent Learning Technologies (TILT) Project's dedicated Evaluation Group, known as TILT-E, of which the author was a member. TILT-E's evaluation work was a result of over twenty evaluation case studies conducted by the group from 1993 to 1998, the majority of which were performed during 1994 and 1995. The TILT-E studies can be viewed as examples of good practice in the evaluation of a range of computer-based teaching situations.

While TILT-E's method and measures provide a useful framework for evaluating computer-based learning they did not fully exploit the strengths and history of the theoretical approaches underpinning the TILT-E work. In fact, research traditions are seldom mentioned in the TILT-E literature yet are central to not only understanding the value of the TILT-E work, but also to assisting future research in the search for a model of the computer-based teaching and learning situation.

By examining the evolution of the TILT-E methodologies through three of the first TILT-E studies, referred to in this thesis as the Pilot Studies, and then assessing several later case studies much is learnt about the need for a pluralist approach to evaluation in the computer-based teaching and learning context. While TILT-E advocates the use of different methods, the group failed to justify this approach and to recommend when and why such a mix would be appropriate. This thesis aims to rectify this imbalance through the detailed examination of eight evaluation episodes covering three different computer-based teaching and learning situations, all of which had been carried out by the author.

Firstly, the Fast Frac case study is considered, which involved evaluating the replacement of a lecture with the Fast Frac software. The Fast Frac study consisted of three evaluation episodes over a period of four years. The study found that the package could replace the lecture, and noted not only that a comparative design does not necessarily constrain the researcher to empirical methods alone, but also that such an approach need not disadvantage the students in either the control or the experimental groups.

The Fast Frac case study demonstrated that the teacher and the evaluator as stakeholders in the evaluation process might have different needs. In the Fast Frac case study this was evidenced by the teacher's explicitly deductive need i.e. the hypothesis that the package could replace the lecture, and the evaluator's inductive need i.e. to enhance evaluation methods and collect data through a range of measures, and so endeavour to better understand the computer-based teaching and learning process.

The second case study, GraphIT!, took place over one year and involved three evaluation episodes with three very different groups of students. The first group was first year undergraduate Accounting and Finance Students, the second was third year Sociology undergraduates, while the third was postgraduate Sociology students. The majority of students reported they would reuse the package, but tracking of their repeated use found they did not return to the package again. It emerged that this was almost certainly because the curriculum moved on rapidly from the basic information covered in the GraphIT! package.

It was also found that there was no explicit deductive approach from the teacher in the GraphIT! study. It was discovered that this was because of untested assumptions made about the package's ability to replace the traditional tutorial on graphical representation of data, specifically that the package could replace the material. The evaluator failed to challenge the teacher on this assumption, and it was recommended that in future assumptions about the computer-based teaching and learning situation should be carefully examined. A theory-driven evaluation approach was considered a useful tool for assisting this.

Finally, the third case study examined NetSem, a system for music students to present their seminars electronically and then discuss them over email. Both the seminar and contributions to the discussion were assessed, so the motivation for participating in the email discussions was theoretically high. The participants were forty second, third and fourth year students from several degree paths. The students were split into eight discussion groups of five students. It was found that those students who knew each other outside the email environment were more successful in their contributions' assessment. Those who did not know the other individuals in their group tended to contribute less frequently, resulting in lower assessment marks.

In NetSem, the culture surrounding the email seminars was found to be very important, and a combination of empirical and ethnographical approaches in the evaluation appeared to be successful.

It is concluded that TILT-E used a pluralist approach to their evaluation, mixing methods from the empirical to the ethnographical extremes. It is highlighted that stakeholders' needs may lead to a mixture of inductive and deductive approaches, despite the fact the two are, like empiricism and ethnography, traditionally contrary. Further, it is shown that GraphIT! and NetSem both implicitly used an action research approach, and more investigation of these approaches in the evaluation of the computer-based teaching and learning context is recommended. It is also concluded that more research should be conducted into assumptions about the interventions and their contexts. Finally, it is concluded that by making explicit theoretical and methodological approaches to the evaluation of the computer-based teaching and learning situation, some progress can be made towards a model of the computer-based teaching and learning process.

I DECLARE THAT THIS THESIS HAS BEEN COMPOSED BY MYSELF AND THAT THE WORK DESCRIBED IN IT IS MY OWN

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FIONA P HENDERSON

CONTENTS

Chapter 8 - Case Study 1: Fast Frac

Table of Figures, Illustrations & Charts

List of Tables

CHAPTER 1

INTRODUCTION

1.1 The Teaching with Independent Learning Technologies (TILT) Project

The Teaching with Independent Learning Technologies (TILT) Project was funded by the Teaching and Learning Technology Programme (TLTP) and the Higher Education Funding Councils of England, Scotland, Wales and Northern Ireland (known as HEFCE, SHEFC, HEFCW, and DENI). It ran for three years from January 1993 until December 1995, with a budget of approximately £1 million. TILT aimed:

'To show how teaching and learning can be made more productive and efficient throughout a single Higher Education Institution, by demonstrating how to use Information Technology effectively in teaching methods, especially to support more independent learning.' [Doughty, 1997: 2]

Its five objectives were as follows:

1. To introduce courseware to a wide range of staff and students.
2. To train students throughout the University to work independently with a computer to handle numerical and textual data.
3. To establish methods to select, evaluate, develop, customise and recycle learning software packages.
4. To adapt and apply methods of evaluating learning as a way of improving the integration of IT into Higher Education.
5. To provide staff training at the University of Glasgow and to mount a series of dissemination workshops through the UK.

To facilitate the fulfilment of these objectives, the project was organised into 6 groups, each independent of the other and supervised by the Project Steering Group.

1. TILT-A - Handling Numerical Data
2. TILT-B - Mathematical Models
3. TILT-C - Handling Textual Data, History, Library, Genetics.

4. TILT-D - Multimedia: Dentistry, Hispanic Studies, Music and Zoology
5. TILT-E - Evaluation
6. TILT-F - Dissemination

TILT-E, the Evaluation Team, were employed on the TILT Project to evaluate the products developed and used by the four TILT development groups, Groups A - D. The evaluation group employed 2 full-time and 1 part-time research assistants and was based in the Department of Psychology at the University of Glasgow. The group aimed to:

'Develop and apply evaluation methods for improvements in teaching and learning by using IT.' (Draper et al, 1997: 1).

As part of the project objectives, TILT-E produced a framework and methodology for evaluating computer-based learning in higher education. This has since been adopted by other researchers and adapted and included in other 'evaluation handbooks' (e.g. Harvey, 1998). It was and continues to be a frustration for the TILT-E team that no adequate theory of the teaching and learning situation and the causal factors determining learning outcomes, particularly in the computer-based context, was developed or available during the time of the group's work. It is a requirement still called for by the group today (Draper et al, 1997).

1.2 This Thesis

The TILT project produced more than 20 evaluation case studies (Draper et al, 1997). A leaflet guiding interested individuals was produced detailing the methodologies used in these case studies (Brown et al, 1996), three of which are considered here as pilot studies, while another three are discussed under the three main case studies. Whilst this leaflet states that the evaluation is designed 'separately, depending upon the goals of the evaluation, the particular courseware being studied, and the teaching and learning situation within which it is to be used' [1996: 1], it does not propose what methodology might be most appropriate to what sort of intervention. Nor does it indicate what theory lies beneath method selection and use. Neuman (1997) notes the importance of theory in research, stating:

'An awareness of how theory fits into the research process helps to clarify murky issues. Better designed, easier to understand, and better conducted studies result.' (1997: 37)

Chen (1990) noted that:

'Theory provides...the guidelines for analysing a phenomenon...Traditionally, however, theory has been neglected in the discipline of program evaluation.' (1990: 17)

TILT-E did not work with theories when constructing their evaluations. Instead, they went into the evaluation situation with a range of measures and attempted to measure as many predicted and unpredicted variables as possible. Whilst this approach was valuable, it did not state the theories in which it grounded its work. Jackson (1998) proposes that, even had TILT-E stated their theories about the learning situation, there is very often a discrepancy between such 'espoused' theories and 'theories-in-use', i.e. the theories which in reality are used to explain or design the research. For example, Jackson (1998) notes that many researchers in higher education espouse 'constructivism' as their theory of choice, yet in reality use an objectivist approach to their research, categorised by empirical methods and the belief that knowledge exists independently of the teacher and the learner.

Retrospectively it cannot be established what TILT-E's 'espoused' theory was. What can be determined to some extent however is the 'theory-in-use' because this is reflected in the methods and approaches used during the evaluations.

Jackson's (1998) paper marks the beginning of the movement in Scotland to recognise that theory development does not begin with an explanation of the learning situation, but starts with the way in which the learning situation is scrutinised. In other words, it is important to rigorously examine the learning situation before the process of developing a model of the learning situation can begin.

1.3 The author's role in TILT-E

As with any large project, many people were involved in the TILT Project. To begin with, six individuals were directly involved in the TILT Evaluation Group (TILT-E). The group chair was Helen Watt, from the Staff Development Service. This position later transferred to Dr Steve Draper, after Helen Watt and her colleague, Euan Smith left to run Group F, the Dissemination Group. The other three members of TILT-E were research assistants, and they were Eddie Edgerton, Margaret Brown, and Fiona Henderson, the thesis author. Eddie Edgerton left the Project and was replaced by Erica MacAteer in January 1994. TILT-E also relied heavily on their colleagues from the development groups (Groups A to D), as they had to work closely in each evaluation. In the results section of this thesis, seven evaluation episodes are described. Unless otherwise indicated, the thesis author had the task of administering the evaluation, collecting the data, analysing it and writing up the evaluation report.

No measure in the TILT Project was developed by just one individual, nor was any evaluation study designed without the input of teachers, developers and other evaluation group members. The work of this thesis centres on the author's ideas and interpretations of the TILT-E work, and focuses on those studies in which she had a lead role. It is recognised throughout this work that TILT-E was never a solo endeavour, and the quality of the case studies are such because of the number of individuals involved and their talents.

1.4 The contribution of this thesis

It is rare to be able to examine a number of very different case studies conducted using the same methods and by the same research team. This thesis centralises eleven evaluation episodes into one document, and uses them to illustrate the need for a model of the computer-based teaching and learning process. It indicates how difficult the development of such a model will be, and presents some first steps towards the development of such a model. In particular, this thesis demonstrates that a good grounding in evaluation approaches and an acceptance of a pluralist approach to evaluation methodologies may assist the development of a model of the computer-based teaching and learning process. This thesis also has value in unravelling some confusions in terms, particularly between 'model' and 'framework'.

This thesis considers the following eleven evaluation episodes. The first four were pilot studies describing the evolution of the TILT-E methodology, while the remaining seven demonstrate the use of a more cohesive methodology and allow consideration of the methodological approaches and theories behind the TILT-E design.

1.4.1 Pilot Studies

Study 1 - Schistomiasis: A single exposure to a CAL package which simulated parasite control.

Study 2 - NeuroSim II: A single exposure to a CAL package and then own time use of a simulation package using the Hodgkin-Huxley Model.

Study 3a and 3b - PARADOX and Microsoft Excel: A group of students studying Higher Ordinary Economic History received training in each of these packages.

1.4.2 Case Studies

Study 1a, 1b and 1c - Fast Frac: A single exposure to a CAL package describing fracture processes in materials, taking place over four years and three evaluation episodes.

Study 2a, 2b and 2c - GraphIT!: A single exposure with later logged use of a package explaining the graphical representation of data across groups of students from three different courses, including a formative evaluation of the package during the introduction to these episodes.

Study 3 - NetSem: The use of email to discuss electronically presented seminars throughout an academic year in the Music Department.

The findings from these case studies are discussed in relation to measures used and the implicit theoretical approaches that lay beneath method selection. The conclusions of this thesis focus on how important it is to understand TILT-E's approach to the evaluation of computer-based learning in theoretical terms if a model of the computer-based teaching and learning process is to be developed.

This thesis intends to contribute to the field of evaluating computer-based learning in the following ways:

- By demonstrating that TILT-E adopted a pluralistic approach to evaluation.
- Using measures ranging across the methodological and theoretical spectrum, from the extremes of empiricism to ethnography, can not only be effective but is often advisable.
- TILT-E used both inductive and deductive approaches to their work despite the apparent contradiction, and this too was found to be effective and is recommended.
- This thesis demonstrates comparative studies have value in the computer-based teaching and learning situation.
- An action research approach was implicit in some TILT-E studies, proved useful in describing the dynamics of these studies, and is concluded to be an approach worth further explicit investigation in this context.
- There is a pressing need for a model of the computer-based teaching and learning process.
- Finally, it is demonstrated through this thesis that developers of a model of the computer-based teaching and learning process must examine the approaches taken by TILT-E and other evaluation researchers in this field, and let this work assist them in their model construction.

1.5 This thesis - the author's role

As discussed earlier, TILT-E was a team of researchers specifically examining the evaluation of computer-based teaching and learning. As such, no TILT-E work was done without input from the whole group. In the beginning the whole evaluation team attended the teaching session under scrutiny, as was the case the first two pilot studies documented in this thesis. However, there was always a 'lead' evaluator, who took the role of measure administrator, analyst and reporter. In the first two pilot studies and the three main case studies, this was the author. In the PARADOX episode of the third evaluation case study, the lead evaluator was Eddie Edgerton (Edgerton, 1993). The raw data from the PARADOX episode was passed to the thesis author and reanalysed for reporting here. The author was the lead evaluator on the Microsoft Excel evaluation episode in the third pilot study.

The theoretical arguments, the discussion and conclusions, and all analysis and reporting of the data in this thesis is the work of the author.

1.6 Publications

Several publications have arisen out of the TILT-E work, and more generally from the TILT Project, all of which are relevant to this thesis. The thesis author has been involved in the following publications and presentations:

Brown M, Doughty GF, Draper SW, Henderson FP & McAteer E (1996) Measuring learning resource use *Computers and Education* **27** (2) pp. 103-113.

Brown M, Draper S, Henderson F & McAteer E (1995) Tips and pitfalls of integration & learning through evaluation *TLTP/CTI Conference Proceedings - Embedding Technology into Teaching*, November.

Creanor L, Durndell H, Henderson FP, Primrose C, Brown MI, Draper SW & McAteer E (1995) *A hypertext approach to information skills: Development and evaluation* TILT Project, University of Glasgow: Glasgow.

Doughty G, Arnold S, Barr N, Brown M, Creanor L, Donnelly P, Draper S, Duffy C, Durndell H, Harrison M, Henderson F, Jessop A, McAteer E, Milner M, Neil D, Pflicke T, Pollock M, Primrose C, Richard S, Sclater N, Shaw R, Tickner S, Turner I, van der Zwan R, Watt H (1995) *Using learning technologies: Interim conclusions from the TILT Project* TILT Project, University of Glasgow: Glasgow.

Draper S, Brown M, Henderson F and McAteer E (1997) *TILT Group E - Evaluation* http://www.elec.gla.ac.uk/TILT/E.Eval.html.

Draper S, Brown MI, Henderson FP & McAteer E (1996) Integrative evaluation: an emerging role for classroom studies *Computers and education* CAL95 special edition.

Draper S, Henderson F, Brown M, McAteer E, Smith E & Watt H (1994) TILT evaluation experiences in *TLTP/CTI Conference Proceedings - Evaluation, Dissemination, Implementation*, November.

Draper S, Brown MI, Edgerton E, Henderson FP, McAteer E Smith ED & Watt HD (1994) *Observing and measuring the performance of educational technology* TILT, University of Glasgow: Glasgow.

Duffy C, Arnold S & Henderson F (1995) NetSem - Electrifying Undergraduate Seminars *ALT-J* **2** reprinted in *Musicus* **4** (CTI Centre for Music) June 1995.

Henderson FP, Creanor L, Duffy C & Tickner S (1995) *Case studies in evaluation* Paper presented at CAL95, 10-13th April, University of Cambridge.

Henderson FP (1994) When needs must: What prior experience is necessary for independent learning from technology? Paper presented at the *Interactive Learning Research Group*, 14 December, Strathclyde University.

McAteer E, Neil D, Barr N, Brown M, Draper S & Henderson F (1996) Simulation software in a Life Sciences practical laboratory *Computers in Education* **26** pp101-112.

McAteer E, Draper S, Brown M & Henderson F (1995)*Student confidence logs: Quick, easy and diagnostic* Unpublished paper TILT-E: Glasgow.

CHAPTER 2

LITERATURE REVIEW

2.1 What is evaluation?

There are many definitions of evaluation, but most incorporate the same principles. For example, Cronbach et al (1980) define evaluation as the:

'Systematic examination of events occurring in and consequent on a contemporary program – an examination conducted to assist in improving this program and other programs having the same general purpose.' (1980: 14)

Reber (1986) states it is:

'The determining of the value or worth of something. More specifically, the determination of how successful a programme, a curriculum, a series of experiments, a drug etc. has been at achieving the goals laid out for it at the outset.' (1986: 253)

Reber (1986) defines evaluation research as:

'An area of applied psychology concerned with development of procedures for testing the effectiveness of social, educational, therapeutic or other applied programs.' (1986: 253)

Patton (1990) gives it a general definition, stating it is:

'...any effort to increase human beings effectiveness through systematic data-based enquiry.' (1990: 11)

Rossi & Freeman (1993) present a more detailed definition:

'Evaluation research is the systematic application of social research procedures for assessing the conceptualisation, design, implementation, and the utility of social intervention programs. In other words, evaluation researchers (evaluators) use social research methodologies to judge and improve the ways in which human services policies and programs are conducted, from the earliest stages of defining and designing programs through their development and implementation.' (1993: 5)

The key aspects of an evaluation definition appear to be the determining or judging of the effectiveness, value or conduct of programmes. The Rossi and Freeman (1993) definition is the most comprehensive, and includes reference to the research procedures. This will be taken as the evaluation definition for this thesis.

2.2 About evaluation and educational research

It is recognised that 'evaluation studies are grounded in social science research techniques' (Rossi & Freeman, 1993: 52). Educational research is also reliant on social science methodologies (Scott and Usher, 1996). It is important to briefly consider the history of social science research and its evolution to understand the position of both evaluation and educational research today. Pawson and Tilley (1997) state:

'Historically, alas, evaluation attempted to establish its scientific credentials when the philosophical orthodoxy about science ran along over-simple positive lines. This resulted in early evaluation employing a rather mechanical experimental format and emerging with a mixed bag of findings. Nowadays, the philosophy of science is avowedly post-empiricist and rests on a view of explanation which is not simply driven by 'method' and 'measurement', but which suggests a more extensive role for 'theory'.' (1997: xiii)

2.3 Theories and methodologies in the social sciences

Several theories in the social sciences have been particularly influential in the development of social science research techniques and are 'a central part of the history and practice of social sciences' (May, 1996: 3). The following sections consider empiricism, positivism, hermeneutic/ interpretive, action research, realism, constructivism, ethnography and a comparison of deductive and inductive approaches, including consideration of critical theory. By assessing such a wide range of both historical and currently popular approaches, better insight into TILT-E's approach is gained.

2.3.1 Empiricism

Empiricism is both a philosophical position and a method of conducting research, begun by British philosophers in the 17th Century, including Locke, Hume, Berkely and Hartley. However, it has been suggested that to understand empiricism one should keep the empirical theory distinct from the empirical method (Reber, 1986). As a theory, it assumes that the human mind is devoid of knowledge until touched by experience. In short, that all we can know is what we have experienced. As a method, it is grounded in experimental research, i.e. it demands the collection and analysis of data. This theory and method has been the driving force for many decades in psychology and other social sciences (Reber 1986). Neuman (1997) notes that empiricists see 'facts' as observable measurable phenomenon, whilst theories are 'soft' and concerned with values and ideals.

2.3.2 Positivism

Auguste Comte (1798-1857) was a French philosopher and sociologist who borrowed from the work of the British empiricists like Francis Bacon and formulated positivism. Essentially this approach argued that what you see is what is there, in contrast for example to the enquiries of theologists. It proposes that only questions which can be answered by scientific enquiry are worth asking, as nothing exists beyond that which can be explored by scientific methods. It is more limiting than empiricism, as it places boundaries on knowledge.

2.3.3 Hermeneutic/Interpretive

While empiricism and positivism focus on asking a question then assessing its answer scientifically, an hermeneutic approach is interpretive. Usher (1996) nicely summarises the conflict he perceives between positivist/empiricist approaches and hermeneutic/interpretive approaches thus:

'In social research, knowledge is concerned not with generalisation, prediction and control but with interpretation, meaning and illumination.' (1996: 18)

There is no right or wrong in the theoretical approach to a problem in educational research. However, there is a suggestion through the *method* of enquiry demanded by empiricists that those approaching a problem in an empirical way will rely on the least subjective method, which is usually deemed to be quantitative. Conversely, qualitative methods can be seen as more subjective and open to the bias of the investigator because they tend to be less structured and predictive than quantitative methods, and amongst the more extreme empiricists 'the very antithesis of scientific enquiry' (Patton, 1990: 54).

2.3.4 Action Research

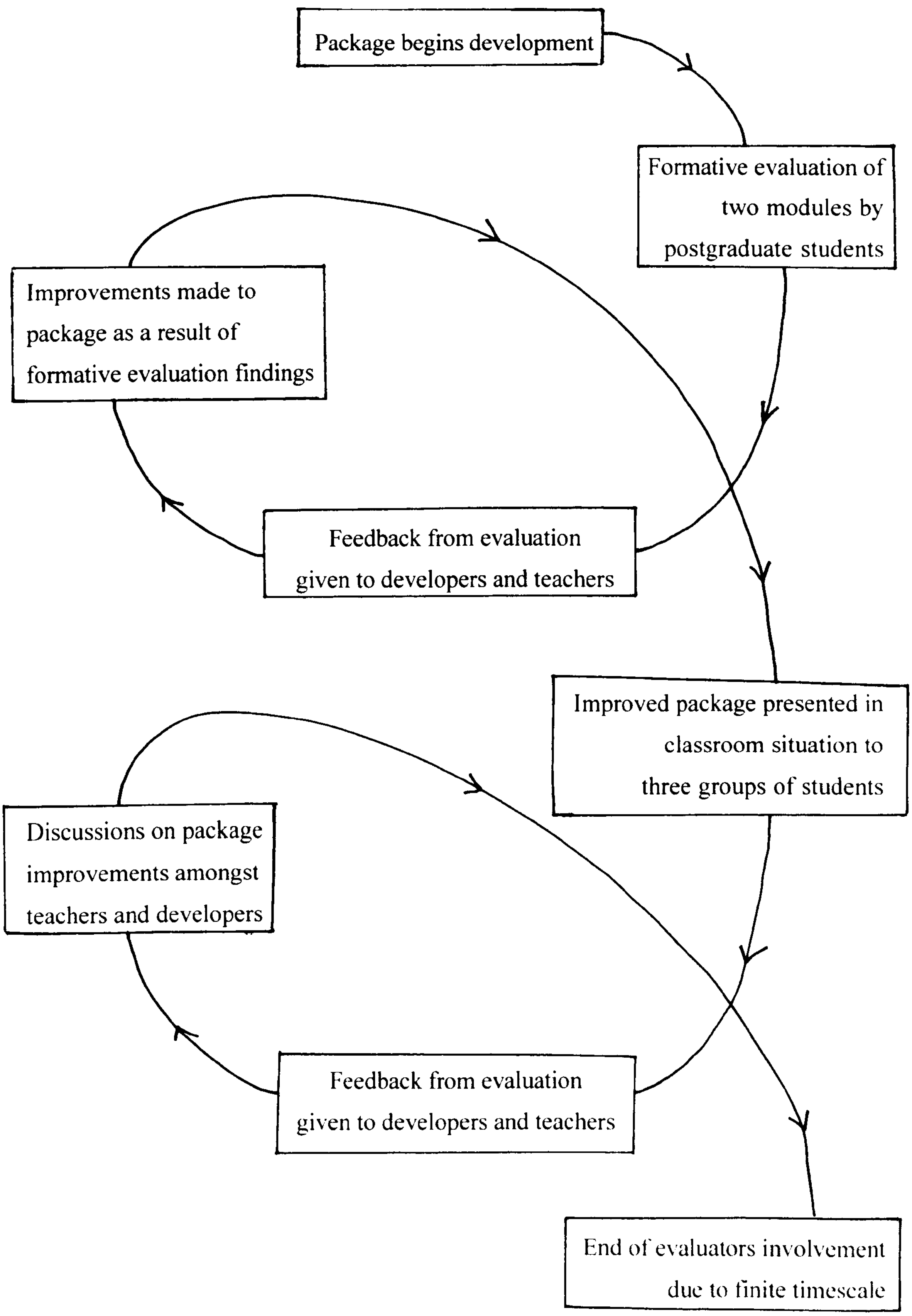
Hammersley (1992) argues persuasively that distinguishing qualitative from quantitative methods is of limited use. What is increasingly accepted as more important is the views of the participants in guiding their education. Scott (1996) states that 'there is...always a gap between different accounts, regardless of the sophistication of the representational devices we use.' [1996: 71]. The participant-centred approach gaining popularity throughout the educational and social science fields proposes that the student is central to the teaching and learning process, and although there may always be a gap in different accounts of a learning experience, it is what is done with the information obtained to improve the learning experience that is important. This approach is known as action research.

Action research is a cyclical process, with evaluation and feedback central to change (Henderson, 1999). It is a sociological technique of making and managing change at a community or group level (Lewin, 1948; Hart & Bond, 1995; Henderson 1999), and is reliant upon the participant as a collaborator in programme design (Banister et al, 1994; Hart & Bond 1995; Dugdill & Springett, 1997), 'including the participants as stakeholders in the process of change' (Henderson, 1999: 40). Banister et al (1994) describe it as having a 'concern with power relations between researcher and researched and the rights of the individual' (1994: 109). An action research approach also allows for a variety of appropriate methods to be employed in data collection, both qualitative and quantitative (Banister et al, 1994; Hugentobler et al, 1992), making it attractive to practitioners and evaluators alike (Brannen, 1992).

Action research has other attractions for the evaluator as it allows the programme to be planned as it is happening and has process evaluation inherent in its framework, as it must monitor everything from intervention selection to intervention effect at every stage. It is more of a spiral than a cycle, as illustrated in Figure 1. Figure 1 uses as an example the GraphIT! case study included later in this thesis. Action research principles did underlie the evaluation approach of TILT-E, although action research as an approach to package change and improvement was not recognised and acknowledged by TILT-E.

Figure 1 - An Action Research Description of the Development and Evaluation of the GraphIT! Package

GraphIT! Package conceptualised to address a need identified by teaching staff



2.3.5 *Realism*

Another philosophy of science, more modern than those mentioned earlier, is realism (Hesse, 1974; Harré, 1972, 1986; Lakatos, 1970). Realism is a school of thought which advocates the explanation of how a change has occurred. It calls each individual explanation a mechanism. These explanations, or mechanisms, look for the connection and causation between two events. For example, a student is distinct from knowledge, so there must be mechanisms which connect students with knowledge. A realistic researcher may wish to propose several explanations (mechanisms) for how the two became linked. These need not be explicit or conclusive. The students may have obtained the knowledge from a teacher, from a book, from each other, from overhearing a conversation etc. To further facilitate the explanation, realists state the mechanisms invoked are context-dependant i.e. depends on the context in which the phenomena, in this case the student and the knowledge, are linked. More than one mechanism may be operating simultaneously in one context (Pawson and Tilley, 1997). Hypothetically, for example, a student presented with a learning tool on a computer may use three mechanisms - note-taking, discussion with peers and rehearsal strategies - to understand and retain the information they are receiving.

2.3.6 *Constructivism*

Pawson & Tilley (1997) note the movement away from positivist & empirical approaches to the interpretative approaches of hermeneutics and naturalism, and propose that this movement occurred at the same time as 'the pragmatic turn in evaluation' (1997: 17). They suggest that the combination of the two led to the formation of the approach known as *constructivism*. Reber (1986) defines the essence of constructivism as that:

'Perceptual experience is viewed as more than a direct response to stimulation. It is instead viewed as an elaboration or 'construction' based on hypothesised cognitive and affective operations.' (1986: 151).

However, it has been argued that this constructivist approach is too extreme. Pawson and Tilley (1997) note that within the constructivist approach there is a failure to:

'Grasp those structural and institutional features of society which are in some respects independent of the individuals' reasoning and desires. The social world...consists of more than the sum of people's beliefs, hopes and expectations.' (1997: 23).

The physical constraints of this work prevent deep consideration of the arguments surrounding constructivism. Instead, in this thesis Reber's (1986) definition of constructivism is used, and interpreted in evaluation terms as the call to consider the context of the event or phenomenon that is being evaluated, as this interacts with and is interpreted by the student to form their learning experience. Within that context a number of processes will occur including events such as negotiation, reasoning, influence, and/or change. By considering the complexities surrounding the evaluated intervention, more insight may be gained into what made the intervention a success or failure. Through this constructivist movement evaluation can shift from focusing on the ultimate outcome to examining the processes and contexts in which the outcome is or is not achieved.

Jackson (1998) states that 'constructivism is now the dominant espoused theory in higher education' (1998: 23). By 'espoused' he means the overtly stated theory in a study. He differentiates between 'espoused theories' and 'theories-in-use', which he regards as 'the actual, unexpressed theories which guide practice in reality' (1998: 23). Jackson proposes that the dominant theory-in-use is not in fact constructivism, but instead 'objectivism'. He describes 'objectivism' in this context as locating knowledge outside those who acquire it, and adds:

'In this tradition knowledge exists independently of the knower, and understanding is coming to know that which already exists...teaching is a matter of transmitting this knowledge and learning is a matter of receiving, storing and applying it.' (1998: 23).

Jackson (1998) believes a stated constructivist approach in a teaching innovation such as computer-based learning should match with the theory behind the selection of methods for the evaluation. Then not only are the theories consistent, but by using methodologies appropriate to constructivism the later description of the evaluation in theoretical terms should be more insightful and credible. Jackson (1998) notes that an evaluation of learning using a constructivist framework would be difficult, but suggests that it could be achieved if context and implementation are studied and not simply outcome. In the TILT-E studies, this was already being done though again without any theoretical statement.

2.3.7 Ethnography

Ethnography is an anthropological approach focussing on culture (Reber 1986; Patton, 1990). It has been argued that ethnography is the extreme of empiricism (Hammersley, 1992). Hammersley notes:

'Ethnographic research...requires the study of situations that would have occurred without the ethnographer's presence, and the adoption of a role in that situation designed to minimise the researcher's impact on what occurs' (1992: 43).

In considering the merits of empiricism and positivism, Hammersley (1992) uses the example of a survey researcher conducting formal, structured interviews, while an ethnographer may use:

'Unstructured and/or informal interviews, where the interviewer plays a less dominant role...their closeness to ordinary conversation renders them approximations to the natural.' (1992: 43-44).

Ethnography is used as an approach to both programme evaluation (Fetterman, 1984 & 1989) and to educational research (Dobbert, 1982) as all programmes have within them a culture, and this culture may influence the programme's success (Patton 1990). Patton (1990) states that:

'Improving a program...may include changing the program's culture. An ethnographic evaluation would facilitate such change.' (1990:68)

2.3.8 Deductive vs. inductive approaches

May (1996) states that 'social theory is not something which can be separated from the process of social research.' (1996: 20). He also goes on to note that in order to test a theory we perform research. This is known as *deduction* i.e. 'where theorising comes before research.' (1996: 22) In other words, the theory is tested by the data and can be proven or refuted. This is an empirical or positivist approach, where a hypothesis is made and the researcher sets out to significantly prove it or return the null hypothesis.

It is also possible to perform research and then construct the theory. This is called *induction* i.e. research comes before theory and theoretical propositions are then generated on social life from the data. In this case, the prediction of results by a hypothesis would not be appropriate. However induction, like deduction, demands facts from the research.

An important difference between a deductive and an inductive approach is supposedly that a deductive approach provides a theory which can be proven or rejected based on the evidence collected (Popper, 1959). However Kuhn (1970) refuted Popper's (1959) assertions, and proposed instead that any contrary data provides the opportunity for future research. Kuhn (1970) suggested that research is performed in scientific paradigms, which provide examples of good practise and remove the binding rules featured in deductivism and inductivism.

Kuhn's (1970) argument was considered weakened in the eyes of some researchers by his assertion that where anomalies occur which cannot be understood within the current paradigm i.e. the current general idea of the world, a new paradigm is suddenly engaged and the old one abandoned (Abercrombie et al. 1988). However, the dismissal of one paradigm in favour of another is not a result of evidence contrary to the paradigm (Kuhn 1970), but is instead a product of research forces such as, for example, an influx of new research minds (May 1996). Not surprisingly, the abandonment of one paradigm in favour of another was thought too narrowing, and did not fully exploit the potential of paradigms. Giddens (1976) suggested that rather than dismiss a paradigm in favour of another, it is more useful if the two are evaluated and compared and so the possibilities of each are determined.

2.3.9 Critical Theory

In all these approaches the theories, paradigms and research structure are defined by the researcher. Those who participate, who are the study's subjects and are living the research, are not involved. Hegel (1937) regarded human history as a dynamic process with constant changes, continually pushing the social boundaries and constraints. Hegel moved 'criticism' from its meaning as a negative judgement to a proactive process freeing society by examining and exposing existing forms of belief. Thus Critical Theory became a theory of change, with its roots beyond Hegel in Marxian thought and the 'Frankfurt School' of critical sociology. Critical theory refutes the supposition that natural science is the only valid method of obtaining truth or knowledge. Rather than collecting facts, critical theory as a social theory is in essence about informing action and so facilitating change, particularly in a political context (Johnson et al, 1990).

The move away from fact to interpretation, or to the 'interpretive paradigm' (May 1996) of social theory research is best illustrated by the work of Weber (1949) who refuted the idea that human behaviour could be explained by 'laws', as was the intention of the natural sciences. Instead he proposed that research should start with the action and understand that before moving towards models. May (1996) interprets Weber's propositions as being that 'subjective meanings used by people in social interaction are a starting point for the objective analysis of society' [1996: 28].

2.4 A brief history of evaluation research

The roots of evaluation are in the scientific theories and approaches discussed above. In that sense, evaluation comes from disciplines established as early as the seventeenth century. Evaluation as a field in its own right has evolved from work in the 1950's examining the effectiveness of large-scale social programmes in the UK, USA, and the rest of the world. For example, delinquency prevention projects in the UK; family planning in Asia; nutrition and health care in Latin America (Freeman et al, 1980; Levine et al, 1981).

Perhaps the single most influential force in the dramatic increase in the supply and demand of evaluations, and hence the emergence of modern evaluation, was the crisis in social welfare in the USA in the 1960s. The cost of welfare in the States was escalating rapidly, and evaluation became important in attempting to stem the flow of funds into ineffective programmes (Rossi & Freeman, 1993). Campbell and Stanley (1963) were influential in raising the profile of evaluation early in the decade with their book on experimental evaluations in social research, and by 1967 the field had grown large enough for Suchman (1967) to publish a review of evaluation research methods.

Soon there were many publications on evaluation, and in 1976 there was sufficient interest to launch a dedicated journal, the Evaluation Review. One estimation has put the number of dedicated evaluation research journals world wide at about a dozen (Rossi & Freeman, 1993). The rise of evaluation from a side issue in the social sciences to the core of policy and programme administration in health, politics and education prompted Cronbach et al (1980) to suggest that 'evaluation has become the liveliest frontier of American social science' (1980: 12). A more cynical Pawson & Tilley (1997) propose that '*evaluation* has become a mantra of modernity' (1997: 2). Pawson & Tilley (1997) go on to suggest that Kaplan's (1964) 'law of the hammer' i.e. that a child given a hammer discovers the truth that all things need pounding, is now true also of evaluation. They propose, with a measure of sarcasm, that 'as we move towards the millennium...*everything, but everything, needs evaluating*' (emphasis theirs, 1997: 2).

2.5 Evaluation today

Quantitative approaches have in the past been the most prevalent methods of evaluation research when attempting to assess the effectiveness of a programme (Herman et al, 1987). These methods have proven to be limited in providing information about the success or failure of a programme. As early as the seventies researchers were beginning to question the gaps left by quantitative research. Martinson's (1974) meta-analysis of all published reports in the English language about the evaluation of programmes rehabilitating offenders from 1945 to 1967 is a prime example. Rather than completely dismissing all methods of rehabilitating offenders as unsuccessful, he states:

'This is not to say that we have found no instances of success or partial success; it is only to say that these instances have been isolated, producing no clear pattern to indicate the efficacy of any particular method of treatment.' (1974: 49).

Similarly, Weiss (1972) described 'the effect of little effect' (1972: 126), and noted that evaluations of education and other programmes have a 'dismaying tendency' (1972: 26) to show that the programmes have had little effect. Cronbach et al (1980) devote several theses to this issue:

'12. The hope that an evaluation will provide unequivocal answers, convincing enough to extinguish controversy about the merits of a social program, is certain to be disappointed.

26. What is needed is information that supports negotiation rather than information calculated to point out the 'correct' decision.

30. It is unwise for evaluation to focus on whether a project has "attained its goals".' (1980: 3-5)

Such negativity about the potential for evaluation to achieve conclusive answers is perhaps excessive, but its basic principles are true of a certain type of evaluation, what Weiss (1995) calls the 'standard evaluation methods' (1995: 66). However, Pawson and Tilley (1997) argue that this is because the 'traditional' evaluator is 'attempting to demonstrate an unequivocal causal relationship between program and outcome' (1997: 31). Now that there is a wealth of evaluation research approaches, the standard quantitative indicators/ impact / outcome measurement referred to by Weiss (1995) is no longer seen as adequate. Pawson and Tilley (1997) state that they 'do not balk at the need to establish a scientific methodology for evaluation.' (1997: xiii). Further, they add:

'Historically, alas, evaluation attempted to establish its scientific credentials when the philosophical orthodoxy about science ran along over-simple positivistic lines. This resulted in early evaluation employing a rather mechanical experimental format and emerging with a mixed bag of findings. Nowadays, the philosophy of science is avowedly post-empiricist and rests on a view of explanation which is not simply driven by 'method' and 'measurement', but which suggests a more extensive role for 'theory'.' (1997:xiii)

2.6 Evaluation and educational research

Examination of an issue in an academic or scholastic environment falls under the umbrella of *educational research.*

In a report for the Organisation for Economic Co-operation and Development (OECD), it is stated that:

'It should be borne in mind that there is no agreement at the international level about the precise meaning of the term 'educational research and development' (CERI, 1995: 29).

Essentially the difficulties of defining the term have their roots in the stakeholders involved in educational policy-making, research, practise and consumption (CERI, 1995). The CERI (1995) on behalf of the OECD propose the following definition:

'Educational R & D is a systematic, original investigation or inquiry, and the associated development activities that are undertaken in order to increase the stock of knowledge about education and learning and the use of this stock of knowledge to devise new applications or otherwise improve the deliberate, systematic, and sustained effort to transmit, evoke or acquire knowledge, attitudes, values, skills, and sensibilities, and any learning that results from that effort.' (1995: 37)

A more simplistic definition from Borg et al (1992) states:

'Educational research involves the systematic collection of information (sometimes called data) to describe, predict, control, or explain the phenomena involved in learning and teaching.' (1992: 6).

While the former description is more encompassing, the latter summarises the essence of educational research. Educational research is a broad term, and like its stakeholders, originates from a variety of fields. It is, in academic terms, a young science (CERI, 1995) and with its diversity of origin and its youth has found itself involved in the complex debates on research methods and practises prevalent in the social sciences.

Scott and Usher (1996) acknowledge the social research foundations of educational research, but argue that 'this does not imply that it should be trapped in the latter's often sterile dichotomies and questionable paradigms' (1996: 1). It is important to consider the research traditions in the social sciences as they inform the methodological approaches to educational research problems, such as those found in evaluating learning technologies. It should be noted that the distinctions between approaches can get blurred, such as the tendency to combine positivist and empiricist approaches (Usher 1996, Scott 1996).

Educational research blends the philosophical, social and methodological approaches of the social and political sciences. Educational research 'clearly has a multi- or cross-disciplinary basis' (CERI, 1995: 33). The CERI (1995) make a distinction between two paradigms in educational research. The first attempts to *understand* education, and is viewed as evolving through the humanities. Its emphasis is regarded on holistic, qualitative information, and it encourages interpretative approaches (Husén, 1985). The second paradigm in educational research attempts to *explain* education (CERI, 1995). It emerged from the natural sciences, and holds the principles positivism and experimental psychology at its heart. It is therefore focussed on quantitative data and empirical approaches. Husén (1985) proposes its goal is to determine causal relationships.

In the twentieth century, the different poles in social research (the extremely empirical to the critical and realistic) have begun to coexist rather than condemn. A movement from the 1960's onwards has encouraged many researchers to see the complementary possibilities of the poles of philosophical approaches (CERI, 1995). This has led to the acceptance of a position termed pluralism, that is, the acceptance that causation of a phenomenon can be multifactorial (Reber, 1986). The CERI (1995) propose that 'there is both 'good' and 'bad' positivist research, as well as 'good' and 'bad' qualitative research, depending on the problems investigated.' (1995: 34).

Although teaching and learning lie at the heart of the computer-based learning situation, it is not possible within the scope of this thesis to consider the large volume of theories, frameworks and issues surrounding teaching and learning in higher education, other than those which explicitly include the use of information and communication technologies.

2.7 Theory-driven evaluation

Chen (1990) defines theory as:

'A frame of reference that helps humans to understand their world and to function in it. Theory is crucial in research. Theory provides not only the guidelines for analysing a phenomenon but also a scheme for understanding the significance of research findings. Traditionally, however, theory has been neglected in the discipline of program evaluation.' (1990: 17)

Lipsey et al (1985) reviewed 175 evaluation studies across a range of disciplines and found little evidence of theory. They noted that this was a widespread issue in the evaluation community regardless of the author's academic background and beliefs, or the type of intervention under investigation.

To address this, some researchers (e.g. Weiss, 1995; Chen, 1990) suggest that rather than set a series of indicators and outcomes and use quantitative measures to determine success, evaluators should instead accept that 'programs are based on explicit or implicit theories about how and why the program will work' (Weiss, 1995: 66). Then the evaluator should collect all the assumptions inherent in the programme and construct methods for examining these assumptions during the programme's lifetime. It can then be shown where assumptions breakdown (if they do), and which of the 'several theories underlying the program are best supported by the evidence' (1995: 67). Before they begin this stage, however, it is the view of this thesis that the evaluators should be clear about theoretical positions and methodology.

2.8 Evaluating computer-based learning: The need for methodological theories

An extreme approach to evaluation was described by Chen and Rossi (1983) as a prescriptive, step-by-step approach, with scant regard to theory. This is effectively the position of the evaluation of computer-based learning in Scotland in the 1990's, as evidence by the recent publication of the Learning Technology Dissemination Initiative's 'Evaluation Cookbook', (Harvey, 1998) in which several of the TILT-E methods are featured. However, while such 'cookbooks' or 'toolkits' were popular several years ago (Chen 1990), they are increasingly viewed as hindering evaluation research by oversimplifying it and resulting in an input/output or black box evaluation (Chen 1990; Chen and Rossi, 1983).

The debate between which of the extreme theoretical approaches (i.e. empirical or naturalistic) is most useful has raged for decades (Chen 1990). By abandoning the delineation between the methodological approaches and mixing methods, evaluators can give themselves more opportunity to consider the theories lying beneath these approaches in more depth and improve the quality of their research in the process (Smith, 1986). Mixing methods allows the evaluator to predict issues (i.e. an empirical, deductive approach), while at the same time measuring unpredicted issues (i.e. a naturalistic, inductive approach). As Cronbach et al (1980) state:

'The evaluator will be wise not to declare allegiance to either a quantitative-scientific-summative methodology or a qualitative-naturalistic-descriptive methodology.' (1980: 7)

While Cronbach et al (1980) provide sound advice, and TILT-E mixed methods as seen in the pilot studies and the case studies sections later, this does not mean that the use of mixed methods should be automatic and the theoretical sources of the methodologies should be ignored, as most researchers evaluating computer-based learning, and indeed TILT-E, have done.

Chen (1990) comments:

'If the appropriateness of a research method or methods for any given evaluation can only be judged within a specific context, then without linking the evaluation process to the context, further efforts to advance research methods alone may not appreciably expand the focus and scope of program evaluation. The refinement of research methods is helpful, but what is most needed in the future for advancing program evaluation may be conceptual and theoretical efforts to systematically integrate these contextual factors and research methods.' (1990: 28).

Although there is a growing call for theories about programmes (e.g. see Weiss, 1995; Chen, 1990), these theories demand appropriate methods and approaches to adequately test them (Jackson, 1998). This has yet to be widely achieved in the evaluation of the computer-based learning field.

Evaluation has developed into what Chen (1990) refers to as an atheoretical discipline, and this is particularly true in the computer-based teaching and learning field. In part at least, however, this is because the evaluation of computer-based teaching and learning is still relatively young, and using Kuhn's (1970) philosophy Shadish and Reichardt (1987) argue that in all disciplines action and practice come before theory. Draper et al (1997) have called for a model of the teaching and learning process, but such a model demands understanding of computer-based learning through research. Inductive research must therefore be conducted and then, on reflection of the findings of many studies, patterns and hence theories and models can emerge.

Evaluation has also suffered the tension of multi-perspective practitioners battling for methodological and so theoretical dominance (Pawson and Tilley, 1997). Those following the experimental paradigm (e.g. Reicken and Boruch, 1974; Cook and Campbell 1979) argue for a randomised experimental design using quantitative methods, while the naturalist paradigm advocates ethnographic or qualitative approaches in evaluation (Lincoln and Guba, 1985; Patton 1990). Just as the constraints on the situation under investigation imposed by the empiricists are considered by them to be the key to superior evaluation design, so the freedom offered by ethnography and qualitative approaches are considered to be superior by the naturalistic practitioners.

While this thesis proposes that the field of evaluating computer-based learning must advance to the stage of focussing on the theory behind the methods, it accepts Chen's (1990) observation that evaluators:

'In relying so heavily upon research methods as cornerstones of their approaches, they have also contributed to the traditional emphasis upon methodological and research issues to the neglect of program theory in doing evaluations.' (1990: 21).

This thesis proposes that until evaluators of computer-based learning become aware of their own research perspective, their espoused theories and their theories-in-use when selecting methods in an evaluation, no progress in developing program evaluations can be made.

In the TILT-E method, the evaluators had little time or resources to consider the theoretical approach behind their methodological use. Draper et al (1994) declared their approach empirical, and repeated this claim in 1996 (Draper et al, 1996). Yet as will be seen throughout the later sections of this thesis, the TILT-E approach is not singularly empirical but rather a blend of different methodological and theoretical approaches.

In summary, it is important to understand the theoretical underpinnings of the research methods employed in the evaluation of computer-based learning for three main reasons:

1. To assist in the development of better instruments and methods for evaluating computer-based learning.

2. To assist in the appropriate application of methods and instruments when evaluating computer-based learning.

3. To assist the development of program theory and models of the computer-based learning context.

2.9 Doughty's paradigm diagram

Doughty (1999) developed a diagram of paradigms which may be applied to the computer-based teaching and learning situation. His diagram is reproduced in Figure 2. The diagram is useful in three ways:

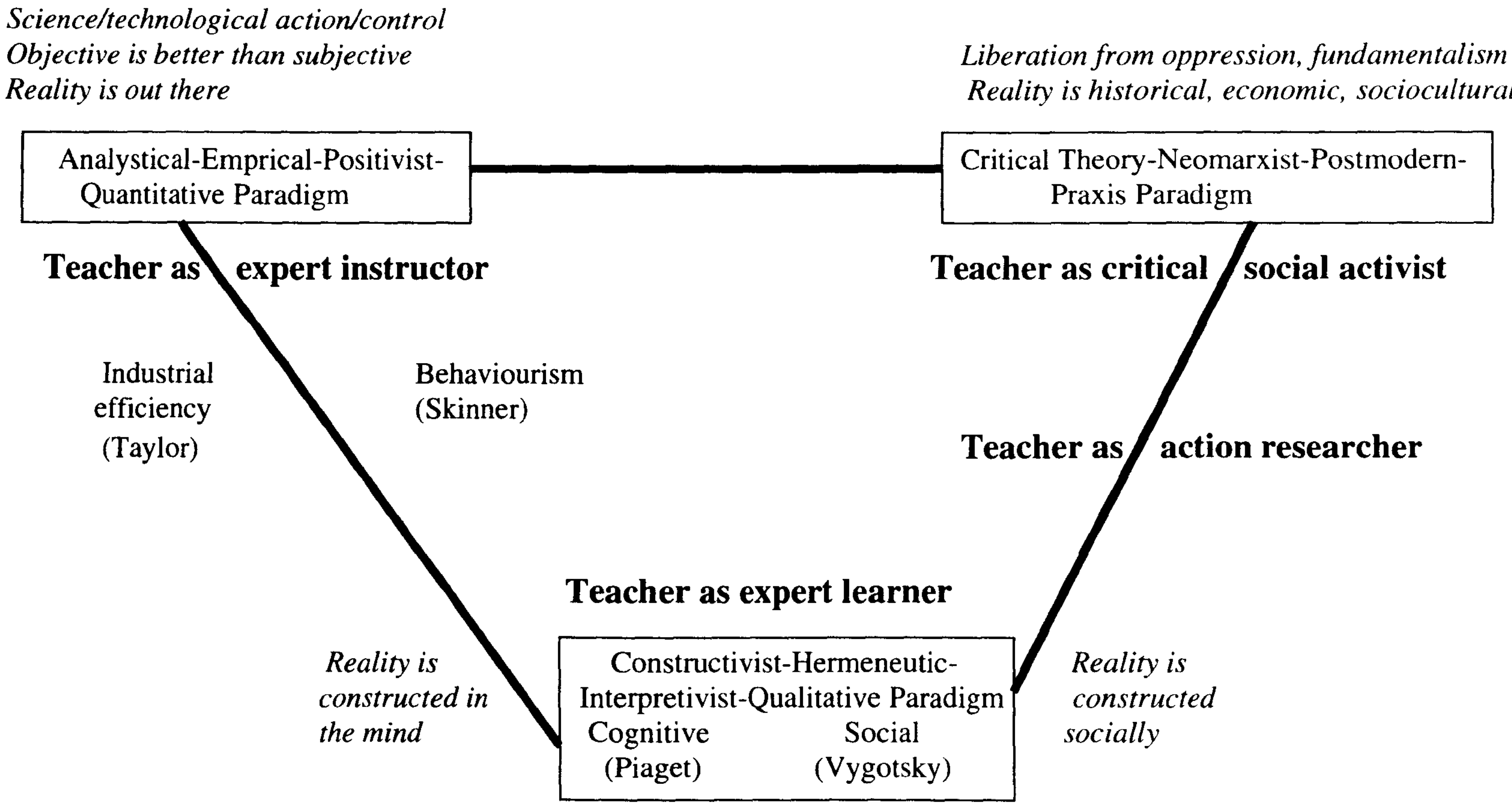
1. As a tool for package developers or for those looking for a theory behind the structure of a package.

2. To assist the researcher in assessing underlying package development theories and approaches.

3. As a first stage in getting developers, researchers and evaluators to consider the real theoretical approaches to their research i.e. their actual theory-in-use rather than their espoused theory (Jackson, 1998).

However the diagram is limiting because it may inspire the researcher or the evaluator to adopt the 'appropriate' evaluation approach e.g. for a drill-and-practice package requiring simple retention an empirical approach may be deemed most appropriate. In reality, there will always be a context to the teaching and learning situation regardless of the theoretical grounding of the package, so constraining the evaluation to quantitative methods by 'matching' the theory to the evaluation may in fact lead to a reduction of understanding and information from the situation. This goes against Jackson's (1998) call for a 'constructivist' approach to the evaluation of constructivist teaching, and highlights the reality that evaluation, although inextricably linked to the phenomenon under investigation, must be guided by its own appropriate rules, approaches and theories.

Figure 2 - Doughty's Paradigm Diagram



Source: G. Doughty

It is not just theoretical approaches which attempt to tie evaluations to a set of methods. Oliver (1997) states that Laurillard's (1993) conversational framework of the teaching and learning process in higher education (see Figure 3) 'forms the basis of an evaluative methodology' (1997: 9). The methodology in question is described by Oliver as follows:

'In order to establish the interactions which occur, observations, interviews and traces of performance (including written protocols, program inputs, dialogue etc.) are carried out. Laurillard's approach is distinctive in that data is gathered in retrospect...Analysis and data collection occur in two phases. The first phase covers the learning session, and involves observation work and logs of activity. The data from this phase is then analysed phenomenographically (Marton, 1981), and is used to focus, prompt and guide students' explanations during follow-up interviews.' (1997: 9)

The are two errors with Oliver's (1997) interpretation of Laurillard's work. Firstly, the data is not collected in retrospect. It is collected during the learning situation as Oliver (1997) himself states. Secondly, the data is collected through a combination of approaches, from ethnographic (observation) to empirical (logs of activity), just as it is in the TILT-E method. Rather than being the basis for an 'evaluative methodology', Laurillard (1993) has used the existing but poorly-described methods common in computer-based learning.

What can be argued as different about the Laurillard (1993) 'evaluative methodology' is the analysis of the data using phenomenographical techniques. Here at least the approach to one part of the evaluation, the analysis of the data, is explicit and it can therefore be replicated or used to assess its' worth. Just as there are many theoretical approaches and hence methods of collecting data, there are many ways of analysing it also. In this thesis however the emphasis is on understanding and explaining the approaches to evaluation needed to construct an evaluation of computer-based teaching and learning, and how this may in turn assist in the development of a model. Data analysis therefore must be left to be debated elsewhere due to the space constraints of this work.

2.10 Evaluating computer-based learning

Evaluating computer-based learning is a complex process which appreciates that the student's learning from the software or computer-based intervention is a vital indicator of the effectiveness of an intervention, but concedes that measuring this is difficult (Jones et al, 1996). Mason (1995) suggested that part of this problem may lie in a change in the nature of what students are learning from the computer-based resource, instead of the predicted general increase in performance demanded from most evaluations (Jones et al, 1996).

Jones et al (1996) note that the effectiveness of a computer-based learning resource was frequently investigated through comparative studies such as the Fast Frac study later in this thesis. They believe however that the 'problem' of evaluating computer-based learning is too complicated for such an investigation as it is too different from 'traditional' teaching and learning situations. While there is value in their comments, their discarding of all comparative studies in the evaluation of computer-based teaching and learning is not appropriate. Using a control group, as in the third evaluation episode of the Fast Frac study, does not constrain the evaluation to an empirical approach. While the use of controlled studies is of course an empirical design, what occurs within the design (i.e. what methods are used) does not have to be. In the Fast Frac study qualitative methods were used alongside quantitative methods, the naturalistic approach of observation with the empirical questionnaire method. Similarly the control group in the Fast Frac studies did not 'miss out' on the innovation, but instead received the teaching interventions in a different order from the experimental group so that no student was disadvantaged. Other researchers have recognised the value in such research. For example, Oliver (1997) argues that there is value in comparing contextualised studies (i.e. evaluations) of the teaching and learning situation with and without educational technology i.e. comparing the use of computer-assisted learning with a conventional presentation. He proposes that this makes the 'results more generic without losing authenticity' (1997: 18).

By performing comparative and other research-driven studies and tackling problems and criticisms like those made by Jones et al (1996), some advancement in the field may be achieved. It is interesting to note that in Jones et al's (1996) paper about fifteen years of evaluation of computer-assisted learning in the Open University, they do not demonstrate any theory behind their methodological choice, nor do they present a program theory. As argued earlier the evaluation of computer-based learning is young, but still should consider the lessons learned in other fields by other researchers (e.g. Pawson & Tilley, 1997; Weiss, 1995; Chen, 1990) if it is to move towards the development of models and theories about the computer-based learning experience.

2.11 Computer-Mediated Communication

As a newer aspect in the computer-based learning field, computer-mediated communication is worth consideration in its own right. Computer-mediated communication (CMC) includes tools such as email and communication and conferencing packages. CMC benefits education in theory by allowing students to control the learning experience in a flexible way. In this thesis, computer-mediated communications are considered in the NetSem case study later. This study involved the electronic presentation of seminars by students, followed by discussion of issues raised in the seminars amongst groups of students over email.

Steeples et al (1996) noted that 'a framework for effective uses of computer-mediated communication in higher education is currently lacking' (1996: 71). They report that the experience of using electronic seminars with students at Lancaster University found three benefits:

1. Learners with a disability (for example, deafness) could participate in the discussions.

2. Shy and unconfident students get a chance to contribute to the discussions.

3. Foreign students can consider their responses before framing them in English.

Steeples et al (1996) also discussed NetSem, and reported that the view of NetSem staff was:

'That the seminars had been interesting, informed and provocative, when compared to the traditional face-to-face seminars they had previously used with the students. Staff suggested that there had been an improvement in the quality of contributions and an increase in the quantity of contributions.' (1996: 77).

This to some extent makes up for TILT-E's lack of stakeholder interviews in the NetSem study, and it will be interesting to compare this report with the students' perspective later in this thesis.

2.12 The difference between a framework and a model

A model is defined by Reber (1986) as:

'A representation that mirrors, duplicates or in some way illustrates a pattern of relationships observed in data or in nature...a kind of mini-theory, a characterisation of a process and, as such, its value and usefulness derive from the predictions one can make from it and its role in guiding and developing theory and research.' (1986: 447)

This definition is used in this thesis. However there is confusion over what is a model and what is a framework. For example, Patton (1990) in his discussion of evaluation models states:

'Models are developed to help evaluators know what steps to follow and what issues to consider in designing and implementing a study. Models are not so much recipes as frameworks.' (1990: 115)

The Collins English Dictionary distinguishes between the two, describing a model as 'a standard to be imitated...A simplified representation or description of a system or complex entity especially one designed to facilitate calculations and predictions', whilst a framework is simply described as 'a structural plan or basis of a project.' This distinction is used in this thesis i.e. that a framework is a plan or listing of processes and or stages, whilst a model is a representation which aids prediction. A model is therefore a conceptual phenomena, and a framework a list of actions, events or processes which do or should occur.

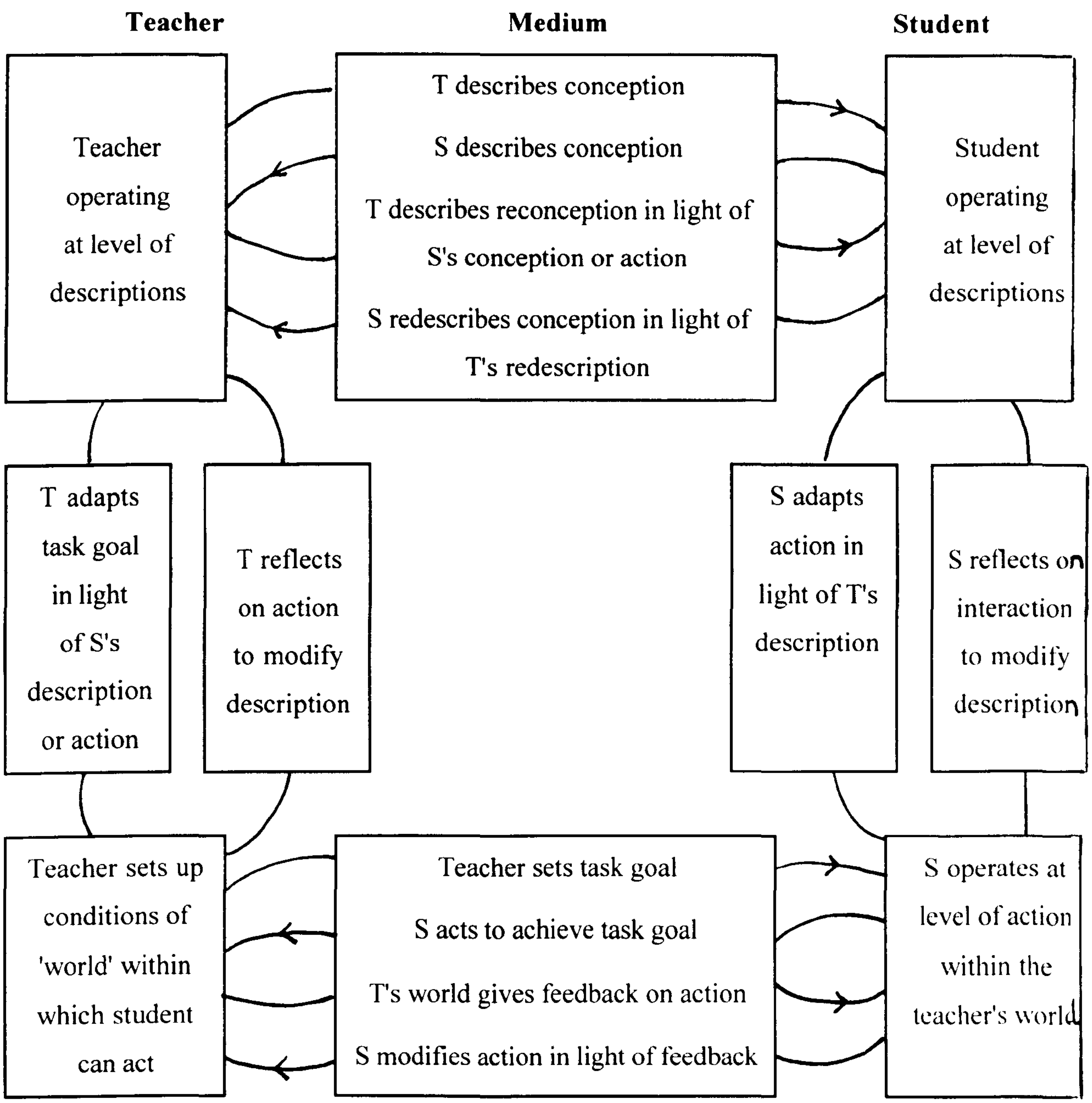
To provide an example of what a framework in the computer-based teaching and learning situation may look like, Laurillard's conversational framework is shown in Figure 3. As an example of an evaluation framework, Oliver's (1997) framework for evaluating the use of educational technology is shown in Figure 4.

The examples shown in Figures 3 and 4 represent a series of actions or events. In conceptual terms, a framework may be more easily developed because of its active nature, whilst a theory or model representing a situation must have scope for making and testing predictions. Despite an abundance of frameworks, there are no adequate theories or models of the computer-based teaching and learning process to demonstrate here as a contrast to the frameworks (Draper 1997). This could be because of the movement towards more inductive and interpretive approaches (e.g. Pawson & Tilley, 1997). Shadish and Reichardt (1987) argue using Kuhn's (1970) philosophy that in all disciplines action and practice come before theory, while Weber (1949) proposed that research should start with the action and understand that before moving towards models. Given that computer-based teaching and learning is a young but rapidly advancing field, it may be that there is not enough quality research available yet to assist in the understanding of the processes involved, let alone develop a model. As Draper (1997) states:

'We have a great need for an adequate theory of the learning and teaching process that could at least describe which factors are important and so structure observation, evaluation, design and other research. The literature does not provide us with the answer.' (1997: 1)

It is interesting to note that Draper et al (1994) did examine Laurillard's framework and to an extent attempted to adopt it, particularly with reference to the integration of resources in a course (Oliver, 1997). However, Draper (1997) has since made some amendments to it, and as reflected in his quotation earlier, does not see the framework as reducing the need for a theory of the computer-based teaching and learning process. In his paper 'Adding (negotiated) learning management to models of teaching and learning', Draper (1997) confuses the terms 'frameworks' and 'models' and uses them interchangeably, a common problem in the computer-based learning field (e.g. Oliver, 1997).

Figure 3 - Laurillard's (1993) Conversational Framework



Source: Laurillard D (1993) *Rethinking University Teaching: A framework for the effective use of educational technology* Routledge: London

Figure 4 - Oliver's (1997) Framework for Evaluation

Intention	Involves	Method
Select appropriate resources, or identify appropriate uses for resources	Practitioners	Interview
Specify assessment criteria and learning outcomes	Practitioners	Interview
Identify factors which may influence learning outcomes	Researchers, Practitioners	Interview, literature review
Gather background information about course and context	Institution	Requests for information
Gather background data on subjects	Students, Institution	Survey, requests for information
Gather data on initial level of knowledge	Students	Pre-test
Assess effects of interventions, such as:		
Condition 1 (e.g. Lecture-based), Condition 2 (e.g. Distance learning), Condition 3 (e.g. Open learning), and so on	Students, Practitioners	Observation, activity logs, examples of work
Gather data on final level of knowledge	Students	Post-test
Assess feedback on material and learning experience	Students	Survey, interviews
Gather data on long-term level of knowledge	Students	Delayed post-test
Assess time commitments and involvement of tutors	Staff	Observations, interviews

Source: Oliver M (1997) *A framework for evaluating the use of educational technology* ELT Report 1 http://www.unl.ac.uk/tltc/elt/elt1.html

CHAPTER 3

METHODOLOGICAL ISSUES

3.1 TILT-E: Method and measures

TILT-E proposed three outcomes of their research (Brown et al 1995):

1. A framework for planning an evaluation of a computer-based teaching intervention

2. A prototypical design for evaluating a computer-based intervention

3. A battery of methods and instruments for evaluating a computer-based intervention

3.1.1 TILT-E's framework for planning an evaluation

Five stages were proposed for this framework and are summarised below:

1. Meeting between evaluators, teachers and developers to agree objectives, teacher's goals etc.

2. An evaluator runs through the software.

3. The teacher will define assessment methods.

4. The evaluator and teacher will finalise a design for the study.

5. The classroom study will take place.

3.1.2 Prototypical design for evaluating a computer-based intervention

Brown et al (1995) proposed a prototypical design may include the following seven measures:

1. A pre-task questionnaire including prior experience and task knowledge administered at the start of the session.

2. Confidence logs after each activity with baseline administration at the start of the session.

3. A learning test (quiz) at the start and end of the session.

4. Post-task questionnaire examining respondent's personal experience of the intervention after the session.

5. Observations by the evaluator during the session.

6. Focus groups before or after the intervention, as appropriate.

7. Access to subsequent exam performance.

3.1.3 Battery of methods and instruments for evaluating a computer-based intervention

Most of the TILT-E instruments are covered under the evaluation design section above. Also used were the Resource Questionnaire (Brown et al, 1996), semi-structured interviews, videotaped observations, computer-based tracking of the students through a package, informal discussions, and ad hoc paper instruments developed and adapted for use in specific situations.

3.2 TILT-E today

As time has passed, the TILT-E method has been refined and its description increased (Draper et al, 1996; Brown et al, 1996). A focus for the methodology became the integration of resources in a course, and the development of a measure called the Resource Questionnaire (Draper et al 1996; Brown et al 1996). Just as Oliver's (1997) framework earlier, TILT-E developed a framework for evaluating computer-based learning in the classroom, or 'real-world'. This involved what Draper et al (1996) called the 'inner' and 'outer' methods. The outer method included the five stages listed in the framework for planning an evaluation earlier, and added two further points relating to the production of reports. The inner method was simply the measures used, from computer experience questionnaires to focus groups.

3.3 The value of TILT-E's method and measures

TILT-E provided the higher education community with the evaluation planning framework, design and battery of measures described earlier. TILT staff still support individuals using them today. TILT-E's work may be viewed as an example of good practice across a wide range of computer-based learning situations and applications. The advantage of TILT-E's work is that the case studies were conducted using similar methods and by the same evaluators, despite the range of innovations encountered. This is rare in the computer-based learning field.

3.4 The weakness of TILT-E's method and measures

The nature of TILT-E's work was reactive, and as a result several papers from TILT-E did not emerge until 1996, after the rush of evaluation was over (e.g. Draper et al 1996; Brown et al, 1996; Pollock et al, 1996), particularly one which reflected on the results and proposed a new category of evaluation termed 'integrative evaluation' (Draper et al, 1996). However, in the paper presenting this new form of evaluation, Draper et al (1996) describes TILT-E's approach as empirical because it focused on learning. This thesis proposes that this statement is misleading, and that TILT-E neglected to analyse in any detail where their methodologies had come from and what approaches they were actually using in their evaluation work. It is a feature of TILT-E that the evaluation literature from other fields, and indeed from the evaluation field in its own right, was largely ignored due to time constraints and resource issues. This thesis endeavours to rectify this weakness, and demonstrates that detailed consideration of the evaluation methodologies and approaches are needed to facilitate movement towards models of the teaching and learning situation demanded by the field (Draper et al 1997).

Another weakness in the TILT-E outcomes was the failure to indicate when and where the measures TILT-E developed could be most usefully applied. By examining the approaches underlying the TILT-E method, it is hoped some insight can be given into when to use a particular approach.

3.5 Reliability, Validity and the TILT-E methodology

As with any methodology, reliability and validity of the measures proposed are a necessary focus. Reliability refers to a measure's consistency across applications, while validity refers to its measurement of the variable under examination, specifically whether it is measuring the variable it is intended to, and if it is measuring all aspects of that variable.

3.5.1 Validity

A good method will measure only what it is supposed to (validity), and do it consistently when completed by the same person or in the same situation (reliability). Assessing validity can be an arduous task due to the volume and complexity of definitions and measures of the concept (Reber, 1986). There is within the mire of validity an important distinction between internal validity and external validity. The latter, external validity, is applicable to the TILT-E studies as it, unlike controlled experimental studies, allows investigation in a natural situation, and accepts that confounding may interfere with the findings to a degree, but offsets that against the generalisability of the findings. In other words, it accepts real-world research and all its noise will provide more informative, generalisable findings than the results gained from a laboratory. Therefore a real-world approach such as that taken by TILT-E can be said to have *external validity*. As Cronbach et al (1980) note:

'External validity - that is, the validity of inferences that go beyond the data - is the crux; increasing internal validity by elegant design often reduces relevance.' (1980: 7)

The measures themselves have to stand the test of validity also. Again, there are different approaches to this, but in TILT-E the validity was assessed by a combination of the researcher's opinion that the measure had or had not measured what it was intended to measure, and the analysis of findings suggesting unexpected and unexplained patterns (arising from poor validity), or providing consistently expected results. The former is referred to as face validity i.e. the measure appears to the researcher to be measuring what they wanted it to, and it appears to make sense. The latter borders on construct validity, that is it provides data or information which assists in the examination of a hypothesis. In other words, it provides the researcher with information consistent with their hypothesis or theory about a variable (Nation, 1997; Whitley, 1996; Reber, 1986).

3.5.2 Reliability

Neuman (1997) notes that 'perfect reliability and validity are virtually impossible to achieve' (1997: 138). He suggests there are three types of reliability, specifically stability reliability; representative reliability; and equivalence reliability.

1. Stability reliability

Stability reliability asks whether the measure gives the same result each time it is administered across different times. For example, if repeatedly asking the same students the question 'Would you have taken this course if you had known computer-based learning would be involved? Yes/No' throughout an academic year, as is done in the NetSem study later, the answers should be consistent. This is known as a test-retest measure of reliability.

2. Representative reliability

Representative reliability asks whether the measure obtains the same result across different groups or subpopulations. The measure should provide accurate information for every group.

3. Equivalence reliability

This asks whether a measure examining the same variable on several different items produces consistent results. It is also known as the split-half method, where such a method is divided and each half should produce the same results.

The discussion of reliability and validity of measures focuses itself on issues derived from quantitative studies. Qualitative methods, such as observation, were traditionally regarded as without reliability and validity (Patton, 1990). According to Patton (1990), reliability of qualitative methods is achievable, but depends on 'the methodological skill, sensitivity, and integrity of the researcher.' (1990: 11) The way in which one can use the one-off 'ad hoc' approach with mixed methods (i.e. both qualitative and quantitative measures) and still believe in methodological reliability and validity is through a process known as *triangulation*. Denzin (1970, 1978) developed the concept of triangulation, and with the revolution of the theoretical/methodological approaches in the 1970's, fed into the belief that mixing methods and approaches (i.e. pluralism) could produce the best results. Denzin (1978) stated 'because each method reveals different aspects of empirical reality, multiple methods of observations must be employed' (1978: 28). Neuman (1997) commented that:

'Getting identical measurements from highly diverse methods implies greater validity than if a single or similar methods had been used.' (1997: 151).

In essence, triangulation takes two methods or data sources, examines the findings from each, finds them to be similar and thus creates a third point, the result. The following simple illustration perhaps best describes the concept:

Illustration 1 - Triangulation

Data Source 1 - An interview
'I enjoyed using a computer today'

Data Source 2 - A questionnaire
Did you enjoy using a computer today? **Yes**

The student enjoyed using a computer

The variable under examination was enjoyment of using a computer, and it was found that both Data Source 1 and Data Source 2 came up with the same answer, suggesting that the data is reliable and valid.

3.6 The value of repeated evaluations

Evaluation of a program tends to be singular rather than repeated. If the evaluation data suggests something works for one group, an intervention is often used again with little thought to improvement or the characteristics of subsequent recipients. As Pawson and Tilley state 'Sadly, most evaluation studies seem to be one-off affairs.

They neither look back and build on previous findings, nor look forward to future evaluations' (1997: 115). Yet it is through replication that the findings of any study are proven or discarded. Professor John Davies in 1992, at that time editing the journal *Addictions*, stated during an informal discussion that the biggest loss to the academic world was the absence of a journal dedicated to replication. Without confirming or refuting claims, one cannot be sure they are accurate. Indeed, the reliability of a measure has as a core principle the ability to replicate its findings under the same conditions with a similar group.

The opportunity to use a package across several years with a similar target group was made available in the Fast Frac case study in this thesis. This allowed a consideration of the evolution of the methods as well as a cross-year comparison of results. Similarly, GraphIT! offered a cross-discipline evaluation opportunity, with participants coming from three academic levels and three different courses.

3.7 The role of the researcher

A potentially confounding factor in any research is the researcher. In both social and educational research the researchers are '*always* the medium through which research occurs; there is not method or technique for doing research other than through the medium of the researcher' (Stanley & Wise, 1983: 157). The researcher is therefore a variable in the research (Patton (1990). In the three case studies in this thesis the researcher was the same individual and the author of this work. It can be suggested that, as with any variable in any study, the researcher may confound the investigation. Work has gone into the effects of researchers as interviewers for this reason (e.g. Davies & Baker, 1987). Cronbach et al note:

'Observations of social programs require a closer analysis than a lay interpreter can make, for unassisted judgement all too easily leads to false interpretations.' (1980: 3)

How the researcher in any study may have influenced the results is very difficult to tell. Where it is the same researcher throughout, as with this thesis, the influences and effects the researcher has on each study is likely to be similar, making the researcher effect a stable and consistent variable throughout the studies.

3.8 Stakeholders

The agendas and backgrounds of each group of stakeholders are as diverse as the stakeholders themselves. A stakeholder in any programme or event is defined by Usherwood (1996: 3) as:

1. The intended and actual users of a service.

2. The people who, through their actions, provide the service.

3. The people and agencies who control the resources consumed by the service (and who explicitly or implicitly define the needs which it is intended to address).

Pawson & Tilley (1997) note that an issue of concern in evaluation must be whether 'he who pays the researcher calls the methodological tune' (1997:14) i.e. whether the funding stakeholder demands a certain approach which the evaluator is forced to oblige. At the heart of this issue is the concern that the politics of evaluation can influence its' results. Their attitude is somewhat idealistic, however, as evaluation is a value judgement which has to be credible and make sense to all stakeholders, from the participant to the paymaster. Patton's (1981) proposal that the selection of the method should always consider 'different situations, different purposes, different people, different languages' [1982:49] is realistic, if frustrating for the academic idealist.

TILT-E failed to conduct documented interviews with stakeholders other than the students prior to and after the interventions, although the evaluators did discuss the needs of the teacher and the needs of the evaluation with the whole development team at every stage. Interviews were not formally conducted with package developers, though again they were at the heart of the evaluation process. What is particularly regrettable about the absence of such information is the wealth of explanation such data may possess, and its central importance to attempts to evaluate the process of designing and implementing a computer-based learning resource. It is strongly recommended that in future such interviews be carefully documented, if not formally at the time of interview, then later in a diary kept by the researcher (Henderson, 1999).

3.9 Outline of the results' sections

The following sections consider the results of evaluations conducted in a range of departments and with very different content. The first three studies described in Section 2 of this thesis were conducted by the whole TILT-E team, and served to evolve the methods and measures from crude and cumbersome to more manageable and informative. They also allowed the evaluators to gain experience observing and interviewing students about computer-based teaching and learning, as well as helping them understand the teachers' and developers' needs and wants from the evaluation. These three studies are referred to as pilot studies because of their central role in the evolution of the TILT-E methods. All three pilot studies required an internal report, and these were written up by the author of this thesis who played a lead role in each study and was responsible for method administration, collection and analysis, as well as reporting.

The three main case studies were also designed, conducted, analysed and reported by the author of this thesis. Generic methods, such as the confidence log and the pre- and post-task measures were devised by TILT-E. The teachers, developers and staff involved with the package or the course played a critical role in the design of each of the studies, including developing quizzes, scheduling time for evaluation, and providing aims and objectives of the teaching and the software. As with all work in the TILT Project, the case studies could only happen with the co-operation and involvement of many people, including the students. Thus the evaluation studies reported here are the work of many, but the analysis of the results and the reporting of the studies is the work of the thesis author alone.

CHAPTER 4

PILOT STUDIES: FORMATIVE DEVELOPMENT OF METHODOLOGY

4.1 Instrument Development

TILT-E developed their instruments through the experience of the group members in the first instance (Draper et al, 1994). Draper et al (1994) noted that:

'A seemingly obvious aim (of TILT-E) is to test the effect of various new educational tools...with a view to deciding whether they diminish, maintain, improve or change what is learned, and whether they change other factors such as student enjoyment or total cost. When the TILT project began, group E decided to bring to bear a selection of techniques on this kind of aim. (The set included questionnaires, semi-structured interviews, checklists, thinkaloud protocols and direct observation, focus groups and incident diaries). Important to our attempts were quizzes designed by the course teachers).' (1994: 9)

The selection of methods in the first instance was therefore not overtly built on previous research. Instead the methods were piloted in several studies, and evolved throughout the life of TILT. The approach to method evolution and use could be framed as an action research approach, as at no time were the measures themselves declared 'finished' or 'inflexible'. Rather they offered frameworks for adaptation to every situation and if something did not work, as demonstrated in the following pilot studies and indeed in the subsequent case studies themselves, it was changed no matter what stage of the project. The action research approach to the development of the methods shown in this section and in the later case studies is shown in Figure 5.

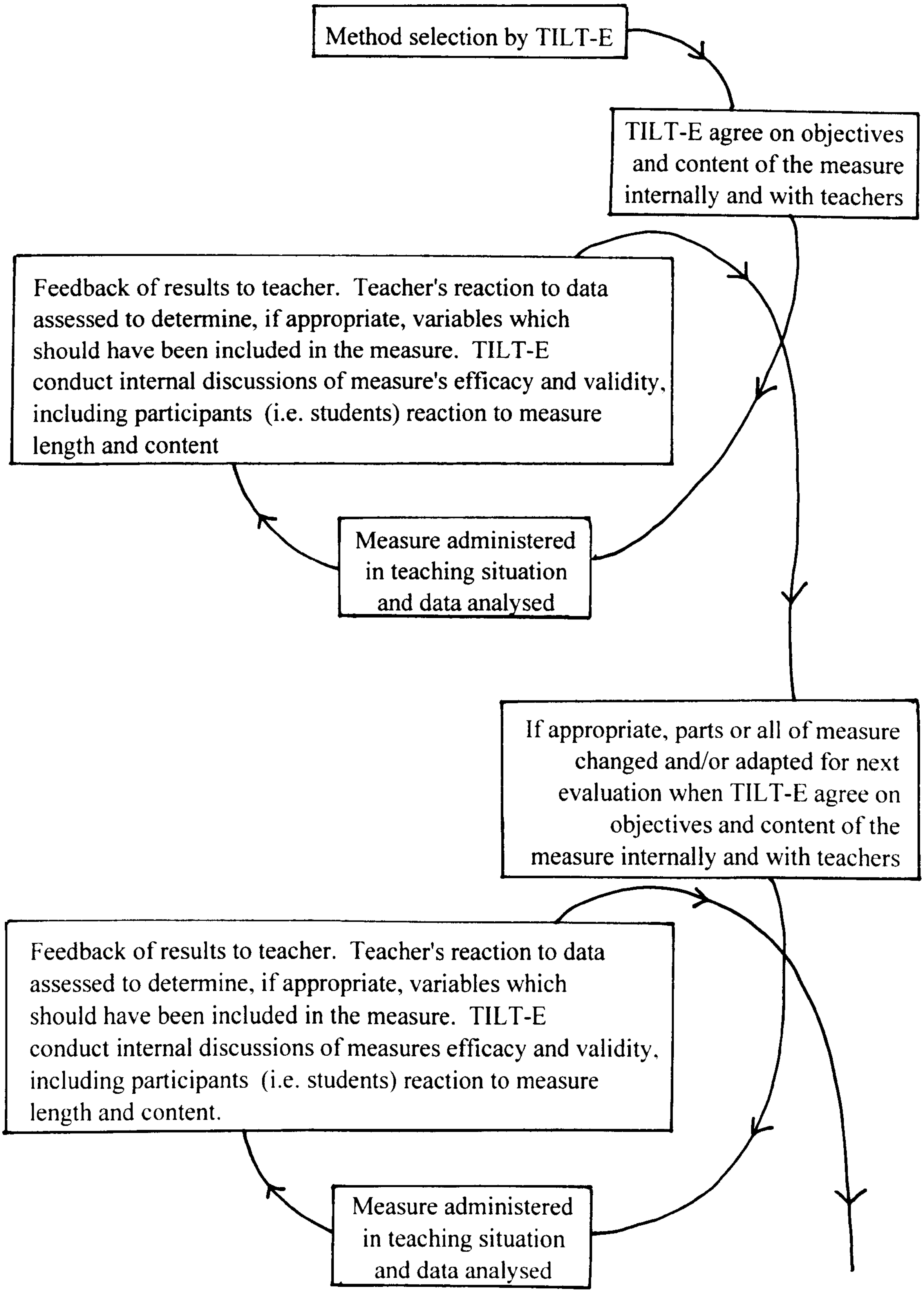
4.2 The Pilot Studies

Three pilot studies are considered, presenting the first three formal TILT-E studies. The studies are presented in chronological order. The first study, a classroom evaluation of MacDonald Simulation Model for Intervening in Schistosomiasis, involved sixteen Parasitology students and took place on 2nd February 1993, a month after the TILT Project began. The second study was conducted ten days later on the 12th February 1993. It also involved a simulation package, this time using the Neurosim package with third year Zoology students.

The third pilot study involved two evaluation episodes, both with second year Economic History students. This study took place during November and December 1993, and involved evaluating the teaching of PARADOX and Microsoft Excel skills to the students to enable them to use databases and census data as part of their course.

Each study generated a large amount of data. Space constraints prevent the listing of all the results, so summarized results focusing on particularly relevant findings from each study are presented instead.

Figure 5 - TILT-E's action research approach to method development



Chapter 5

Pilot Study 1: MacDsim

5.1 Aim

5.1.1 Evaluators' aim

The aim of this study was to pilot measures to evaluate computer assisted learning situations using the MacDonald Simulation Model for Intervening in Schistosomiasis.

5.1.2 Teacher's Aim

This intervention was a pilot study for the Zoology department, who wished to incorporate more CAL material in their course. The teacher thought highly of this package and hoped to continue using it, but was uncertain whether the students would accept this method of learning. Therefore the package was not integrated into the course (i.e. subsequent lectures, exercises, exam questions were not designed to refer to the package), although the material and the specific model (McDonald simulation model for intervening in Schistosomiasis) had been dealt with in lectures.

5.2 The Software

The software was a simple 4 parameter simulation model of parasite control run on IBM PC-clones, specifically the MacDonald model of controlling schistosomiasis, developed in Copenhagen. It was preceded by 3 warm-up sections that presented basic conceptual (revision) material on schistosomiasis control, and the simulation model which was explained in detail with fixed examples.

5.3 The Students

Sixteen third year Honours Parasitology students completed all pre- and post-measures, out of a class of 20. Five males and 11 females made up the group, with ages ranging from 19 to 31 years (mean age 22). Only 3 students were over 23, and all were female. The majority (10 students) were 21 or under.

5.4 Measures

In this study, 7 measures were used. They were as follows:

- Biographical Questionnaire (BQ)
- Computer Attitude Questionnaire (CAQ)
- Quiz
- Informal Semi-Structured Feedback Interviews
- Think-aloud protocols
- Demonstrator's log of help given
- Post-Package Evaluation Questionnaire (PPEQ)

These measures are described in more detail in the following subsections.

5.4.1 Biographical Questionnaire (BQ)

A lengthy questionnaire (See Appendix 1.1) was devised by TILT-E staff, to assess the importance of as many potentially influential variables defining ability to use and reaction to computers as possible. The 39 questions on this questionnaire examined 4 dimensions, summarised below:

1 - Personal details, including age, gender, date of birth, native language.

2 - Academic details from school to current course.

3 - Computer use, including computer ownership and access, frequency & type of use, any computer skills courses attended.

4 - The current course, specifically how the students feel about using a computer in the course.

At the end of this measure, the statement 'Finally, please list below any comments you have about this questionnaire and/or its content:' was included, inviting the students to evaluate the measure.

5.4.2 Computer Attitude Questionnaire (CAQ)

A 34-item questionnaire was constructed by the TILT-E team to examine students' attitudes towards computers. The questionnaire presented an equal number of positive and negative statements about using computers generally, and in the teaching situation (See Appendix 1.2). For example, 'It is a good idea to use computers to assist in the teaching of the subjects I study', and 'I find using computers confusing'. The questionnaire used a five-point scale from 'Strongly Agree' to 'Strongly Disagree', and included a 'Statement Unclear' option at each item to assess participants' response to the items and the measure's clarity.

The CAQ's aim was to assess whether a negative attitude towards computers was related to a negative experience of the teaching situation. If so, then the CAQ could be used to predict problems amongst negative students before they attempted the CAL. Also, it was hoped that the CAQ would be a dynamic evaluation instrument overtly affected by the CAL experience of the respondent i.e. the students' attitudes after the CAL should shift in some way as a result of using the CAL. A positive experience can be hypothesised to relate to a positive shift in post-CAL attitudes on the CAQ, and vice versa for a negative experience.

5.4.3 Quiz

A 10-item quiz measuring pre & post-CAL knowledge was developed by the Zoology department staff participating in this study, measuring a) general concepts & b) specifically the control variables simulated by the CAL. The quiz was not released to the evaluation team, but was administered, marked and filed by staff within the Zoology Department. The results however were made available.

5.4.4 Informal Semi-Structured Interviews

Seven students were randomly sampled from the 16 participants and asked to go over either their own completed BQ, CAQ and PPEQ, or a blank one. The purpose of this was to obtain informal verbal feedback about these measures and their possible development, as well as to probe for any other problems with the learning situation the students encountered and which were not picked up by the PPEQ.

5.4.5 Think-aloud protocols

Think-aloud protocols give immediate feedback from the user about their experience of using the package. This method has been described as 'the closest one can get to a window into the mind of the user' (Draper, 1992). The think-aloud is performed by sitting beside the computer user(s) and asking them to talk their thoughts as they work through the material. For example, if they decide to move the mouse, they would say so, and why they are performing that action. If they pause, they would be prompted to describe why they have stopped. It is in effect a combination of observation techniques and a semi-structured interview, and hence is good for assessing HCI issues in formative studies.

5.4.6 Demonstrator's log of help given

The demonstrator agreed to write down questions she was asked and solutions she gave in a log of help requests, again to pick up on any problems that the paper measures may have missed. No paper measure was drawn up for this. Instead, the demonstrator made her own notes in her style and fed them back verbally to the evaluators later.

5.4.7 Post-Package Evaluation Questionnaire (PPEQ)

The Post-Package Evaluation Questionnaire was a 10-item combination of questions about both the student's experience of using the package and their investigation of the package topic (See Appendix 1.3). The measure asked a range of questions, including:

- Whether the students found the package easy to use, enjoyable and interesting.
- What purposes the package was most useful for, including revision, presenting new information, and increasing knowledge of the subject.
- Whether the students would like to spend more time using the package.
- How many simulations they had run.
- How they had previously covered the package material.
- How the package compared to previous teaching they had encountered.
- What extra work (if any) they had done on the subject.

5.5 Method

The CAL experience and evaluation was announced to the students at 10am after their first morning lecture. They were asked to complete the Biographical Questionnaire (BQ) and the Computer Attitude Questionnaire (CAQ). These measures took approximately 15 minutes to complete. The students attended another lecture at 10:30am, then a practical class from 11:30am to 5.00pm.

At the start of the practical class, the students were asked to complete the Schistosomiasis Quiz (Quiz 1) at a free moment before the start of the computer sessions at 3.00pm.

To cope with student numbers the package was introduced in two sessions. Students were randomly assigned to paired or single person use. In the first session 8 individuals used a computer each, while in the second noisier session 5 pairs and 1 single student worked through the package. Two TILT-E evaluators each conducted a think-aloud in both sessions.

The intervention took on average 30 minutes to complete. The students had a paper sheet of instructions, and there was a demonstrator available throughout the sessions. After package use the students were asked to complete Quiz 2, the Post-Package Evaluation Questionnaire (PPEQ), and the CAQ. These measures took approximately 15 minutes to complete.

The timing of the administration of measures is summarised as follows:

Pre-Intervention (Time 1)

- The Biographical Questionnaire (BQ)
- The Computer Attitude Questionnaire (CAQ)
- Quiz 1

During Intervention

- Thinkalouds
- Help Log

Post-intervention

- Quiz 2
- The Post-Package Evaluation Questionnaire (PPEQ)
- The Computer Attitude Questionnaire (CAQ)

The following sections describe the results of these measures.

5.6 Results

5.6.1 The Biographical Questionnaire (BQ)

The BQ asked students to provide personal and academic details, information about previous computer experience, and how they felt about the use of computers in the course they were taking. As the questionnaire evolved and ultimately disappeared, as discussed later in these pilot studies, it became clear that TILT-E was trying to cover too many potentially influential variables, i.e. variables that members of the group *predicted* would influence success of the package. At this early stage, the group was attempting to use a more deductive approach reflected in its quantitative methods, hypothesising that biographical details such as age and gender would impact on package success. This generated a large amount of data of questionable relevance to the teaching and learning situation the students were encountering, much of which is not listed here for that reason.

5.6.1.1 Prior computer use

The results of the prior computer use and training component of the questionnaire are considered below. Of all the items on the BQ, the prior use of computers was the most enduring in the TILT-E studies, though its depth was diminished progressively as will be shown in the later case studies. At the time of the first pilot study, the computer use component of the BQ probed several dimensions. They were:

1) Taught courses
2) Access to computers
3) Frequency of computer use
4) Purpose of use
5) Types of package and computers used
6) Programming experience

The results of these items are considered in the following subsections.

1) Taught courses

Only 3 students had been taught computing or computing skills. One student had 'O' Grade computing (Student 1), one had attended a 30-hour course in computing in medicine (Student 4), while the third had passed Computing 1B in their first year at Glasgow University (Student 5).

2) Access to computers

None of the students who had participated in a taught course had access to a computer at home, all reporting that the University owned the computer they most frequently used. Three other students did report having a computer at home. One had an Amstrad 6128, one had an Atari STFM, and one had an Amiga (Students 8, 9 & 12 respectively). Not surprisingly, these students reported having regular access to a computer, and to most frequently using their own computers. Two other students reported having regular access to their flatmate's and their boyfriend's computer (Students 14 & 15 respectively). Eight students stated the University owned the computer they most frequently used, and of these 3 reported not having regular access to them (Students 3, 5 & 7), while the other 5 felt that the University computers were regularly available. Students 2, 11 & 13 reported they did not have regular access to a computer.

3) Frequency of computer use

The students as a group did not use computers frequently.

The results from these three items on the BQ are summarised in Table 5.6.1.

Table 5.6.1 - Computer use: Taught courses, access, ownership & frequency

Student Number	Formally taught computing skills	Do you have regular access to a computer?	Who owns the computer you frequently use?	How often do you use a computer?
1	Yes	Yes	University	Once/twice a year
2	No	No	Not Applicable	2 times a year
3	No	No	University	Not very often
4	Yes	Yes	University	Very rarely
5	Yes	No	University	Missing
6	No	Yes	University	Never
7	No	No	University	Very rarely
8	No	Yes	Self	Once a week
9	No	Yes	Self	Several times a week
10	No	Yes	University	Every 2 days (library system)
11	No	No	Not Applicable	Never
12	No	Yes	Family	Almost never
13	No	No	Not Applicable	Never
14	No	Yes	Flatmate	Sometimes
15	No	Yes	Boyfriend	Once a month
16	Missing	Yes	University	Once every 2 weeks

4) Purpose of use

To further explore the students' reported computer use, they were asked if they ever used a computer for academic purposes and/or non-academic purposes, and if so what they used it for. The students' responses are given in Table 5.6.2.

5) Types of package and computers used

Students were also asked to select what computer package types they had used from a comprehensive list of 9 types of package, including word-processing, databases, spreadsheets and games. The types of computer they had previously used was also probed. The students' responses are given in Table 5.6.2.

6) Programming experience

The students were asked if they had any experience of computer languages. The students' responses are also given in Table 5.6.2.

Table 5.6.2 - Computer use: Type, programming & packages

Student Number	Use a computer for academic purposes? What do you use it for?	Use a computer for non-academic purposes? What for?	Which packages have you used?	What makes of personal computers have you ever used?	Language used
1	Yes - Word processing, Statistics	No	WP, Statistics, Databases	Mac, BBC	Basic
2	Yes - Biometry course last term	No	Library CD-ROM	Can't remember	None
3	Yes - Biometry CD-ROM	Yes - Writing a CV: WP	WP, Statistics	Missing	None
4	Yes - In physiology, self-help questions. Biometry.	No	WP, Spreadsheets, Statistics, Databases, Games	BBC, Amstrad	None
5	No	No	WP, Spreadsheets, Graphics, Databases	Missing	Pascal
6	No	No	Statistics, Games, Bibliography Packages	Missing	None
7	No	No	Missing	Missing	None
8	Yes - WP	Yes - Games	WP, Games	Amstrad	Basic, Logo
9	Yes - Essay writing (if time permits)	Yes - Games	WP, Games, Library CD-ROM system	BBC, Atari, Commodore, Amstrad, Sega	None
10	Yes - Library for book searching	No	WP, Spreadsheets, Games, Maths software packages	Amstrad, Atari, Mac, BBC	Turbo & Light Pascal
11	No	No	Never	Not Applicable	None

Table 5.6.2 - Computer use: Type, programming & packages (Cont.)

12	Yes - WP	Yes - Games	WP, Statistics, Games	Spectrum, BBC, Amiga	None
13	Yes - Once for Biometry course	No	Not Applicable	Not Applicable	None
14	No	Yes - Computer games	Games	Amstrad	None
15	Yes - WP	Yes - WP	WP, Statistics, Games	Missing	Basic
16	Yes - Typing out reports, essays, letters	Yes - Games	WP, Games	Vic 20, Nintendo, Atari	None

Tables 5.6.1 and 5.6.2 show the difficulty in analysing and generalising from prior computer experience. The students differ in their answers to such a degree that it is impossible to draw conclusions and make statements about the group. For example, receiving a taught course in computing does not mean that you will have experience of programming languages, and vice versa. With no consistent pattern, there can be no group correlation with the results of the students' experience of the learning situation as measured on the Post-Package Evaluation Questionnaire.

5.6.1.2 Concern about computer use in the course

Students were asked if they had known that computers would be used on the course prior to them choosing the option. Four students said they did (Students 1, 3, 11 & 12), but all reported that it did not influence their decision to take the course in any way.

Six students responded that they were concerned that computers were going to be used on the course. Of these, two had earlier stated that they had known that computers were going to be used but it didn't influence their decision to take the course (Students 11 & 12). The concerned students gave the following reasons for answering the question in the way they did:

Student 5 - 'I think it will help me to understand my course more and be helpful in later jobs.'

Student 7 - 'I am not very confident when using computers.'

Student 9 - 'I think it would be useful to learn computer skills.'

Student 11 - 'Never used or had access to computers. Left school before they were introduced.'

Student 12 - 'I hope that I will be taught the very basics if I'm to use it myself.'

Student 13 - 'Because I do not know how to use a computer.'

From the comments above, Students 5 & 9 have a positive attitude towards the inclusion of computer use. The other 4 students, however, report a confidence and skills gap as underlying their concern. In summary, 25% of the sample is concerned about computer use in the course because they feel they will have difficulty with the medium. However, as the BQ was collected immediately prior to the learning experience, there was no opportunity to assist these students in improving their skills before package use.

The remaining 10 students reported being unconcerned about computers being used, although 3 students in their written comments appeared to be more concerned that the others. They stated:

Student 4 - 'In science I would expect the use of computers to be encouraged. However, I'm not too keen on them myself.'

Student 6 - 'If it is part of my course I would have to use them but only if they were completely relevant and not time-wasting. Computers good for statistics.'

Student 14 - 'I personally don't like computers, but that is because I am not efficient at using them other than a 'games' sense. I find them frustrating but wouldn't mind learning how to use one.'

Additional comments

Finally, the BQ asked the students if they had any additional comments they would like to make about the questionnaire or its contents. Only 4 students responded, and their answers are shown below:

Student 2 - 'My first year at Uni was spent doing the first year of the Dentistry course, which I dropped out of.'

Student 4 - 'No Comments. Easy to understand. Very detailed.'

Student 12 - 'Good - Its about time someone took an interest in people who can't use computers.'

Student 16 - 'Too long!'

The comments about the length and detail of the BQ were not entirely unexpected, and were probed further in the semi-structured interviews with the students.

5.6.2 Student Feedback about the BQ - Semi-structured interviews

Students were invited to go over their own or a blank questionnnaire (all 7 selected their own completed questionnaire), and were then taken through the questionnaire and asked to highlight specific problems they had with any of the sections. The excessive length of the BQ was a recurrent complaint in the seven semi-structured interviews conducted. Students complained that the problem was compounded for some students by their difficulty in remembering the 'whens' and 'whats' of the things they had done.

Aside from the 'length' issue, students had several other problems, the prominent one being that Q17 - the courses they had completed at university, was perceived to be difficult to complete if you study medicine or if you have repeated a year. The 'repeated year' issue could have been easily resolved if actual year of course completion (i.e. 19__) was included in the table, and this was amended before the next study. One student expressed concern over the relevancy of the measure, and suggested this increased reluctance to complete it, stating they could see no connection between giving all this information and running a simulation package.

5.6.3 Computer Attitude Questionnaire (CAQ)

The CAQ like the BQ was a lengthy measure, and the students had to complete it twice, once before and once after using the package. The results were then analysed to assess shifts in attitude across the two administrations. It was hypothesised that should shifts occur, they could be attributable to the influence of the package.

5.6.3.1 Coding the CAQ within students

Firstly, a within-subject analysis was conducted to determine student attitude before and after using the package. To do this, the mean of each individual's responses to the 34 items on the CAQ at pre-test was compared with the same mean at post-test.

To calculate the mean, the questionnaires were first coded on a scale of 1 (most negative) to 5 (most positive) with respect to the polarity of the questionnaire item. An unclear statement was coded as 9, as were missing answers. Mixed feelings was coded as '3', or neutral. Scores of 9 were discounted in the following analysis. The results of the comparison of CAQ means within students are shown on Table 5.6.3

Table 5.6.3 - Comparison of CAQ means within student

Student Number	Pre-test Mean	Post-test mean	Difference
1	3.63	3.61	-0.02
2	4.12	4.03	-0.09
3	3.41	3.47	0.06
4	3.74	4.03	0.29
5	3.65	3.85	0.2
6	2.82	2.94	0.12
7	3.53	2.97	-0.56
8	3.56	3.53	-0.03
9	4	4.13	0.13
10	3.59	3.62	0.03
11	2.26	2.03	-0.23
12	3.44	3.56	0.12
13	1.94	1.94	0
14	3	2.94	-0.06
15	3.44	3.36	-0.08
16	2.68	2.56	-0.12

Table 5.6.3 shows 8 students, 50% of the sample, became more negative towards computers after using the package. One student showed no difference. Seven students, approximately 44% of the sample, showed an improvement after using the computer. The results of a comparison of these CAQ results with the students' answers to the BQ questions 'Does it concern you that computers are going to be used?' and 'Why did you answer the way you did to the question above?' is shown in Table 5.6.4. Table 5.6.4 presents the data ranked from most negative student to most positive student.

Table 5.6.4 - Comparison of CAQ means within student (Ranked)

Student	Pre-test Mean	Post-test mean	Difference	Are you concerned	Explanations for concern
13	1.94	1.94	0	Yes	Because I do not know how to use a computer
11	2.26	2.03	-0.23	Yes	Never used or had access to computers. Left school before they were introduced.
16	2.68	2.56	-0.12	No	I enjoy & interested in the subject anyway
6	2.82	2.94	0.12	No	If it is part of my course I would have to use them but only if they were completely relevant and not time-wasting. Computers good for statistics.
14	3	2.94	-0.06	No	I personally don't like computers, but that is because I am not efficient at using them other than a 'games' sense. I find them frustrating but wouldn't mind learning how to use one.
3	3.41	3.47	0.06	No	Some things are easier done on computer
12	3.44	3.56	0.12	Yes	I hope that I will be taught the very basics if I'm to use it myself
15	3.44	3.36	-0.08	No	It will probably be useful in the future.
7	3.53	2.97	-0.56	Yes	I am not very confident when using computers

Table 5.6.4 - Comparison of CAQ means within student (Ranked) (Cont.)

8	3.56	3.53	-0.03	No	Useful as long as shown properly how to use them & knowledge is not assumed.
10	3.59	3.62	0.03	No	Have had some training with them in 1st year.
1	3.63	3.61	-0.02	No	Computers and the use of them does not bother me in any way
5	3.65	3.85	0.2	Yes	I think it will help me to understand my course more and be helpful in later jobs
4	3.74	4.03	0.29	No	In science I would expect the use of computers to be encouraged. However, I'm not too keen on them myself
9	4	4.13	0.13	Yes	I think it would be useful to learn computer skills.
2	4.12	4.03	-0.09	No	I have no qualms at all about using computers

Table 5.6.4 shows that the 4 students who were most negative on the BQ (i.e. reported they were concerned and gave a negative reason for their concern) did not return the lowest 4 attitude means. Two of the students who were negative, Students 11 & 13 did return the lowest mean scores at pre-test, but Students 7 & 12, the other negative students, returned the 8th and 10th highest mean respectively.

Students 16 & 6 returned negative means, while Student 14 was neutral. Student 6 was positive in response to the BQ prompts, reporting being unconcerned and stating 'If it is part of my course I would have to use them but only if they were completely relevant and not time-wasting. Computers good for statistics.' Student 16 was also unconcerned, stating 'I enjoy & interested in the subject anyway'. Student 14, the neutral student, reported that she was unconcerned, but commented that she didn't like using them and found them frustrating.

From these results two conclusions can be drawn. Firstly, the CAQ is not effective at returning consistent data in this study when compared with the BQ, and secondly, either the CAQ is flawed in a more serious sense, or the computer intervention was a negative experience for half the students. This latter conclusion can be examined through comparison of these results with those of the PPEQ reported later.

5.6.3.2 Question-by-question analysis of the CAQ

Students' attitudes towards computers can be hypothesised to improve after using a computer as a teaching aid, as they see that computers are a versatile tool which can inform without intimidating. It is important when attempting to identify shifts in attitude to clearly see where the students were at Time 1 (pre-test), and where they ended up at Time 2 (post-test). This is best shown on a chart, where the x-axis describes Time 1 results, and the y-axis describes Time 2 results. In this way, the shifts of the whole sample are represented.

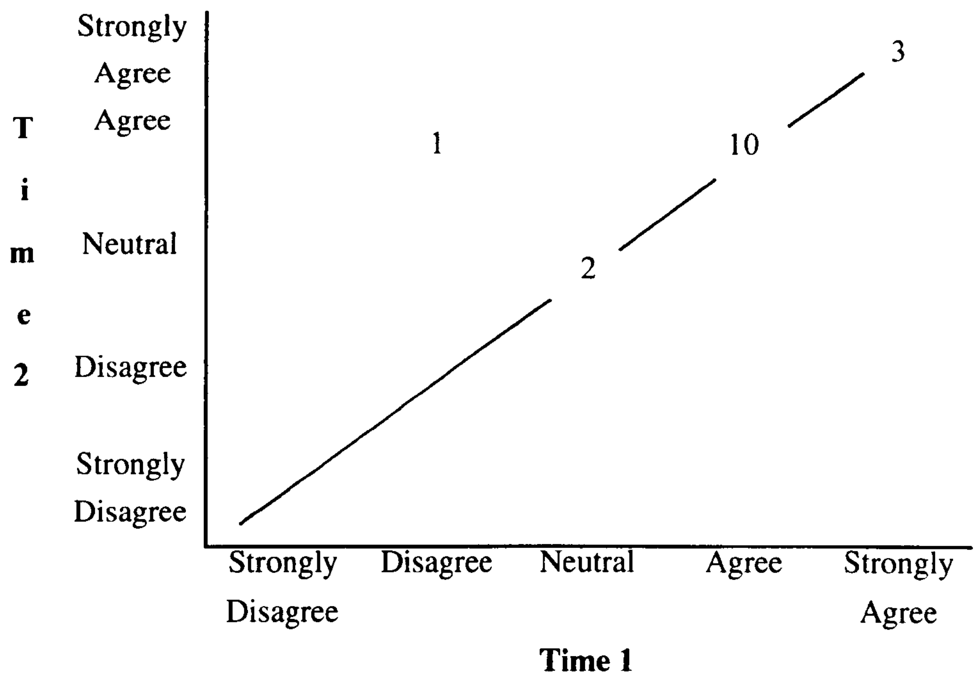
This graphic demonstration of shifts has the additional benefits of showing clearly the number of students who were at the ceiling (i.e. most positive) at Time 1 and therefore couldn't shift higher, and the number who were at the floor (i.e. most negative) at Time 1 and therefore couldn't slip lower.

The differing polarity of the statements (i.e. 17 negative and 17 positive statements) means that the range on the axis alters depending on the statement. For a positive statement, the highest point (i.e. most positive) is 'Strongly Agree', whilst the lowest is 'Strongly Disagree'. On the negative statement charts, this is reversed, and the most positive answer becomes 'Strongly Disagree', while the most negative is 'Strongly Agree'.

In the charts the answers at the top right of the charts are the most positive, whilst the low answers near the axes' convergence are the most negative, regardless of the polarity of the statement. A full listing of the charts for all the CAQ prompts in this study is shown in Appendix 1.4.

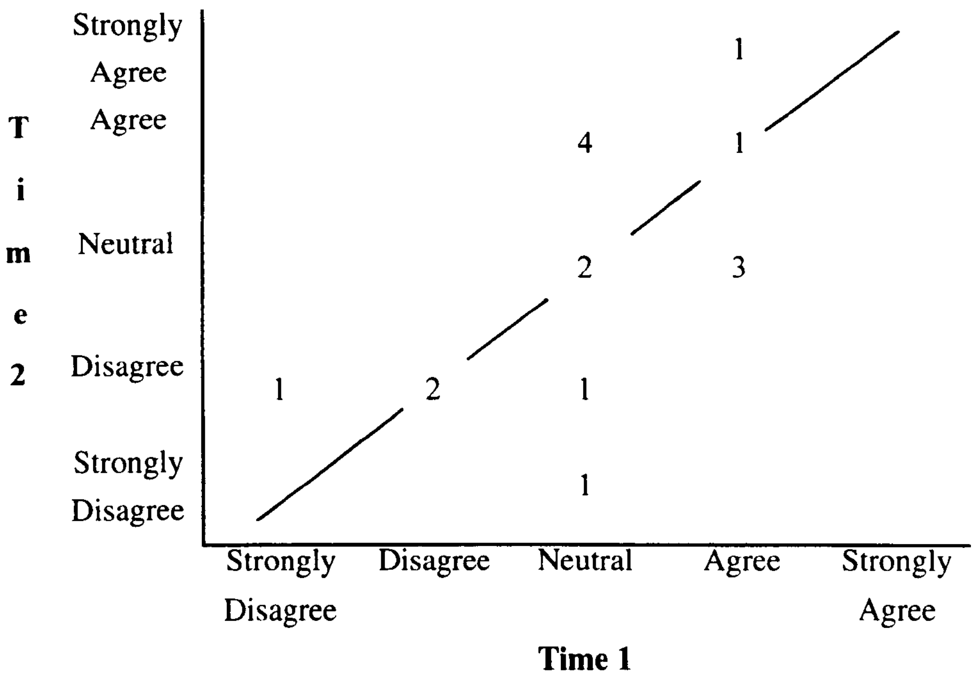
The charts detailing the between-student responses over time show a wide variety of movement. For example, in response to the statement 'The opportunity to learn about computers and their use is valuable' (CAQ17), 15 students returned identical responses across the two testing times, suggesting that the CAL didn't influence their attitudes about this generic statement, as shown on Chart 5.6.1.

Chart 5.6.1 - CAQ17



At the other extreme, only 5 students did not shift their position after the CAL session in response to the statement 'Using computers as a teaching aid makes learning easier' (CAQ6). Four students moved from 'Neutral' at the pre-test to 'Agree' in the post-test. This indicates the CAL session swayed 25% of the class in a negative direction. However, 2 students moved from 'Neutral' to disagreeing with this statement, while 3 who had earlier agreed with the statement moved into 'Neutral', as shown on Chart 5.6.2.

Chart 5.6.2 - CAQ6

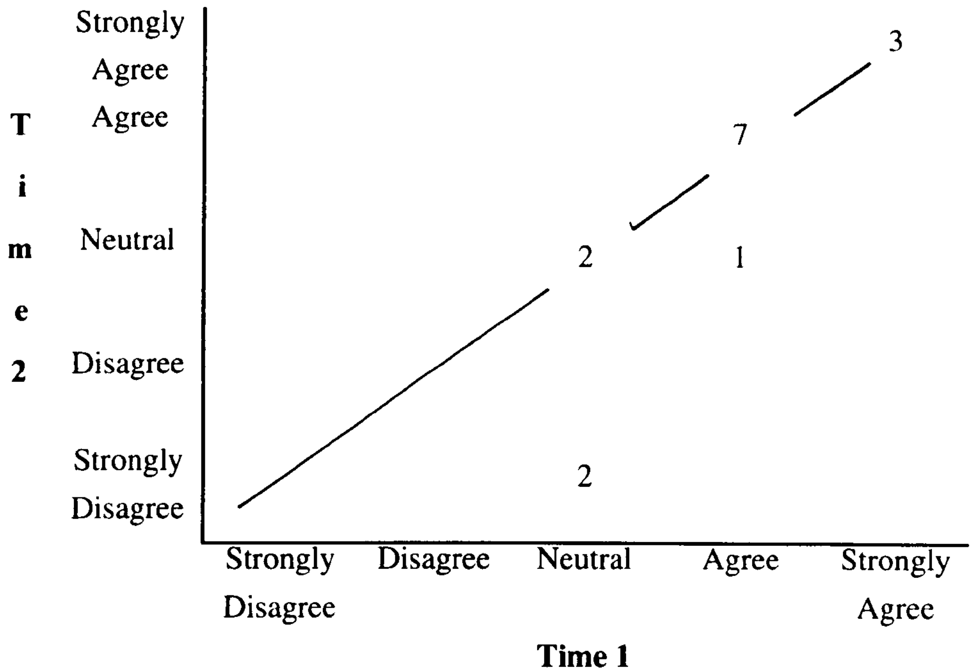


As well as the questions above, 5 other attitude statements probed the students' opinion of computer use in the class. These statements, and their results, were as follows:

CAQ1 - It is a good idea to use computers to assist in the teaching of the subjects I study

Twelve students were consistent across time, 2 of whom were neutral while the remaining 10 agreed with the above statement. One student dropped from 'Agree' to 'Neutral' after using the computer. Two students dropped from 'Neutral' at pre-test to 'Strongly Disagree' at post-test. With the exception of these latter students, the sample was positive about using CAL and this was unaffected by the CAL session, as shown on Chart 5.6.3.

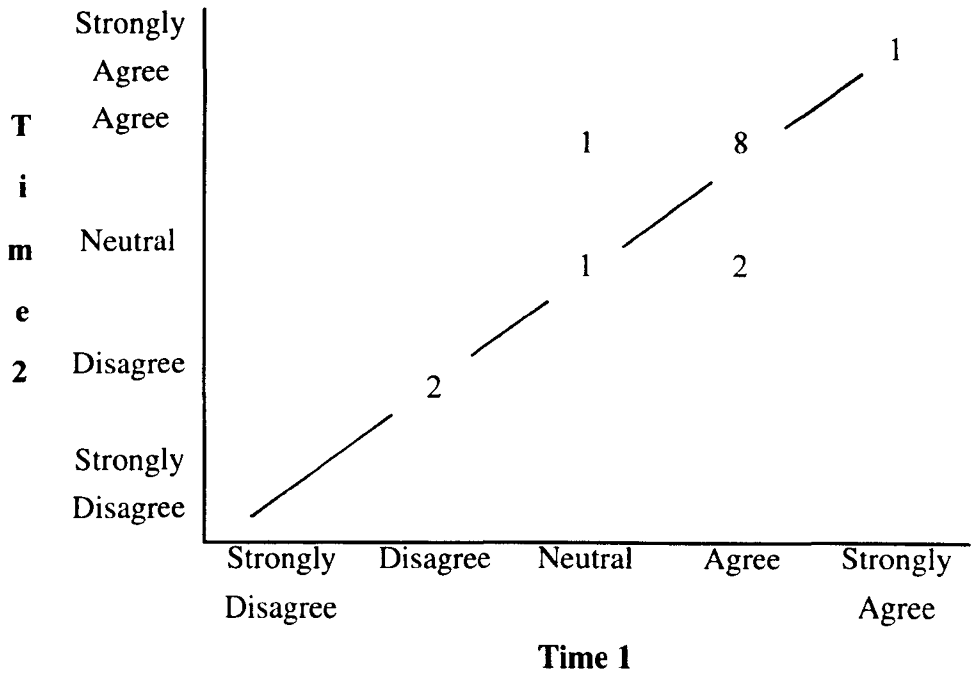
Chart 5.6.3 - CAQ1



CAQ10 - Using computers in class varies the course.

Again, twelve students were consistent across time. Two disagreed, 1 was neutral, and 8 agreed with the statement. Two students dropped from 'Agree' to 'Neutral', while one rose from 'Neutral' to 'Agree'. Again, the overall result at both times was positive, and the finding that 50% of the sample were both positive and consistent over the testing time suggests the CAL session did not influence their opinion, as shown on Chart 5.6.4.

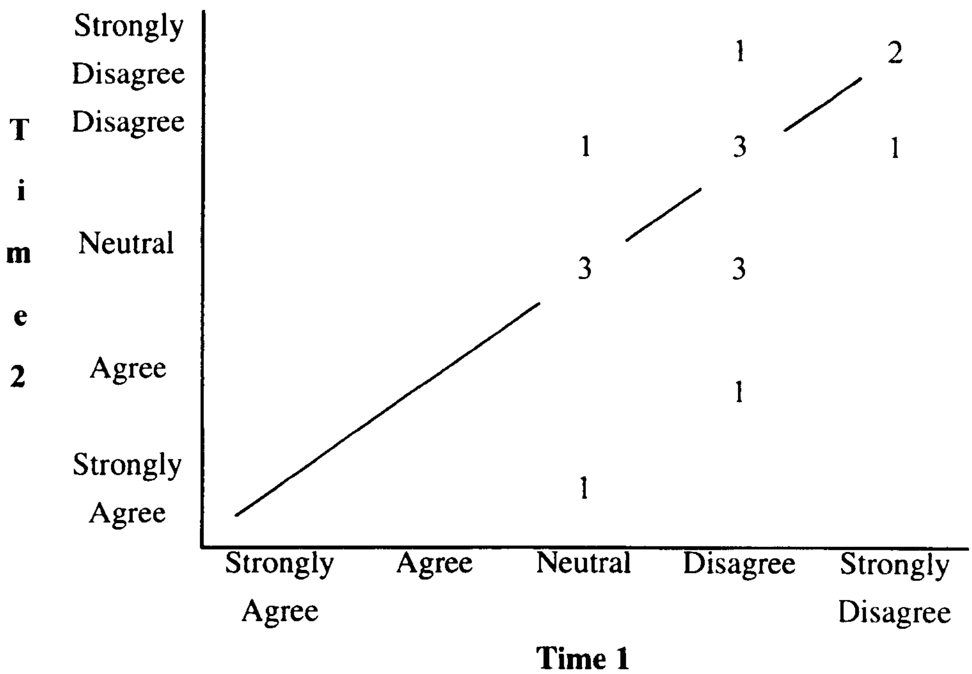
Chart 5.6.4 - CAQ 10



CAQ18 - The use of computers within a course makes the understanding of course material harder.

A positive answer to this statement was made by disagreeing with the statement. In total, 8 students were consistent across the testing times. Three disagreed with the statement, 2 strongly disagreed with the statement, and 3 were 'Neutral'. After experiencing the CAL session 6 students fell, one from 'Neutral' to 'Strongly Agree', one from 'Disagree' to 'Agree', 3 from 'Disagree' to 'Neutral', while 1 slipped from 'Strongly Disagree' to 'Disagree'. Two students rose however, one from 'Neutral' to 'Disagree', and one from 'Disagree' to 'Strongly Disagree'. The CAL experience had more influence in response to this statement than the previous statements, with 50% of the sample shifting attitude after using the computer, and 38% of the sample falling (i.e. moving more towards agreeing with the statement). These results are shown in Chart 5.6.5.

Chart 5.6.5 - CAQ 18

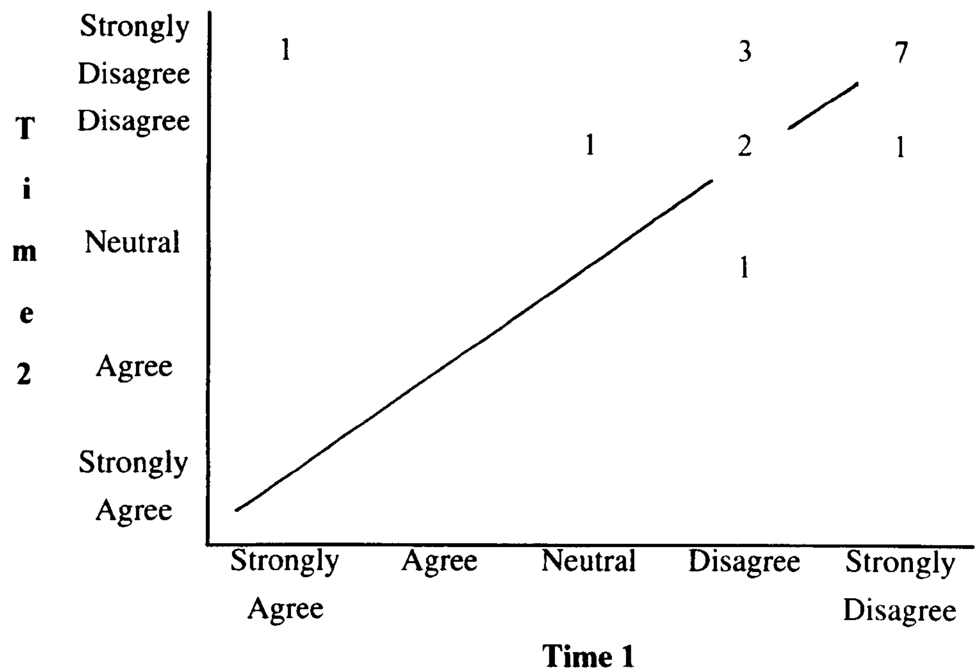


CAQ33 - There is no difference between being taught by a lecturer and being taught by a computer.

This item is difficult to interpret, as some may argue that a lack of perceived difference between the two teaching resource types would be a good result, while others may argue that a difference should be found. If such a difference was found in this study, it does not give any insight into what that difference is.

Chart 5.6.6 shows all students bar one disagreed or strongly disagreed with the statement i.e. almost all felt there was a difference. Nine students were consistent across testing times, 7 strongly disagreeing with the statement and 2 disagreeing with it. One student dropped from 'Strongly Disagree' to 'Disagree', while 3 rose from 'Disagree' to 'Strongly Disagree'. Only 1 student was neutral at Time 2, dropping from 'Disagree'. Another student who was neutral at Time 1 rose to 'Disagree' after using the computer, whilst the most dramatic shift was from 'Strongly Agree' to 'Strongly Disagree' (Student 11).

Chart 5.6.6 - CAQ 33

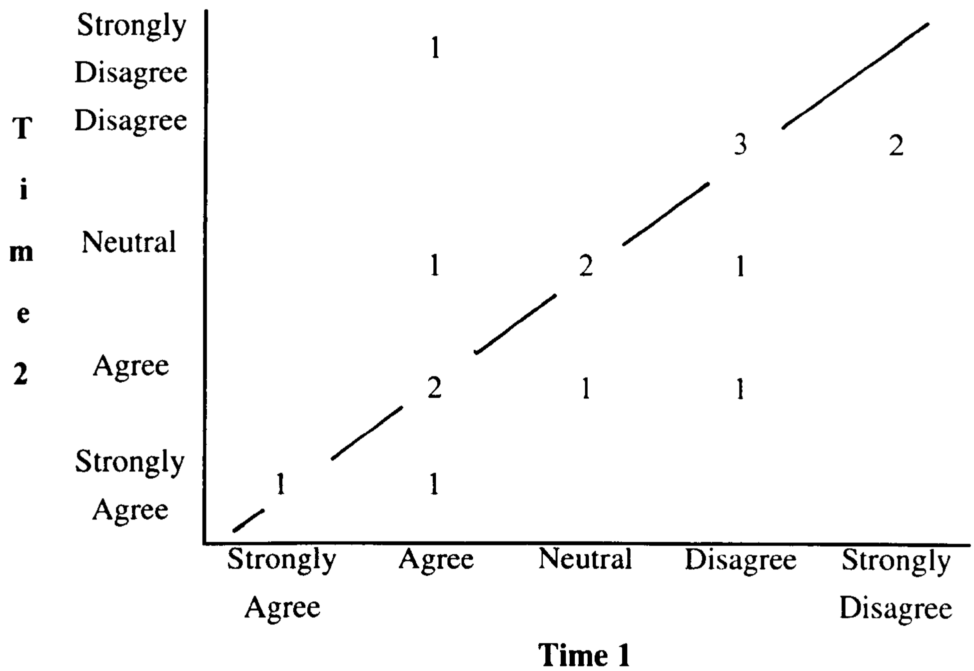


CAQ34 - Using a computer would distract me from what I am supposed to be learning.

This statement was perceived as negative and coded as such because a learning experience should not be negatively disrupted by the medium of presentation. Therefore disagreement with this statement would present a positive answer. Eight students were consistent across the testing times. Three disagreed with the statement, 2 were neutral, while 2 agreed and 1 strongly agreed that using the computer would distract them from what they were supposed to be learning. Only 1 student selected 'Strongly Disagree' at Time 2, having selected 'Agree' at Time 1 (Student 4). One student moved from 'Agree' to 'Neutral' while another fell from 'Neutral' to 'Agree'. Two students moved from 'Strongly Disagree' to 'Disagree' after using the computer, whilst 2 fell from 'Disagree', one to 'Neutral' and one to 'Agree'. Finally, one fell from 'Agree' to 'Strongly Agree'.

In total, 6 students (38% of the sample) agreed that using the computer would distract them from what they were supposed to be learning. These findings are shown on Chart 5.6.7.

Chart 5.6.7 - CAQ34



5.6.3.3 Summary

63% of the sample agreed that it was a good idea to use computers to assist in the teaching of the subjects they studied, and these students did not alter their view after using this particular package. Nor did 50% of the sample who felt that using computers in the class varied the course. In fact, only 2 students (13% of the sample) disagreed with both these statements. Six students (38% of the sample) felt that using a computer as a teaching aid made learning easier, while 5 students (31% of the sample) disagreed.

Most students reported a difference between being taught by a lecturer and being taught by a computer. Two students (13% of the sample) felt that using a computer to learn makes understanding the material harder, and 38% also agreed that using a computer would distract them from what they are supposed to be learning.

5.6.3.4 Improvements to the CAQ

Four unclear statements were reported in this questionnaire on the pre-test. Two students found CAQ32 'It is easier to answer a question truthfully when it is asked by a computer' to be unclear (Students 1 & 9). One student found CAQ 15 'I would like to spend some of my spare time using computers' unclear (Student 2), while CAQ19 'A knowledge of computing is useful in my degree subject' was also perceived by one student as unclear (Student 6). The post-test returned 5 'unclear statement' responses. Students 1 & 9 once more felt CAQ32 was unclear. Student 9 also reported both CAQ5 'I find computers confusing' and CAQ9 'Computers make tasks less time-consuming' were unclear at post-test, although this had not been noted at pre-test. CAQ27 'I would voluntarily attend a computing skills course' was also reported as unclear on post-test (Student 15). Only one answer was missed in all 32 completions, and that was CAQ1 'It is a good idea to use computers to assist in the teaching of the subjects I study' by Student 14 on post-test.

From these results, we can see that CAQ32 'It is easier to answer a question truthfully when it is asked by a computer' was reported as unclear by 2 of the 16 respondents, but that the other items were only reported as unclear by individuals. However this lack of clarity involving 5 statements is of concern. Analysis by the evaluator of those statements they found confusing shows no consistent statement type or topic pattern.

Aside from the unclear statements, another issue surrounding the CAQ asks when a statement becomes an attitude item and when it is more appropriate to place it on a factual 'Yes-No' response scale. For example, CAQ 15 'I would like to spend some of my spare time using computers' can be answered factually i.e. 'Yes, I would' or 'No, I would not'. Perhaps then some confusion arises from the response demanded from the students rather than the statement itself.

Finally, coding the items found that the polarity of some items was dubious, particularly CAQ33 'There is no difference between being taught by a lecturer and taught by a computer.' If the students disagreed with this statement, they were scored positively, while agreement resulted in a negative score. However, this coding scheme was obviously decided by the attitudes of the measure developers, and some people may see computer-based learning as something that should present no difference in style or quality from that of a lecturer.

5.6.3.5 Student feedback about the CAQ

No space was provided for student feedback on the attitude questionnaire itself, but seven semi-structured interviews were conducted for this purpose. The students reported no problems with this questionnaire, although one felt it was too long.

5.6.4 The Post-Package Evaluation Questionnaire (PPEQ)

It is appropriate to examine the PPEQ's results across the sample and within each student. By doing so, an overall picture of the package's success is gathered and some idea of individual differences across the sample is gained.

5.6.4.1 Between-Student Analysis

The first 4 questions of the PPEQ were constructed as positive attitude statements. They asked for responses on a 5-point Likert-type scale running from 'Strongly Agree', coded as 5, to 'Strongly Disagree', coded as 1. A neutral option, coded as 3, was provided and explicitly stated as such (See Appendix 1.3). However, the questions asked were more factual than attitudinal. They asked for example if the package was easy to use, which is more suited to a 'Yes it is/ No it isn't' response scale. Therefore for the purposes of a between-student analysis the scale will be collapsed into 3 categories equivalent to Yes / No / Neither:

Yes = Agree, incorporating Agree & Strongly Agree

Neither = Neutral

No = Disagree, incorporating Disagree & Strongly Disagree

These categories can also be thought of as 'Yes' = Positive response, and 'No' = Negative response. Question 1 asked the students to show their level of agreement with three statements:

a) This package was easy to use
b) This package was enjoyable
c) This package was interesting

Question 2 asked the students to show their level of agreement with the statements that this computer session was useful for:

a) Revision purposes
b) Presenting new information
c) New angles on old information
d) Increasing knowledge of the subject
e) Stimulating interest in the subject

Question 3 stated 'I would like to spend more time using this package' and again asked the students to agree or disagree on a 5-point scale. Question 4 asked students whether 'This package is most suited to students working on their own.' The students' responses to all four questions are listed in Table 5.6.5. The table shows the number of students falling into each response category.

Table 5.6.5 - Between-student responses to Questions 1-4

	Yes	Neutral	No
1a) Easy to use	11	3	2
1b) Enjoyable	5	6	5
1c) Interesting	8	4	4
2a) Revision	5	4	7
2b) New information	10	4	2
2c) New angles	8	6	2
2d) Increasing knowledge	7	5	4
2e) Stimulating interest	7	6	3
3) More time on package	9	3	4
4) Working alone	8	4	4

Table 5.6.5 shows 11 students (69% of respondents) found the package easy to use, but only 8 students (50%) found it interesting and just 5 students (31%) found it enjoyable. The package was therefore generally successful in usability, but poor on interest and enjoyment.

The package was seen as being particularly useful for presenting new information by 10 of the respondents (63%), and for new angles on old information by 8 respondents (50%). It was considered least useful for revision purposes, with only 5 respondents, (31%) selecting this option. Four respondents (25%) stated they would not like to spend more time using the package, although 9 of their colleagues (56%) would. Half the sample (8 respondents) felt the package was best suited to students working alone.

Students were also asked how many simulations they ran whilst using the package. These results are considered in Table 5.6.6 by level of agreement with the statement that the package was most suited to students working on their own, and whether the student worked in a pair or alone.

Table 5.6.6 - Single vs. Pair use, working preference and simulations run

Student Number	Single (S) or Pair (P)	This package is most suited to students working on their own	Reported number of simulations run
7	P	Agree	Missing
8	P	Agree	4
12	P	Agree	6
14	P	Agree	2
3	P	Neutral	3
9	P	Neutral	8
13	P	Neutral	1
2	P	Disagree	5
15	P	Disagree	2
4	P	Disagree	4
1	S	Agree	2
5	S	Agree	5
6	S	Agree	5
16	S	Agree	2
11	S	Neutral	3
10	S	Disagree	2

Table 5.6.6 shows 4 students who worked in a pair reported that the package was best used alone, while 3 paired workers disagreed and 3 paired workers were neutral. Most of the students who worked alone agreed it was best used alone (4 students), while one was neutral and one disagreed. None of these students were classified as being the most computer-naive (see the 'Within-Student Analysis' section), so it

seems it is learning preference rather than concern over their ability to use a computer that influences their response. The number of simulations the students reported running varied widely, from 1 simulation to 8 simulations, regardless of single/pair usage.

Students were asked in what ways they had previously covered the topic. They had a choice of lectures, textbooks, practicals, tutorials, essays and personal research on the subject. All students selected lectures and textbooks, with all but two (Students 1 & 2) adding practicals. Seven of these students also reported covering the material in tutorials, whilst 3 (Students 5, 8 & 11) added essays. Only one student (Student 11) reported doing personal research on the topic.

These results suggest a wide range of previous experience of the topic, from minimal (Students 1 & 2) to more intensive (Students 5, 8 & 11). The 'Within-Student Analysis' section deals with the impact the students reported previous coverage of the topic had on their perception of the best use of the package.

Question 7 was open-ended, asking the students 'How does this package compare to the teaching you have previously encountered?'. The student responses were quantified by the evaluator into 3 category types: negative, positive, and positive with qualification. Seven students gave negative responses to the package, 3 students were classified as positive, while the remaining 6 were positive with qualification and/or explanation. The responses are listed in Table 5.6.7 student-by-student. Responses to Question 10 'What do you feel you have gained, if anything, from this package?' are also included in the table, as where a response to Question 10 was given it was found to relate to the student's response to Question 7.

Table 5.6.7 - Student responses to PPEQ Questions 7 & 10

Student Number	How does this package compare to other teaching?	What have you gained from this package?
1	I much prefer being taught when encountering something new, but this was good to put ideas into practice	Left blank
2	Useful because it shows how the system will actually work when various factors are varied. I had heard about computer models and enjoyed working with them.	An understanding of the usefulness of the computer model.
3	Teaching was better	Nothing
4	Good - very enjoyable. Easy to understand	Basic info. about schisto.
5	Quite well. It was very interesting.	My knowledge on Schistome's life cycle was improved considerably.
6	Different aspect that the teaching previously encountered. This package highlighted mathematical models and epidemiology of Schistosomes not really covered in lectures.	Graphic models of epidemiology, very useful.
7	I understood better when being told about it in lectures, practicals and textbooks.	I feel as if I have gained nothing from this package.

Table 5.6.7 - Student responses to PPEQ Questions 7 & 10 (Cont.)

8	Did not learn anything more than I knew already except who MacDonald was.	Left blank
9	Useful for understanding the effect of interacting factors upon a population and in control - the bulk of the text was less useful.	A better understanding of the effect of a combination of factors on Schistosomiasis infections.
10	Much more to the point at giving information i.e. does not expand on the precise point of the topic it is covering.	On first try not a lot. But hopefully given more time with it more understanding and information could be taken from it.
11	No good.	Nothing
12	V. Different. Can go at your own pace.	Learned to use computers for something useful.
13	This package is not good at teaching.	Nothing.
14	Does not cover the same material. Some of the graphs and data are the same as we do in labs but outside. *(NB: Student's wording)*	I gained a more total feeling of incompetence than ever before but it was enjoyable. If there had been time available perhaps things would have been different. Gained more knowledge about computer and how they work.
15	Personal teaching draws more of your attention	The two best ways of controlling Schistosomiasis.
16	V. Complex compared to teaching. Teaching you can write notes, with computer can't look back as to notes. Found it v. diffcult to concentrate on the computer and take in the information.	Not much.

Five of the negative students reported that the package did not compare well with other teaching (Students 3, 7, 1, 13 & 16). One negative student did not answer Question 10 (Student 8), while the remaining negative student reported that she had learnt 'The two best ways of controlling Schistosomiasis' (Student 15).

The other students all gave positive feedback to Question 10. Student 10 stated that 'On first try not a lot. But hopefully given more time with it more understanding and information could be taken from it.' This was considered positive as the student saw the potential of the package, just as Student 14 found the experience was daunting but pleasurable.

In summary, six students (38% of the sample) reported learning something directly related to Schistosomiasis (Students 2, 4, 5, 6, 9 & 15). Two reported learning something about the use of computers (Students 12 & 14), and one that they hadn't learnt a lot at that session, but felt they would if they used the package again (Student 10).

Questions 8 & 9 asked the students if they had done any extra work on the topic in the last month, and if so what methods (e.g. read references etc.) they used, and how often they had used them. Only 5 students reported they had done other work, and none gave a frequency. However two of these (Students 11 & 13) appeared to have misinterpreted the question, Student 11 reporting 'Reading books. Recent lectures.' and Student 13 stating that she had covered the topic through 'Reading, lectures, labs.' Lectures and labs did not count as 'extra' work, so these responses are in part invalid. The remaining 3 students stated:

Student 1 - 'Read references.'

Student 7 - 'Read references. Read over my notes for a recent test and also revised the subject over the Christmas holidays.'

Student 16 - 'Reading my notes. If come across an article in Para. Today read it.'

Only 19% of the sample can be regarded as having done extra work on the topic in the month before the study, although of them one of them went further back to the Christmas holidays. More insight into extra work may have been gained if the time scale had not been specified, as students who may have done work in the Christmas holidays, for example, were excluded if they answered the question correctly.

Finally, students were asked to list any comments they had about the questionnaire and/or its content. Only 4 students responded, and their answers were as follows:

Student 5 - 'It was better when you had to press enter at the end of each page as opposed to a new page just disappearing after a certain amount of time.'

Student 8 - 'A good idea to use computers. I was personally not interested in the graphics and long passages but the factual info. such as the life cycle of Schistosomiasis was useful.'

Student 9 - 'Graphics section proceeded too fast in some parts - would be better if you could slow down/pause/repeat pages. Text sections could be made more interesting by varying (illegible)/adding graphics in some parts. They were really boring.'

Student 10 - 'Content is adequate.'

5.6.4.2 Session problems highlighted in the PPEQ

Two problems with the session were highlighted by the PPEQ. The first was an interface issue, namely that the pages did not have enough user-control. This led to one student rating the package as worse than conventional teaching:

Student 16 - 'V. Complex compared to teaching. Teaching you can write notes, with computer can't look back as to notes.'

The other problem was a lack of time, highlighted by at least two students as perhaps influencing their possible gains from the package:

Student 10 - 'On first try not a lot. But hopefully given more time with it more understanding and information could be taken from it.'

Student 14 - 'I gained a more total feeling of incompetence than ever before but it was enjoyable. If there had been time available perhaps things would have been different. Gained more knowledge about computer and how they work.'

5.6.4.3 Within - Students Analysis of the PPEQ

From the BQ and the CAQ's administrations, students who were more negative and less confident about computers than the others have been identified. The following section looks at any influence these students' negativity and inexperience may have had on their ratings of the package, and examines the PPEQ data within students.

A within-student analysis of the students' evaluations of the package is important, in case an influential factor in students' evaluation of the package is their previous experience of and attitude towards computers. If this is the case then the package may not be as poor as first seems from the evaluation results. Instead, a skills gap may be the reason, or some other external factor out with the CAL situation that is brought into the teaching experience.

From the results on the BQ and the CAQ, some identification of those in the sample who were particularly inexperienced or negative should be possible, although any such categorisation from these measures alone will be crude. In order to do this criteria must be set, hypothesising key variables that demonstrate best students' experience and attitudes. Frequency of use, packages the students reported using, and the students' self-reported concern about computer use were all targeted on the BQ, and were hypothesised to give insight into actual behaviour, knowledge, and attitude respectively. These in turn should relate to some extent to the CAQ results. The students who report being negative towards computers or being intimidated by them on the BQ should hypothetically score lower on the CAQ than their more confident or experienced peers. Further, it is hypothesised that these negative/unconfident students will evaluate the CAL situation more negatively in the following ways:

1 - They would report the package as being less easy to use, less interesting and less enjoyable than their peers

2 - They would report running fewer simulations than the rest of the sample.

3 - They would state they would not like to spend more time using the package.

4 - They would rate the package more negatively than conventional teaching.

5 - They would report gaining nothing from this package.

If the above hypotheses are proven, then the implications may be:

a) Only certain dimensions of the BQ may be needed to identify knowledge/ skills/ attitude gaps.
b) The CAQ may be useful for determining students negatively pre-disposed to package use, as its' ratings would be consistent with negativity on the BQ and negative evaluations of the package.

To classify the students into groups in order to determine the inexperienced or negative students, the results of BQ and CAQ are revisited in the following subsections. From the BQ, the dimensions of frequency of use, package experience and concern about computer use are considered, while the students' means on the CAQ are used to determine attitude.

5.6.4.4 - The inexperienced students - BQ classification

1. Frequency of use

Students who rated themselves as using the computer 'Sometimes' to 'Never' in response to BQ26 were considered to be possibly inexperienced or unconfident users. Eleven of the 16 students (69%) fell into this category (Students 1, 2, 3, 4, 6, 7, 11, 12, 13, 14, 15). Students 1 & 4 (as well as Student 5, a more frequent user) had reported some training on computers, however. Therefore, on its own this does not reflect the sort of use students have had in the past. In order to examine prior use, the packages the students have used are considered.

2. Package experience

The results were taken from BQ35, which asked the students to tick which types of packages they had previously used from a list of 9, and included an 'Other' category with space for them to state any which were not in the list. Students who listed either none, computer games or the library CD-ROM only (i.e. hadn't used a word processing or other basic package) were included as inexperienced users (Students 2, 7, 11, 13, and 14.

3. Concern about computer use

BQ 40 and BQ41 asked students if they were concerned about computer use in the course. Students 7, 11, 12 & 13 reported being concerned in some negative way (some students were concerned but gave positive answers for their concern - see BQ section earlier). The 4 negative students' explained their concern as follows:

Student 7 - 'I am not very confident when using computers.'

Student 11 - 'Never used or had access to computers. Left school before they were introduced.'

Student 12 - 'I hope that I will be taught the very basics if I'm to use it myself.'

Student 13 - 'Because I do not know how to use a computer.'

All 4 students indicate they are concerned about their computer skills. Not surprisingly, the students had reported their frequency of computer use as Never' (Students 11 & 13), 'Very rarely' (Student 7) and 'Almost never' (Student 12). Student 12 had listed word-processing, statistics and games as the packages he had previously used, however, so he is not included in the list of inexperienced students.

The inexperienced students from the BQ results appear to be Students 7, 11 & 13, equivalent to 19% of the sample. In order to discover if their inexperience relates to a negative attitude towards computers, the CAQ results are discussed below.

5.6.4.5 Negative students - CAQ classification

Students who were negative about computers on pre-test (i.e. who had overall means of less than 3.00) were, in ascending order, Students 13, 11, 16 & 6. While Students 13 & 11 had been classified as inexperienced on the BQ, Student 7 (CAQ mean 3.53), was not amongst the negative students, suggesting that inexperience alone did not necessarily correlate with a negative attitude towards computers.

Post-test results showed, in ascending order, Students 13, 11, 16, 6, 14, & 7 were negative. Student 7 therefore dropped down to a negative position with a post-test mean of 2.97, a drop of 0.56 and the greatest shift of all the students in the sample.

Students 6, 14 & 16's inclusion in the negative attitudes at post-test is interesting. Student 16 did not feature in the BQ inexperienced criteria. Student 6 & 14 were infrequent users, and Student 14 reported only ever having used Games. Neither were classified as inexperienced, however, as neither reported being concerned about using computers. Revisiting the concerns section on the BQ, Students 6 and 14, who were not classified as inexperienced, had stated:

Student 6 - 'If it is part of my course I would have to use them but only if they were completely relevant and not time-wasting. Computers good for statistics.'

Student 14 - 'I personally don't like computers, but that is because I am not efficient at using them other than a 'games' sense. I find them frustrating but wouldn't mind learning how to use one.'

Student 16 was unconcerned about computer use in the course and did not add comments.

Conversely, Student 4 stated in response to the concern prompts:

Student 4 - 'In science I would expect the use of computers to be encouraged. However, I'm not too keen on them myself.'

Despite this lack of enthusiasm, the student did not feature amongst the negative users on the CAQ.

In summary, the negative students at post-test on the CAQ were Students 6, 7, 11, 13, 14 & 16. The most inexperienced were Students 7, 11 & 13. It was not possible to accurately predict negativity or inexperience from the BQ or the CAQ in isolation.

The PPEQ responses of the 6 negative students are considered to assess whether this negativity was evident in their evaluation of the package.

5.6.4.6 Negative and inexperienced students and the PPEQ

Question 1 on the PPEQ asked students whether they agreed with the statement 'This package was a) easy to us b) enjoyable and c) interesting. Table 5.6.8 shows the students' responses, with each student number prefixed with 'S' for 'Student':

Table 5.6.8 - Ease of use, interest and enjoyment amongst negative students

Prompt	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Easy to use	None	Student 7, Student 11	Student13, Student 14	Student 6, Student 16	None
Enjoyable	Student 11, Student 13	Student 7, Student 16	Student 14	Student 6,	None
Interesting	Student 13	Student 11, Student 16	Student 7, Student 14	Student 6	None

Table 5.6.8 shows that the negative and inexperienced students, i.e. students 7, 11 & 13, generally rated the package on the three dimensions listed negatively, although Student 13 was neutral on the package's ease of use and Student 7 was neutral on the package's interest. Of the students reporting a negative attitude towards computers on post-test, Student 16 was the only student to rate the package negatively, disagreeing that it was interesting or enjoyable. She agreed that the package was easy to use, however, as did Student 6. Student 6 also reported the package was interesting and enjoyable. Student 14, the other student who rated the CAQ negatively, returned a neutral verdict on all 3 dimensions.

In summary, Students 11 and 13 were negative towards computers on the CAQ, reported little experience of them, and gave low ratings of the package. Student 16 was negative towards computers, but had slightly more knowledge and therefore didn't show on the BQ criteria. However, Student 16 found the package uninteresting and unenjoyable, although agreed it was easy to use.

Student 7 was one of the less knowledgeable students on the BQ, but was positive on the CAQ at pre-test (mean 3.53). However, she became negative on post-test (mean 2.97), and on the PPEQ disagreed the package was easy-to-use and enjoyable, although was neutral on interest.

Student 12 made it through to the third stage on the BQ (i.e. as a less experienced student) but was positive on CAQ pre- and post-test, and actually showed an increase in positive attitude on post-test. Student 12 thought the package was easy to use, but was neutral on interest and enjoyment. Student 12 did not therefore rate the package as negatively as Students 7, 11 and 13.

Students were also asked to state what the package was useful for, from revision to presenting new information. The negative students' responses are shown in Table 5.6.9.

Table 5.6.9 - Usefulness of the package: Negative students' responses

Student Number	Revision	Presenting new information	New angles on old information	Increasing knowledge	Stimulating interest
6	Neutral	Agree	Agree	Agree	Neutral
7	Disagree	Neutral	Disagree	Neutral	Agree
11	Disagree	Disagree	Neutral	Disagree	Strongly Disagree
13	Strongly Disagree	Neutral	Strongly Disagree	Neutral	Neutral
14	Disagree	Agree	Neutral	Agree	Neutral
16	Neutral	Agree	Agree	Agree	Disagree

Table 5.6.9 shows that Students 11 & 13 did not feel the package was useful for any sort of learning. Student 7 agreed the package was useful for simulating interest in the topic. Student 1 felt it was useful for revision and stimulating interest, whilst Student 16 felt it was more useful for presenting new information, new angles on old information, and increasing knowledge. These findings demonstrate individual differences in perception of the best use of learning resources.

Students 11 and 13 strongly disagreed they would like to use the package again, Student 16 disagreed, and Student 14 was neutral. Student 6 agreed that she would like to spend more time using the package and Student 7 failed to respond.

Students were asked how the package had compared with the teaching they had previously encountered, and what, if anything, they felt they had gained from the package. To assess the persistency of negativity, the answers of the CAQ-negative students are shown in Table 5.6.10.

Table 5.6.10 - Responses to comparison and gain from package: Negative students

Student Number	How does this package compare to other teaching?	What have you gained from this package?
6	Different aspect that the teaching previously encountered. This package highlighted mathematical models and epidemiology of Schistosomes not really covered in lectures.	Graphic models of epidemiology, very useful.
7	I understood better when being told about it in lectures, practicals and textbooks.	I feel as if I have gained nothing from this package.
11	No good.	Nothing
13	This package is not good at teaching.	Nothing.
14	Does not cover the same material. Some of the graphs and data are the same as we do in labs but outside. *(NB: Student's wording)*	I gained a more total feeling of incompetence than ever before but it was enjoyable. If there had been time available perhaps things would have been different. Gained more knowledge about computer and how they work.
16	V. Complex compared to teaching. Teaching you can write notes, with computer can't look back as to notes. Found it v. diffcult to concentrate on the computer and take in the information.	Not much.

Students 7, 11 & 13 rated the package as poor next to other teaching methods, and reported gaining nothing from it, as did Student 16. Students 6 & 14 were much more positive however, as were all the other students in the sample.

5.6.4.7 Discussion of the Within-Student Analysis

Students 11 & 13 show that a reduced number of questions on the BQ and CAQ should be enough to determine the most inexperienced and negative students. In this study, negativity on the CAQ predicted a negative response to the package.

All students identified as negative using a combination of BQ and CAQ measures were generally negative on the PPEQ, most notably in reporting they had gained nothing from package use as opposed to their colleagues. Note however that students who barely figured on the BQ and CAQ criteria featured in the group with negative responses to the package.

5.6.4.8 Student Feedback About The PPEQ

Only two semi-structured interviews about the PPEQ could be conducted after package use, as the students were rushing to complete their lab work, the quiz, and the three questionnaires. One student reported that the questionnaire was fine. The second student disliked the Likert-type response scale which was a feature of the first four questions on the PPEQ. He stated he would have preferred to write in his own answers.

Only 1 student wrote feedback about the PPEQ when asked to comment on the questionnaire itself, writing simply 'Content is adequate.' (Student 10)

In summary, there is little information or suggestions from the students on possible revisions to the Post-Package Evaluation Questionnaire.

5.6.5 The Quiz

A 10-question quiz was devised by the demonstrator. The questions were open-ended, requiring a written response. The quizzes were marked anonymously by an independent examiner who had taught the students schistosomiasis, but was unfamiliar with the package. The quiz was administered both at pre-test and post-test, with no change in question type, content or order (i.e. the quiz was identical at both times).

Unfortunately, on the post-test quiz the students frequently referred the examiner to their response to the question on the pre-test quiz. As the marking had been done blind, the examiner had no choice but to mark all such responses as zero. Further, inconsistencies emerged between the examiner's terminology and the terminology used in the package, and hence in the students' answers to questions relating to package content. These problems make the Quiz results meaningless, and so they are not included here. Further, the demonstrator refused to release a copy of the Quiz to the evaluation team, so the measure is absent from the Appendices.

In addition to the problems above, the students were tired by the time they completed Quiz 2 and were frustrated at being presented with the same Quiz they had already completed. The Quiz, by virtue of the demand for written responses, needed some time and concentration to complete. This Quiz was not realistic in the midst of a very intensive teaching day and an overburdening of evaluation measures.

5.6.5.1 Discussion of the Quiz

The problems with the Quiz highlights several issues:

1 - The Quiz should have had some fixed-response scale, for example multiple choice or single word/short answers.

2 - The Quiz should have had a pre-agreed answer grid, with all terminology consistent with the teaching situation under examination.

3 - The Quiz should have been freely available to the evaluators, and this should have been negotiated early in the planning cycle.

4 - Quizzes should be appropriate to the situation, taking into account content of the teaching material, time available, student attitude, and other external influences (e.g. time already set aside for other evaluation measures).

The loss of the Quiz results was unfortunate not only for the evaluators, but also for the teaching staff who were left uncertain about the influence of the package on the students' knowledge. However, even without demonstrating actual knowledge gain or loss, much was learnt from this evaluation *about* evaluation of computer-assisted learning, and it was invaluable at indicating the way forward in measure development.

5.6.6 Demonstrator's Log

In total, 20 students used the package on the day of the study. Four of these failed to complete the post-test evaluation measures and were excluded from the study. The Demonstrator's Log showed 10 help interventions in total across the two sessions. To avoid creating help requests by unbidden interventions from the demonstrator, she kept her back to the students throughout the session forcing them to actively seek her attention. Whilst this is unnatural in most demonstrations, it was believed by the staff in the study that the confounding effects of the demonstrator mingling with the students would muddy the help log, and perhaps create help requests where there was no real need.

The help requests fell mainly into two human-computer interaction (HCI) issues:

1) Navigation

The software was supplied in multiple parts, 4 of which were to be used by the students in a specific order given on a paper sheet prepared by the teachers. Three out of the 10 demonstrator interventions arose from confusion and difficulty in keeping the order caused by not reading the instructions properly, getting confused over the numbers on the sheet and the numbers on the computer menu, and not being able to get back out of a section wrongly entered.

The above problem was also documented during one think-aloud when a student got to the end of some on-line help. They wanted to know what key to press to get back to where they were. The key was <escape>, but the two messages displayed about <escape> were contradictory and wrong.

2) Parameter values

Four out of 10 demonstrator interventions involved entering parameter values, though all students encountered some difficulty with this but most managed to move on without help. The names of the simulation parameters also caused some difficulty and led to one student asking for help. This was a content rather than HCI problem, and may have affected more than this 1 student, but other students proceeded possibly without feeling the need to understand each parameter.

5.6.7 Thinkalouds

The thinkalouds highlighted a number of issues alongside the navigational issue mentioned above, including the use of a log scale (poorly explained), control of the package (the students couldn't control the presentation pace in one section, but in two other parts their interaction with the computer consisted of them pressing one button to move on), and the active use of the simulation.

The think-aloud facilitators observed four sessions, 6 students in total. They found one student to be very positive, whilst another student indicated the package was a waste of time. This student was observed by the evaluator in the session (the author) to be negative before starting to work on the intervention. The remaining students were positive but did not appear enthusiastic.

5.7 Discussion

5.7.1 Problems with the package

There were 10 help requests, suggesting that the package is not ready for stand-alone use. These requests were most frequently about navigation and entering parameter values. Modifications were suggested, particularly to ease the jump between passive and active interaction with the computer. Further, there were some small confusions in the content, such as the log scales and the parameter names.

5.7.2 Student negativity

As described earlier, 50% of the sample became more negative towards computers as measured on the CAQ after using the package, while 6% showed no difference and 44% became more positive. This suggests that the package actually pushed the majority of students into a more negative attitude towards computers, an unexpected and unwanted finding. The implication is that some part of the CAL experience was negative.

The Computer Attitude Questionnaire found that 63% of the sample agreed that it was a good idea to use computers to assist in the teaching of the subjects they studied, and these students did not alter their view after using this particular package, nor did 50% of the sample who felt that using computers in the class varied the course. In fact, only 2 students (13% of the sample) disagreed with both these statements. Six students (38% of the sample) felt that using a computer as a teaching aid made learning easier, while 5 students (31% of the sample) disagreed.

An important finding was that on pre-test 38% agreed that using a computer would distract them from what they are supposed to be learning, and this figure (38%) was unchanged on post-test. This suggests that while it could be hoped that the package would shift this impression, it is not to blame for the existence of this finding.

In conclusion, the students were reasonably positive about the topic and the medium, but there is a great deal of room for improvement. Of particular concern is the finding that students became more negative towards computers after using the CAL, despite 50% of the sample reporting they had gained something from the experience.

5.7.3 Benefits to the students

From the evaluation results there may be doubt over the perceived benefits of the CAL to some of the students in the sample. Overall, however, the students reported gaining something from its use although not being particularly interested in the package or enjoying it. There is scope for package improvements to enhance these interest and enjoyment factors by, for example, giving control of the pace of presentation to the students.

5.7.4 Package integration

The lack of integration of the package and its evaluation was informally commented on by the demonstrator, students, and evaluation staff during this evaluation. As an 'add-on' to an already hectic teaching day which was focusing on another topic, the package created a delay and a distraction that was unwanted by the students although tolerated by the teachers. The need to complete other set work seemed to prevent the students from fully concentrating on the package, and the time it took to complete the evaluation measures added to their frustration. In future the package should, where at all possible, be fully integrated and scheduled as part of the teaching situation.

5.7.5 Stakeholders' views

Informal discussions with the demonstrator found she felt there was not enough information to draw a conclusion about the package's success or failure, particularly because of the loss of the Quiz data. For the evaluators, there was evidence which suggested that under different conditions the package may be more successful. The students as a group reported they gained something from the experience.

5.8 Conclusions

It is concluded that the package has some value and should be run again under very different conditions and with some modifications to the interface. The following points would need particular attention:

1) Both the CAL session and its evaluation should be properly integrated into the course.

2) Evaluation measurement should be kept as brief and unobtrusive as possible, whilst still generating quality data.

3) The Quiz should not be identical across both times. Changing question order may be sufficient to gain better concentration from the students.

4) The Quiz should have a fixed marking scheme with terminology understood by all who complete, present and mark it.

5) The students should have total control over the pace at which the information is presented.

This study also suggested that evaluation of the computer-based teaching and learning situation may be influenced in extreme cases by the students' prior experience and/or attitudes. This phenomenon should be further explored, as this finding was only demonstrated in a minority of cases and the results were generally inconsistent.

5.9 Discussion of Measure Modification Prior to Pilot Study 2

Much was learnt from Pilot Study 1. However, the sample was small and it was the first TILT-E study, so it was agreed amongst the evaluation group to use the paper measures again, with some essential alterations, on a similar population.

Ten days after the first study, Pilot Study 2 began. The CAQ was kept identical in both studies as there was no consistent evidence of problem questions within it, but the BQ and the PPEQ were both slightly altered, as detailed below.

5.9.1 Alterations to the BQ

The BQ contained more alterations than the PPEQ, although these were kept to the minimum perceived necessary to gather worthwhile data (See Appendices 1.1 and 2.1). The changes were as follows:

- BQ18 - 'Have you ever had to repeat a year?' - was deleted in the second version of the BQ, as the question is answered by the number of courses the student lists in response to BQ17.

- The items from BQ17 onwards were re-numbered, as two numbers had been missed on the original BQ (There was no BQ19 nor BQ28 on the original). Old BQ20 became BQ18, old BQ21 became BQ19 and so on.

- BQ35 was moved up to immediately after the computer course question (BQ19), and became BQ20.

- BQ22 - 25 were re-numbered as BQ21-24.

- BQ26 - 'How often would you say you use a computer?' - was changed from an open-ended response to a fixed response scale running from 'Daily' to 'Less than once per month'. This response scale change was repeated for BQ36 - 'How often would you say you use the library on-line catalogue?'. These questions became BQ25 and BQ30 respectively.

- BQ27-31 were removed, and replaced with the open-ended question 'What do you use a computer for?' (new BQ26).

- BQ32-34 were retained, and renumbered as BQ27-29.

- BQ37-41 were retained and renumbered as BQ31-35.

- The final prompt - 'Finally, please list below any comments you have about this questionnaire and/or its content' - was put into bold from normal text.

5.9.2 Alterations to the PPEQ

The PPEQ was modified for Pilot Study 2 in the following 3 ways (See Appendices 1.3 and 2.2):

- The first page was compressed so that PPEQ6 fitted on to it.

- PPEQ8 was altered to ask 'Have you *in the last month* done any extra work on the package topic?'.

- 'Finally, please list below any comments you have about this questionnaire and/or its content' was written in bold to encourage students to respond.

CHAPTER 6

PILOT STUDY 2: NEUROSIM II

6.1 Aim

6.1.1 Evaluators' aim

The aim of this study was to further pilot measures during the evaluation of a computer-based learning situation using the Hodgkin-Huxley Model within NeuroSim II. This study presented the challenge of piloting the measures on a class who had to use the package in their own time, rather than during a scheduled class as in Pilot Study 1.

6.1.2 Teacher's Aim

This intervention was also considered a pilot study by the course staff, who felt that the package allowed students to manipulate an environment in a way that could not be done in a laboratory. The course staff stated they saw the package as an addition to the lectures the students had received or were about to be given, rather than as revision material.

6.2 The Software

The NeuroSim II package was developed by Dr. Bill Heitler of St. Andrews University's Gatty Marine Centre. The software consisted of 10 simulations, of which 5 were available on 8 PC-compatible machines in the departmental computer laboratory.

The students were given an introduction to the study including the use of one of the 5 selected simulations (Cable). This enabled the students to use the package with their lecturer present and to discuss any unanticipated issues which could present problems later. The running order of the 4 simulations was specified by teachers to ensure all students ran the simulation which was chosen by course staff for evaluation - the Hodgkin-Huxley Model - before any others. It was unclear how many of these chosen simulations the students would complete, as each simulation possessed many factors which the students could spend time influencing. It was anticipated by the course staff that the students would take approximately an hour per simulation.

6.3 The Students

Sixteen third year Zoology students (7 males and 9 females) were given an introduction to the study and completed the pre-test measures. Ages ranged from 19 to 25 years (mean age 20). Only 1 student, a male, was over 23 (Student 1 - age 25). The majority (12 students) were aged 20 or under.

6.4 Measures

The measures used in this study were:

- The Biographical Questionnaire (BQ)
- The Computer Attitude Questionnaire (CAQ)
- The Post-Package Evaluation Questionnaire (PPEQ)
- The Quizzes

The differences between these measures in this study and their form in Pilot Study 1 are discussed below.

6.4.1 The Biographical Questionnaire (BQ)

The BQ was included with alterations as described in Section 5.9.1 earlier. (See Appendix 2.1).

6.4.2 The Computer Attitude Questionnaire (CAQ)

The CAQ was identical to that used in Pilot Study 1 (See Appendix 1.2).

6.4.3 The Post-Package Evaluation Questionnaire (PPEQ)

The PPEQ was included with alterations as described in Section 5.9.2 earlier (See Appendix 2.2).

6.4.4 The Quiz

The Quiz was different in topic content and structure from that used in Pilot Study 1. The Quiz were administered on the computer using a package called 'Q-Mark', and all questions were multiple choice. 'Q-Mark' also allowed the randomisation of answer presentation. Important features of using the computer as the examiner was that a log was taken of who used the package, and also the quiz completion time was accurately measured. The students had to complete the Quiz after they logged in and before they got access to the simulations, and again immediately after they used the package prior to logging out. It was hoped that this would lead to a 100% return rate of Quiz results despite the absence of evaluators and teaching staff when the students were using the package (i.e. because the students had to use it in their own time). Unfortunately it was not feasible to put the PPEQ into Q-mark.

Two forms of the Quiz were developed by course staff. The first (Quiz 1) contained 10 topic-general questions. It was administered on Friday 12 February. The other version contained 5 subject-specific questions and 4 package-specific questions which, in theory, the students should not be able to answer until after they use the package. This second version was to be completed immediately before (Quiz 2T1) and immediately after (Quiz2T2) package use. It was planned that at the end of the study, Quiz 1 and 2 would be combined and re-administered to the students. Despite negotiating before this study for a copy of both versions of the Quiz, the evaluation team were unable to obtain them from the teaching staff.

6.5 Method

The students were introduced to the study on Friday 12 February 1993. During the lecturer's verbal introduction to the study, the students were informed of its purpose and introduced to the evaluation team and the participating teaching staff. The students were also given instructions about the order of simulation completion. The author then described the evaluation methodology to the students and asked them to complete the PPEQ immediately after using the package.

The Computer Attitude Questionnaire (CAQ) was administered immediately after the introduction. Due to limited computer availability, 8 students (Group 1) were taken through to the computer lab. They completed Quiz 1, then ran the demonstration simulation (Cable). The remaining 8 students (Group 2) completed the BQ and were given a copy of the PPEQ. They were reminded not to complete the PPEQ until after they had run the Hodgkin-Huxley Model.

After completing the measures, Group 2 swapped places with Group 1 and completed Quiz 1 and the demonstration simulation. Group 1 meanwhile completed the BQ, and were each given a copy of the PPEQ and briefed about the requirements of its completion. Group 1 then returned to the computer lab where they paired up with the Group 2 students already working on the 8 available machines.

Immediately prior to the class being dismissed, they were told about the Hodgkin-Huxley Model simulation, and were asked to run it before any of the other three simulations. They were informed that they must run the 4 simulations in their own time before the 25th February.

The summary of the planned measure administration timetable was as follows:

Friday 12 February 1993

<u>All students:</u>

- Introduction to the study
- Computer Attitude Questionnaire (CAQ)

<u>Group 1</u>

- Quiz 1
- Demonstration Simulation
- Background Questionnaire (BQ)

<u>Group 2</u>

- Background Questionnaire (BQ)
- Quiz 1
- Demonstration Simulation

Tuesday 16 February - Wednesday 24 February 1993

<u>All students</u>

- Quiz2T1
- Run the Hodgkin-Huxley simulation
- Quiz2T2
- Post-Package Evaluation Questionnaire (PPEQ)

Thursday 25 February

<u>All students</u>

- Computer Attitude Questionnaire (CAQ)
- Quizzes 1 & 2 (combined)

However, by Thursday 18 February it was evident that no student had run the simulations. A class was hastily arranged for Friday 19 February to ensure the students ran the Hodgkin-Huxley simulation. Only 8 students turned up to this session however, one of whom had not completed the pre-test measures. Further, 2 students' Quiz2T1 and Quiz2T2 data was lost due to computer malfunction, reducing the sample size in this group to 5 who had completed all measures. The students completed the PPEQ and the CAQ at this session.

Another class was arranged to attempt to get at least another 8 students to complete the simulation. This class ran on the 25th February, and only 5 students attended. All 5 had completed the measures on the 12th February. Again, the students completed the PPEQ and the CAQ at this session.

The summary of the actual measure administration timetable was as follows:

Friday 12 February 1993

<u>All students:</u>

- Introduction to the study
- Computer Attitude Questionnaire (CAQ)

Group 1

- Quiz 1
- Demonstration Simulation
- Background Questionnaire (BQ)

Group 2

- Background Questionnaire (BQ)
- Quiz 1
- Demonstration Simulation

Friday 19 February 1993

8 students

- Quiz2T1
- Run the Hodgkin-Huxley simulation
- Quiz2T2
- Post-Package Evaluation Questionnaire (PPEQ)
- Computer Attitude Questionnaire (CAQ)

Thursday 25 February

5 students

- Quiz2T1
- Run the Hodgkin-Huxley simulation
- Quiz2T2
- Post-Package Evaluation Questionnaire (PPEQ)
- Computer Attitude Questionnaire (CAQ)

The results of the evaluation are considered in the following section.

6.6 Results

6.6.1 The Biographical Questionnaire (BQ)

As in Pilot Study 1, 4 dimensions were examined on the BQ:

1 - Personal details, including age, gender, date of birth, native language etc.

2 - Academic details from school to their current course

3 - Computer use, including computer ownership and access, frequency & type of use, any computer skills courses attended

4 - The current course, specifically how the students feel about using a computer in the course.

At the end of this measure, the statement 'Finally, please list below any comments you have about this questionnaire and/or its content:' was included, inviting the students to evaluate the measure.

Again as in Pilot Study 1, only the prior computer use, concern about computer use in the course and additional comments are considered in the following analyses of the BQ's results.

6.6.1.1 Prior computer use

Six aspects of computer experience are considered:

1) Taught courses
2) Access to computers
3) Frequency of computer use
4) Purpose of use
5) Types of package and computers used
6) Programming experience

The results of these items are considered in the following subsections.

1) Taught courses

Six students had been taught computing or computing skills. However 1 student (Student 8) had failed to explain what the tuition she had received had been.

Of the others, 3 had achieved passes in Computing Science 1B at Glasgow University (Students 5, 7, and 16). The remaining 2 (Students 9 & 11) reported that they had used computers 1 hour a week as part of their Psychology 1 laboratory course at Glasgow University.

2) Access to computers

Only 2 students reported owning a computer (Students 5 & 8), and these were an Atari STE and a Toshiba respectively. These students reported having regular access to a computer, and that they themselves owned the computer they most frequently used. Student 9 reported having regular access to his brother's computer, while Student 15 stated she had regular access to her father's computer. Aside from these 4 students, 6 students reported that they had regular access to a computer, and that the University owned the computer they used most frequently. However, 6 of their colleagues (Students 3, 6, 7, 11, 12 & 16) reported that they did not have regular access to a computer, and that they also used the University computers most frequently.

3) Frequency of computer use

Students were asked how often they used a computer on a fixed response scale running from 'Daily' to 'Less than once a month'. The same scale was applied to the question asking about frequency of use of the library on-line catalogue. No student reported using computers or the catalogue daily, and only 1 reported using the library catalogue 3-5 times a week (Student 16). No student reported using computers generally 3-5 times a week. Students 1, 2 & 16 reported using a computer 1-2 times per week, while Students 1, 2, 10 & 15 reported using the catalogue that frequently. Six students reported using a computer 1-3 times per month (Students 4, 5, 7, 8, 12, 14). Similarly, 6 students reported using the catalogue 1-3 times per month (Students 4, 7, 8, 12, 13, 14).

Computer use less than once a month was reported by Students 3, 6, 9, 10, 11, 13 & 15. Catalogue use less than once a month was reported by Students 3, 5, 6, 9, 11.

In summary, 7 students (44% of the sample) are infrequent general users of computers, while 5 (31% of the sample) are infrequent users of the library on-line catalogue.

The results from access to computers, frequency of use, and use of the library on-line catalogue are summarised in Table 6.6.1.

Table 6.6.1 - Computer use: Access, ownership & frequency

Student Number	Do you have regular access to a computer?	Who owns the computer you most frequently use?	How often do you use a computer?	How often do you use the library on-line catalogue?
1	Yes	University	1-2 times per week	1-2 times per week
2	Yes	University	1-2 times per week	1-2 times per week
3	No	University	Less than once per month	Less than once per month
4	Yes	University	1-3 times per month	1-3 times per month
5	Yes	Self	1-3 times per month	Never
6	No	University	5 - Never except if its' part of class work	5 - When I have to find something
7	No	University	1-3 times per month	1-3 times per month
8	Yes	Self	1-3 times per month	1-3 times per month
9	Yes	Brother	5 - About once every 2 months	5 - Very rarely!
10	Yes	University	Never	1-2 times per week
11	No	University	5 - Only a few times per year	5 - Only a few times per year
12	No	University	1-3 times per month	1-3 times per month
13	Yes	University	5 - Very Rarely	1-3 times per month
14	Yes	University	1-3 times per month	1-3 times per month
15	Yes	My father	About 1 time a year	1-2 times per week
16	No	University	1-2 times per week	3-5 times per week

4) Purpose of use

To explore computer use in more depth, the students were asked what they used a computer for. The BQ in Pilot Study 1 split use into academic and non-academic categories, but the revised version used in this study did not.

It was found that all the students had used computers before for some purpose. Despite the finding that almost half the sample (44%) used computers less than once a month, this prompt suggests these students do appear to have some knowledge and experience of computers and are not entirely naive.

5) Types of package and computers used

Students were asked what sort of packages they had used (out of a fixed list of 9 and 1 open-ended option), and what makes of computers they had used. It was found that all students reported using a package or a computer make, with most reporting both and 13 students listing more than 1 package type. Of the 3 students who did not report more than 1 package type, 2 (Students 6 and 10) reported using statistical packages, although neither listed a make of computer. One student (Student 11) failed to list a package type, but did list 3 types of hardware. Another student (Student 15) reported that they had 'never looked at the make', so could not answer the computer hardware prompt. Student 3 also failed to answer this prompt. Of the remaining 12 students, only 2 listed 1 sort of hardware used (Students 7 and 16, both listing Macs), the rest listing multiple computer makes and types.

6) Programming experience

Students were asked what programming languages they were familiar with. Only 4 students reported being familiar with programming languages (Student 5, 7, 14 and 16).

The findings of these items addressing purpose of use, types of hardware and software used, and programming knowledge are summarised in Table 6.6.2.

Table 6.6.2 - Computer use: Type, packages & programming

Student Number	What do you use a computer for?	Which packages have you used?	What makes of personal computers have you used?	Languages
1	Word processing	Word processing, spreadsheets, statistics, databases, Microsoft DOS, games	Atari, BBC, Apple Mac, Spectrum, PC	None
2	Word processing	Word processing, spreadsheets, graphics, statistics, Microsoft DOS, games, Email, bibliography packages,	Apple Mac, BBC, Amstrad	None
3	Statistics and first year Psychology lab work.	Word processing, statistics	Missing	None
4	Reference searches at the University library (SALBIN)	Word processing, statistics, games, bibliography packages	Spectrum, BBC	None
5	Games, writing up essays etc. (word processing).	Word processing, spreadsheets, graphics, statistics, databases, games, Other - Programming (Cobal, T. Pascal, Word Star)	Apple Mac, Atari	T. Pascal, Cobal, W. Star
6	I intend to start using them for word processing and maybe graphs, stats etc.	Statistics	Missing	None
7	To look up book titles/authors in the library	Word processing, spreadsheets, graphics, databases	Apple Mac	Pascal

Table 6.6.2 - Computer use: Type, packages & programming (Cont.)

8	Making graphs, word processing	Word processing, graphics, Microsoft DOS, games, Email	Apple Mac, IBM, NEC, Toshiba	None
9	Games & graphics (art, drawing programmes)	Graphics, statistics, games	BBC, Amiga, Apple Mac	None
10	If I ever had to use a computer it would be to type essays or projects.	Statistics	Missing	None
11	Only in conjunction with course work	None selected	Apple Mac, Commodore, Amiga	None
12	First term - statistics. Also, looking up book titles in the library.	Statistics, Psychology - computer experimental labs first A Mac programme for DNA sequencing	Sharp MZ 700	None
13	For statistical analysis	Graphics, statistics	BBC, Apple Mac	None
14	Course-related e.g. Cricket Graph and Microsoft Word	Word processing, spreadsheets, graphics, statistics, Microsoft DOS, games, bibliography packages, other - Music Sequencer	Sinclair, Commodore, Atari, IBM	Basic
15	Games, or essay writing with a printer for a neat copy.	Word processing, statistics, Microsoft DOS, games.	I've never looked at the make.	None
16	Data retrieval - Library, word processing (Occasional).	Word processing, spreadsheets, graphics, statistics, databases.	Apple Mac	Pascal

Table 6.6.1 and Table 6.6.2 show the students in this sample have all used computers before.

6.6.1.2 Concern about computer use in the course

Students were asked if they had known that computers would be used on the course prior to them choosing the option. Seven students said they did (Students 1, 4, 5, 6, 7, 14 & 16), but all reported that it did not influence their decision to take the course. Two students commented in response to this prompt as follows:

Student 4 - 'I have wanted to do Zoology since school as am purely interested in animal/environmental study. Computers are not a factor I even thought about when choosing this course.'

Student 14 - 'I assumed they would be used in line with other teaching methods, not as a substitute.'

Four students reported that they were concerned that computers were going to be used (Students 2, 7, 11 & 14). Students 7 & 14 had earlier reported that they had known that computers were going to be used on the course, although both had reported that this knowledge had not influenced their decision to take the course. The explanations the 4 students gave for their concern are listed below:

Student 2 - 'Use of computers instead of hands-on practical experience -> loss of reality and feel of zoology.'

Student 7 - 'Because I am not confident with computers and often find it easier using my head.'

Student 11 - 'I think it is a good idea to use computers in courses.'

Student 14 - 'I feel that the main reason for the introduction of computers is not as much for our becoming familiar with them, facilitating use in later work-related life, but as a money-saving exercise, replacing quality teaching and expertise with a computer program. This and much more points again and again toward the Government desire to turn advanced level educational institutions into degree machines. What the hierarchical evil seems to ignore is how vital hands-on experience is - computers are excellent tools to assist but they are a very poor substitute for real knowledge and expertise and a non-viable (educationally speaking) alternative to labs. They may be cost effective but if I knew they were to be used in a course as a replacement for labs, teachers etc. then I would think twice about taking it.'

Student 14's views suggest that he came to the teaching situation with a pre-existing prejudice against computer use for learning, although this is based on a limited knowledge of the actual role of the package in his course.

Of the other students, Student 2 sees the use of the package as a loss of practical experience, although the simulation and alteration of parameters the package affords could never be performed in an undergraduate lab. Therefore contrary to his concern, the package is actually giving him an opportunity to go further into the field than the hands-on experience that remains in the course would allow. Student 7 is the only student to express concern about his ability to use a computer. Student 11 on the other hand feels that computer use in the course is a good thing.

The remaining 12 unconcerned students explained their lack of concern several ways. Firstly, 3 students see it as a transferable skill:

Student 3 - 'I would like to get used to using computers which I have had little experience with, as you come across them so much now in every day life and most jobs.'

Student 8 - 'I think that computers should be used without tremendous debate. After learning some simple techniques, they can make a world of difference - particularly in science for plotting out raw data and results tables.'

Student 9 - 'It is essential to understand at least the basics of computing and to become more familiar with the way they work.'

One student felt that it can aid learning (Student 1), whilst another gave cautious agreement:

Student 4 - 'I agree that computers can be helpful, but on saying this they should still be a secondary source of learning. It is more vital that lectures and practicals are given by a flexible method and not a pre-ordained programme.'

The most common reason for lack of concern was that the respondent felt they would be able to cope with computer use i.e. they had confidence in their ability (Students 5, 12, 13, 15 and 16). Finally, 2 students reported less confidence than their colleagues above, although neither were resistant to the idea of using them:

Student 6 - 'I think they are a useful basic skill to be learnt. If I am concerned, its only because I have not got a clue how to work them and I don't understand them.'

Student 10 - 'I would not mind using computers, if I knew how to work them.'

6.6.1.3 Additional comments

Finally, the BQ asked the students if they had any additional comments they would like to make about the questionnaire or its contents. Only 4 students responded, and their answers are shown below:

Student 1 - 'I hope that computers are not used as a substitute for lecturing.'

Student 2 - 'A question about one's future career to put the questionnaire in context i.e. if the student plans to be an actor, there is no point in the student being able to use a database.'

Student 5 - 'The only part I found was unnecessary was the years that we were at diff. colleges etc. it is quite hard to remember when etc. (or maybe I'm just stupid).'

Student 15 - 'There are no questions asking if computer use is compulsory on the course i.e. computer tests etc. and none asking if you would prefer not to use computers if you had the choice.'

Student 1 share's Student 4 and 14's concern that computer-assisted learning will replace conventional teaching. The other 3 students all made suggestions about improvements to the BQ.

6.6.2 Computer Attitude Questionnaire (CAQ)

The CAQ is analysed as in Pilot Study 1 earlier.

6.6.2.1 Within Student Analysis

The mean response is calculated for all respondents at pre- and post-test. These are then compared to assess the impact of the CAL experience on each individuals. Note that in this study, the CAQ was not completed immediately before the Hodgkin-Huxley simulation was used, having been administered a week before the first students used the package, and almost a fortnight after the second group of students used the package. Further, the pre-test CAQ was completed by 1 group after they had run the demonstration simulation. Unfortunately no record was taken of who was exposed to the CAL before completing the CAQ and who was not. These confounding factors should be born in mind when considering the CAQ results.

The CAQ is coded the same way as it was in Pilot Study 1. To calculate the mean, the questionnaires were first coded on a scale of 1 (most negative) to 5 (most positive) with respect to the polarity of the questionnaire item. An unclear statement was coded as 9, effectively a missing answer. Mixed feelings was coded as '3', or neutral. A mean of above 3 indicated an overall positive attitude, while a mean of less than 3 indicated a negative attitude. Scores of 9 were discounted, and will be discussed later in the 'Improvements to the CAQ' section. The time at which the students used the package is described, as are the results of the comparison of CAQ means within students, on Table 6.6.3.

Table 6.6.3 - Comparison of CAQ means within student

Student Number	Date package used	Pre-test Mean	Post-test Mean	Difference
1	19 Feb	3.88	3.76	-0.12
2	"	3.87	Invalid	Invalid
3	"	3.35	3.03	-0.32
4	"	3.09	3.24	0.15
5	"	4.09	4.06	-0.03
6	"	3.29	3.24	-0.05
7	"	2.91	2.91	0
8	25 Feb	4.24	4.24	0
9	"	3.53	3.82	0.29
10	"	3.55	3.66	0.11
11	"	4.81	4.82	0.01
12	"	3.44	3.35	-0.09
13	Failed to Return	4.03	None	Not Applicable
14	Failed to Return	3.97	None	Not Applicable
15	Failed to Return	2.97	None	Not Applicable
16	Failed to Return	3.09	None	Not Applicable

Table 6.6.3 shows 4 students failed to return to use the package (Students 13, 14, 15 & 16). Their results are therefore discounted. One student attended the package

session on 19 February, but had not been present at the introductory session, hence had not completed the BQ or the first CAQ. This student's results are also discounted, and do not appear in the Table. Student 2 missed a page of items on the post-test CAQ, so the post-test mean is invalid.

Only 1 student who completed both pre- and post-test CAQs was negative in attitude at both times (Student 7). The remaining 10 were all positive, although Students 1, 2, 3, 5, 6 and 12 became more negative on post-test (i.e. after using the package). Students 7 & 8 were consistent across time (i.e. did not shift), while Students 4, 9, 10 & 11 became more positive. However, movement was small for Students 5, 6 & 12, leaving 3 students shifting more than 0.1 in a negative direction. Similarly, Student 11 had a small shift to the positive on post-test CAQ, leaving 3 students shifting 0.1 or more (Students 4, 9 & 10).

Considering the type of shift rather than its magnitude, the results are similar to that found in Pilot Study 1, with 50% of students becoming more negative towards computers on post-test, while 33% became more positive.

From the results of the CAQ and the BQ, it appears the students in this study were more computer literate and more positive towards computers than the students in Pilot Study 1, although both studies saw 50% of the sample become more negative on the CAQ at post-test. Student 14 had been negative about computer use on the BQ, but his average on the CAQ at pre-test was surprisingly positive (Mean =3.97). Unfortunately he did not return to complete the post-test, so it is unclear what the impact of the teaching intervention would have been on his attitudes towards computers. It would also have been very useful to see which students used the package before completing the BQ, as it may be that Student 14 completed the BQ after using the software.

6.6.2.2 Question-by-question analysis of the CAQ

As described in Pilot Study 1, the changes across the sample are best displayed graphically. In the charts, the x-axis describes Time 1 results, and the y-axis describes Time 2 results. The axes scale reverses depending on the polarity of the item, so that the most positive answers are always at the top right of the chart, and the most negative are always near the axes convergence in the bottom left. The charts are shown in full in Appendix 2.3

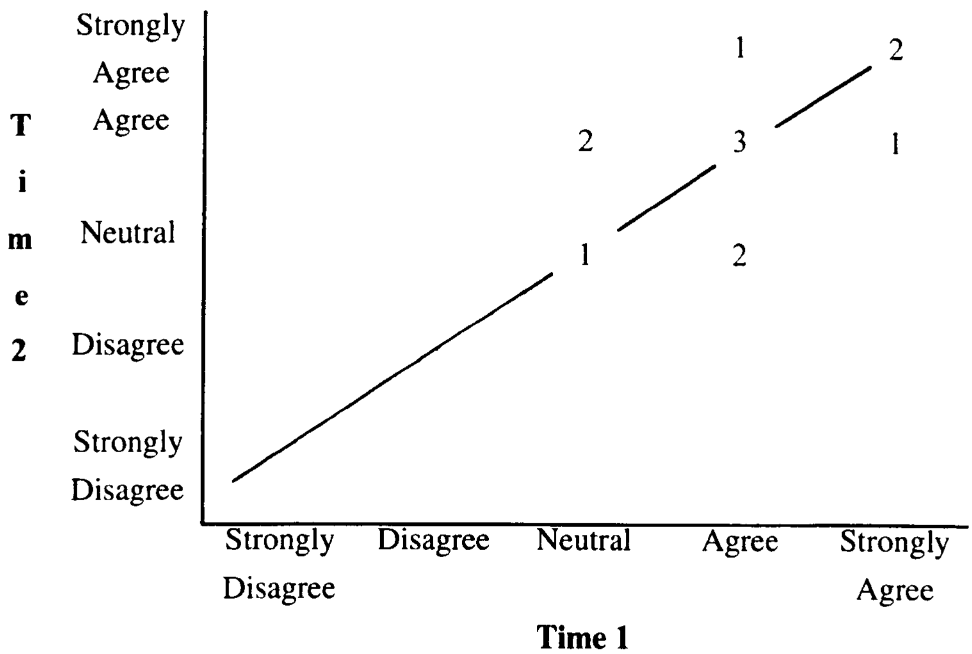
Only 12 out of the 34 CAQ items were completed by the whole sample at both times. As indicated earlier, Student 2 missed a page of the questionnaire, resulting in at least 1 student being missing from the charts of Q24-34, and indeed in 6 out of 10 of these questions Student 2 was the only missing student. Those other items, which at least one student found unclear, will be discussed later.

Six statements on the CAQ specifically examined the students' opinion of computer use in the class. These statements and their results were as follows:

CAQ1 - It is a good idea to use computers to assist in the teaching of the subjects I study

Six students were consistent across time, 1 of whom was neutral while 3 agreed and 2 strongly agreed that it was a good idea to use computers to assist in teaching. One student dropped from 'Strongly Agree' to 'Agree' after using the computer, while another did the reverse. Two students dropped from 'Agree' to 'Neutral', and 2 did the reverse. Overall, 7 of the 12 students (58% of the sample) agreed or strongly agreed with the statement across both testing times. No student disagreed with the statement on either administration. The findings are shown on Chart 6.6.1.

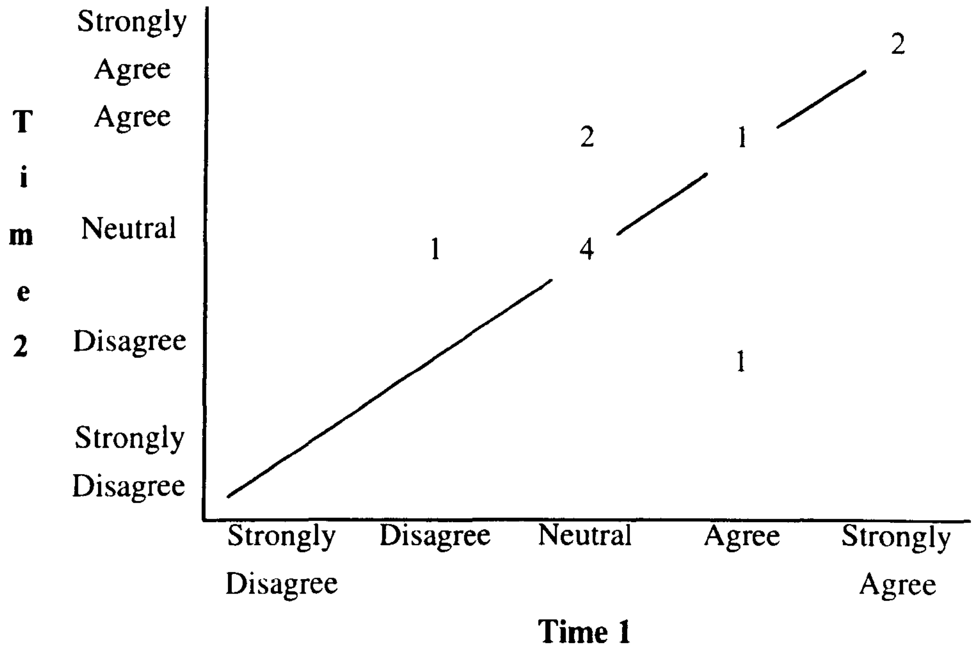
Chart 6.6.1 - CAQ1



CAQ6 - Using computers as a teaching aid makes learning easier.

Seven students were consistent across time. Two stated they strongly agreed with the statement, 1 agreed, and 4 were neutral at both times. Two students were negative - 1 before using the computer disagreed with the statement but rose to neutral after using the software, while another agreed with the statement on the first CAQ but fell to 'Disagree' on the second. Two other students moved from 'Neutral' to 'Agree' on post-test. In summary, the sample were again generally positive about using computers in the classroom, with only 1 student becoming negative towards the statement after using the software. These results are shown on Chart 6.6.2.

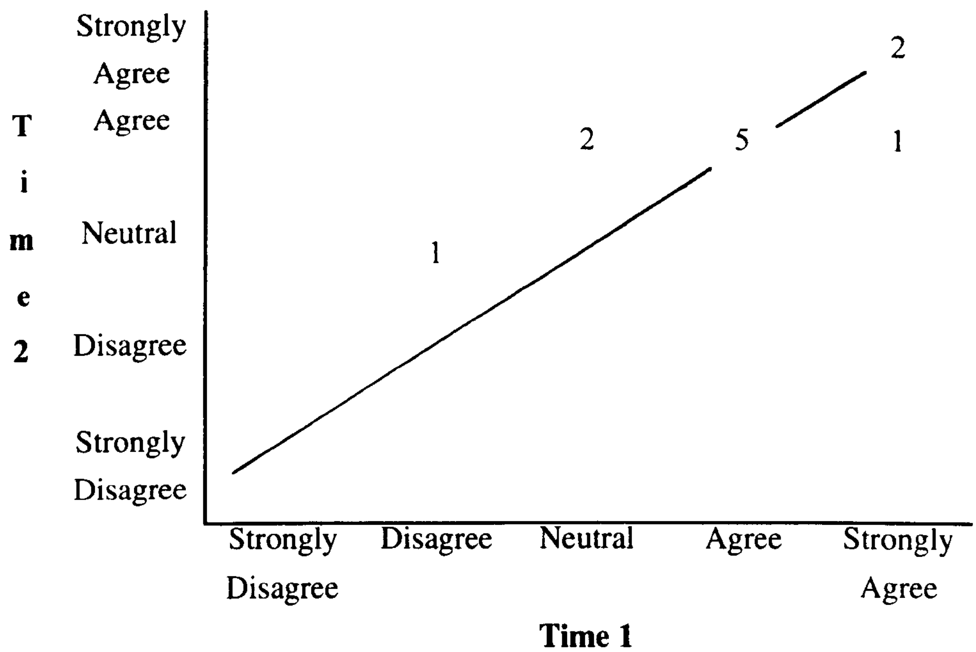
Chart 6.6.2 - CAQ6



CAQ10 - Using computers in class varies the course.

Again 7 students were consistent across time. Two strongly agreed while 5 agreed with the statement at both testing times. Only 1 student fell, going from 'Strongly Agree' to 'Agree' after using the software. The remaining 3 students all moved, one from disagreeing with the statement to neutral, and two from neutral to agreeing with the statement. Once more the overall findings suggest that the students were positive towards CAL. These results are shown on Chart 6.6.3.

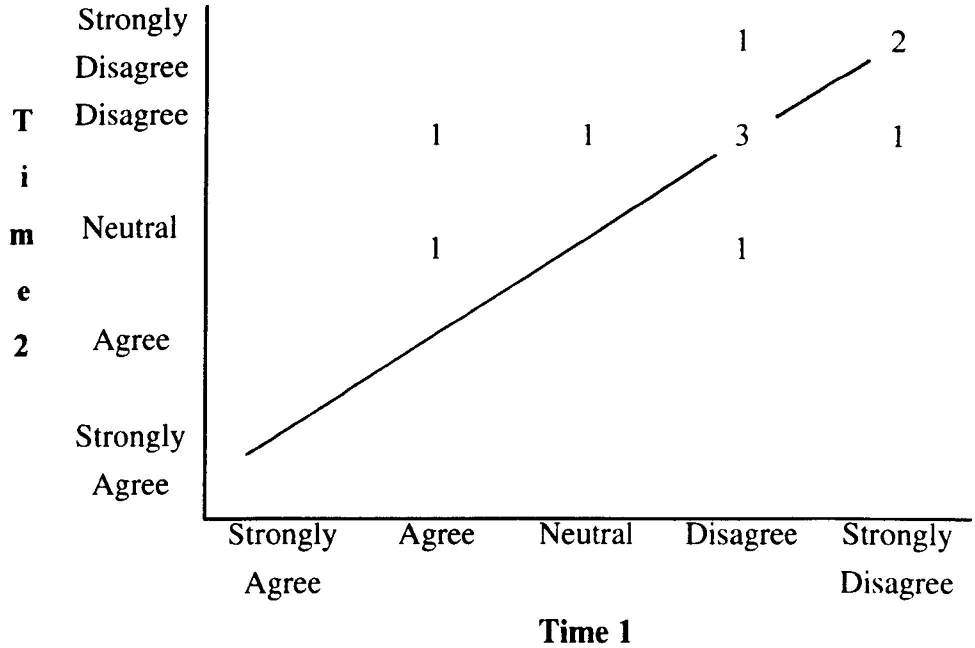
Chart 6.6.3 - CAQ10



CAQ18 - The use of computers within a course makes the understanding of course material harder.

A positive answer to this statement was made by disagreeing with the statement. In total, 5 students were consistent across the testing times. Three disagreed with the statement and 2 strongly disagreed with it. After experiencing the CAL session 2 students fell, one from 'Strongly Disagree' to 'Disagree', and one from 'Disagree' to 'Neutral'. Conversely, 3 students rose after using the software. Two moved from agreeing with the above statement at pre-test to 'Neutral' and to 'Disagree' respectively. The final student rose from 'Neutral' to 'Disagree'. These finding show that of 11 students, only 2 were 'Neutral' after using the software, and none were negative. These findings are shown on Chart 6.6.4.

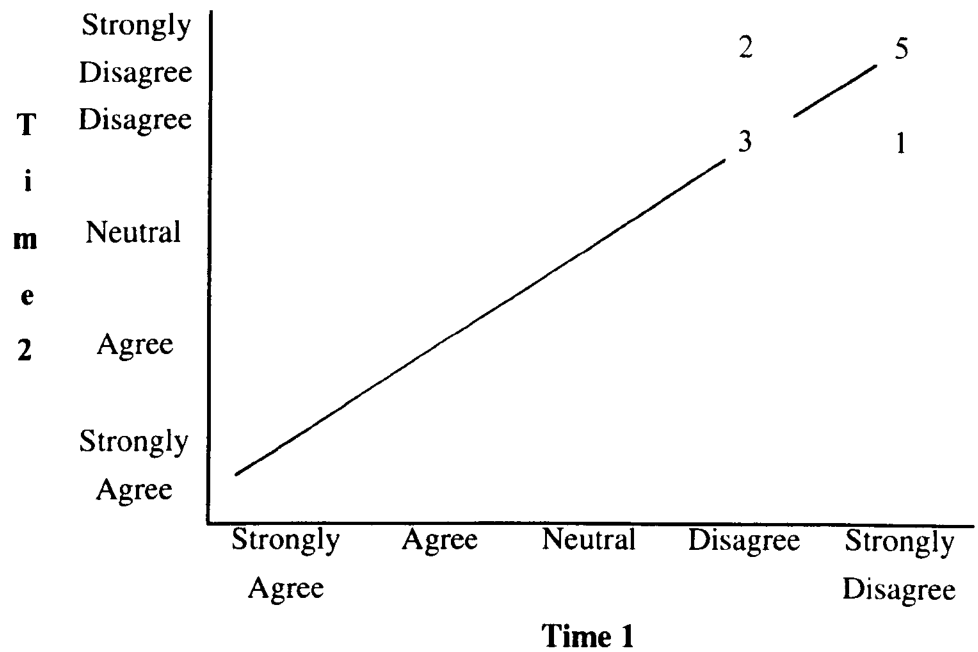
Chart 6.6.4 - CAQ18



CAQ33 - There is no difference between being taught by a lecturer and being taught by a computer.

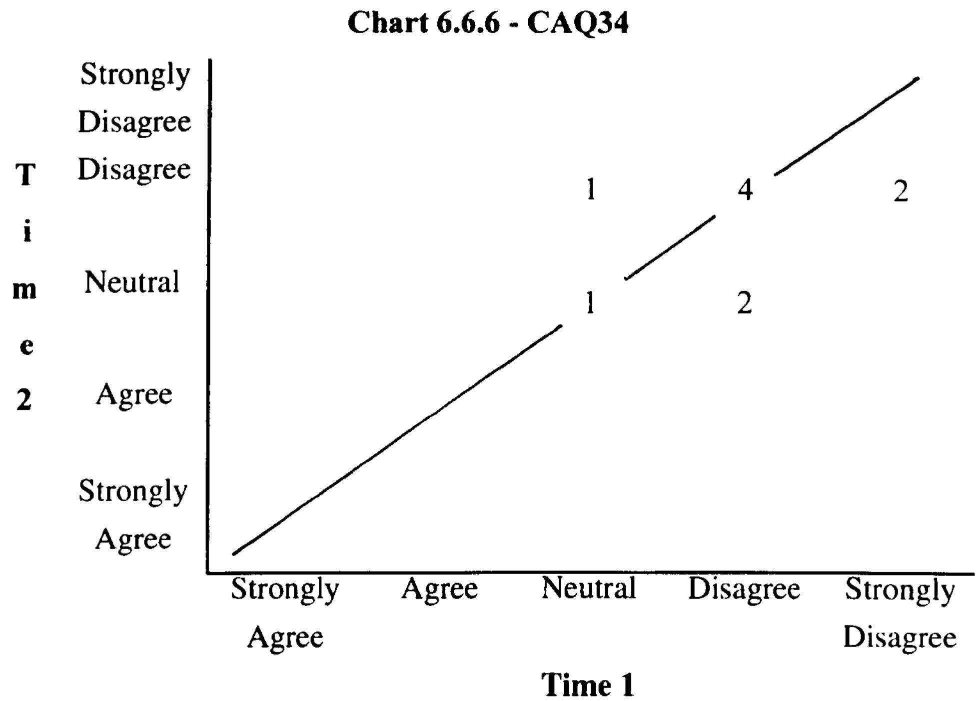
The polarity of this statement is debatable, as discussed in Pilot Study 1. Eight students were consistent over time, 5 strongly disagreeing with the statement, and 3 indicating they disagreed. After using the software, 1 student fell from 'Strongly Disagree' to 'Disagree', while 2 rose from 'Disagree' to 'Strongly Disagree'.

Chart 6.6.5 - CAQ33



CAQ34 - Using a computer would distract me from what I am supposed to be learning.

The polarity of this statement was considered negative, therefore disagreement would present a positive answer. Five students were consistent across the testing times, 4 disagreed with the statement and 1 remained neutral. Two students fell from 'Strongly Disagree' to 'Disagree', while 1 student rose from 'Neutral' to 'Disagree'. Conversely, 2 students fell from 'Disagree' to 'Neutral' after using the package. In total then, 4 students (40% of the valid respondents) fell after using the CAL package. However, none agreed that they would be distracted by the medium unlike the students in Pilot Study 1, where 38% of the sample agreed with CAQ34.



6.6.2.3 Summary

CAQ1 and CAQ34 had no negative students at any point during the study. CAQ10 and CAQ18 both had negative students on pre-test (1 negative student and 2 negative students respectively), but all moved up to neutral or high on post-test. CAQ6 - 'Using computers as a teaching aid makes learning easier.' was disagreed with by 1 student at pre-test, but they moved up to 'Neutral' after using the software. However, 1 student moved from 'Agree' to 'Disagree', believing after using the computer that using a computer made learning harder. CAQ33 is not considered here due to the polarity issue.

The CAQ findings can be interpreted as a good result for the package, and more positive than the findings in Pilot Study 1. It can be concluded from these results that these students generally believe that teaching using computers is a good thing.

6.6.2.4 Improvements to the CAQ

In the first administration of the CAQ no student missed an answer. However, 7 students reported statements as unclear, and these students and their list of unclear statements are shown in Table 6.6.4a.

Table 6.6.4a- Unclear question numbers reported on pre-test CAQ

Student 2	Student 4	Student 7	Student 10	Student 11	Student 14	Student 15
15, 16, 18, 32	10, 34	25, 32	2	3, 24, 26	6	31

From the 14 items listed as unclear, only CAQ32 - 'It is easier to answer a question truthfully when it is asked by a computer' was described as unclear by more than one student. This is a similar finding to Pilot Study 1. Of the others, there is no agreement, so while the dropping of CAQ32 in any further study may be justified, the other 'unclear' statements may depend on personal preference and individual differences. This is not a criteria for their removal, although if the findings are consistent across more than one student in the second administration, their removal may have to be considered.

The second administration of the CAQ saw Students 13-16 fail to complete it, and Student 2 to miss CAQ24-CAQ34 inclusive. The only other missing answer was from Student 1, who missed CAQ12.

Five students reported statements as unclear on the CAQ post-test, and they are shown in Table 6.6.4b.

Table 6.6.4b - Unclear statements reported on post-test CAQ

Student 2	Student 4	Student 7	Student 10	Student 11
5, 6, 9, 11, 16, 18	26	25, 32	3, 9	26

Student 2 reported 2 items (CAQ16 and CAQ18) were unclear at both testing times. Student 4 found a different item unclear on post-test than the two selected at pre-test. Student 7 was consistent across both testing times, while Student 10 returned different unclear items. Student 11 was consistent in part, but had dropped the previously unclear items CAQ3 and CAQ24. Student 11 maintained CAQ26 was unclear, and was joined on this occasion by Student 4. Student 2 and Student 10 agreed that statement CAQ9 - 'Computers make tasks less time consuming.' was unclear. Aside from these latter two prompts, however, there was no cross-student agreement. The inconsistencies shown by the students in item selection across the two administrations are of concern, but remained unexplained. Had semi-structured interviews been conducted in this study, these inconsistent findings may have been explained by the students.

6.6.3 The Post-Package Evaluation Questionnaire (PPEQ)

The PPEQ's results are considered both within-students and between-students.

6.6.3.1 Between-Student Analysis

As with Pilot Study 1, the first 4 questions of the PPEQ were constructed as positive attitude statements, with a 5-point response scale running from 'Strongly Agree' to 'Strongly Disagree'. Again the scale is collapsed into 3 categories for the purpose of this analysis:

Positive = (Agreement), incorporating Agree & Strongly Agree
Neither = Neutral
Negative = (Disagreement), incorporating Disagree & Strongly Disagree

PPEQ Question 1 asked the students to show their level of agreement with three statements:

a) This package was easy to use
b) This package was enjoyable
c) This package was interesting

Question 2 asked the students to show their level of agreement with the statements that this computer session was useful for:

a) Revision purposes

b) Presenting new information
c) New angles on old information
d) Increasing knowledge of the subject
e) Stimulating interest in the subject

Question 3 stated 'I would like to spend more time using this package' and again asked the students to agree or disagree on a 5-point scale. Question 4 asked students whether 'This package is most suited to students working on their own.' The number of students responding to these questions positively, neutrally and negatively are listed in the Table 6.6.5.

Table 6.6.5 - Between-student responses to Questions 1-4

	Positive	Neutral	Negative
1a) Easy to use	10	2	0
1b) Enjoyable	5	6	1
1c) Interesting	7	5	0
2a) Revision	12	0	0
2b) New information	8	3	1
2c) New angles	10	2	0
2d) Increasing knowledge	11	0	1
2e) Stimulating interest	4	7	1
3) More time on package	7	4	1
4) Working alone	5	5	2

Table 6.6.5 shows that negativity is limited amongst the sample. Only 1 student (Student 7) felt the package was not enjoyable, and most found it easy to use and interesting. Generally there was agreement across the sample about what the package could be useful for. However, Student 2 disagreed that the package was useful for presenting new information, and Student 4 disagreed that the package would be useful for increasing knowledge of the subject. Student 7 disagreed that the package was useful for stimulating interest in the subject. Only Student 3 disagreed that she

would like to spend more time using the package, whilst Students 3 & 8 were in agreement that the package was not best suited to students working on their own. There were a considerable number of neutral responses to these 4 questions, particularly regarding enjoyment, interest, working alone and future use of the package.

Students were also asked how many simulations they had run. The answers ranged from 2 to 20, with 5 students reporting under 10, 4 reported running 10, and 3 stating they did 20 runs.

Students were asked in what ways they had previously covered the topic. Five students reported covering the topic in lectures and practicals, while 2 stated they covered it in lectures and textbooks, and another 2 students reported covering it in lectures, practicals and textbooks. One student (Student 1) had covered it in practicals only, whilst another (Student 11) stated they had covered it in lectures, practicals and tutorials. Student 8 stated using lectures, practicals, essays, textbooks and personal research on the subject. Student 8 was also the only student to report doing extra work on the package in response to PPEQ Question 9, stating 'Everyday after lecture when topic was covered - textbook.'

PPEQ7 was open-ended, asking the students 'How does this package compare to the teaching you have previously encountered?', while PPEQ10 asked 'What do you feel you have gained, if anything, from this package?' . The results of both questions are shown on Table 6.6.6.

Table 6.6.6 - Student responses to PPEQ Questions 7 & 10

Student number	How does this package compare to the teaching you have previously encountered?	What do you feel you have gained, if anything, from this package?
1	It is very good, but should NOT be used as a substitute for teaching by staff. It is limited in its usefulness.	It is useful since many neurophysiology labs don't give good results. One can see what results one would have expected by altering parameters.
2	I lacked necessary knowledge and understanding of this topic and thus the teaching was more helpful than the simulation.	This package is helpful if you have read up on the subject, but as a teaching aid, unless help is on hand to explain simulations, is not so effective.
3	About the same	I know about the different drugs on the channels and which gates open which channels.
4	It helped as a revision learning programme and made some aspects a bit clearer to understand (graphically) but did not teach me anything new (from previous lectures).	A bit of revision and more graphic memorisation of processes in the nervous system.
5	It backs up what I've been taught.	Slightly greater knowledge.
6	A bit confusing to begin with but once you understood what was going on, helped me learn a few things. Only problem is it does not explain results.	Helped confirm my understanding of aspects, although would have to read up on what some of it was trying to show me.
7	Some parts of it make the subject easier to understand - You have more time to go over various parts.	More understanding about the gates opening and closing.
8	Provides a much better visual aid and is something we can spend a lot of time on without using anyone else's time i.e. it is ACTIVE learning.	Sense of what the Actn P. LOOKS like when drugs are applied etc. Visual aids of Na+/K+ gates.

Table 6.6.6 - Student responses to PPEQ Questions 7 & 10 (Cont.)

9	More interesting.	Better understanding of the subject.
10	Normally work that I have done has been in practicals or information that I have gained in lectures, that real researchers have found out. This was quite good to 'play around' with the different variables.	It is interesting if you follow through and try to explain all the factors you have changed. It is good to have a lecturer present to explain things to you - why particular patterns happened. But it is very easy to just change the parameters and put in different rather without thinking about it, like you were just playing a game. It would be good to do this in pairs and discuss it as you go along - otherwise you get bored and don't understand much at all.
11	More interesting.	More confidence with computer - learned easy ways of gaining new info.
12	Favourably.	A greater knowledge of the basic ideas of action potentials.

Table 6.6.6 shows all students saw benefits from package use, even Student 7 who had on occasion been negative about computer use. Question 10's results suggest that the students by and large saw the pedagogic benefit of the software. The results indicate that the package was considered useful and therefore was a success from the students' point of view. Earlier, there had been some doubt expressed by some students about the relevancy of the package. As shown above, this is no longer an issue, although note from Student 1's response that the concern about computers replacing conventional teachers is still there.

Four of the 12 students ' (Students 8, 9, 11 and 12) reported that they believed the Hodgkin-Huxley simulation compared favourably with conventional teaching methods when asked 'How does this package compare to the teaching you have previously encountered?' Another student reported that it made parts of the subject 'easier to understand' (Student 7), primarily because you could return to parts of the model you had difficulty with.

All of the 5 students described above reported some form of 'gain' when asked 'What do you feel you have gained, if anything, from this package?'. Four reported an increase in knowledge or better understanding of the subject as a result of using of the simulation (Students 7, 8, 9, and 12). The remaining student reported that it gave them more confidence when using computers, and that they had learned an 'easy way of gaining new information' (Student 11).

Three students (Students 1, 2 and 6) reported some problems with the package when comparing it to other teaching methods, but even these comments had a positive edge, and all 3 felt they had gained something from package use. Overall, then, the response to the package was favourable, and self-perceived gains were reported for all of the 13 students who completed the questionnaire.

6.6.3.2 Session problems highlighted in the PPEQ

Finally, students were asked to list any comments they had about the questionnaire and/or its content. No student wrote anything in response to this prompt.

6.6.3.3 Within-Student Analysis of the PPEQ

The results of the between student analysis of the PPEQ and the results of the BQ and CAQ, suggest that prior computer experience and attitudes towards computers is not an issue in this study, unlike Pilot Study 1. Further, the students who used the package evaluated it favourably regardless of background or attitude. For these reasons the within-subject analysis is not performed.

6.6.4 Student Feedback About The PPEQ

Interviews were not conducted with this group about the measures, so no feedback was obtained about the PPEQ verbally, nor in response to the prompt at the end of the PPEQ itself.

6.6.5 The Quiz

Two forms of the quiz were developed by course staff. The first (Quiz 1) contained 10 topic-general questions, and was administered on Friday 12 February. The other version (Quiz 2) contained 5 subject-specific questions and 4 package-specific questions. This second version was completed immediately before (Quiz 2T1) and immediately after (Quiz2T2) package use.

The Quizzes were multiple choice, and administered & scored on the computer using a package called 'Q-Mark'. The responses to the questions were randomised, although the questions themselves remained in the same order.

It had been expected that at the end of the study, Quiz 1 and 2 would be combined and re-administered to the students. The adjustments to the scheduling of the study, however, meant that the administration of another quiz could not be fitted into the timetable.

The Quiz results were returned to the evaluation group by testing time only, rather than by student and question-by-question as had been hoped. Further, only the means for each Quiz and the minimum and maximum score was given to the group, and these are shown in Table 6.6.7. The lack of data by student prevents any detailed analysis of the findings.

Table 6.6.7 - Available Quiz results

Quiz	Mean	Minimum Score	Maximum Score
Quiz 1	5.33	4	6
Quiz2T1: Pre-simulation	5.00	1	7
Quiz2T2: Post-simulation	5.44	3	7

The means of the Quiz results in Table 6.6.7 are similar, as are the maximum scores at each time. The minimum scores vary, but without data on the distribution of the entire sample no conclusion about the significance of these differences can be reached.

6.6.6 The Thinkaloud

Owing to the re-organisation of the course, the unexpected opportunity to conduct a thinkaloud arose. The student involved in the thinkaloud had some computer experience, but no formal training in computer use. This student had reported using computers 1-3 times per month on the BQ, although he used a computer almost exclusively for reference searches. He did report having used word-processing and statistical packages, but which packages and how often are unclear. From these results, it appeared that this student would be fairly representative of the class.

The thinkaloud found the student had problems loading the simulation initially, as he didn't know what to type in. This may have been a result of not listening to instructions. It was also noted that after running the simulation there was nothing to tell him how to get out of the simulation screen and back to the main menu (the command required was <enter>). After hitting <enter>, there was a gap of about 5-10 seconds where nothing appears to be happening i.e. the screen goes blank. The student assumed the system had crashed (it had earlier) and hit <enter> several times. This resulted in the next simulation being run before the student could change the parameters. These two bugs could be resolved if the instruction to press <enter> to return to the main menu was presented on the screen, and if there was some feedback indicating that the system was responding to the initial pressing of <enter>.

This student did not know if it was possible to freeze the simulation or slow it down, although the instructions on how to slow down the simulation were on screen. It seemed a feature of this student's interaction with the computer that he seldom read any instructions on the screen, and hence had problems in running the simulation.

The student admitted that much of the information was 'new stuff' to him, but did seem to learn something from it - in particular, he realised that TTX blocks Na (sodium) and TTA blocks K (potassium). The student reported that the package was good for revision, but that he probably wouldn't use it as he was used to books. He believed he would not learn anything from the package that wasn't already in the books.

6.7 Discussion

Several unmeasured factors almost certainly influenced this study. Primarily, despite classes being arranged within the timetable specifically to run the simulation in an attempt to reduce pressure on students, the students' general feeling, collected through informal interview prior to package use, appeared to be that the simulation was extra-curricular, and non-essential. Specific coaching on the benefits this package presented to students may have prevented this. For example, placing greater emphasis on the gains available to students by using these simulations may have increased motivation. In addition, assured access to the relevant computers might have increased the possibility of students returning to run the simulations in their own time.

The package was also used incorrectly. The package author stated that it was designed to replace practical laboratories, and was at no point meant to stand alone. Sending the students away to use it in their own time was therefore inappropriate. This problem was rectified in later years.

Another notable point concerns the simulation itself. The screen was divided into 3-4 animations/graphs, all of which appeared simultaneously. This led to an overload of information, and it seemed impossible to study all that was happening on screen until after the animations had ended. Thus the students could easily miss part of the simulation or be distracted by the overloading they were encountering. Yet surprisingly none of the students commented on this.

Finally, the students who turned up to run the simulations may not have been representative of those who did not attend. This study did not include any measure to examine reasons for attendance or non-attendance, and so the representativeness of the sample is unknown.

6.7.1 Problems with the package

No help log was kept in this study because the package was to be used on its own without a demonstrator available. When this design altered at short notice, there was not time to include a help log. The study instead relied on the PPEQ and the thinkaloud. No student reported any particular HCI issue on the PPEQ, although Student 6 reported it was 'a bit confusing to begin with'. The thinkaloud showed two HCI bugs, and some evidence of a gap between the students pre-existing topic knowledge and the package's expected prior topic knowledge. This issue could be addressed by integrating the package into the course for use at a time when the students' knowledge is fresh, and also by priming the students immediately prior to package use.

6.7.2 Student negativity

It was found that 50% of students became slightly more negative towards computers on the CAQ at post-test, while 33% became more positive. However, the between students analysis found that no student disagreed with the statement 'It is a good idea to use computers to assist in the teaching of the subjects I study' (CAQ1), nor did they agree with the statements 'There is no difference between being taught by a lecturer and being taught by a computer' and 'Using a computer would distract me from what I am supposed to be learning.' (CAQ33 and CAQ34 respectively). Only 1 student disagreed with the statement 'Using computers in class varies the course.' (CAQ10) on pre-test and none disagreed on post-test. Two students agreed on pre-test with the statement 'The use of computers within a course makes the understanding of course material harder.' (CAQ18), but again none agreed on post-test. In fact, the only statement about computer use in the classroom which a student disagreed with on post-test was CAQ6 - 'Using computers as a teaching aid makes learning easier', where a student dropped from 'Agree' on pre-test to 'Disagree' on post-test.

Generally the students' attitudes towards computer-based teaching after using the package were good. Only 1 negative student on 1 item suggests that the package did not have a negative effect on these students as far as teaching and learning was concerned, although 50% did report more negative attitudes towards computers generally after using the package.

6.7.3 Benefits to the students

The students were positive towards both the topic and the medium. Indeed, some felt the package taught the subject better than more conventional methods had. It appears then that the package was a success amongst those students who used it. All students reported some form of gain (PPEQ10).

6.8 Conclusions

This study found no evidence that the students' evaluations of the package were influenced by their prior experience and attitudes, although no student in this study was completely naive nor particularly hostile towards computers, unlike the sample in Pilot Study 1. This suggests that Pilot Study 1's finding that attitudes and experience can influence results may only apply in extremely naive and hostile cases, and if so, more work should be done on this issue.

The Hodgkin-Huxley Model in the NeuroSim II Package does seem to be effective at increasing students' self-reported knowledge and understanding of the material, and in several cases also increased the student's interest in the subject.

The conclusions and recommendations from this study are listed below:

1 - There is a need for the package to be integrated into the curriculum.

2 - Two bugs in the program need attention.

3 - The package needs an explanatory front-end if it is to be used in a stand-alone situation, or else clear priming of the students should occur.

4 - The introduction to a CAL session is critical. The students in this study were observed to receive poor instruction and explanation.

5 - It should be clear to staff and students whether the Quiz is to be completed with or without assistance i.e. whether consultation with other resources and students is permitted.

6 - The current measures need refined to allow more rapid completion.

7 - Future evaluation designs should build on flexibility and responsiveness, so that in the event of an unexpected alteration to the teaching plan there are alternative approaches ready to collect useful data.

6.9 Discussion of Measure Modification Prior to Pilot Study 3

6.9.1 Problems with the BQ and CAQ

The BQ and the CAQ were clearly still too long, and both returned considerably more information than was needed for these studies. The dimensions found most useful in Pilot Studies 1 and 2 were previous computer experience, stated confidence in computer use, and attitudes towards computer use in the classroom.

6.9.2 Problems with the PPEQ

The PPEQ was lacking in opportunity for the students to be critical of HCI issues. PPEQ1 asked if the package was easy-to-use, interesting and enjoyable, but the results show that the latter 2 components of this question (interest and enjoyment) were effectively re-administered in PPEQ10. Another example of this is found in PPEQ2, which was also essentially asked again in PPEQ7. Finally, whether or not the students believe the package is best suited to students working alone or in a pair seems to reflect individual differences rather than provide a definitive answer.

6.9.3 The absence of semi-structured interviews and help logs

Semi-structured interviews and help logs all proved useful in Pilot Study 1 and their insight and power of explanation was missed in Pilot Study 2, suggesting an important role for qualitative measures in the methodology.

6.9.4 The Quiz

The Quiz failed in both pilot studies, in Pilot Study 1 because of marking and repetition issues, and in Pilot Study 2 because of administration issues. From these case studies it can be concluded that more work is needed to make quizzes successful and useful measures in the evaluation of computer-based learning.

6.10 The Next Step

A thorough redesign of the measures appeared necessary after this pilot study, for the reasons discussed earlier. The measures were therefore completely revised as described in Pilot Study 3 in the following section.

CHAPTER 7

PILOT STUDY 3: PARADOX AND EXCEL

7.1 Instrument Redevelopment

The introduction of two existing commercial software packages, PARADOX and Microsoft Excel, to Higher Ordinary Economic History students provided TILT-E with the opportunity to test redesigned evaluation measures. The earlier pilot studies found the TILT-E measures too long to be practical in a classroom situation. Much of the data collected had been discounted due to flaws and perceived irrelevancy by the TILT-E team. As the measures were redeveloped, it was decided that age, gender, and computer experience were the most relevant and quoted of the results in the earlier studies, so these were drawn from the previous version of the BQ (See Appendix 2.1) and placed into a new measure called the Computer Experience Questionnaire (CEQ) (See Appendix 3.1).

The software was to be introduced across time, presenting a new evaluation challenge for TILT-E. In this study, the taught classes took place over 4 weeks - 2 two-hour sessions on PARADOX, a week apart, and 2 two-hour sessions on Excel, again a week apart. The students were free to practice in between classes and so complete the worksheets that were linked to the computer teaching sessions. To keep track of 50 Higher Ordinary students across 4 teaching sessions and two terms meant that the students' computer use had to be logged, either by computer or by paper.

Having already encountered problems with computer logs in Pilot Study 2, the final decision taken by the teaching and development staff and the evaluators was to go with a paper measure, termed a 'Diary'. The Diary evolved from the Post-Package Evaluation Questionnaire (PPEQ) and the Computer Attitude Questionnaire (CAQ). Where the CAQ had been relied on to show shifts in attitudes, the Diary contained within it a new section called the 'Understanding Log' which was relied on to show shifts in understanding of the tasks the students had to complete. It was self-judged, i.e. completed by the students themselves, so was not objective. Unfortunately, there was no time available to perform a skills test to correlate with the understanding of tasks section. Had this been possible, some insight may have been gained into the validity and reliability of the Understanding Log.

The following sections describe the measures used in this study in more depth.

7.1.1 Computer Experience Questionnaire (CEQ)

The CEQ asked respondents for their name, matriculation number, date of birth and gender. It then went straight to Page 3 of the BQ used in Pilot Study 2 and listed questions BQ18-20, asking students about taught courses they had received. Much of the original instructions in the BQ were dropped, the table being considered self-explanatory by the evaluators. CEQ1 became the taught experience of computers, while CEQ2 went on to ask what packages the students had previously used.

The second page of the CEQ incorporated BQ21 and BQ22 (now CEQ3a and CEQ3b), which asked if the students owned a computer and if so what make it was. BQ23 (now CEQ4) and BQ24 (now CEQ5) were also included, asking students if they had regular access to a computer and who owned the computer they most frequently used. Also included were BQ25, ' How often would you say you use a computer?', now CEQ6 with an amendment from the BQ open-response to a fixed scale; BQ29, asking students what makes of computers they had used was now known as CEQ7, with an amendment from BQ open-response to a fixed-response scale; and finally BQ30, 'How often do you use the library 'on-line' catalogue?', now known as CEQ8 and with a response scale identical to CEQ6.

It was hoped that the CEQ would be faster to complete than the BQ, and so less frustrating for students. It was also hoped that the CEQ would provide evaluators with enough information to sketch an outline of the students' experience with computers in the same way as in earlier pilot studies.

7.1.2 The Diary

The Diary was developed from the experience of the first two pilot studies and consideration of the more useful prompts on the CAQ and the PPEQ (see Appendix 3.2). The first page consisted of 3 questions:

- D1 asked if the students had done any more work on the computer since the last time they had completed a diary. If the students answered yes, they were prompted to expand on the work they did.
- D2 asked whether the student worked alone; worked alone but sought help; worked with a friend using a computer each; or worked in a group of two or more. It left space for comments if the students felt they needed to add more.
- D3 asked the students to mark on a 7-point scale running from 0-6 whether they had spent more time working out how to use the computer or more time concentrating on the learning task.

7.1.3 The Understanding Log

On Page 2 of the Diary came the 'Understanding Log' (UL). This asked the students to indicate their understanding of each task they were supposed to be able to accomplish as a result of the teaching during the session. These tasks were effectively the learning objectives of the session, but only became recognised and known as such after this study. The answer options on the UL was a 4-point scale running from 'I fully understand' to 'I don't understand at all' (see Appendix 3.3). For example, UL prompt 1 stated 'Using the keyboard', and students then had to rate their understanding of using the keyboard. A space was available below the UL for respondents to add any additional comments.

7.1.4 Observations

Observation of the students' interaction with the teaching material was considered important to the success of piloting the measures in this study. This was largely because of the reduction of measurement, the length of the study, and the sort of teaching (i.e.

training in software use rather than a learning package), which were all different from the earlier pilot studies.

The purpose of the observation was also seen by TILT-E as a way of validating the paper measures and monitoring any unpredicted events. TILT-E was conscious of the fact that the paper measures may never be enough on their own because of their focus on predicted variables. At this stage, however, TILT-E was still hopeful of an empirical basis to their methods because of the endemic belief that quantitative data is more credible that qualitative data.

7.1.5 Semi-structured interviews

Semi-structured interviews were included in this study because of the loss of possibly explanatory data by their omission from Pilot Study 2. Like observation, it was hoped the use of this technique would not only add to the explanation of the evaluation, but would also validate the results collected by the paper measures.

7.2 Aim

7.2.1 Evaluators' aim

The aim of this study was to pilot greatly-reduced measures to evaluate computer-based learning situations occurring across time (i.e. with more than one exposure to the CAL both within and outwith the classroom). Eddie Edgerton was the lead evaluator in the PARADOX evaluation, assisted by the author i.e. he negotiated with teachers, confirmed design of measures, administered measures, analysed results and wrote the report. For the purpose of this thesis the data was reprocessed and reanalysed by the author, then written in a format suitable for this thesis. The author was the lead evaluator in the Excel evaluation.

7.2.2 Teacher's Aim

The Economic History Department required the students in this study to produce a word-processed essay in the second term of their second year. This required them to be familiar with and able to meaningfully use the PARADOX package, and also to be able to examine and analyse data on population and employment using the Microsoft Excel package, including inputting formula and printing out charts. The students had to be computer literate enough to produce this essay by the end of second term as a recognised and predetermined course requirement. To ensure that the tutoring and design of the course best met this ambition, the course co-ordinator approached TILT-E and asked for an evaluation of the teaching.

7.3 The Software

PARADOX was used to answer textual queries and retrieve information for the user from linked computerised census aggregates. Microsoft Excel was then used for its graphing and mapping abilities, with data and formula entry also required.

7.4 The Students

Fifty second year Economic History students were told that participation in the evaluation was compulsory. However, by the end of the study, which began in November 1993 and ended in January/February 1994, only 17 students (34% of the total sample) had completed all classroom-administered measures. Only these 17 students' results will be considered in this study. Four of these 17 students were male and 13 were female. The ages of males ranged from 19 to 33 years, while the ages of the females ranged from 18 to 51 years. Note all students on this course had attended a 2-hour tutorial about word processing at the start of the first term (October 1993).

7.5 Measures

The measures used in this study were:

- The Computer Experience Questionnaire (CEQ)
- The Diary
- The Understanding Logs (UL)
- Observation
- Semi-structured interview

These measures and their evolution are described in Section 7.1 earlier.

7.6 Method

Unlike the earlier pilot studies, the teaching sessions in this study were integrated into the curriculum. The packages were introduced and used during regular tutorial sessions with the students' usual tutor. There were 7 tutorial groups in this study, ranging in size from 3 to 14 students.

The students were introduced to the study at their first PARADOX lab session in November 1993. They were told participation in the evaluation was compulsory. They then completed the CEQ. They were given the first Diary to complete at the end of the 2-hour lab, and asked to complete the Diary every time they returned to use the computer whether or not it was in scheduled class time. A bundle of spare Diaries for out-of-class use was left in the lab, as was a box for posting the Diaries on completion.

The Understanding Logs were different for the two parts of the study, each containing tasks appropriate to the package under scrutiny i.e. one Log was developed for the PARADOX package, another Log for the Excel package. The package-appropriate tasks listed in the Understanding Logs were supplied by the course co-ordinator.

7.7 Results

7.7.1 The Computer Experience Questionnaire (CEQ)

The CEQ explored two aspects:

1) Taught courses in computing
2) Computer ownership, access and frequency of use

The findings are considered in the following subsections.

7.7.1.1 Taught courses in computing

Seven of the 17 students reported that they had received a taught course in computing. Table 7.7.1 lists the courses attended by student.

Table 7.7.1 - Computer-related courses attended

Student Number	Course details
1	1991, Intro to word processing, database and spreadsheets, 8 months, 3 hours per week, Motherwell College.
4	1991 Computing Studies 'O' grade, 1 year, 6 hours per week, Bannerman High School; 1992, Computing Studies 'H' Grade, 1 year, 7 hours per week, Bannerman High School.
6	1991 (no title) 1 year, 4 hours per week, Higher Secretarial Studies, Abronhill High School.
7	1991, Post-Grad certificate in Computing Studies, 8 months, 10 hours per week, Caledonian University.
8	1990, Introduction to computers, 3 months, 4 hours per week, Cardonald College.
11	1991, Apple MacIntosh, 9 months, 3 hours per week, Computing Science, Glasgow University.
13	1992, Introduction to spreadsheets, 6 weeks, 1 hour per week, Accountancy, Glasgow University.

The students with most computer experience on paper would appear to be Student 4, with a Higher grade in Computer Studies, Student 7 with her post-graduate certificate in Computing Studies, and Student 11, who studied Computing Science at the University. It seems reasonable to expect that none of the 7 students listed in Table 7.7.1 had any problem with the operation of PARADOX and Excel.

7.7.1.2 Computer ownership, access and frequency of use

Only 3 students reported owning a computer - Student 5 (a Commodore), Student 8 (an Archimedes) and Student 15 (an Apple Mac). However, Student 5 reported that she did not have regular access to a computer, and that the University owns the computer she most frequently uses. Students 8 & 15 most frequently use their own computer, and both report having regular access to it. Table 7.7.2 lists this finding and further information on computer use, including frequency of use, type of use, and make of computer.

Table 7.7.2 - Access, ownership frequency & type of use

Student Number	Regular access?	Computer ownership	Frequency of use	Frequency of library catalogue use	Packages used	Hardware makes
1	Yes	Parents	Once a week	Once a week	Word processing, Databases, Spreadsheets	IBM-Compatible
2	Yes	Father	Once a month	Less than once a month	Word processing, Graphics, Spreadsheets	Spectrum Laptop with word processor
3	No	University	Never	Once a month	Word processing, Games	Apple Mac, Sega, BBC
4	No	University	Less than once a month	Every 2-3 days	Word processing, Graphics, Databases, Games, Spreadsheets,	Apple Mac, Commodore, Sega, Amstrad
5	No	University	Once a week	Every 2-3 days	Word processing, Email	Apple Mac, Commodore, Sega
6	No	University	Less than once a month	Once a week	Word processing, Spreadsheets	Apple Mac
7	No	University	Once a week	Every day	Word processing, Databases, MS-DOS	IBM PC
8	Yes	Self	Once a month	Every 2-3 days	Word processing	Apple Mac, IBM-Compatible, Amstrad, BBC
9	No	n/a	Less than once a month	Every 2-3 days	Graphics and Games	BBC

Table 7.7.2 - Access, ownership frequency & type of use (Cont.)

Student Number	Regular access?	Computer ownership	Frequency of use	Frequency of library catalogue use	Packages used	Hardware makes
10	Yes	University	Less than once a month	Once a week	Word processing	IBM-Compatible, Amstrad
11	No	n/a	Less than once a month	Every 2-3 days	Word processing, Games	Apple Mac, IBM PC
12	No	n/a	Never	Once a week	None	None
13	No	n/a	Never	Once a week	Spreadsheet	None
14	Yes	University	Once a week	Once a week	Word processing, Games, Electronic mail	IBM-compatible, Sun Workstation, Sega
15	Yes	Self	Every 2-3 days	Once a week	Word processing, Games	Apple Mac, Commodore
16	Yes	University	Less than once a month	Every 2-3 days	MS-DOS	Apple Mac
17	No	Sister	Less than once a month	Every 2-3 days	None	Amstrad

Table 7.7.2 shows 12 students had previously used a word-processing package, while 6 had used databases and spreadsheets, and only two reported they had never used a package (Student 12 and Student 17). All used the library on-line cataloguing system, including the two who had never used a package. Student 17 reported using an Amstrad, (again, despite never using a package), while Student 13 did not list any computer make, but had used a spreadsheet. Only Student 12 (a male aged 33 years) reported never using a computer, never having access to one on a regular basis, never using a package and didn't list a computer make. However he, like Student 17, failed to regard the library on-line computer as a package or a computer.

7.7.1.3 Conclusions from the CEQ

The revised CEQ was much shorter than in the earlier studies and appeared on observation to be more easily completed. A general picture of prior computer experience is gained from the information provided by the students, although as seen from Table 7.7.2 consistency is still an issue.

7.7.2 The PARADOX Diary

As mentioned earlier, the Diary incorporated another measure, the Understanding Log. The findings from this latter measure are considered in section 7.7.3, later.

The Diary contained the post-sessions evaluation prompts, and probed 3 areas:

1. Use between scheduled classes
2. Working alone or with others, and help requests
3. Concentrating on package operation vs. learning session content

The following sections present the results of this measure for each student after both the first and the second PARADOX teaching sessions.

7.7.2.1 Use between scheduled classes

One student reported using a computer to perform work related to the Economic History course on the first PARADOX Diary they completed, stating 'Word-processing an essay on Apple Mac' (Student 15). Although specifically asked to leave Question 1 blank on the measure itself if they had never completed a diary before, Students 10, 11, 12 and 17 all answered the question (all stating they had not used a computer for Economic History work).

At the end of the second session the diary was administered again. Only two students reported doing any work since the last time they completed a diary:

Student 6 - 'Continued query work on Gorbals census.'
Student 12 - 'Archaeology computer class.'

7.7.2.2 Working alone or with others and help requests

Question 2 asked the students if they worked alone or with others during the session. On the diary completed after the first of the two PARADOX sessions, 12 students (71%) reported working alone but occasionally seeking help or advice. Two students (12%) reported working with a friend using a computer each. Three students (18%) worked in a group of 2 or more using the computer (Students 2,12 & 17). No student reported working entirely alone.

The students were given the opportunity to expand their answer by a 'Comments' prompt underneath Question 2. Only 3 students commented, and their statements are listed below:

Student 3 - 'When in difficulty it was hard to get back to screen wanted.'

Student 8 - 'Need advice.'

Student 11 - 'Helpful if you need advice.'

On the second diary, completed after the second PARADOX session a week later, the students answered in the same way as the first diary with the exception of 3 students. Students 4 & 7 now reported working completely alone, while on the first diary they had stated they worked alone but sought help and advice. Student 17 now worked alone but sought help and advice, whereas on Diary 1 she had worked with a group of two or more on the same computer. No student commented after Question 2 on the second diary.

7.7.2.3 Concentrating on package operation vs. learning session content

Question 3 attempted to discover how much time the students spent on operational issues rather than on coursework i.e. how much of a barrier to learning the content operating the computer was to them. Illustrations 7.7.1 and 7.7.2 show the results for the whole group on the answer scale itself. The number of students selecting each point on the scale is shown in bold above the relevant point.

Illustration 7.7.1 -Operation vs. content on PARADOX Diary 1

Discovering details of how to operate PARADOX	**3**	**2**	**2**	**3**	**3**	**2**	**1**	Concentrating on course-work problems and answers
	0	1	2	3	4	5	6	

Illustration 7.7.2 -Operation vs. content on PARADOX Diary 2

Discovering details of how to operate PARADOX	**0**	**1**	**0**	**2**	**2**	**6**	**5**	Concentrating on course-work problems and answers
	0	1	2	3	4	5	6	

One student gave an inadmissible answer at Time 1 (Student 1), selecting two points from the scale and writing one number in each box. One student gave an inadmissible answer at Time 2 (Student 7), marking two points on the scale.

Illustrations 7.7.1 and 7.7.2 show a shift upwards across the two testing times, with more students concentrating on content by the end of the second session. The shifts student-by-student are shown in Chart 7.7.1. This chart compares Diary 1's results (the x-axis) with Diary 2's results (the y-axis). The line drawn diagonally separates increase (i.e. focusing more on the content) from decrease (i.e. focusing more on operating the computer), those above the line increasing, and those below the line decreasing. The 2 students who had missing answers on the diary are excluded from this analysis, resulting in 15 students represented on the chart.

Chart 7.7.1 - Operation vs. content: Within-student results

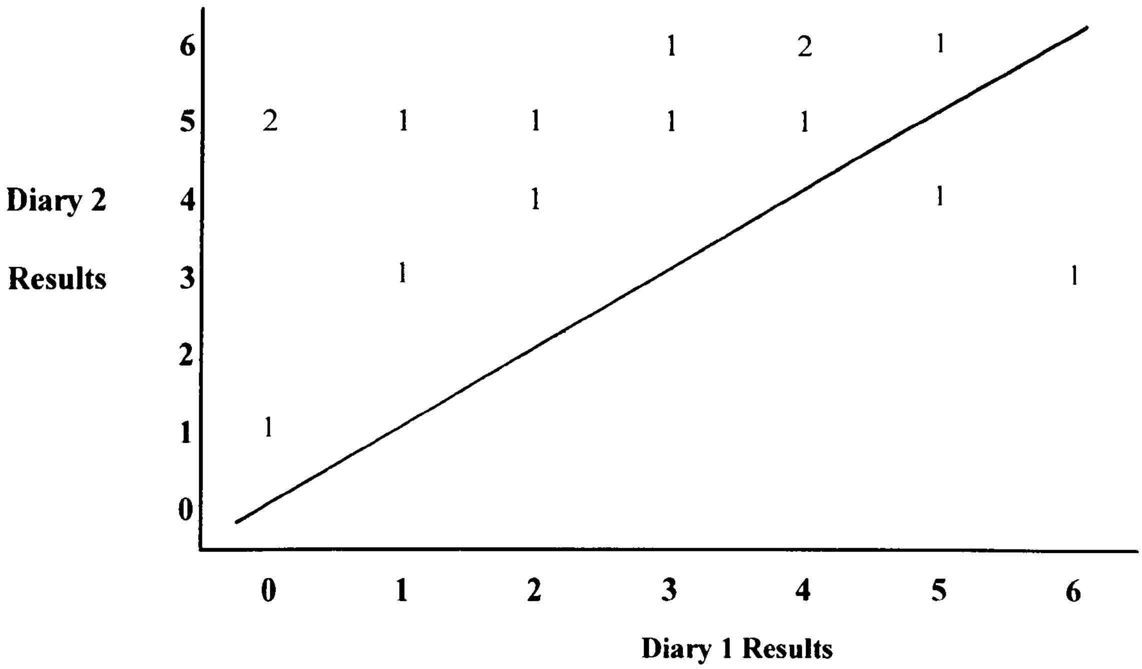


Chart 7.7.1 shows that while there is a general increase, 2 students have decreased over time. Student 11 dropped 1 from a rating of 5 on Diary 1 to 4 on Diary 2, while Student 8 fell from 6 to 3. This latter student stated that they were tired and unwell. Student 11 failed to given an explanation for their fall in performance.

Students were offered the opportunity to comment after Question 3, and 4 students chose to comment after Question 3 on Diary 1. Four students also commented after Question 3 on Diary 2, three of whom had commented at this point on Diary 1. The students' comments are listed by Diary below:

Diary 1

Student 7 - 'Beginning to 'just' understand the functions/working of the computer.'

Student 8 - 'Looking for KEY PAD *(illegible).*'

Student 14 - 'Once worked out how to use, its fairly simple to use.'

Student 16 - 'Most time was spent coming to terms with the programme.'

Diary 2

Student 3 - 'Getting better.'

Student 7 - 'I need more help with computers generally.'

Student 8 - 'Tired.'

Student 16 - 'Although there was still some problems adjusting to the programme (i.e. using computer) most of the problems were primarily due (to) using the correct input.'

Student 16's comment on Diary 2 does not make sense, an occasional occurrence when students are filling out the measures and rushing to get away. However, it seems likely he meant <u>in</u>correct input.

7.7.2.4 Later use of the PARADOX Diary

Only 1 student who returned to use the computers after the teaching sessions completed a PARADOX diary. The goal of the diary was to monitor all use of the package, both within and outwith class. In the case of Student 10 it was successful, as she went on to use the computer for PARADOX on two later occasions. Both times she used the computer alone, reported spending all her time on the content, and rated all 9 Understanding Log prompts as 'I fully understand.' She did not add comments anywhere on the diaries. It seems likely from these findings that she was finishing the work rather than returning because she had problems with the computer.

7.7.3 The Understanding Log

The PARADOX Understanding Log contained 9 key tasks the students were expected to understand as a results of the tutorial sessions, and these are listed below:

UL1 - Using the keyboard

UL2 - What the column names signify

UL3 - What the information contained in each column means

UL4 - Using the "VIEW" command to see the table contents

UL5 - Knowing what the "F keys" do

UL6 - Using the "ASK" command to make queries about age and birthplace

UL7 - Using the "ASK" command to make queries about occupations

UL8 - Using the "ASK" command to make queries about employment

UL9 - Using the "ASK" command to make queries about status

The Log asked the students to 'Please tick the box that best matches your understanding of the following topics during this session.', the 'topics' being the tasks listed from UL1 to UL9. There were 4 response points - 'I fully understand'; 'I mostly understand'; 'I am quite confused'; and 'I don't understand at all'. It was found that there were missing answers on every prompt on this measure, and the number of missing responses increased as the UL items moved further into the teaching objectives of the day. For example, UL1 had 2 missing answers, while UL9 had 8 missing responses. This problem was considered to occur in part because the students hadn't reached the later items in the teaching situation, and the UL design altered as a result before the Excel Diary was used.

To establish where changes in understanding, i.e. increases or decreases, were significant the sign test is used. The sign test is a non-parametric technique, which excludes cases with missing data and tied cases (i.e. non-movers over time), and treats the remaining cases as either positive (a positive shift over time) or negative (a negative shift over time). The number of positive cases are compared with the number of negative cases, and the significance of the distribution is calculated. In this study, 9 sign tests were performed, 1 for each task. None of the tests showed a significant difference in understanding across the two PARADOX Logs (See Appendix 3.4 for a listing of the results). Charts showing the results are displayed in Appendix 3.5.

7.7.4 PARADOX Observations

The results of the observation were fed back to TILT-E through an informal internal report (Edgerton, 1993). In it, Edgerton (1993) noted that the problems he observed related largely to students' use of the keyboard, and that students had trouble with basic skills such as deleting characters and using the shift key, a surprising findings given the amount of experience students reported on the CEQ.

In Edgerton's (1993) conclusion and recommendations, he stated that it was difficult to get students to fill in the diaries outside scheduled classes, and suggests that if resources were available it would be better to have the diaries on the computer in the same way the quizzes were on computer in Pilot Study 2. No resources were available for this, however, and the Excel diaries had to remain a paper measure.

7.7.5 The Excel Diary

The Excel diary was almost identical to the PARADOX Diary, and deliberately so, to test the design under different conditions with the same students. The only change was to Question 2, which was divided into 2 parts separating the worked alone/ worked in a group request from the help requests. The second part of the question also asked who they sought help from. The comments option was retained.

As with the PARADOX diary, three dimensions were considered:

1. Use between scheduled classes

2. Worked alone or with others and help requests

3. Concentrating on package operation vs. learning session content

7.7.5.1 Use between scheduled classes

Four students reported using a computer to perform work related to the Economic History course on the first Excel Diary they completed (Students 2, 11, 14 & 17). Student 12 failed to answer the prompt asking them what work they did, but the other 3 students did respond as follows:

Student 2 - 'Sandyford/Gorbals - used info. for essay.'

Student 11 - 'Second part of population worksheet.'

Student 17 - 'Went over the first term worksheet.'

All 3 students had gone back over the PARADOX work, but none had completed the Diary, despite the fact that Diaries had been left in the lab along with a box for collection.

At the end of the second session the Diary was administered again. Only one student (Student 11) reported doing any work since the last time they completed a diary, stating:

Student 11 - 'Population change and employment - the Scottish Dimension.'

Although no other student stated they had done any work since they last completed a diary, Student 14 answered the second prompt asking what work they had done:

Student 14 - 'Finishing of last term's Gorbals and Sandyford tutorial.'

Both students reported working on the PARADOX material.

7.7.5.2 Worked alone or with others and help requests

Twelve students reported working alone, 4 reported working with a friend using a computer each, while 1 student (Student 17) reported working in a group of 2 or more on one computer. All 17 students reported asking for help. Student 1 failed to state who they asked for help, but the other 16 cited the tutor. Other help sources were the evaluator (Student 2), and fellow students and friends (Students 3, 11, & 16). Student 15 reported asking 'Everyone.' Comments were invited under Question 2, and 5 students responded as follows:

Student 2 - 'Difficult.'

Student 8 - 'More help.'

Student 11 - 'Helpful.'

Student 12 - 'Helpful.'

Student 14 - 'After getting to know the calculations, no problem.'

Diary 2 found 11 students worked alone, 3 worked with a friend using a computer each (Students 4, 11 & 16), and one worked in a group of 2 or more (Student 2). All 17 students reported asking for help. Students 1 & 5 failed to state who from, while the remaining 15 cited the tutor. Other help sources cited were 'Everyone else I could find' (Student 8), 'Friends' (Student 11) and 'Partner' (Student 16). Again comments were invited under Question 2, and 8 students responded:

Student 2 - 'Needed help for every question.'

Student 6 - 'More help.'

Student 8 - 'New language: afraid of losing everything.'

Student 11 - 'They were very helpful.'

Student 12 - 'Helpful.'

Student 13 - 'Very helpful advice.'

Student 14 - 'No problems, programme well-explained.'

Student 16 - 'Sought advice from *(End of sentence).*'

7.7.5.3. Time spent on learning to operate the package vs. concentrating on content

Question 3 considered how much time the students spent on operational issues rather than on coursework. Illustrations 7.7.3 & 7.7.4 show the results for the whole group on the answer scale itself. The number of students selecting each point on the scale is shown in bold italics above the relevant point.

Illustration 7.7.3 -Operation vs. content on Excel Diary 1

Discovering details of how to operate PARADOX	**4**	**4**	**4**	**2**	**0**	**2**	**0**	Concentrating on course-work problems and answers
	0	1	2	3	4	5	6	

Illustration 7.7.4 -Operation vs. content on Excel Diary 2

Discovering details of how to operate PARADOX	**2**	**0**	**1**	**4**	**2**	**4**	**2**	Concentrating on course-work problems and answers
	0	1	2	3	4	5	6	

One student did not answer Question 3 on Diary 1 (Student 1), while 2 students failed to give a valid answer on Diary 2 (Student 7 & 8).

The Illustrations suggest there was a substantial shift upwards with more students concentrating on content by the end of the second session, as found in the PARADOX study. The shifts student-by-student are shown in Chart 7.7.2, comparing Diary 1's results (the x-axis) with Diary 2's results (the y-axis). The 3 students who had missing answers on the diary are excluded from this analysis.

Chart 7.7.2 - Operation vs. content: Within-student results

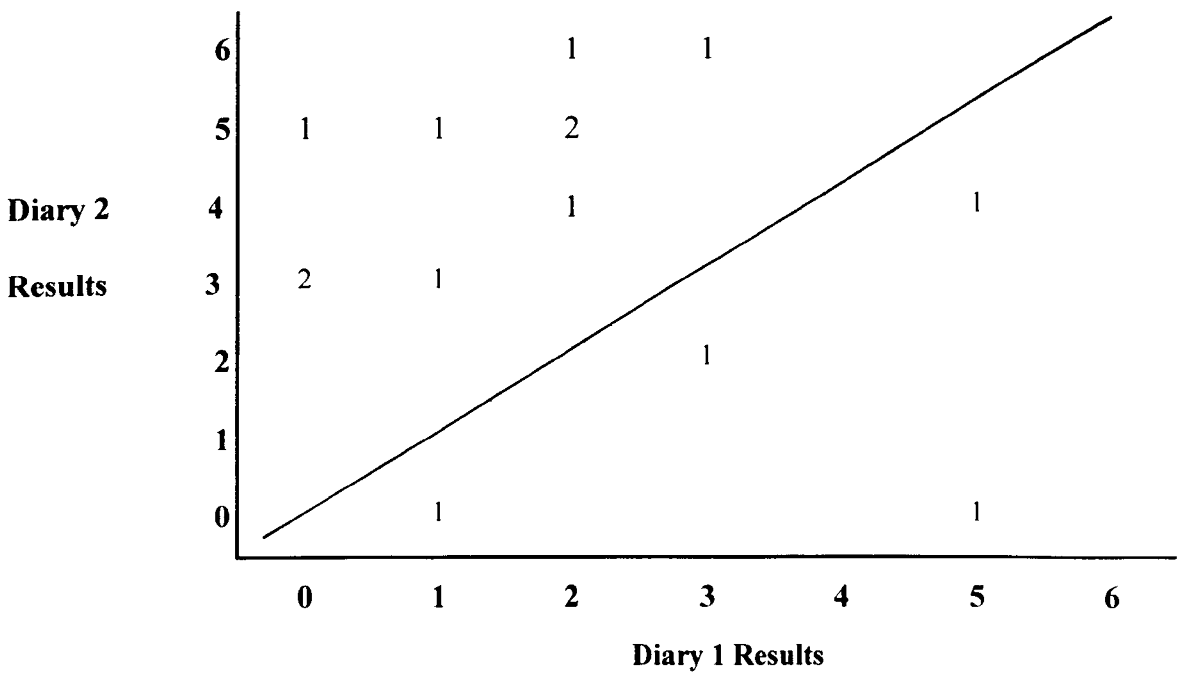


Chart 7.7.2 shows 4 students decreased in understanding over time (Students 3, 5, 15 and 17). The students were invited to add their comments after the Understanding Log, and their responses are listed by Diary below:

Diary 1

Student 1 - 'Found it quite difficult to operate so didn't bother about what it was doing.'

Student 2 - 'I found operating it quite difficult and worksheet hard to understand.'

Student 8 - 'Did all and still needed help. Two different tutors who both had different methods not a good idea.'

Student 16 - 'The coursework booklet was a good guide through the work, the majority of the problems encountered were due to the computer.'

Diary 2

Student 2 - 'Very difficult to understand. Too big a jump from last week.'

Student 3 - 'Got pretty baffled.'

Student 6 - 'Easy-read question leaflet would be useful i.e. basic knowledge: charting, save to a: drive, opening, closing.'

Student 14 - 'Easy to use & understand all aspects.'

Students 2 & 3 appear to be having difficulty at the close of session 2. In contrast, Student 14 felt the teaching was clear.

7.7.5.4 Independent use of the Excel Diary

Only 1 student (Student 4) completed the Excel diary outside the scheduled tutorials. She completed the diary between the first and second scheduled sessions. She reported that she had 'Used Excel - working back through handout for better understanding'. She reported she worked alone and didn't seek help, and that her time was spent evenly between using the package and concentrating on coursework. She stated that she had not reached Objective 7 'Adding texts and legends to graphs and charts' and Objective 8 'Moving between charts and worksheet', but fully understood Objectives 1 & 2, and mostly understood Objectives 3, 4, 5 &6.

7.7.6 The Understanding Log

The Understanding Log in the Excel episode was different in two ways from that used in the PARADOX episode, aside from the obviously different learning tasks. Firstly, the Excel Log had 8 rather than 9 objectives. Secondly, an extra response point on the UL scale was included which stated 'I haven't reached this yet', in an attempt to avoid the missing answers in the PARADOX study.

The Excel Understanding Log contained 8 key tasks the students were expected to understand as a result of the tutorial sessions, and these are listed below:

UL1 - Selecting active cells and entering text and numbers

UL2 - Loading files

UL3 - Saving a file to your own disk

UL4 - Entering formulas

UL5 - Highlighting: drawing graphs and charts

UL6 - Highlighting non-adjacent columns

UL7 - Adding text and legends to graphs and charts

UL8 - Moving between charts and worksheets

The Log asked the students to 'Please tick the box that best matches your understanding of the following topics during this session', the 'topics' being the tasks listed from UL1 to UL8. There were 5 boxes -'I fully understand'; 'I mostly understand'; 'I am quite confused'; 'I don't understand at all'; and a new column arising from the PARADOX problems 'I haven't reached this yet'. Again the sign test is used to analyse these results, comparing increases or decreases in reported understanding across the two Logs.

Eight sign tests were performed, 1 for each task. Four of these tests showed a significant difference in understanding across the two Diaries (See Appendix 3.6 for a full listing of the results), as listed below:

UL2 - Loading files ($p<.05$) (8 students increasing)

UL3 - Saving a file to your own disk ($p<.005$) (9 students increasing)

UL6 - Highlighting non-adjacent columns ($p<.05$) (8 students increasing)

UL7 - Adding text and legends to graphs and charts ($p<.05$) (7 students increasing)

The effects the inclusion of the 'I haven't reached this yet' prompt may have had is unclear, so the data is further explored in Charts 7.7.3, which lists the charts of UL1 to UL8. By examining the charts of both the significant and insignificant responses, insight may be gained into the effect of including the 'I haven't reached this yet' prompt, as well as giving insight into the nature and direction of the significant shifts.

Charts 7.7.3 - Charts of shifts in understanding over time

Chart 7.7.3a - UL1 Selecting active cells and entering text and numbers

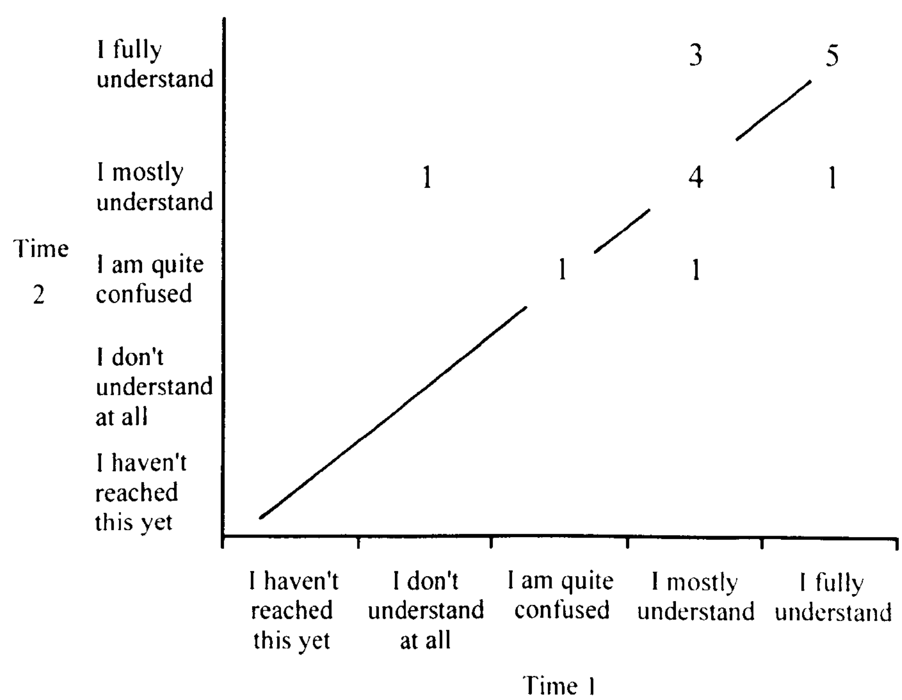


Chart 7.7.3b - UL2 Loading files

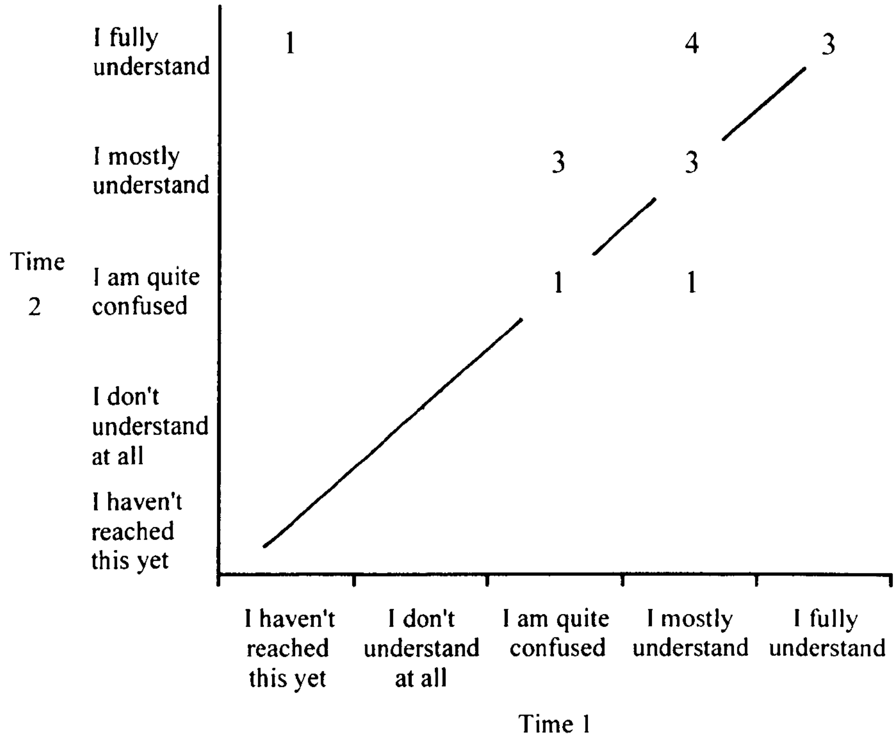


Chart 7.7.3c - UL3 Saving a file to your own disk

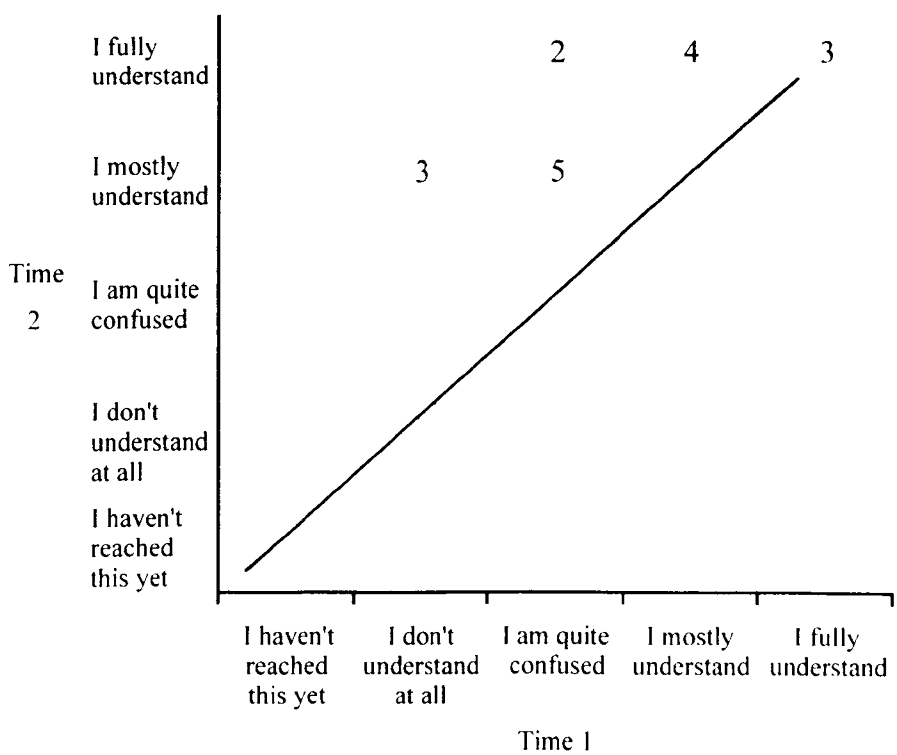


Chart 7.7.3d - UL4 Entering formulas

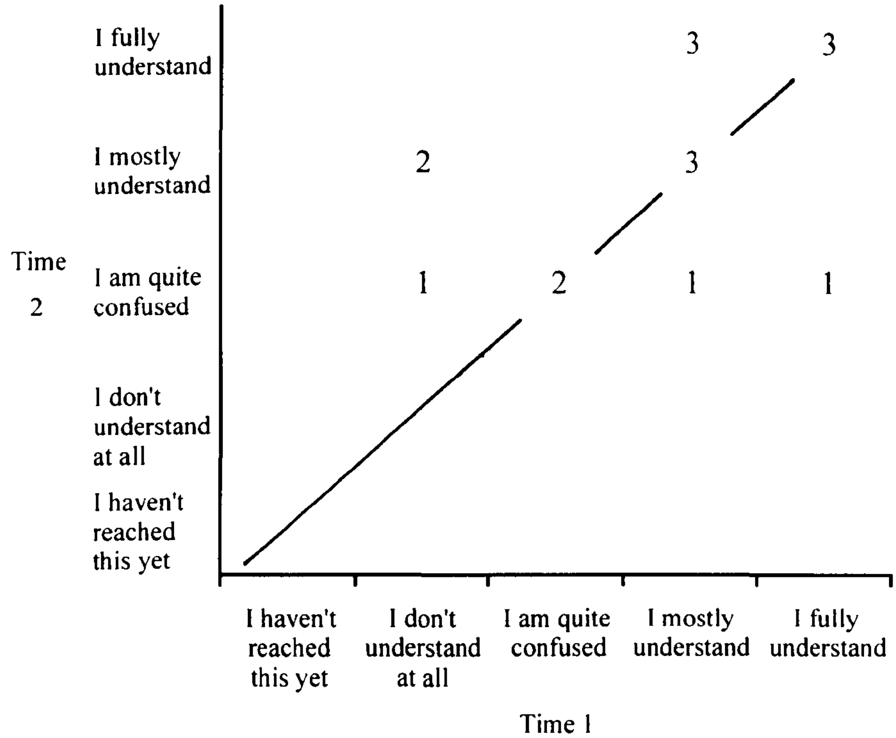


Chart 7.7.3e - UL5 Highlighting: Drawing graphs and charts

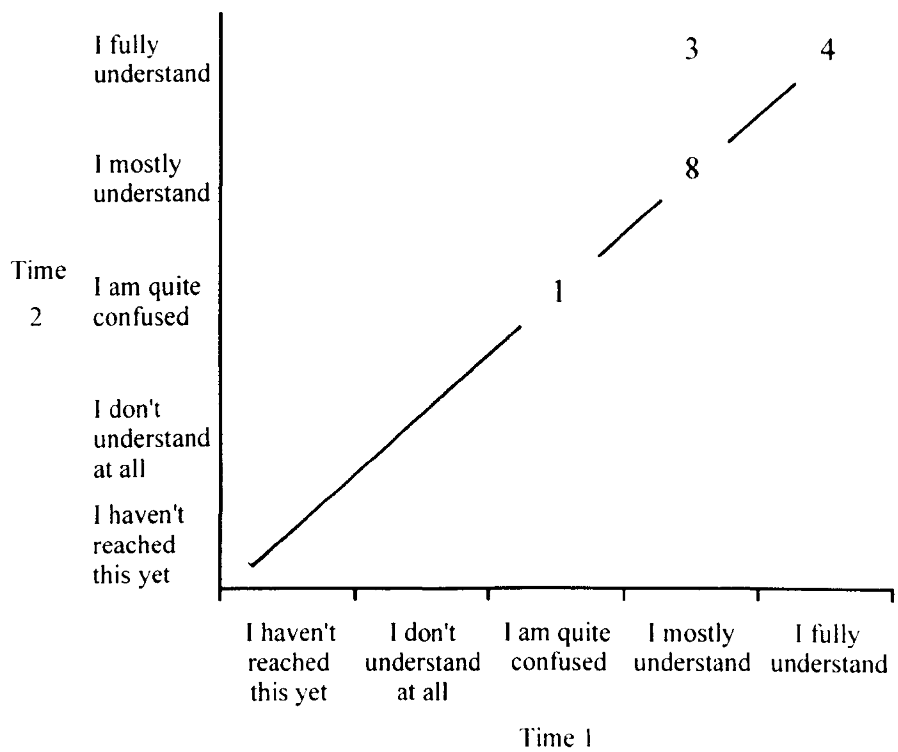


Chart 7.7.3f - UL6 Highlighting non-adjacent columns

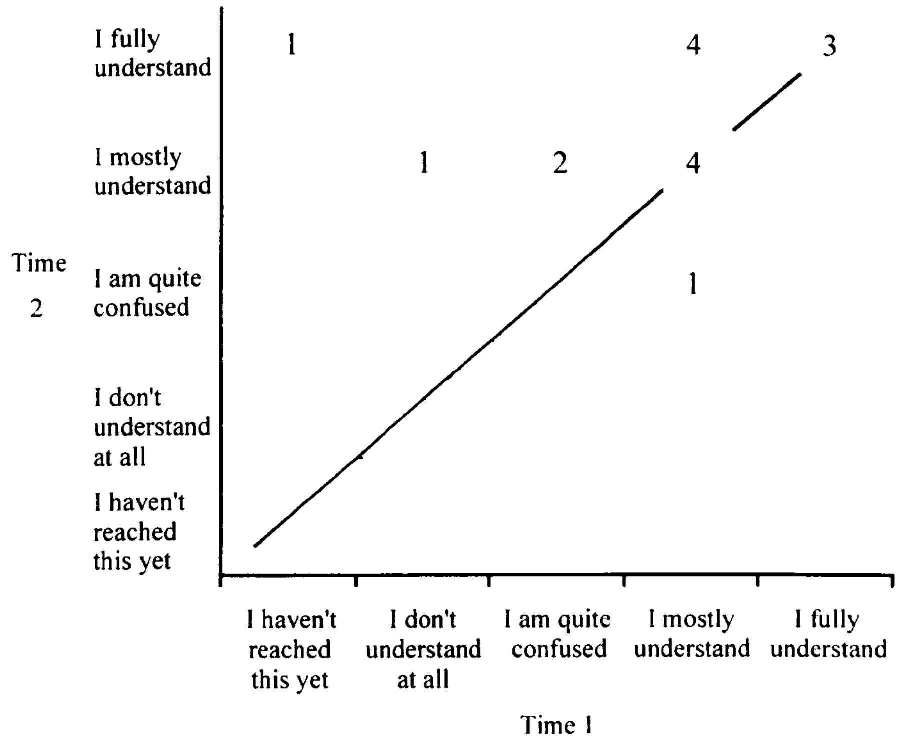


Chart 7.7.3g - UL7 Adding text and legends to graphs and charts

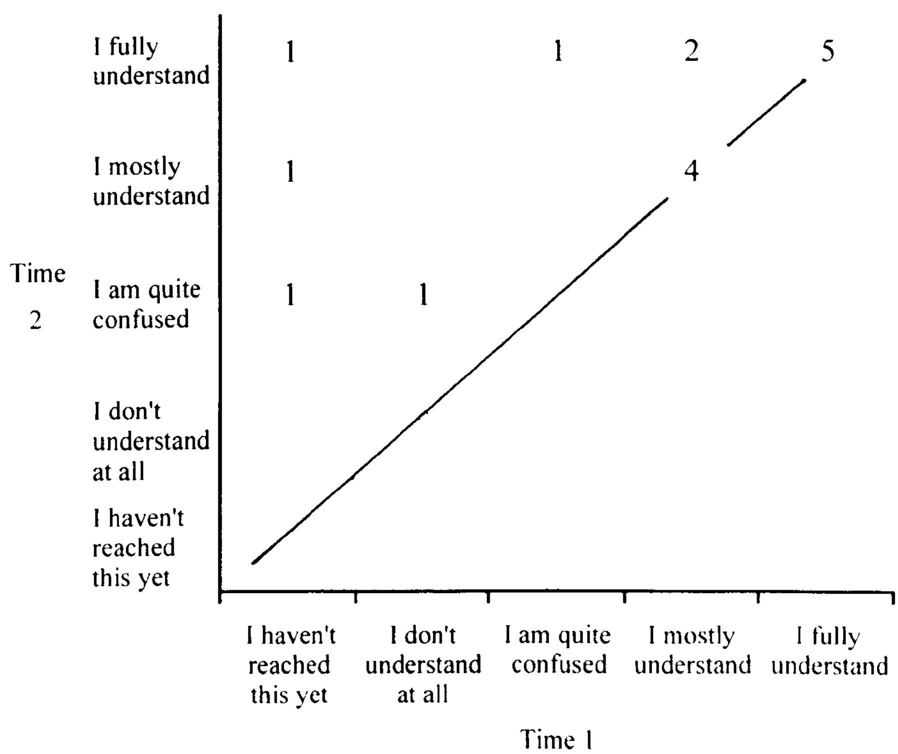
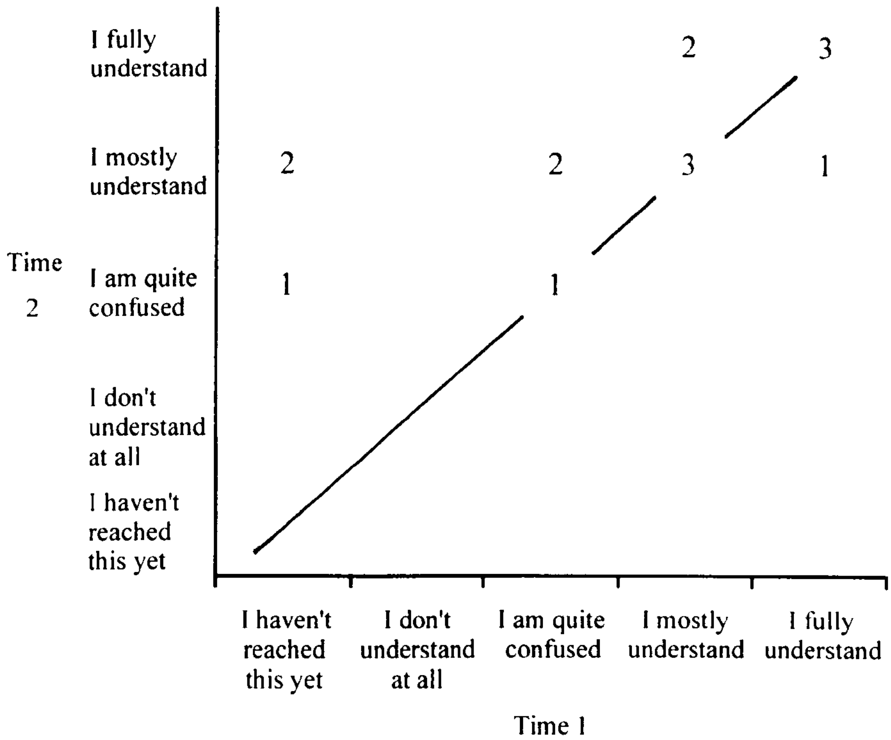


Chart 7.7.3h - UL8 Moving between charts and worksheets



Charts 7.7.3 suggests that any concern that the significant shifts shown by the sign test were a product of the 'haven't reached' response's inclusion was unfounded. It seems likely the students were in fact struggling with the material more at the first tutorial, and then making some headway at the second. In the PARADOX study, the students did not appear to have the same difficulty with the material or the computer, and hence did not have a significant difference in understanding across the tutorial sessions.

Students were also asked to comment at the end of the Understanding Log. Their comments for both Diary 1 and Diary 2 are listed below:

Diary 1

Student 16 - 'After some experimentation with each procedure most of the work was straightforward.'

Diary 2

Student 3 - 'Percentages increases etc. confuse my mind.'

Student 6 - 'Formulas difficult due to mathematic nature.'

Student 16 - 'Feeling more confident.'

Student 16 appeared to have no problems with the material. Students 3 & 6 on the other hand seemed to be having more difficulty.

7.7.7 Observations from Excel tutorial sessions

The evaluator took detailed notes of her observations. She was present in almost all labs over the fortnight and noted various points that the tutors were largely aware of. As with the PARADOX episode, the problems centered around keyboard controls, and in this case mouse control as well. Students were observed to have trouble with simple concepts like scrolling, and difficulty with activating more advanced commands accidentally, like moving data into a different column. It was observed and agreed amongst all tutors and the evaluation staff that the students were having difficulty mastering Excel, and noted that none had completed the first week's worksheet. As a remedial measure, all of the tutors were present at the first tutorial group's second week session to see how the 4 students got on with Worksheet 2. Help for these students was intensive. The two Monday labs (Groups 1 and 2) were told they were guinea pigs, and that they were not expected to get all the way through the worksheet. They left knowing they were supposed to come back to complete the worksheet and print out two graphs in their spare time, which were going to be assessed so it was essential that all students achieved this. However, there were no written instructions on printing given to the students. The lab manager gave a brief verbal introduction to printing with a visual demonstration on the computer-linked television. Unfortunately he was observed to go too fast in every presentation, and tried to tell the students too much. These observations was endorsed by the students during the interview reported later, when they stated that they could barely understand their notes on printing because they had scribbled them down so quickly and had not fully understood what the teacher was saying.

Anecdotal evidence was not considered until this study. During this study, it was observed that Student 7, a mature female student, had noted at the end of the second diary that 'I need more help with computers generally.' Yet looking back at her CEQ results she had a post-graduate certificate in Computing Studies. She used a computer once a week, the library on-line catalogue every day, and had used word processing and database packages, as well as MS-DOS. In the Excel observations, it emerged she had never used a mouse, and despite her 4 hours on PARADOX and 2 hours word-processing experience in the Autumn term, she had her arm at full stretch when she wanted the cursor to move, to the point where she was so far across the table she couldn't see the screen. This made the TILT-E team question the worth of gathering information about prior computer experience, and how misleading such information may be (Henderson, 1994).

From the findings of the observations the information gleaned from the diary questions seems reliable and valid, if very brief and lacking in detail. The observations roughly outlined why the students needed help and what the issues and difficulties were for the students. They appeared to give more detail than the diaries, and so themselves appeared at this stage to be a very important measure, especially if paper measures were to be kept short.

Observations are a good qualitative technique, but offer only the evaluator's interpretation of the situation. To verify these interpretations by collecting the students' thoughts of the Excel and PARADOX tutorial sessions, the evaluator attempted to recruit students for semi-structured taped interviews. The section below summarises the interview findings.

7.7.8 Semi-Structured Interview

Despite vigorous recruitment attempts, only two female students consented to participate in a semi-structured interview. They were interviewed together, and reiterated several points emerging from the data above. Both students believed they were being taught how to use computers because they would need it in the future. They proposed that mouse control, transferable commands e.g. saving, copying etc., and keyboard familiarity would have been much less intimidating and easier to learn if they had been taught these skills during the word-processing component of the computer teaching.

They also stated that 10 hours of computer use (i.e. the word processing, the PARADOX sessions and the Excel sessions) sounded a lot but wasn't long enough, and the more computer-naive student (Student B) suggested a detailed handout allowing them to work independently in class and in their own time would have been better. She also stated that the Excel tuition was too fast, and that the time constraints meant covering things once before being pushed on to the next thing (i.e. no time to practice). Further, she stated the amount of time the tutors spent helping certain students wasted her time and left her to work out a lot by herself.

Student A reported difficulty moving between labs because of an erroneous belief about software incompatibility. As a result, she thought she could only use the one small teaching lab they were taught in, rather than computer laboratories around the campus. Both students agreed a manual covering these issues would be very useful, as well as the basic 'open, close, save, copy, paste etc.' commands.

Both students reported they felt more confident about using computers as a result of the teaching. However they also felt that they would rather work to a large extent independently, as the classroom situation was intimidating (other students type faster; other students make you panic by asking questions you hadn't thought of etc.), and there was too much pressure (time constraints, tutor observation etc.).

Student A admitted she was just trying to finish the worksheet and that she didn't think she had learnt much, while Student B reported just finding her way around the package and not really concerning herself with the answers to the worksheet. She felt the worksheet actually detracted from learning the package and stated that you couldn't finish the worksheet (i.e. it was impossible), which Student A agreed with.

The students did feel that Excel was interesting and did appear to gain something from the experience. Student B felt she learnt more about using computers from Excel than PARADOX, although Student A felt Excel was more intimidating than PARADOX. The naive user felt Excel was more fun than PARADOX because 'It was just a bit different, quite exciting' (Student B).

7.8 Conclusions from Pilot Study 3

The two evaluation episodes in Pilot Study 3 illustrated difficulties with the learning situation, the greatest of which appears to be the lack of computer skills before using PARADOX and Excel and the size of the worksheet in the Excel tutorials. These issues were fed back to the teaching staff.

7.9 Methodological Conclusions from Pilot Study 3

From a methodological viewpoint, the studies suggest asking less questions in this study than the earlier studies was fairly successful, but it was still particularly helpful to back up the results with observations and interviews. Pilot Study 3 marked the beginnings of a shift in TILT-E methodology from a largely empirical and quantitative approach to a mixed method design.

7.10 Conclusions from the Pilot Study Section

The Pilot Studies traced the evolution of the TILT-E methodology from cumbersome and impractical measures to 3 brief questionnaires - the CEQ, the Diary and the Understanding Log. The value of qualitative techniques in the evaluation of CAL was emphasised, both for generating more information to contextualise the paper measure results, but also to validate the findings of the paper measures and assess their reliability. After the Economic History results, the TILT-E methodology had begun to take shape and the next section of this thesis considers the use of the methods, their changes and advances in later studies.

To trace the methods and their usefulness, 3 different packages/CAL experiences are considered in the following chapters:

Chapter 8 - The Fast Frac Study

This chapter examines the same package in classes spanning a period of 4 academic years, and considers the changing methodology of TILT-E and how it can be used in a comparative study situation. This study is unique amongst the TILT-E case studies in its experimental approach to the real-classroom situation, as it compares conventional teaching with computer-based teaching with a view to dropping the conventional teaching from the curriculum.

Chapter 9 - The GraphIT! Study

This chapter considers the evaluation of the same package across three different student groups - first year Accounting & Finance students, third year Sociology students, and a class of post-graduate Sociology students. By moving from the formative evaluation of the package through to these summative studies, the action research approach to evaluation is demonstrated. Then, through examining the package's presentation to differently experienced students, an attempt is made to gain insight into students' experience of using CAL. It also considers the question of the appropriateness of a fixed evaluation design based on TILT-E methods across three different populations using the same package. Finally, it examines the findings of logging package use on the computer and compares these findings to a prompt asking students if they would use the package again.

Chapter 10 - The NetSem Study

Finally, the NetSem intervention presents a completely different use of the TILT-E methodology, and allows further consideration of some of the issues arising in the above studies. This study examines the success of computer-based seminars in a Music Course. The intervention lasted a full academic year, and was assessed as part of the students end-of-year result. The students all had to write a seminar and post it on to the network, then discuss it and each other's seminars over email in tutorial groups. They were assessed on both the seminar and these contributions.

An action research approach to evaluation is demonstrated in the NetSem study. Also important to this study was ethnographical and naturalistic techniques, making some evaluation measurement informal yet effective. NetSem takes the TILT-E methods through the methodological and theoretical spectrum from the more empirical approach, as seen in the first Pilot Studies, to the naturalistic and ethnographical approach in marked contrast to the empirical paradigm.

CHAPTER 8

CASE STUDY 1: FAST FRAC

8.1 Introduction

The Fast Frac study offered the opportunity to assess a computer-based teaching method, the Fast Frac package, and compare it with a traditional lecture covering the same material. It involved using the TILT-E methods in three evaluation episodes in four years. The teacher had hypothesised that the package could replace her lecture, and hoped the evaluations could demonstrate this.

Although the package's teaching episode took only approximately an hour, as did the lecture, the package's integration into the course meant the opportunity to study its' effects arose annually. Hence the timespan of the study. Using the TILT-E methods across three different episodes over four years demonstrated the evolution of the methodologies over time. The methods were also tested for their ability to conclude whether a package could replace conventional teaching.

8.2 Aim

8.2.1 Evaluator's Aim

The aim of this evaluation was to assess the feasibility of comparative studies in the computer-based teaching and learning context. Further, the studies aimed to trace the evolution of the methodology across time, and determine its accuracy as a predictor of the ability of a computer-based teaching innovation to replace a conventional lecture. Finally, the third evaluation episode in this study afforded the opportunity to determine whether the Confidence Log could predict performance on the Quiz.

8.2.2 Teacher's Aim

The teacher wished to demonstrate through independent evaluation that the Fast Frac package could replace a lecture on the same topic.

8.3 The software

Fast Frac was a package designed for use on the Materials course given to students on the Bachelor of Technological Education degree course at the University of Glasgow.

The package was a 34-page HyperCard stack with illustrations and animated examples designed to teach students about fast fracture processes in various metals. It was developed at Glasgow University by Dr. M. Pollock and Mr. I. Turner as part of the TILT Project.

8.4 The Students

All students in these studies were from the Bachelor of Technological Education and Bachelor of Technology Studies degree courses, who were all taking a 'Materials' module. Twenty-three students in their third year participated in the first evaluation episode during academic year 1993-1994. The second evaluation episode involved 14 third-year students who participated in academic year 1994-1995. No biographical data (i.e. age and sex) was collected for either of these groups, who were predominantly mature male students.

The students in the third evaluation episode were from both second and third year due to an alteration in the scheduling of the courses. Thirty-six students took part in this study, 19 in the Package-First group (third year students only), and 17 in the Lecture-First group (second year students only). Age ranged amongst the Package-First group from 20 to 47 years (mean age 31 years), of whom 15 were male and 3 were female. One student failed to give their gender. Amongst the Lecture-First group age ranged from 19 to 45 years (mean age 27 years), with 10 students identifying themselves as male and 4 as female. Three students failed to give their gender.

8.5 Measures

The measures used in this study were similar across all 3 evaluation episodes in accordance with the TILT-E methodology. However, they did evolve over time as the following description of each measure shows.

8.5.1 Computer Experience

The first evaluation episode took place in April 1994, shortly after the Economic History pilot studies detailed in Chapter 7 earlier. At this time, the computer experience questions were still under scrutiny, and it was considered important to generate detailed information about the students' previous computer experience. This was collected through a number of questions, including previous training courses in computer skills, and previous experience of packages and networks.

It was becoming apparent to the TILT-E team that the computer experience information gathered was not useful for explaining the students' reactions to computer-based interventions, as it was inconsistent and difficult to measure accurately. Further, the teaching staff were uninterested in the information. This led to the removal of most computer experience questions before the second evaluation episode in December 1994, after which only minor changes were made before the third evaluation episode in February 1998. Comparable and non-comparable questions across the three evaluation episodes are considered in the following subsections.

8.5.1.1 Comparable questions

Only two computer experience questions were asked on the Pre-Test Questionnaire administered in February 1998. These questions were also asked on the pre-test questionnaires in the two earlier episodes. The first question asked 'How often would you say you use a computer?'. The second asked 'How confident do you feel about using a computer today?'. In the pre-test measure in April 1994 the wording of this latter question was slightly different, asking 'How comfortable and confident do you feel about using a computer today?'

For the purposes of the cross-year comparison in this study, only these computer experience questions asked in all three episodes will be analysed.

8.5.1.2 Non-comparable questions

The first evaluation episode in this sequence (April 1994) was conducted shortly after the pilot study in Economic History and contained many computer experience questions. Seven questions were asked on this measure which were not repeated in the later episodes, including questions about prior taught courses in computer skills, what hardware and software they respondents have used, and how skilled they felt they were at using a computer. The findings from these prompts are not reported in the *Results* section later because they cannot be compared with relevant findings from the two subsequent evaluation episodes.

Aside from the two questions discussed under *Comparable questions* earlier, the December 1994 evaluation episode included a third question not on the April 1994 or February 1998 measures of computer experience. It asked if the students owned or had constant access to a computer outside the University. Improvements in facilities within the University made this question obsolete by February 1998, as the students had 24-hour access to computers on campus.

8.5.2 Prior Topic Experience

The Pre-Test Questionnaires also asked the students about their previous topic experience, specifically if they had ever learnt about failure mechanisms in materials in either coursework or employment. This question was identical across all three evaluation episodes and is considered in the analysis reported later.

8.5.3 The Post-Task Questionnaires

The design of each of the evaluation episodes differed slightly. In the April 1994 episode, the whole class received the lecture, including an introduction and a video, then moved on to use the package. The Post-Lecture Questionnaire was administered after the lecture and before package use, and the Post-Package Questionnaire was administered after the package at the end of the teaching session. In December 1994, all the students received the introduction and video, and then went straight to package use without receiving the lecture. This group completed a Post-Package Questionnaire after using the package.

In the February 1998 episode, all students received the introduction and the video before the class was split by academic year. One group received the lecture then the package, whilst the other received the package then the lecture. For this reason the post-task questionnaire took different forms depending on what intervention it was assessing and when. The order of administration of the Post-Lecture Questionnaire and the Post-Package Questionnaire therefore varied. As these questionnaires would be administered at different times depending on the group, a Final Questionnaire was constructed and given to all students at the end of the teaching session in this evaluation episode only.

All post-task questionnaires asked the students if they needed help during the teaching intervention, and if so from whom, with the exception of the Final Questionnaire in February 1998.

8.5.3.1 The Post-Package Questionnaire

All three evaluation episodes had a Post-Package Questionnaire.

8.5.3.1.1 Comparable questions

There were 3 questions which remained very similar throughout the course of the three evaluation episodes, although there were some slight wording or response alterations. These questions are quoted below under the date of the evaluation episode, to allow easy comparison of wording and response options.

<u>April 1994</u>

1a) Did you seek help/advice

1b) If yes, from who and how often?

2) What did you spend most of your time doing during this computer session? Discovering details of how to operate the program; Concentrating on course-work problems and answers

3) Would you like to use this package again? Please explain your answer.

<u>December 1994</u>

1a) Did you seek help/advice

1b) If yes, from who and how often?

2) What did you spend most of your time trying to do when you were using Fast Frac? Discovering details of how to operate the package; Concentrating on subject-related problems and answers

3) Will you use the Fast Frac package again? Why/Why not?

<u>February 1998</u>

1a) Did you seek help/advice?

1b) If yes, who helped you? Lecturer Other student

1c) How many times did you get help from each source?

2) What did you spend most of your time trying to do when you were using Fast Frac? Discovering details of how to operate the package; Concentrating on subject-related problems and answers
3) Will you use the Fast Frac package again? Why/Why not?

8.5.3.1.2 Questions comparable in two of the studies only

Some post-test questions were asked in some evaluation episodes and not in others. They are described under the date of the evaluation episodes below.

<u>April 1994 & December 1994</u>

The Post-Package Questionnaires in these evaluation episodes both asked 'During this session did you work alone with others?'

<u>December 1994 & February 1998</u>

The Post-Package Questionnaires in these evaluation episodes both asked the following:

- What type of help did you require? Help related to the subject material; Help related to the operation of the package

- Did you learn anything from the Fast Frac package? If yes, please give one or two examples.

- Please list the things you particularly liked and particularly disliked about the Fast Frac package.

8.5.3.1.3 Non-Comparable Questions

There were no additional questions asked on the post-package measure in February 1998 that had not been asked in the two earlier questionnaires, and only one question 'Did you find the video useful?' asked in the December 1994 evaluation episode and not in the others. The April 1994 students were asked if they took notes and to quantify the amount, and if they would recommend the package to other students. These two prompts were discarded before the December 1994 study because the note-taking findings were confounded by writing size and line width, while the recommendation prompt was considered unnecessary, as the package was specifically for this course.

8.5.4 The Post-Lecture Questionnaire

8.5.4.1 Comparable questions

The Post-Lecture Questionnaire was administered in the first and last evaluation episodes only. The only question the 2 measures had in common asked about help requests. As with the Post-Package Questionnaires earlier, there were small wording and response differences in this prompt across the 2 measures. The two versions are listed by episode date below:

<u>April 94</u>

1a) During this session, did you seek help/advice?

1b) If yes, from whom and how often?

<u>February 1998</u>

1a) Did you seek help/advice?

1b) If yes, who helped you? Lecturer Other student

1c) How many times did you get help from each source?

8.5.4.2 Non-comparable prompts

In the first evaluation episode (April 1994) the students were asked 'How many times did you find the lecturer/tutors response to other peoples' help requests useful?'. The students were also asked if they had taken notes, and to quantify their note-taking. Finally, they were asked what proportion of their time was spent concentrating on the meaning of the lecture material as opposed to scribbling notes; losing the thread of the lecture etc. There were no comparable questions in the February 1998 measure.

The February 1998 episode asked the students if they learnt anything from the lecture and, if so, to give one or two examples of what they had learnt. It also asked them to list the things they particularly liked and particularly disliked about the lecture. There were no comparable questions in the April 1994 measure.

8.5.5 The Quiz

The Quiz was devised by the teacher, and its 10 questions remained the same throughout the three evaluation episodes. There were three question orderings, referred to as Version 1, Version 2 and Version 3. Version 1 was always administered at the start of the teaching intervention, Version 2 after the first intervention, and Version 3 after the second intervention, where applicable. In April 1994 and February 1998 all three quizzes were used, while in December 1994 only Versions 1 and 2 were necessary.

8.5.6 Confidence Log

The Confidence Log contained 5 learning objectives in the first two evaluation episodes (April 1994 and December 1994). In the third evaluation episode, the number of statements was increased to 10 to match directly with the quiz questions, making it possible to compare the students' confidence ratings with their actual performance and so assess the validity of the Confidence Log. Unfortunately, the 10-item Confidence Log was not comparable with the 5-item Log of the earlier two evaluation episodes.

The 5-item log asked the students about their 'understanding' of the learning objectives, whilst the 10-item Log asked if the students were confident they knew the learning objectives, an evolution of the Log across the evaluation episodes. Understanding was considered by the TILT-E evaluation team to be too elusive a concept, with multiple definitions. Instead, it was considered that asking the students how confident they were that they were either 'able to' or definitely 'know' the objectives would produce more accurate findings, as confidence was perceived by the group to have more basis in 'fact' than understanding.

The order of the objectives list in the Confidence Log did not change at any administration time in the three studies.

The Confidence Log asked the students for any additional comments at the end of the measure, and provided them with space to do so. This was standard over all administrations of the Log in the three evaluation episodes.

8.5.7 The Final Questionnaire - February 1998 only

The Final Questionnaire in February 1998 asked the students whether they thought the lecture could replace the computer package, which teaching method taught them most and why, and finally any other comments. These were not included in any of the earlier measures and were added in this third episode to assess any order effects on preference for learning resources. In fact, it found only 6% of the sample felt the lecture could be dropped in preference to the package, while the majority of respondents (approximately 60%) felt the lecture taught the material best. Approximately 30% felt that a combination was the most enlightening. No order effects were found.

8.5.8 Observation

The students were observed working through the package in all three evaluation episodes. This not only allowed some sense of the atmosphere and the issues perhaps missed elsewhere, it also verified that the students' introduction to the package was as similar as possible across all three evaluation episodes.

8.6 Method

The following study is a cross-year comparison of a teaching intervention, the Fast Frac package, manipulating the order and inclusion of conventional and computer-based teaching components. To facilitate this, there were three evaluation designs:

8.6.1 Episode 1 – April 1994

In this episode, the students were given the lecture and then used the Fast Frac Package. The measures used in this study were administered as follows:

Pre-Task measures, administered before the lecture at the start of the teaching session:

- Computer Experience Questionnaire including
  Topic Experience (See Appendix 4.1)

- The Quiz Version 1 (See Appendix 4.2)
- The Confidence Log (See Appendix 4.3)

Mid-Task measures, administered after the lecture but before the package:

- Post-Lecture Questionnaire (See Appendix 4.4)
- The Quiz Version 2 (See Appendix 4.5)
- The Confidence Log (See Appendix 4.3)

Post-Task measures, administered after the package at the end of the teaching session:

- Post-Package Questionnaire (See Appendix 4.6)
- The Quiz Version 3 (See Appendix 4.7)
- The Confidence Log (See Appendix 4.3)

In addition, the students were observed completing the measures and working through the package. They were not observed in the lecture.

8.6.2 Episode 2 –December 1994

In this evaluation episode, the students were given the package only and the lecture was dropped. The measures used in this study were administered as follows:

Pre-Task measures, administered before the package at the start of the teaching session:

- Computer Experience Questionnaire
  including Topic Experience (See Appendix 4.8)
- The Quiz Version 1 (See Appendix 4.2)
- The Confidence Log (See Appendix 4.3)

Post-Task measures, administered after the package at the end of the teaching session:

- Post-Package Questionnaire (See Appendix 4.9)

- The Quiz Version 2 (See Appendix 4.5)
- The Confidence Log (See Appendix 4.3)

In addition, students were observed working through the package.

8.6.3 Episode 3 -February 1998

In 1998 the second and third year students both took the Materials course at the same time. This allowed the class to be spilt into two groups by academic year. One group received the lecture then the package (second year students), while the other received the package then the lecture (third year students). Although there was a difference in academic year, both groups would have to sit the same exam on the same topics on this course as part of their assessment. They were therefore being treated as equal by the course staff, and so were treated as equal for evaluation purposes.

The measures used in this study were administered as follows.

Pre-Task measures, administered before the package at the start of the teaching session:

- Computer Experience Questionnaire
  including Topic Experience (See Appendix 4.10)
- The Quiz Version 1 (See Appendix 4.2)
- The Confidence Log (See Appendix 4.11)

Mid-Task measures, administered after the first intervention but before the second:

- The Post-Package Questionnaire (see Appendix 4.12)
- **or** the Post-Lecture Questionnaire (See Appendix 4.13)
- The Quiz Version 2 (See Appendix 4.5)
- The Confidence Log (See Appendix 4.11)

Post-Task measures, administered after the package at the end of the teaching session:

- The Post-Package Questionnaire (see Appendix 4.12)
- **or** the Post-Lecture Questionnaire (See Appendix 4.13)
- The Final Questionnaire (See Appendix 4.14)
- The Quiz Version 3 (See Appendix 4.7)
- The Confidence Log (See Appendix 4.11)

The students in both groups were also observed working through the package.

8.7 Results

To enable easy comparison across the three groups, the results in this study are translated into percentages, as well as represented by the number of students who selected each option or chose to comment.

8.7.1 Pre-Test Questionnaires

The Pre-Test Questionnaires examined three dimensions:

1. Frequency of computer use
2. Confidence in computer use
3. Topic experience

8.7.1.1 Frequency of computer use

The students were asked how often they used a computer in all three episodes. The response scale was consistent across all testing times. The results are shown by evaluation episode in Tables 8.7.1a, 8.7.1b and 8.7.1c.

Table 8.7.1a - Frequency of computer use by group: April 1994

	Every day	Every 2-3 days	Once a week	More than once a month	Once a month	Less than once a month
Number of students	6 (26%)	12 (52%)	4 (17%)	0 (0%)	1 (4%)	0 (0%)

Table 8.7.1b - Frequency of computer use by group: December 1994

	Every day	Every 2-3 days	Once a week	More than once a month	Once a month	Less than once a month
Number of students	4 (29%)	5 (36%)	1 (7%)	2 (14%)	1 (7%)	1 (7%)

Table 8.7.1c - Frequency of computer use by group: February 1998

	Every day	Every 2-3 days	Once a week	More than once a month	Once a month	Less than once a month
Package first	9 (50%)	8 (44%)	0 (0%)	1 (6%)	0 (0%)	0 (0%)
Lecture first	3 (18%)	9 (53%)	2 (12%)	2 (12%)	0 (0%)	1 (6%)

8.7.1.2 Confidence in computer use

All evaluation episodes asked the participants to indicate on a 5-point scale how confident they were about using a computer. The findings are shown in Tables 8.7.2a, 8.7.2b, and 8.7.2c.

Table 8.7.2a - Confidence in computer use: April 94

	Very Confident	Confident	Some Confidence	Little Confidence	No Confidence Whatsoever
Number of students	6 (29%)	3 (14%)	12 (57%)	0 (0%)	0 (0%)

Table 8.7.2b - Confidence in computer use: December 1994

	Very Confident	Confident	Some Confidence	Little Confidence	No Confidence Whatsoever
Number of students	2 (14%)	4 (29%)	6 (43%)	2 (14%)	0 (0%)

Table 8.7.2c - Confidence in computer use: February 1998

	Very Confident	Confident	Some Confidence	Little Confidence	No Confidence Whatsoever
Package first	4 (22%)	10 (56%)	3 (17%)	1 (6%)	0 (0%)
Lecture first	4 (25%)	4 (25%)	6 (38%)	2 (13%)	0 (0%)

The computer experience prompts do not show a marked difference between any of the groups. The respondents in the majority used a computer at least weekly, and had some confidence in their ability to use a computer on the day of the intervention.

8.7.1.3 Topic Experience

Respondents were asked whether they had they had ever learnt about failure mechanisms in coursework or employment. The findings are shown in Table 8.7.3.

Table 8.7.3 - Topic experience

	Have you ever learnt about failure mechanisms?	
Evaluation episode	**Yes**	**No**
April 1994	5 (24%)	16 (76%)
December 1994	4 (29%)	10 (71%)
February 1998 Package first	7 (39%)	11 (61%)
February 1998 Lecture first	8 (47%)	9 (53%)

The students in the February 1998 episode were more experienced than the students in the earlier episodes. This differences was more marked with the students who received the lecture first and then the package. The influence this extra experience may have had on the results, if any, should be seen in the Quiz results.

8.7.2 Post-test results

The following analysis of the post-test results considers questions which were common to either all the evaluation episodes, or at least 2 of the three evaluations episodes.

8.7.2.1 The Post-Lecture Questionnaire

Two evaluation episodes (April 1994 and February 1998) included the lecture in the teaching session. The Post-Lecture Questionnaire was administered at each of these episodes, although there were differences in the measures as discussed earlier. Both groups were asked if they needed help and advice, from whom and how often. It was found that 10 students in the April 1994 episode asked for help. Five reported asking the lecturer, while the remaining five asked friends and neighbours. Only one student reported asking for help more than twice, stating instead 'a few times' (Student 19 - April 1994).

In contrast in the February 1998 episode only 1 student in the Package First group reported seeking help, and stated they only asked the lecturer for help on one occasion. Two students in the Lecture First group reported seeking help. Both sought helped from the lecturer, one twice and the other 5 times. One also sought help from their student colleagues on one occasion.

8.7.2.2 The Post-Package Questionnaire

All three evaluation episodes had a post-package measure. As with the Post-Lecture Questionnaire, one question common to all three measures concerned help requests, from whom and how often. In addition, the respondents were asked in all three episodes to indicate the proportion of time they spent concentrating on operating the package versus concentrating on its content. All three measures also asked the students if they would use the Fast Frac package again.

In addition to the prompts above, some questions appeared on only two of the three measures. In April 1994 and December 1994 the students were asked if they worked alone or with others. In December 1994 and February 1998 the students were asked if they required help related to the subject material or help related to the package content. They were also asked if they had learnt anything from the package and to list the things they particularly liked or disliked about the package. These findings are considered in the following sections.

8.7.2.2.1 Help Requests

In April 1994 7 students (30%) reported asking for help. In December 1994 6 students (43%) reported asking for help. In February 1998, 5 students in the package first group (26% of the package first group) stated they sought help, while 3 students in the lecture first group (18% of the lecture first group) reported asking for help.

All students requiring assistance in April 1994 reported asking a neighbour or friend. None asked the demonstrator. In December 1994 help was sought only from the demonstrator. In February 1998, the 3 students in the lecture-first group reported asking for help from the demonstrator, and 1 of them also asked for help from their from colleagues. In the package-first group, all 5 students asked from help from their colleagues, and none reporting asking for assistance from the demonstrator.

Most students in all 3 evaluation episodes who sought help reported doing so only once or twice. One student (Student 8) in the February 1998 study asked for help from his colleagues 4 times.

8.7.2.2.2 Nature of help required - December 1994 & February 1998 only

Only 1 student in the February 1998 episode (3% of the February sample) asked for help related to the subject material (Student 27), and this student was from the lecture first group. The other 7 students (19% of the sample) who asked for help stated they needed assistance in operating the package. In December 1994, 4 students (29%) asked for help with the operation of the package. Two students (14%) reported requesting help related to the content of the package.

8.7.2.2.3 Collaborative Working - April 1994 and December 1994 only

In the April and December 1994 episodes, the students were asked if they worked alone, with a neighbour/ friend at a computer each, or in a group of 2 or more working at the same computer. All students in the December 1994 study reported working alone. In April 1994, the size of the group meant due to a lack a of computers the students had to share the machines. Twenty of them (87%) reported working with a neighbour or a group. Only 3 (13%) reported they had worked alone.

8.7.2.2.4 Operation versus Content

The findings of the prompt asking students what proportion of their time they spent concentrating on coursework versus concentrating on package operation are displayed on Illustrations 8.7.1a, 8.7.1b, 8.7.1c and 8.7.1d. Number of students selecting a particular point in the scale is shown in bold typeface about the scale itself in the illustrations.

Illustration 8.7.1a - Operation vs. content: April 1994

Discovering details of how to operate the package	**0**	**2**	**0**	**3**	**2**	**8**	**5**	Concentrating on course-work problems and answers
	0	1	2	3	4	5	6	

Illustration 8.7.1b - Operation vs. content: December 1994

Discovering details of how to operate the package	**0**	**1**	**0**	**2**	**1**	**5**	**4**	Concentrating on course-work problems and answers
	0	1	2	3	4	5	6	

Illustration 8.7.1c - Operation vs. content: February 1998 Package first

Discovering details of how to operate the package	**0**	**0**	**2**	**3**	**2**	**8**	**2**	Concentrating on course-work problems and answers
	0	1	2	3	4	5	6	

Illustration 8.7.1d - Operation vs. content: February 1998 Lecture first

Discovering details of how to operate the package	**0**	**1**	**0**	**6**	**3**	**3**	**3**	Concentrating on course-work problems and answers
	0	1	2	3	4	5	6	

8.7.2.2.5 Package Reuse

Students were asked if they would use the package again. Twenty-two students (96%) in the April 1994 episode said they would like to use it again. Twelve students (88%) in the December 1994 episode stated they would use the package again. In the February 1998 episode, 11 students (73% of respondents) in the Package First group stated that they would use the package again, while 13 Lecture First students (87% of respondents) reported they would use the package again.

The students in all 3 evaluation episodes were asked to give reasons for why the would or would not use the package again. Their responses are listed in Table 8.7.4.

Table 8.7.4 - Students' predicted package re-use

Stud. No.	April 1994.	Stud. No.	December 1994	Stud. No.	February 1998 Package First	Stud. No.	February 1998 Lecture First
1	Yes - It was a new experience	1	Yes - To take notes that are more detailed than the ones I took during the first session	2	No -I have made notes	1	Yes
2	Yes - Found it quite useful and easy to use	2	Yes - Left Blank	6	Yes - I will probably need to	3	No - I find reading off a computer screen difficult - I don't seem to absorb the information
3	Yes - To back-up knowledge already gained from lecture.	3	*Did not select Yes\/No response* - Not sure, may need it for revision on unclear areas	7	No - Prefer learning from book and written examples	4	Yes - Too check up on things and take notes for exams.
4	Yes - For revision purposes.	4	Yes - Interesting. Can work at my own pace	8	Yes - Only if necessary	5	No
5	Yes - Would be ideal for revision.	5	Yes - Left Blank	10	Yes - Not enough time to summarise notes let alone absorb all the info. Layout could have been more simple and concise.	9	Yes - I like different ways of learning
6	Yes - For revision	6	No - Too many other things to consolidate before exam without using package again, but I am not sure if I would use the package again	11	Yes - I may have more time available for proper note-taking.	19	Yes - Good information - backs up Maggie's lecture.
7	Yes - I enjoyed the package:- visual aids were good	7	Yes - If other suitable packages are available and revision exercises on the package used	12	Yes - Provide notes for the exams.	20	Yes - Found the package easy-to-use.
8	Yes - For a limited back-up only	8	Yes - Left Blank	13	Yes - Revision/ reinforcement/ study	21	Yes - If very stuck before exam.

9	No - Couldn't concentrate on it and found it very boring	9	Yes - Once mechanism of operation was learned, contents were very informative	14	No - Prefer reading from book	22	Yes - Quite easy to follow, good for reference.
10	Yes - Easy to use, simple language, could return to a page if I didn't fully understand it	10	Yes - In case I missed any information/ refresher	15	Yes	23	Yes - For a 'refresher' before the exams.
11	Yes - To refresh during study	11	Yes - To keep it fresh in my memory	16	Yes	24	(Missing)
12	Yes - For revision	12	Yes - Left Blank	17	Yes	25	Yes - Revision and updating ideas.
13	Yes - Left Blank	13	Yes - Allows one to work at one's own pace!	18	Because its informative	26	Yes - Study; Revision
14	Yes - I think the package clarified some points, but this could also be done by reading the recommended books	14	Yes - Very useful and easy to follow	30	Yes	27	Yes - Maybe. If I need info on subject.
15	Yes - Only on a one to one basis			32	Yes - Seems to have a lot of information that would need more time to digest.	28	Yes - Clear to understand.
16	Yes - Recap on subject matter			33	Yes - Fairly easy to use; Informative.	29	Yes
17	Yes - Left Blank			34	Yes - To make more detailed notes.	31	Yes - Reference
18	Yes - User friendly			35	Yes - Exam study and writing notes.		
19	Yes - For quick reference			36	No - Don't like using Apple Mac's. Information is easier to read from books.		
20	Yes - Perhaps nearer the exam. I have used the package several times before today						

Table 8.7.4 - Students' predicted package re-use (Cont.)

Stud. No.	April 1994.	Stud. No.	December 1994	Stud. No.	February 1998 Package First	Stud. No.	February 1998 Lecture First
21	Yes - After time has elapsed, and the lecture has sunk in, the package would provide a good method of study						
22	Yes - The material was well presented and clear. It would still need input from a lecturer first						
23	Yes - If I had a problem understanding or remembering I would go back to the package for information						

8.7.2.2.6 Learning from the package - December 1994 and February 1998 only

Thirteen of the 14 students in the December 1994 episode reported they learnt something from the package. One student did not answer the question (Student 3). In February 1998 all of the 18 Package First students who answered this question reported that they had learnt something from the package, while 15 (88%) of the Lecture First students reported that they had learnt from the package. Two (12%) in this latter group stated they did not. The students' answers to this prompt, including the examples of what they had learnt, are listed in Table 8.7.5.

Table 8.7.5 - Student self-reported learning and examples from package use

Stud. No.	December 1994	Stud. No.	February 1998 Package First	Stud. No.	February 1998 Lecture First
1	Most of the Forth Bridge steel is in compression; ductile materials are less likely to fail, due to crack propagation, than brittle materials are.	2	Yes - Gc=toughness	1	Yes - Difference between fast fracture and fracture. New formula to learn and new terms such as cleavage to continue learning.
2	The difference between the types of fracture	6	Yes - Cleavage is the breaking apart of interatomic bonds	3	Yes - Tended to reiterate information given in lecture.
3	Most of the questions asked in the questionnaire	7	Yes - Units; Formulae	4	Yes - What cleavage is
4	What cleavage is; The equations for fast fracture	8	Yes - Cleavage; Ductility	5	No
5	Ductile materials have high values of fracture toughness and brittle materials have low levels	10	Yes - K=Kc etc.	9	Yes - How to use it
6	Considering I knew nothing about fast fracture before using the package I have obviously learnt something from it e.g. two types of crack propogation	11	Yes - Brittle material fracture is known as cleavage.	19	Yes - Not so much learn but reinforce
7	-	12	Yes - Ductility; Cleavage	20	Yes - Brittle materials have low toughness; K=Kc
8	Stress intensity factor defined as MNm-3/2; units of toughness -Gc are defined as kjm-2	13	Yes - Formula	21	No
9	Equations; Examples and applications	14	Yes - Units, different types of failure.	22	Ductility; Stress fracture.
10	Ductile materials absorb more energy than brittle materials; Difference between cleavage and ductile tearing	15	Yes	23	Yes - What cleavage is.
11	Easy to follow as it showed each step of subject, and the equations where laid out step-by-step	16	Yes - Propogation of cracks	24	Yes - Crack propogation; Stress

Table 8.7.5 - Student self-reported learning and examples from package use (Cont.)

Stud. No.	December 1994	Stud. No.	February 1998 Package First	Stud. No.	February 1998 Lecture First
12	To search for more info on the topic on the page. This makes the user more involved in the package as opposed to 'flicking through' the pages	17	Yes - Cleavage relates to a brittle material; Crack in soft (ductile) material have a large plastic zone	25	Yes - Ductile - High fracture toughness; Brittle - low fracture toughness
13	Information on the subject matter, well presented	18	Yes - Formula	26	Yes - Intensity stress factor
14	Mechanism of fast fracture; Stress intensity relationships	32	Yes - Toughness, brittle examples	27	Yes - It just backed up info. I have already learned in lecture - but I did learn I suppose
		33	Yes - Units, Equations	28	Yes
		34	Yes - Animation gives better idea of what happens.	29	Yes
		35	Yes - Ductile materials will crack at low temperatures.	31	Yes - Propogation of cracks less likely in brittle material.
		36	Yes - Know about brittle/ductile materials		

Student likes and dislikes of the Fast Frac package

Students were asked what they particularly liked and what they particularly disliked about the Fast Frac package. The question was open-ended, and asked for written comments which are shown on Tables 8.7.6a and 8.7.6b.

Table 8.7.6a - Student likes

Stud. No.	April 1994	Stud. No.	February 1998 Package First	Stud. No.	February 1998 Lecture First
1	Simple (not to technical) language; Helpful graphics; Worked examples	2	Informative	1	Helpful lectures; Easy to package
2	Graphical demonstration of types of fracture	6	Ease of use	3	Plenty of information
3	Go through at your own pace	11	Diagrams/animation	4	Go through it at your own pace.
4	Easy to understand; Could go back in programme if something was not understood	12	Easy to use; Step-by-step guide	5	Working at own pace
5	The fact that you could take your time on the areas you, yourself needed to go back and re-read the material	13	Simple & straighforward - intuitive to use; Good explanations & keys to formulae	9	Working at my own pace
6	Could use package at your own pace, and if you needed to look at something again you could	14	Step-by-step approach, keeps you moving until end. Do not tend to stop.	19	Easy to follow
7	Own pace through the package	15	Good way of learning	21	Working at own pace.
8	Easy to use, easy to interpret, take notes	16	Step-by-step information	22	Easy to follow.
9	Ability to revise or go over again certain material	17	Clear to understand	23	Pictures. Easy to understand. Go through at your own pace.
10	Study at own pace; video clips; easy to use	32	Simple to operate	24	Ease of use
11	Covered subject well	33	Demonstrations; Explanations.	25	Students pace learning; Interactive activities but could be more and more interesting

Table 8.7.6a - Student likes (Cont.)

Stud. No.	April 1994	Stud. No.	February 1998 Package First	Stud. No.	February 1998 Lecture First
12	Interactive interrogation & the hints that there may be more to find out on a particular page	34	Liked - However, need more time to take better notes.	26	Taken at own pace
13	Facility to go at one's own pace, (illegible) to go back if necessary	35	Reasonably informative	27	Having time to browse and let info. sink in.
14	Easy to follow - moving demonstrations			28	Way information presented.
				29	Examples

Table 8.7.6b - Student dislikes

Stud. No.	April 1994	Stud. No.	February 1998 Package first	Stud. No.	February 1998 Lecture first
1	Did not know when, or if, I had viewed the whole package	2	No trial questions to test K.I.	3	Difficult reading and absorbing from screen
3	Didn't know how many pages were on it	6	Could not find calculations on package.	4	Hard to concentrate on.
4	Video parts - picture quality was poor	10	Need some colour to highlight important points	5	Boring!
5	You had no idea of how long the package was	11	Too many equations repeated.	19	A little (illegible)
6	The lack of instruction on how to use the package -> did not know if entire package was covered or not e.g. especially in fan test examples	12	No worked examples	22	Don't feel as though I learned as much as I did in the lecture.
9	menu system on bottom left	14	Non-colour; reading off monitor.	23	Hard to concentrate; Colour would be good
10	size of video clips; amount of support material (notes)	15	Using Apple Mac computers - too slow	25	Lag in time due to system; Text at side should be click and then read forcing you to read everything
12	I didn't know when I had discovered everything on a page.	16	Not enough information i.e. worked examples of MPa in pressure vessels	27	Not being able to quesions about what it is talking about when unsure.
13	The word cleavage in 'brittle fracture' is not shown during the diagrams etc. only on the first page	17	Getting info.	28	Hard to pick out important info.
14	I don't have a computer - so I would have liked some printouts	32	Far too much information on each page.	31	Presentation i.e. little colour.
		35	It wasn't clear how to use it initially - help desk may make matters easier.		
		36	Apple Mac's too slow; No colour.		

8.7.3 The Confidence Log

8.7.3.1 April 1994 and December 1994

The Confidence Log was administered with each questionnaire with the aim of assessing the students' confidence in being able to fulfil the objectives at each testing time. The objectives listed were identical over the two studies. The April 1994 students completed the Confidence Log at 3 time - pre-session, post-lecture, and post-session (i.e. post-package). The December 1994 class completed the measure on two occasions - pre-session and post-session.

To establish where confidence increases or decreases were significant, the sign test is used. The sample is reduced by the exclusion of cases with missing data, tied cases, and in the case of the December 1994 group, students selecting 'Not covered this yet' (minimum number of valid cases for both groups was 5). The reported confidence is then compared for each objective over time. All valid cases in the December 1994 group significantly increased in confidence ($p<.05$). Similarly, all comparisons in the April 1994 group (Time 1 x Time 2, Time 2 x Time 3, Time 1 x Time 3) showed significant increases, apart from Objective 4 - 'Know some of the factors that cause fast fracture e.g. as in the liberty Ships', where there was no significant shift between the Post-Lecture and the Post-Package measures (7 valid cases, 3 students reported a decrease in confidence) (see Appendix 4.15 for a full listing of these test results).

8.7.3.2 February 1998

The Confidence Log in the February 1998 evaluation episode was deliberately matched to the 10 Quiz questions to allow comparison of confidence and performance. However, as the students were divided into two groups and presented the material in different orders, it is interesting to examine the Log data to assess any influence order may have had on confidence in being able to fulfil the learning objectives.

A sign test was performed for each time-wise comparison, as in the April 1994 episode above (Time 1 x Time 2, Time 2 x Time 3, Time 1 x Time 3). All differences between pre-test and mid-test and pre-test and post-test were significant for both the lecture first and the package first groups ($p<.05$), with the exception of the package first group's performance on Objective 10 between pre-test and mid-test. This result was approaching significance. Between mid-test (post-lecture) and post-test (post-package) the lecture first group significantly increased in confidence on only two objectives, Objective 1 - 'Know the association between crack propogation and material toughness', and Objective 7 - 'Know the mechanism of fracture for a brittle material.' The package first group significantly increased in confidence after receiving the lecture on Objectives 1 and 7 also, along with Objectives 3, 4, 6, 8, and 9. Objectives 2, 5 and 10 showed no significant increase in confidence after the lecture (see Appendix 4.16 for a full listing of these test results).

In summary, after the first teaching intervention regardless of whether it was the package or the lecture, there was a significant increase in confidence amongst each group. Where the second teaching intervention was the package, the group increased in confidence on only 2 objectives, while the lecture as the second teaching intervention caused confidence to significantly increase on 7 of the 10 objectives.

By examining the results of the Quiz across all three evaluation episodes it may be possible to determine whether performance was most improved by the lecture, the package, or both. From the February 1998 results, by comparing the Quiz and the Confidence Log results it may be possible to assess whether the students' self-reported confidence mirrored their performance or was independent of it.

8.7.3.3 Post-Confidence Log comments

In all three evaluation episodes and at each Confidence Log administration time students were invited to comment after they completed the Log. Their comments are listed by evaluation episode and administration time below.

April 1994

Pre-test comments:

Student 2 - 'Only learned about it because I had to investigate a material for a report and these properties were discussed.'

Student 14 - 'My experience is very much based on practical situation.'

Mid-test comments:

Student 4 - 'Ask me again in a week.'

Student 14 - 'These levels will rise as I study the material and read the recommended books.'

Post-test comments:

Student 2 - 'Would not want no lecture input at all! I found the computer stack not very interactive - left only to click on parts and read things, which after a time would be quite boring and concentration would wander. Good as a means of reinforcement.'

Student 3 - 'I liked the computer program for its ability to show the fractures, but I needed the lecture for a good explanation. Without the lecture I think I could have not have understood.'

Student 4 - 'I feel the use of the computer package is very useful for revision. No notes were taken because the notes received were adequate. If you have a problem when using the computer alone for the first time need to know someone is available to assist. Better to work together so can bounce ideas off each other.'

Student 5 - 'The computer programme although very good would not be as useful as live lectures, since interactive discourse between lecturer/student, I feel is very important in the learning process. This programme could be used prior to the lecture as an introduction, or post-lecture as a revision tool.'

Student 6 - 'Using the computer was only reinforcing what (the lecturer) taught us. I would not have understood the material as what I do. (Or think I do). The computer would be good to "come back to" so I wouldn't need to find Maggie.'

Student 7 - 'I think the computer package should have come before the lecture. I do think however that there needs to be a human element. I do not think that one learning situation is any better than the other. Personally, I enjoyed the computer package, although I still feel that I need the opportunity to ask questions.'

Student 8 - 'An enjoyable study session which I hope makes my understanding of fast fracture easier to comprehend.'

Student 9 - 'The computer session didn't add anything to my knowledge on the subject.'

Student 11 - 'The lecture was inferior due to the amount of info and the inclusion of background information.'

Student 12 - 'Could replace lecture if used with video.'

Student 13 - 'Thought lecture was better. However program is good as an additional resource.'

Student 14 - 'I think that the differing teaching methods help by giving different points emphasis. Thus, helps clear up different problems.'

Student 17 - 'The lecture from the tutor is still necessary as he/she can command interest. Mind you, with the computer package you're able to go back and refer to it for studying if you get a copy of the package.'

Student 18 - '1. Computer session is very good, but still would need tutor available to answer questions. Computer needs anecdotal output as well, to help student remember i.e. video about the "Liberty" boats + crack propagation. 2. Questions/answers sessions through the programme would be beneficial.'

Student 20 - 'I preferred the video. It held my interest and motivated me to learn by showing practical applications of the subject. Lecturer didn't hold interest by saying things like "This is not needed for the exam." People tend to be motivated by things which will be in the exam. Lecturer's notes were good. I don't think people greatly attempt to understand lectures at great depth, so much as to obtain a good set of notes which can be used in revision before the exams. I would need to be motivated by the computer - more effort on me to learn. The novelty would wear off too quickly.'

Student 21 - 'Individual machines are definitely required!'

Student 22 - 'The video was very good in providing a background and history. The lecture was necessary to give hard information and to answer questions. The computer package provides a resource for reinforcement of the lecture.'

<u>December 1994</u>

No comments made on pre-test

Post-test comments:

Student 6 - 'If these packages are used then some lecturers may use it as an excuse for doing very little. It is okay if they are only used once in a while.'

Student 9 - 'Enjoyable package but initial difficulty with menu system - quickly overcome however.'

Student 10 - 'Could have used an introduction for 5-10 minutes to explain the use of package.'

Student 11 - 'Fairly good package.'

Student 14 - 'A useful exercise but why didn't the modern fan appear?'

February 1998

No pre-test comments made

Mid-test comments:

Package First Group:

Student 11 - 'Time was very limited, leading to you rushing through programme.'

Lecture First Group

Student 1 - 'Handouts are great.'

Student 4 - 'Why thank you.'

Student 19 - 'Some confidence in most areas but looking at the notes in my own time will help me greater.'

Post-test comments:

Package First Group

Student 31 - 'Reference in notes will improve confidence factor, as recall will improve depth of knowledge received (e.g. revision).'

Lecture First Group:

Student 34 - 'With more time I think I could become very confident in all aspects.'

The students in April 1994 commented at great length after the Confidence Log, and considered several aspects of the teaching and learning situation. This was in response to a prompt by the evaluator to give their opinions of the teaching session in the comments space on the Confidence Log, as she realised there was no question on the measures gathering this kind of information in that evaluation episode. The later evaluation episodes rectified this by including prompts about learning and likes and dislikes.

8.7.4 Quiz Results

The Quiz was administered before and after each intervention. The April 1994 and February 1998 groups completed the quiz 3 times - before the first intervention, after the first intervention, and after the second intervention. The December 1994 group completed the quiz before the package, and then again after the package. The Quiz was identical for all studies, and at all times. Only question order changed for each reiteration of the quiz, and this has been corrected in the following analyses.

8.7.4.1 Total Score

Total score for each student was calculated using correct answers only. These were assigned a value of 1 and totaled, giving a score out of 10. The group means are shown on Table 8.7.7.

Table 8.7.7 - Quiz Score Means By Group

	Pre-test	Mid-test	Post-test
April 1994	1.04	8.52	8.83
December 1994	0.71		8.50
Feb. 1998 Package first	1.278	5.632	7.563
Feb. 1998 Lecture first	0.412	5.589	6.5

Paired t-tests were performed on the total scores from each of the 4 groups. The students from the December 1994 episode were found to significantly increase their total score over time ($t=21.28$, df 13, $p<.001$). Significant increases in total score was found for the April 1994 group between pre-test and mid-test ($t=28.14$, df 22, $p<.001$), and between pre-test and post-test ($t=31.71$, df 22, $p<.001$). No significant difference was found between mid-test and post-test score.

In the February 1998 episode, highly significant improvements in total score amongst the Package First group were found between pre-test and mid-test ($t=8.74$, df 17, $p<.001$), and between pre-test and post-test ($t=15.92$, df 15, $p<.001$). Comparison of mid-test (after the package) and post-test (after the lecture) also found a significant difference ($t=2.81$, df 15, $p<.05$), with the students scoring higher on the quiz after the lecture.

Lecture First students also improved significantly between the pre-test and the mid-test ($t=9.40$, df 16, $p<.001$), and between the pre-test and the post-test ($t=13.16$, df 15, $p<.001$). They too showed a significant increase in score between mid-test and post-test ($t=2.24$, df 15, $p<.05$), unlike the students in the April 1994 study.

8.7.4.2 Differences between groups - February 1998

Unlike the earlier two evaluation episodes, the February 1998 investigation had two groups running simultaneously through the teaching interventions, though in a different order. Statistical comparison between these groups' total scores at each time may provide more insight into the results, particularly in assessing the similarity of the group profiles at pre-test, mid-test and post-test.

An independent 2-tailed t-test was performed to assess the difference between the 2 groups at each of the testing times. The students who received the package first then the lecture were found to score significantly higher at pre-test than the students who received the lecture first then the package ($t=2.83$, df 30, $p<.01$), although a similar number of students had reported prior experience of the topic on the Pre-Test Questionnaire. This significant difference was not found at mid-test, although a result approaching significance was found at post-test ($t=1.72$, df30 $p<.1$), with the package first group performing better on total score than their lecture first colleagues. A conclusion from this result could be that the lecture was slightly more effective at increasing knowledge than the self-paced package.

8.7.4.3 General differences between groups

The findings on Table 8.7.7 earlier suggest that the April 1994 and December 1994 groups achieved better results after the teaching interventions than their February 1998 counterparts. However, the conditions under which the students were tested varied, with more opportunity for discussion between students in the 1994 studies than in the more strictly-controlled 1998 episode. Further, the students were not as closely monitored in the earlier two evaluation episodes, and may have used their notes during their Quiz completion. The evaluator in the February 1998 episode was more aware of this possibility, and the students were specifically told not to use any method of assistance in Quiz completion. The extent of assistance in each of the earlier evaluation episodes is unknown, and this issue prevents comparison between the episodes.

8.7.5 Confidence Log and Quiz Performance - February 1998

Spearman's rank correlation coefficient is used to test the relationship between the Confidence Log data and the Quiz result data. This non-parametric method was chosen because of the small sample size and because the data is ordinal. Table 8.7.8 shows the significant findings only (see Appendix 4.17 for a full listing of these test results).

Table 8.7.8 – Correlations of confidence and quiz performance

	Package first	Lecture first
Objective 1	Time 1: coeff. = -.504, n=18, p=.016 Time 2: coeff.=-.4024 n=18 p=.049	Time 2 coeff.=-.4114 n=17 p=.05
Objective 3	Time 2: coeff. = -.4429 n=17 p=.037 Time 3: coeff. = .5164 n=16 p=.02	Time 1: coeff.=-.5085 n=17 p=.019
Objective 4		Time 2: coeff=-.6891 n=16 p=.002
Objective 5		Time 1: coeff=-.5085 n=17 p=.019
Objective 6	Time 3: coeff = -.5816 n=16 p=.009	Time 2: coeff = -.5448 (n=16) p=.012
Objective 7	Time 3: coeff = .5163 n=16 p= .020	
Objective 8	Time 3: coeff = .4420 n=15 p=.05	
Objective 9		
Objective 10		

The significant correlations shown above do not demonstrate a pattern, and are inconsistent between groups. This suggests that the Confidence Log results do not predict performance on the Quiz and vice versa.

8.7.6 Observations

The April 1994 class was bigger than the groups in the other evaluation episodes and took up most of the space in the computer lab. As a result, they were forced to work in groups which allowed them to easily ask their peers for help. The session was noisy with the students talking amongst themselves throughout their computer use. In contrast, the December 1994 group were observed to work alone at the computers in near-silence. The February 1998 groups were observed to be quite similar to the December 1994 class, tending to work alone and in silence.

The students in December 1994 group were observed to ask the lecturer if they were supposed to take notes. When she indicated they should, they wrote down much of the text on-screen, until the lecturer had to intervene and ask them to take brief notes only.

8.8 Discussion

The results demonstrate that the students achieved the targets on the quiz and also reported an increase in confidence regardless of the number of teaching interventions or their type. This suggests that the package or the lecture could adequately stand-alone as a teaching resource for these students. However, the students' preference as a group appears to be the conventional teaching method. These findings indicate the students' preference and experience of the learning situation i.e. their attitudes towards and opinions about what they have encountered during the innovative teaching session, do not disenchant them to the point of influencing their learning.

8.9 Conclusions

An aim of this study was to document the evolution of the TILT-E methods over time. This evolution was found to have involved a reduction in questions on the Pre-Test Questionnaire, and the emerging of more informative prompts on the Post-Test Questionnaires. The study also aimed to show the usefulness of comparative studies in the computer-based teaching and learning situation. It demonstrated that no student need be disadvantaged, and could still be a member of a control group *and* receive the innovation. The study was successful in fulfilling the teacher's aim, that is, the hypothesis that the package could replace the lecture was found to be proven. This is further evidence of the usefulness of comparative studies in this context.

Finally, the study investigated the relationship between students' performance and their confidence in being able to fulfil learning objectives. A statistical method found no evidence that such a relationship existed.

CHAPTER 9

CASE STUDY 2: GRAPHIT!

9.1 Introduction

The Fast Frac studies examined the experience of students from different years on the same course using the same package. The following study of the use of the GraphIT! package examines the experience of students' from different faculties and year level using the same package, including an initial formative study with a small group. The students came from two departments in the University, namely Sociology and Accounting and Finance.

9.2 The formative evaluation

Three post-graduate Sociology students, representatives of one section of the package's target audience, were invited to evaluate Unit 1 and Unit 2 of the GraphIT package. The session lasted approximately one hour, and required the students to work through the package using the Comment Sheet measure devised for this study (see Appendix 5.1). An evaluator (the author) observed the session. A brief interview was conducted after package use.

The students provided detailed written feedback through the Comment Sheet, and verbal feedback to the evaluator. Issues such as colour, some navigation points and recall of the definitions in the package arose. The students' comments on the content was minimal, and the students' themselves reported during the interview that they had paid little attention to the content.

9.3 The main study

Students used the package as part of their scheduled one-hour tutorial period or one-hour scheduled lecture class. There were three evaluation episodes in this study:

Episode 1 - Full classroom trial of 4 units of the package with 110 first-year Accounting & Finance students.

Episode 2 - Classroom trial of 4 units of the package with 28 third year Sociology students.

Episode 3 - Classroom trial of 4 units of the package with 18 Post-Graduate Social Science students.

9.4 Aim

9.4.1 Evaluator's Aim

The development of GraphIT! provided an opportunity to examine the use of a stand-alone package by students from different faculty backgrounds. This was hoped to facilitate the following:

- Examination of the methodology used on the same package but with different students over time.

- Analysis of the difference between students from different faculties who use the same package and complete the same evaluation measures, to enable consideration of the methods when the package is similar but the students' background changes (unlike Fast Frac where the students were different but were all doing the same degree topic).

- To assess whether the students' self-reported statement of future package use correlated with their actual package reuse after the teaching session.

9.4.2 Teachers' Aim

The teachers' felt GraphIT! would assist them in their teaching of the introductory courses in statistics in their respective departments. It was thought during the planning phase of the software that the package could be standardised over all departments, especially as it had scope for the teacher to adjust it to suit his or her course. Part of the appeal of the package was its use as an open-learning tool, allowing the students to return and revise the material they had been taught as often as they needed.

9.5 The Software

GraphIT! was developed by Sue Tickner and Marion Harrison of TILT Group A, based on content supplied by Margaret Milner (Accounting & Finance Department), Ruth Madigan (Social Sciences) and John McColl, Adrian Bowman & Gordon Murray (Statistics Department). The aim of the package was to provide a cross-department introduction to core concepts of graphical representation of data. The package was produced as part of the TILT Project.

9.6 The Students

There were three groups of students involved in this study:

Episode 1 - 110 first year Accounting & Finance students

Episode 2 - 28 third year Sociology students

Episode 3 - 18 Post-Graduate Social Science students

Use of the package was compulsory for all students as part of their courses in Statistics. Gender and age information was not collected in any evaluation episode.

9.7 Measures

The evaluation episodes in this study took place over a period of four months at a time when the TILT-E methodology was becoming more consistent. As a result, there are few variations in the measures between the three episodes. The measures used are described below.

9.7.1 Pre-Task Questionnaire

The Pre-Task Questionnaire in all three studies attempted to discover:

- How often the students used a computer
- What they used it for
- How confident they felt about using a computer on the day of the study

In the second and third evaluation episodes the Questionnaire was refined to include a prompt asking if the students had had any other statistics training, and if so what, where, when and whether a computer was used. They were also asked to indicate which of a series of 6 IT skills they were sure they could do, including such things as switching between application windows and using a scroll bar. The Accounting and Finance students participating in the first evaluation episode were also asked this latter question, but it was included in a comprehensive Computer Experience Questionnaire administered three weeks before the teaching intervention which was part of another study. Between the time of this administration and the evaluation episode the students participated in an IT training course which covered all these skills. For that reason, the results of this earlier measure are not considered here as they are not a true reflection of the skills the students were bringing to the teaching session.

9.7.2 Post-Task Questionnaire

The Post-Task Questionnaire was similar across all three evaluation episodes. It asked:

- Whether the students worked alone or with others
- If they sought help/advice
- If they needed help, whether it was help in package operation or with the subject material
- Whether they concentrated most on package operation or on subject-related problems and answers
- Whether they would use the package again and why/why not
- If they would recommend it to other students and why/why not
- If they learnt anything from the package and for an explanation of their answer
- And finally, what they particularly liked and disliked about the package

The Post-Task Questionnaire was identical in the first two evaluation episodes, but underwent two refinements before the third evaluation. In the earlier episodes the students were asked to state where they got to in the package. This was found to be unreliable, as the students were asked this after they had logged out of the package and few had noted where they were. It also gave no indication of where the students had been in the package and whether they had engaged with the content. The question was therefore dropped and is not considered in the following analysis.

The third evaluation episode asked the students to give details about the sort of help they had needed during package operation under the prompts 'Help related to the subject material' and 'Help related to the operation of the package'. It was hoped that this prompt would allow the students' help requests to be analysed in more detail, and so give both teachers and package developers more insight into any issues the students were having with the material and its medium. These additional prompts are considered in the following analysis.

9.7.3 Confidence Log

The Confidence Log was designed using the objectives of the package, as agreed by the package developers and the teachers in both departments. Twelve objectives were included:

1. Define discrete and continuous data and discriminate between them.
2. Interpret a simple frequency table including percentages.
3. Name 2 charts or plots relevant to discrete data.
4. Interpret a bar chart and a pie chart.
5. Explain the construction of a bar and a pie chart.
6. Discriminate between nominal and ordinal data.
7. Explain how bar charts and pictograms can be constructed in ways which distort the impression.
8. Define the difference between ordinal and interval scales.
9. Discriminate between the mean, median and mode.
10. Name 2 graphs or plots appropriate for continuous data.
11. Explain the construction of a stem & leaf plot.
12. Explain the difference between the cut-point and the midpoint.

The standard 5-point Confidence Log scale was used, from 'Very Confident' to 'No Confidence Whatsoever'. In the second and third evaluation episodes a sixth point

'Have not covered this yet' was also included, enabling students who were unfamiliar with the material to select this rather than 'No confidence whatsoever.'

At the end of each Log at each testing time, students were asked to add additional comments if they wished.

9.7.4 Quiz

A Quiz was developed for the second and third evaluation episodes by the teacher of the students participating in these teaching sessions. All students were from the Sociology Department. The Quiz was nominally a 10-item multiple choice assessment, administered before and after the teaching intervention. However, 5 of the 10 items either had several answers and/or invited the students to make more than one response. Counting the number of correct responses and taking each as a separate item makes the measure a 19-item test. All items had a 'Don't Know" option.

9.7.5 Observations

The evaluator observed all teaching sessions. In the first evaluation episode, there were eight tutorial groups to deal with the volume of students. In the latter two evaluation episodes the students in each class used the package at the same time in the same computer lab. The aim of the observations was to monitor the groups and assess any otherwise-uncaptured differences between them, and to observe any problems or issues which may not be picked up on any of the evaluation episodes but could conceivably influence the results

9.7.6 Computer Logging

An attempt at logging students reuse of the packages was made in all three evaluation episodes. The logging files collected data on who used the package (the students had to log on to the package using their matriculation number), how long they spent on the material, and where they went in the package. The logging files ran with the help of the system administrators in each laboratory until the end of the second academic term. They were then closed. This date was selected because it was anticipated by the teachers involved in the study that all students should know and be comfortable with the package material by this point as the package's content was introductory, and all students were expected to learn it and move on from the material rapidly.

The first and second evaluation episodes took place in November 1994, the third on 11 January 1995, and the logs were closed on 17 March 1995, giving the students ample time for reuse. The package remained on the network in both computer labs throughout this time.

9.8 Method

On the teaching day, each evaluation episode used the same design. However, the first evaluation episode included a lengthy Computer Experience Questionnaire several weeks before package use. The design for each episode is summarised below:

9.8.1 Episode 1 – Accounting and Finance

A Computer Experience Questionnaire was administered in October 1994, but its findings are not included in the following analyses because of reasons discussed in Section 9.7.1 earlier. This evaluation was conducted in November 1994.

Pre-Task measures, administered at the start of the teaching session were:

- Pre-Task Questionnaire (See Appendix 5.2)
- The Confidence Log (See Appendix 5.3)

Post-Task measures, administered after the package at the end of the teaching session:

- Post-Task Questionnaire (See Appendix 5.4)
- The Confidence Log (See Appendix 5.3)

In addition, the students in this evaluation episode and the following two evaluation episodes were observed completing the measures and working through the package. Computer logging documented any later open-access use of the package in all three evaluation episodes.

9.8.2 Episode 2 – Undergraduate Sociology

This evaluation was conducted in November 1994, and used an identical design to the Postgraduate Sociology evaluation episode described later.

Pre-Task measures, administered at the start of the teaching session were:

- Pre-Task Questionnaire (See Appendix 5.5)
- The Confidence Log (See Appendix 5.3)
- Quiz (See Appendix 5.6)

Post-Task measures, administered after the package at the end of the teaching session:

- Post-Task Questionnaire (See Appendix 5.7)
- The Confidence Log (See Appendix 5.3)
- Quiz (See Appendix 5.6)

9.8.3 Episode 3 –Postgraduate Sociology

This evaluation was conducted in January 1995, and used an identical design to the Undergraduate Sociology evaluation episode described earlier.

Pre-Task measures, administered at the start of the teaching session were:

- Pre-Task Questionnaire (See Appendix 5.8)
- The Confidence Log (See Appendix 5.3)
- Quiz (See Appendix 5.6)

Post-Task measures, administered after the package at the end of the teaching session:

- Post-Task Questionnaire (See Appendix 5.9)
- The Confidence Log (See Appendix 5.3)
- Quiz (See Appendix 5.6)

9.9 Results

The results are considered across all three evaluation episodes, as the measures were comparable. To allow comparison owing to the different sizes of the samples, results are shown in percentages as well as by number of students.

9.9.1 Pre-Task Questionnaire

The Pre-Task Questionnaires in all 3 evaluation episodes considered frequency of computer use, type of computer use and confidence in computer use. In the second and third evaluation episodes, computer skills and prior topic experience were also considered. These dimensions and their results are shown in the following subsections.

9.9.1.1 Frequency of Computer Use

Frequency of computer use was measured on a 6-point scale from 'Every day' to 'Never'. The results are shown on Table 9.9.1.

Table 9.9.1 - Frequency of computer use

	Every day	Every 2-3 days	Once a week	More than once a month	Less than once a month	Never
Accounting & Finance	4 (4%)	73 (67%)	28 (26%)	1 (1%)	3 (3%)	0 (0%)
Undergrad. Sociology	4 (15%)	7 (26%)	15 (56%)	1 (4%)	0 (0%)	0 (0%)
Postgrad. Sociology	14 (78%)	2 (11%)	2 (11%)	0 (0%)	0 (0%)	0 (0%)

9.9.1.2 Type of computer use

Students were asked what they used the computer for. In the first evaluation episode, students stated they used the computer most often for EQL (90% of the sample), Understanding Accounts (65% of the sample) and spreadsheets (45% of the sample). Twenty-one students (19%) stated they used it for word processing. In the second evaluation episode, the Sociology undergraduate students reported using the computer for word-processing (81% of the sample) and statistics (70% of the sample). The postgraduate students reported using it for word processing (89% of the sample), statistics (33% of the sample) and spreadsheets (28% of the sample).

9.9.1.3 Confidence in Computer Use

The students were asked to rate on a 5-point scale how confident they were about using a computer. Their results are shown in Table 9.9.2.

Table 9.9.2 - Students' reported confidence in using computers

	Very Confident	Confident	Some Confidence	Little Confidence	No Confidence Whatsoever
Accounting & Finance	6 (5%)	33 (30%)	50 (45%)	19 (17%)	2 (2%)
Undergrad. Sociology	2 (7%)	8 (30%)	10 (37%)	7 (26%)	0 (0%)
Postgrad. Sociology	4 (22%)	7 (39%)	5 (28%)	2 (11%)	0 (0%)

9.9.1.3 Pre-Task findings from second and third evaluation episodes only

The students from the second and third evaluation episodes were asked about their current computer skills and topic experience, after amendments were made to enhance the data from the Pre-Task Questionnaires. The findings are shown in the following subsections.

9.9.1.3.1 Computer skills

Students were asked to tick any of 6 listed skills listed they were sure they could do. Each skill is in effect a separate question, and the number of students answering 'Yes - I can do that' to each skill is listed in Table 9.9.3.

Table 9.9.3 - Computer skills

	Save a file to a floppy disk	Prepare a new floppy disk for use	Switch between application windows	Print out a file or document	Make a copy of a disk	Use a scroll bar
Undergrad. Sociology	24 (89%)	9 (33%)	18 (67%)	27 (100%)	8 (30%)	21 (78%)
Postgrad. Sociology	18 (100%)	13 (72%)	16 (89%)	18 (100%)	13 (72%)	13 (72%)

9.9.1.3.2 Topic Experience

Students were asked if they had ever covered statistics before this course, and if so, to give details about their prior experience of statistics including course and date. Ten of the undergraduate students (37%) in the second evaluation episode reported having covered statistics on another course. Six of these 10 students had covered some statistics as part of second year Psychology, 1 as part of first year statistics, 2 as part of first year Management Studies and 1 as part of a course in Aeronautical Engineering. None had used a computer on these courses.

Twelve post-graduate students (67%) in the third evaluation episode reported having covered statistics on another course. Only 7 of the 12 students gave the course title, all of whom reported they had covered some statistics as part of earlier undergraduate degree courses. Four students reported they had used a computer on these courses, 3 reported they had not.

9.9.2 Post-Task Questionnaire

The Post-Task Questionnaire looked at 4 dimensions - collaborative working; help requests; operation versus content; & attitudes (including students' perceptions of whether they learnt anything, if they will use the package again, and if they would recommend the package to others). Most questions encouraged explanations and/or comments.

9.9.2.1 Collaborative Working

Students were asked if they worked alone, with a neighbour/ friend using a computer each, or in a group of 2 or more using the same computer. In the first evaluation episode, 103 students (94%) reported working alone at the computer, while 7 students (6%) reported working with a friend using a computer each. In the second evaluation episode, 25 students (89%) reported working alone at the computer, and 2 reported working in a group of 2 or more at the same computer. One student reported working with a friend using a computer each, although no other student stated they had behaved similarly. The postgraduate students in the third evaluation episode all reported working alone.

The design of the room in which both groups of Sociology students worked was observed to discouraged any interaction, as the students worked in winged booths. This was not the case in the Accounting and Finance computer room, where the students had no barriers to interaction and worked side-by-side in an open plan lab. Despite this difference to the setting of package use, the majority of students in all 3 evaluation episodes approached the package in a similar way i.e. chose to work alone.

9.9.2.2 Help requests

Students were asked if they had required help during the teaching session. Twenty-five students (23%) in the first evaluation episode reported asking for help. Twenty-two of these students required assistance related to the operation of the package. Nine of them asked for help with the package content. Students could select both, hence the mismatch between the total number reporting asking for help, and the number needing help with either aspect. Students were not asked on this measure for details of their help request. However, through observations conducted in the computer room by the evaluator, the reason for the relatively high number of package operation help requests amongst this sample was observed to be a product of slightly confusing Minitab instructions in the Minitab section in the package, and a program bug which caused some graphs to be illegible. Both were rectified after this evaluation episode and before the later evaluations.

Only 4 students (14%) in the Undergraduate Sociology sample in the second evaluation episode reported they needed help, 2 asking for assistance related to the operation of the package, while 2 reported requiring help with the package content. In the third evaluation episode, only 2 students (12%) reported asking for help, 1 for help related to the package, although they did not specify what help they needed, and one for help related to the content. This latter student stated they needed help to 'clarify what was meant by discrete data due to an apparent conflict in examples' [Student US14]. This conflict occurred because the students had difficulty understanding the example which stated the number of hours exercise in a day was a different type of data from the number of cups of tea in a day.

9.9.2.3 Operation versus Content

Students were asked to indicate on a seven-point scale what they spent most of their time on - focusing on learning how to operate the package or concentrating on subject-related problems and answers. The findings across all three evaluation episodes are shown on Illustrations 9.9.1a, 9.9.1b and 9.9.1c. Number of students selecting a particular point in the scale is shown in bold typeface about the scale itself in the illustrations.

Illustration 9.9.1a - Operation vs. content: Accounting & Finance

Discovering details of how to operate the package	**2**	**0**	**0**	**20**	**15**	**31**	**41**	Concentrating on course-work problems and answers
	0	1	2	3	4	5	6	

Illustration 9.9.1b - Operation vs. content: Undergraduate Sociology

Discovering details of how to operate the package	**0**	**0**	**1**	**5**	**0**	**8**	**11**	Concentrating on course-work problems and answers
	0	1	2	3	4	5	6	

Illustration 9.9.1c - Operation vs. content: Postgraduate Sociology

Discovering details of how to operate the package	**1**	**0**	**0**	**2**	**0**	**3**	**11**	Concentrating on course-work problems and answers
	0	1	2	3	4	5	6	

9.9.2.4 Attitudes

The students in all three evaluation episodes were asked if they would use the package again, if they would recommend it to other students, and if they felt they learned anything. The results are shown on Table 9.9.4

Table 9.9.4 - Reuse, recommendation and learning

	I will use the GraphIT! package again.	I would recommend it to other students.	I learnt something from the package.
Accounting & Finance	103 (94%)	109 (100%)	104 (96%)
Undergrad. Sociology	26 (93%)	25 (93%)	26 (93%)
Postgrad. Sociology	15 (100%)	16 (100%)	15 (100%)

Although most students responded positively to the three prompts asking them about reuse, recommendations and learning, several did not. In the second evaluation episode, 1 student reported that they would not use the package again because they 'Have been just trained in SPSS & its confusing using a different system... [Minitab]...which does exactly the same thing' [Student US26]. This student also reported they did not learn anything from the package, but failed to indicate why, although they would recommend it to other students. Another student from this group stated they would not use the package again because they 'Dislike packages like this' [Student US14]. Further, they would not recommend it because of their dislike, and went on to add that they learnt nothing from it. They then qualified this by commenting 'I did learn things, but must admit to forgetting them almost immediately due to having to go straight on to something else - should've written it down, I suppose.' [Student US14].

The volume of comments from the largely positive sample is such that they are listed in the appendices (see Appendix 5.10). Most reported that the package was informative and helpful. Aside from the undergraduate Sociology students whose negative comments are listed above, the only other negative student was in the Accounting and Finance class. Student AF91 stated that they would not use it again because it was 'Far too boring and tedious', and that 'Everything on GraphIT! I already knew, its a very basic introduction.'

9.9.2.5 Students' likes and dislikes

The students were asked to state what they particularly liked and what they particularly disliked about the package. Again, the positive responses to the 'Liked' prompt were so numerous across the three evaluations that they are listed in the Appendices (see Appendix 5.11). Included amongst these comments were common themes including clarity of information; self-paced; good examples; user-friendly interface; and self-tests.

Less numerous were the responses to the 'Disliked' prompt. Four postgraduate students (24% of the sample) in the third evaluation episode made comments in response to this prompt. One found working through the package tiring [Student PG4], one found the questions too easy and too scarce [Student PG10], another disliked the red-coloured screens [Student PG16], while another disliked the reference to Minitab [Student PG17]. More undergraduate Sociology students disliked parts of the package, a total of 12 students (43%) responding to the dislike prompt. Their dislikes ranged from 'Too much information at once' [Student US7] to boring, too basic and patronising [Students US1, US5, US6, US16, and US23]. Three student cited the onscreen presentation as the cause of their dislike [Students US3, US14 and US20]. Student US21 felt there needed to be more examples, and Student US 24 felt that the package was 'Quite unclear when distinguishing between continuous and discrete.'

The dislikes for the Accounting and Finance students in the first evaluation episode were similar. Also mentioned by these students and not by the other students, probably because of different machine specifications, was the speed at which the package ran. Only two students mentioned the distortion of the graphs which had been observed by the evaluator to cause problems during the session.

9.9.2.6 *General comments*

The Post-Task Questionnaire, like the Post-Task Confidence Log, offered space for students to make any comments they wished to add. Thirty of the students (27%) in the first evaluation episode reported finding the package good, useful, worthwhile, interesting, and/or helpful. Only one student was negative, Student AF91, who stated 'The mouse is tiring - it should be automatic i.e. Only use mouse when you have difficulty.'

Ten students (36%) in the second evaluation episode commented, half of them positively and half of them negatively. Positive comments were generally about the benefits of the package content, while two negative comments were about the package itself, and three were about the content, two stating that they found it confusing, and one asking for more information about statistical packages.

Seven of the students (41%) in the third evaluation episode commented, four making suggestions for improvements in the content [Students PG5, 7, 8, & 9], one stating 'Should be able to find this useful' [Student PG12], another indicating they found it difficult to comment at this stage [Student PG10] and another asking if lectures could now be done away with [Student PG6]. These responses and the others described above from all three evaluation episodes are listed in the Appendices (see Appendix 5.12).

9.9.3 Observations

As seen in the *Help requests* section earlier, observation of the first evaluation episode found that there was a problem with the package's Minitab instructions and that there was a bug in the program which caused some graphs to be illegible.

The observation of the undergraduate Accounting and Finance students also found that one tutor was disparaging of the package. He had not been involved in its development, and was vocally dismissive of it. The evaluator and teaching staff became aware of this immediately before he introduced the package to his students, and he was asked not to express his opinion of the package to them.

In the second and third evaluation episodes, the observation found that the computer room used was not conducive to interaction. However, the observation also found that the students in all three evaluation episodes did not tend to interact, even when there were no barriers to interaction.

9.9.4 Computer logging

The computer-based logging files which collected information on later open-access use of GraphIT! by the students were analysed after the end of the second term. The reuse rate amongst the students participating in the first evaluation episode was 17% (19 students) against 94% (103 students) predicting they would use it again on the post-package measures. Three students (11% of the sample) from the second evaluation episode returned to use the package, although 93% of the students reported at the end of the teaching session that they would use the package again. Only 1 student (6%) of the 18 in the third evaluation episode reused the package [Student 5], despite 100% of respondents stating they would use the package again on the Post-Task Questionnaire. This suggests that this prompt was not a useful reflection of actual behaviour, which may have been because the students were interpreting the question differently to the evaluators. For example, the prompt could be interpreted as hypothetical, rather than as a request to predict future behaviour.

9.9.5 Confidence Log

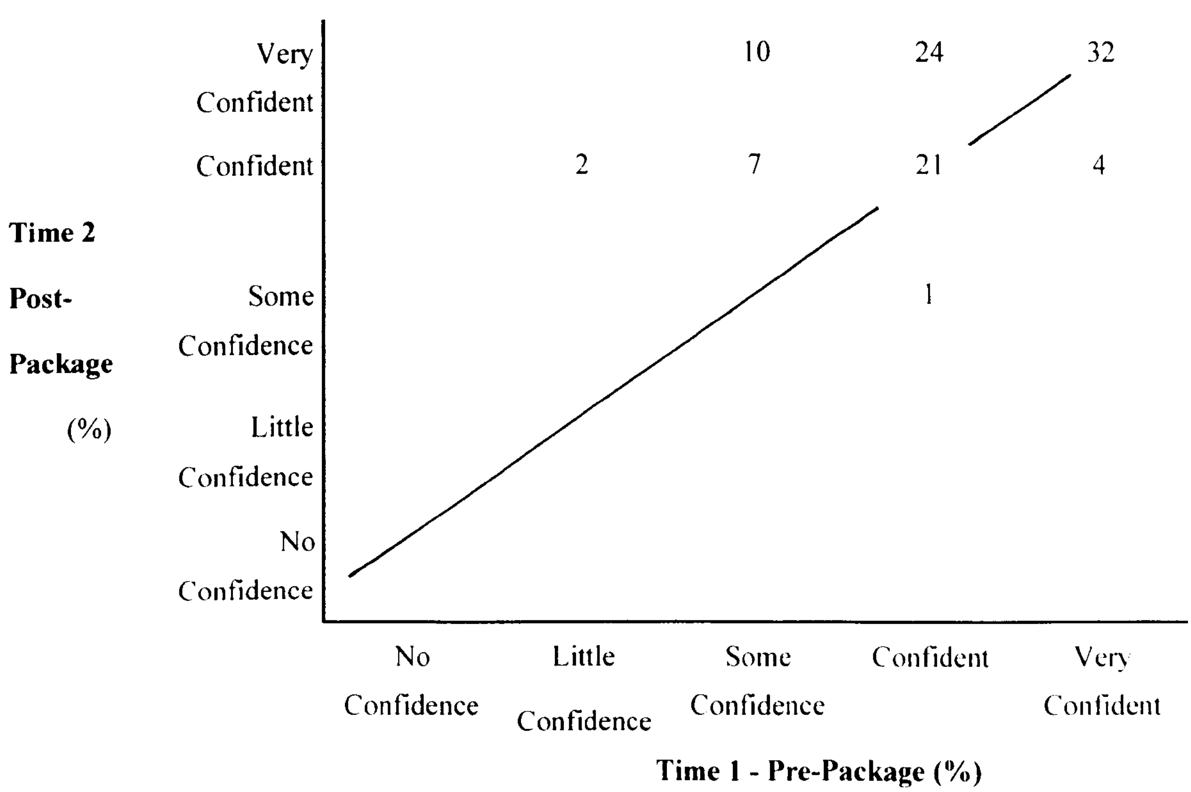
The aim of the Confidence Log was to assess reported shifts in students' confidence in being able to fulfil the learning objectives of the intervention. No shift in confidence would indicate no impact of the teaching on that objective, while a negative shift would indicate the teaching did not assist the students, but instead had a negative impact. A positive shift would reflect well on the package, although as seen in the Fast Frac study, this is not indicative of performance.

9.9.5.1 Evaluation episode one

Sign test results were significant for Objectives 1, 2, 3, 6, 7, 8, and 10 ($p<.001$), that is, the group increased in confidence on the stated objectives after using the package. However, the tests found that the remaining objectives i.e. Objectives 4, 5, 9, 11 and 12 were not significant. More detailed consideration of these insignificant results is necessary, to determine whether the reason for this lack of increase was through high confidence levels to begin with (i.e. the students may have already been at the ceiling), or whether the material has not been successfully taught to the students by the package. This information is available on Charts 9.9.1a, 9.9.1b, 9.9.1c, 9.9.1d and 9.9.1e. The full sign test results are listed in Appendix 5.13.

To chart the data, the frequencies are displayed objective-by-objective to show increase and decreases between the students' pre-package confidence (Time 1) ratings and post-package ratings (Time 2). The x-axis represents the students initial confidence, the y-axis shows where the students' confidence moved to after using the package. A line is drawn through the number of students who did not shift in confidence over time. All those above the line increased in confidence, all those below the line dropped in confidence, and all those on the line did not shift. The data is shown in percentages to allow comparison across the 3 evaluation episodes where appropriate.

Chart 9.9.1a - Objective 4: Interpret a bar chart and a pie chart



From chart 9.9.1a it is clear that over 50% of the sample were already confident or very confident in their ability to interpret bar and pie charts, and did not shift over time, so the failure to obtain a significant result was probably due to the ceiling effect rather than inadequacy in the package.

Chart 9.9.1b - Objective 5: Explain the construction of a bar and a pie chart

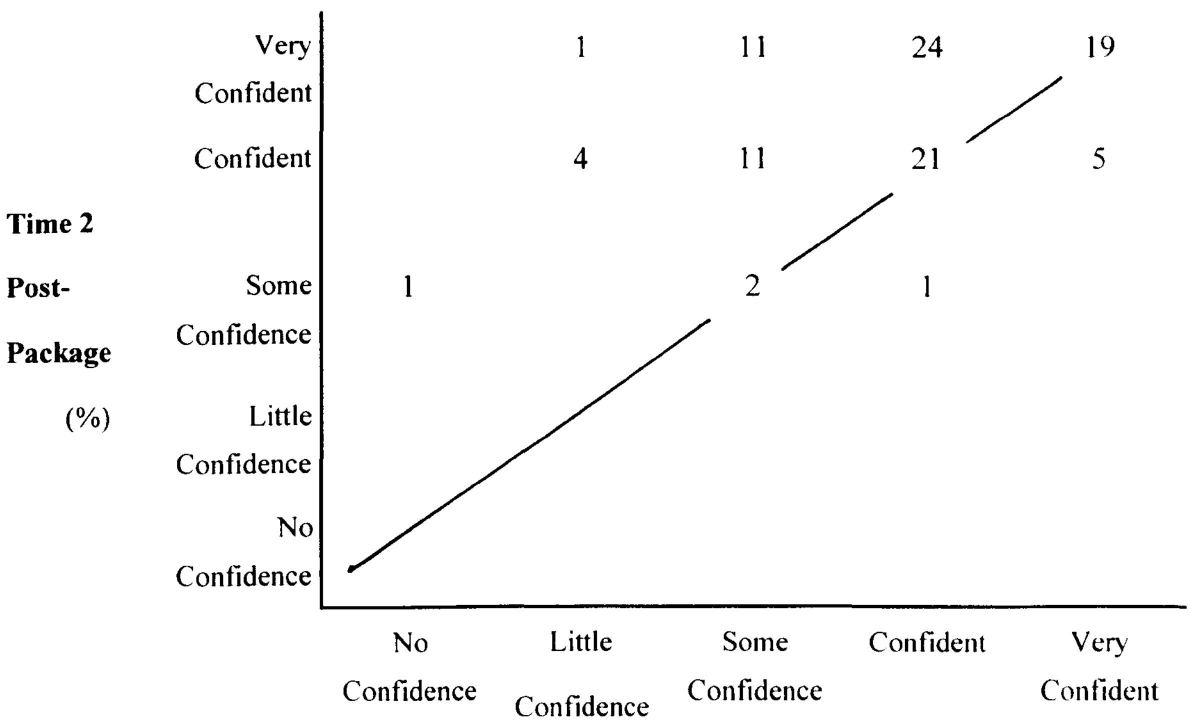


Chart 9.9.1b shows 40% of the sample were confident or very confident and did not shift over time, again suggesting a ceiling effect may have produce the insignificant finding.

Chart 9.9.1c - Objective 9: Discriminate between the mean, median and mode

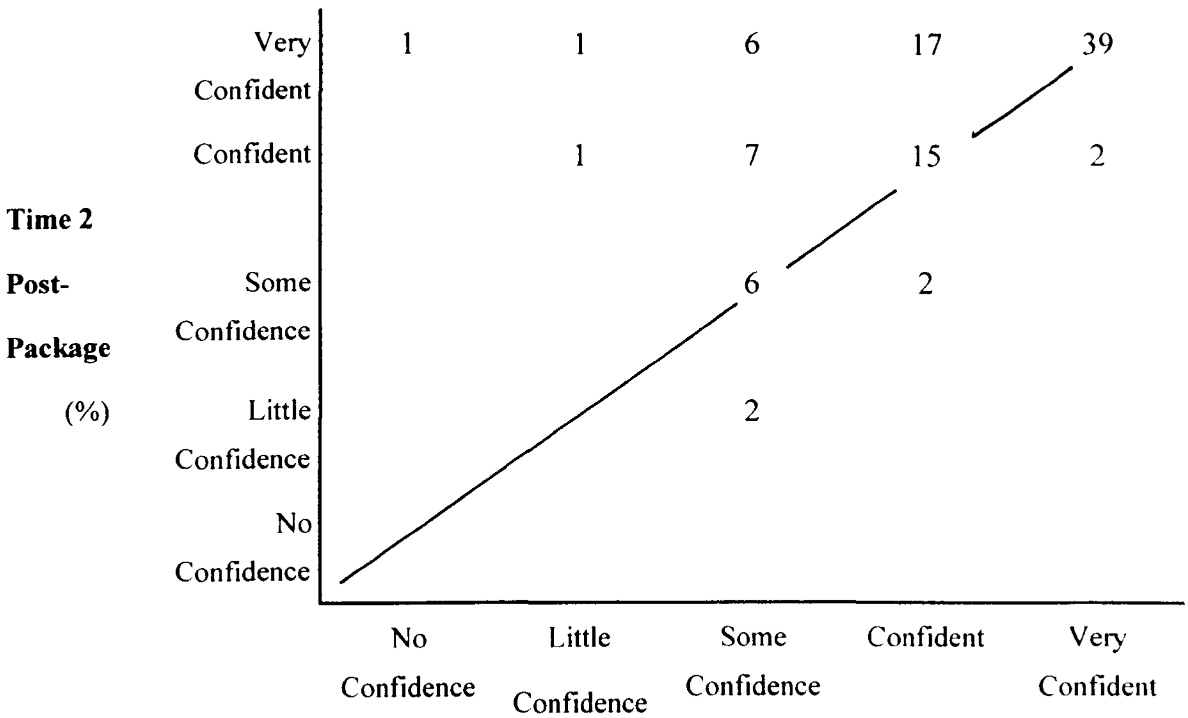


Chart 9.9.1c shows 54% of the students were already confident or very confident and did not shift over time, once more indicating a ceiling effect.

Chart 9.9.1d - Objective 11: Explain the construction of a stem & leaf plot

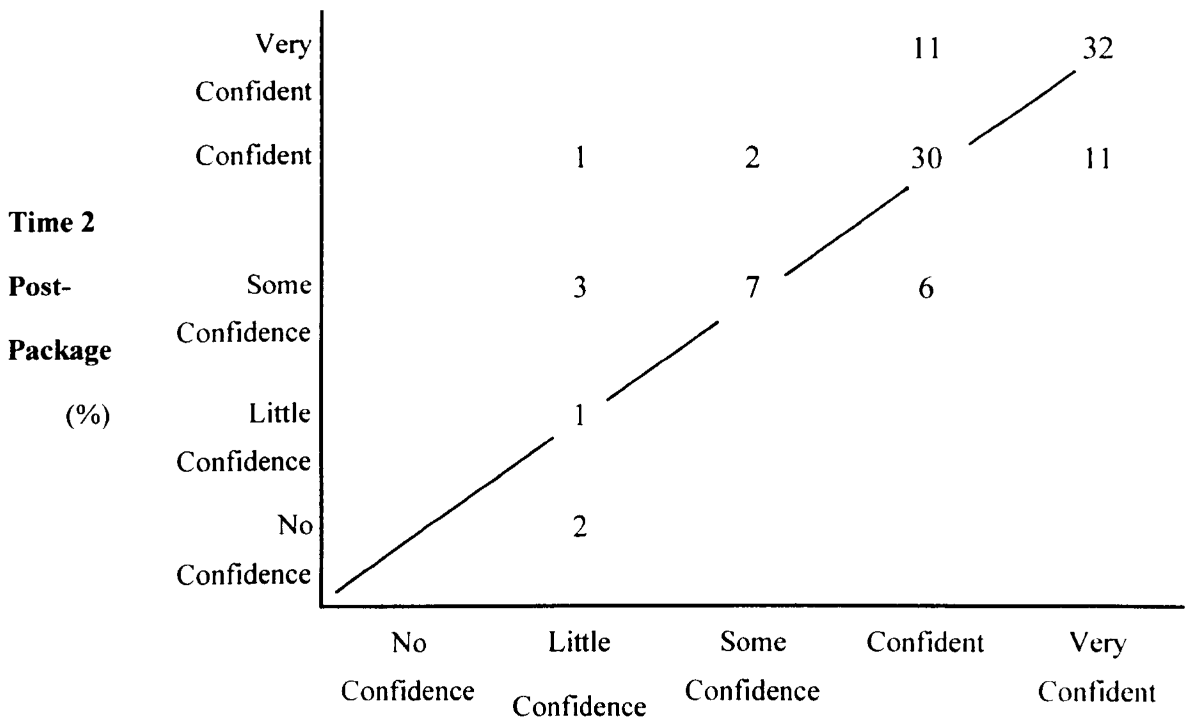


Chart 9.9.1d shows that 63% of the sample did not move, and were reasonably confident before the teaching intervention. Of those who did move, 21 (19%) fell in confidence, while 17 (15%) increased in confidence. The finding of non-significance in this case is therefore a combination of non-movers, the ceiling effect, and an almost equivalent number of students reporting increases and reductions in their confidence.

Chart 9.9.1e - Objective 12: Explain the difference between the cut-point and the midpoint

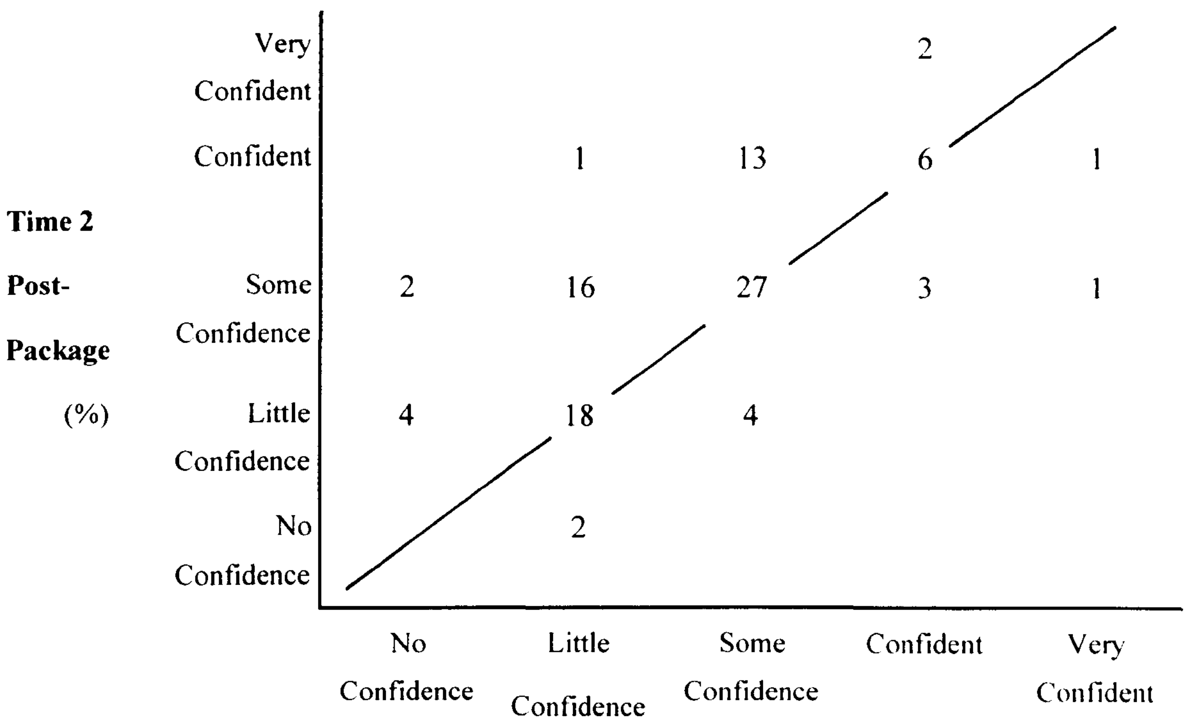


Chart 9.9.1e shows that unlike the earlier charts, almost half the sample (44%) had only some or little confidence in their ability to complete Objective 12, and that 11% fell in confidence after using the package.

9.9.5.2 Evaluation episode two - Undergraduate Sociology students

The sign test results showed a highly significant increase in group confidence at fulfilling Objectives 1, 3, 6, 7, 8, and 10 ($p<.001$). Objectives 2, 4, 5, 9, 11 and 12 showed no significant difference over time, as illustrated by the results on Charts 9.9.2a, 9.9.2b, 9.9.2c, 9.9.2d, 9.9.2e and 9.9.2f. The full sign test results are listed in Appendix 5.13.

Charts 9.9.2a - Objective 2: Interpret a simple frequency table including percentages

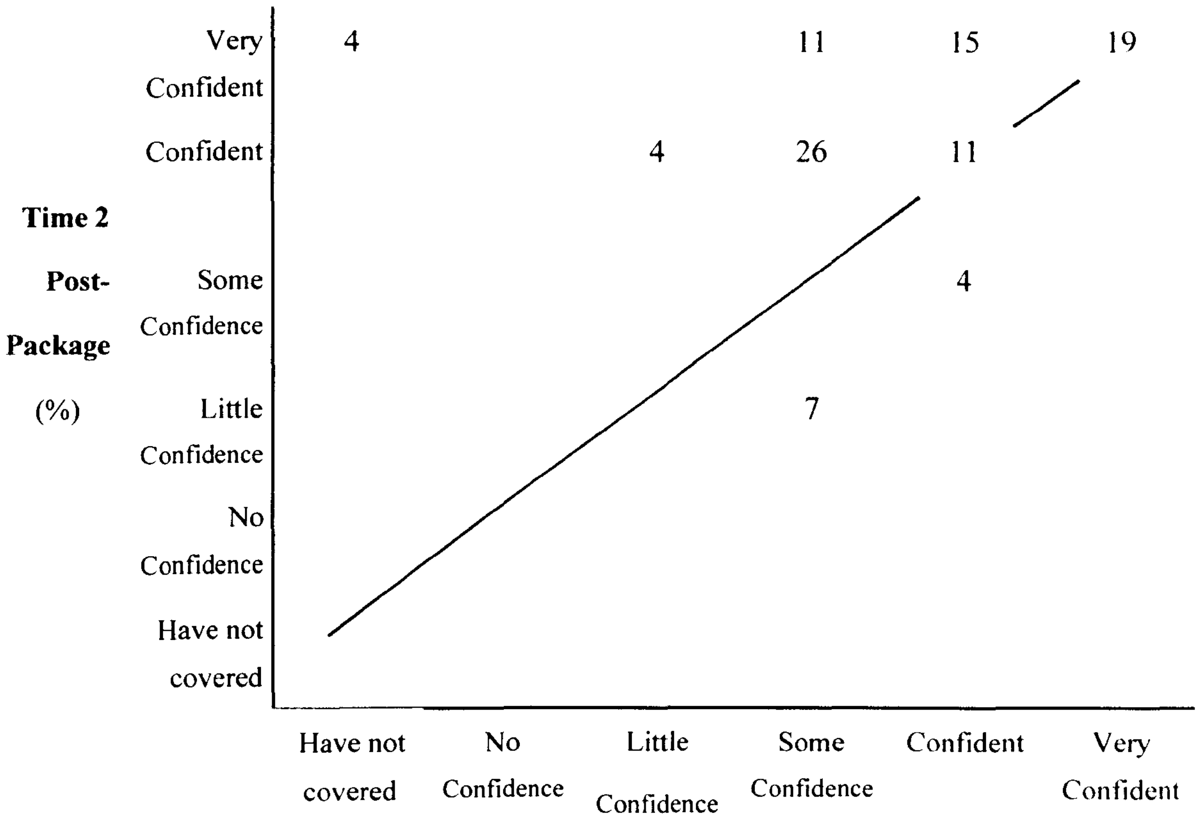


Chart 9.9.2a shows that the lack of significant findings for Objective 2 was probably a product of a combination of results, with 30% of students not shifting, 11% falling and 61% increasing. It is likely that the finding from this objective was approaching significance (see Appendix 5.13).

Chart 9.9.2b - Objective 4: Interpret a bar chart and a pie chart

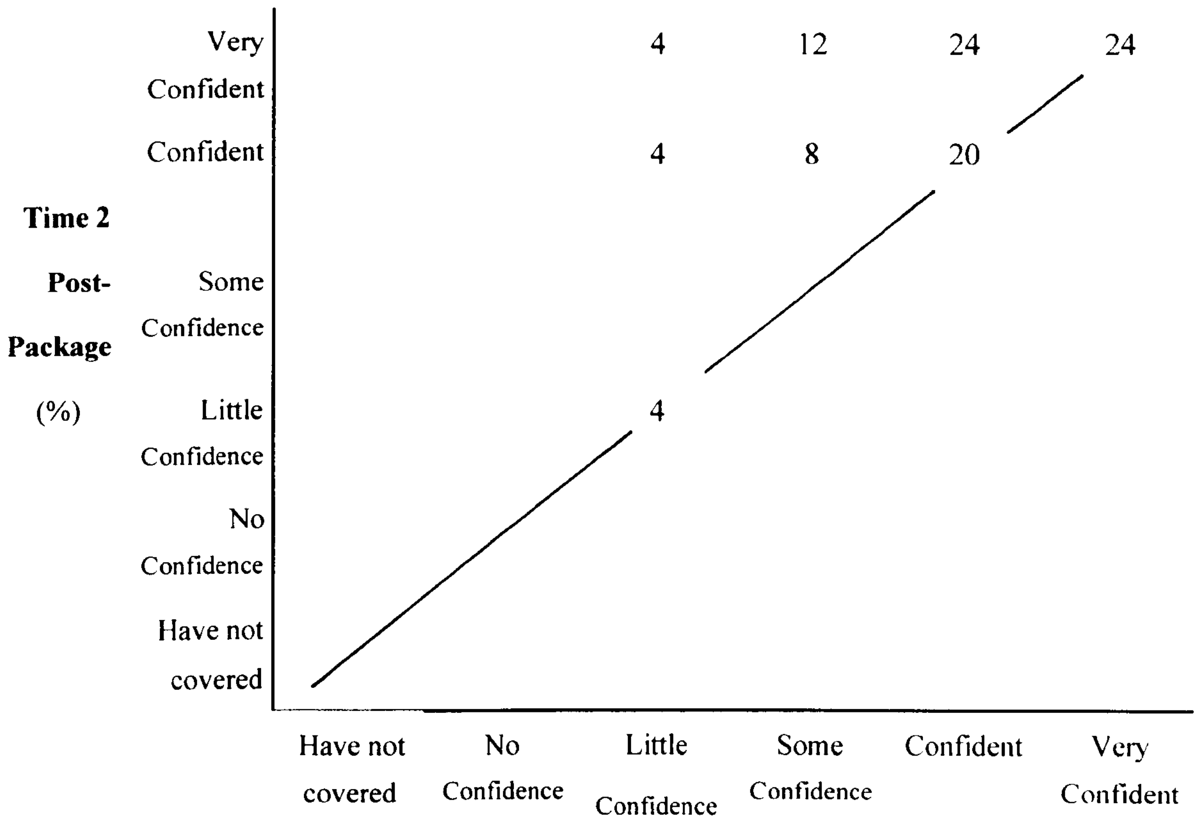


Chart 9.9.2b shows that 48% of the sample did not shift in confidence after using the package, hence an insignificant result for Objective 4.

Table 9.9.2c - Objective 5: Explain the construction of a bar and a pie chart

Time 2 Post-Package (%)	Have not covered	No Confidence	Little Confidence	Some Confidence	Confident	Very Confident
Very Confident			7	7	15	22
Confident			7	11	11	
Some Confidence	4		4	4		
Little Confidence		4	4			
No Confidence						
Have not covered						

Chart 9.9.2c shows 41% of the sample did not shift in confidence after using the package, again producing an insignificant result

Chart 9.9.2d - Objective 9: Discriminate between the mean, median and mode

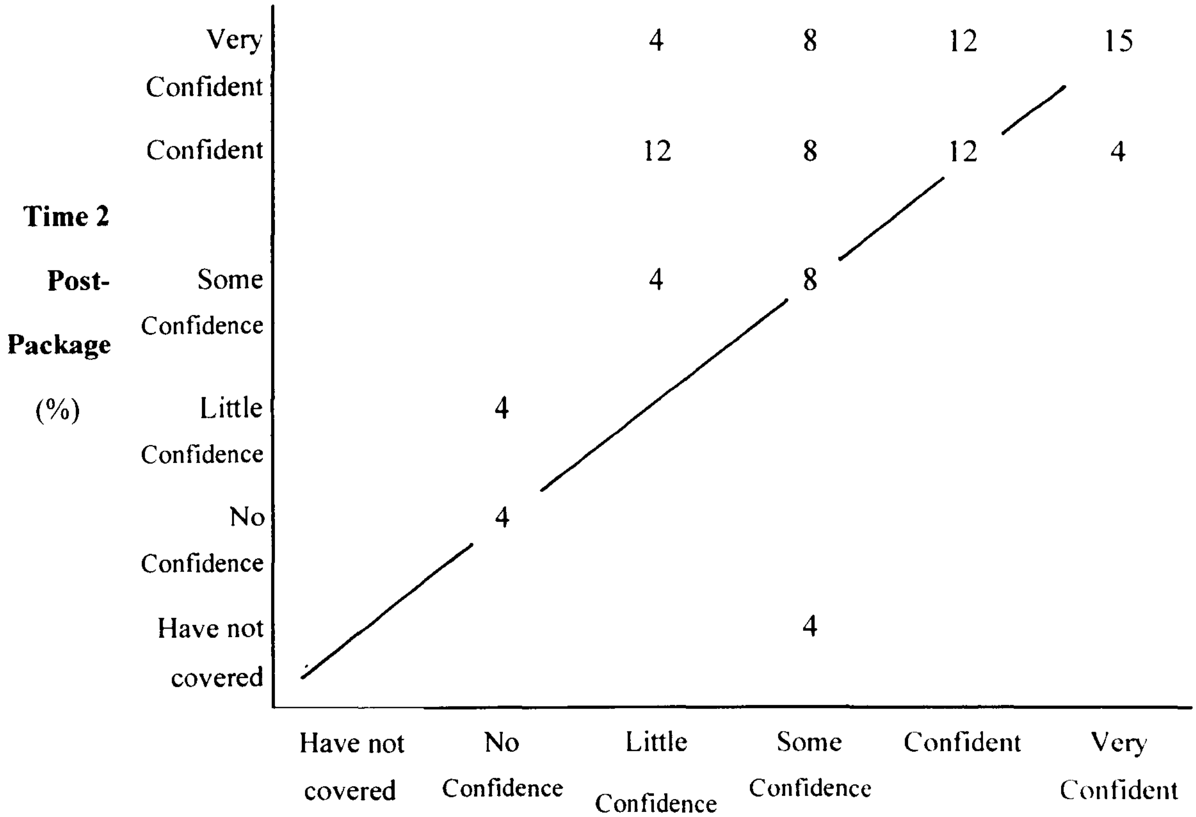


Chart 9.9.2d shows 39% of the sample did not change in confidence after using the package. and 8% of the sample decreased in confidence after package use. combining to produce an insignificant result.

Chart 9.9.2e - Objective 11: Explain the construction of a stem & leaf plot

Time 2 Post-Package (%)	Have not covered	No Confidence	Little Confidence	Some Confidence	Confident	Very Confident
Very Confident	4					
Confident	4		7			
Some Confidence			7	4		
Little Confidence		7	4			
No Confidence		11	4			
Have not covered	26	15	7			

Chart 9.9.2e shows 45% of the sample did not shift in confidence after using the package, and that confidence on this objective was generally low at both pre-test and post-test, with 26% of the sample decreasing in confidence after using the package.

Chart 9.9.2f - Objective 12: Explain the difference between the cut-point and the midpoint

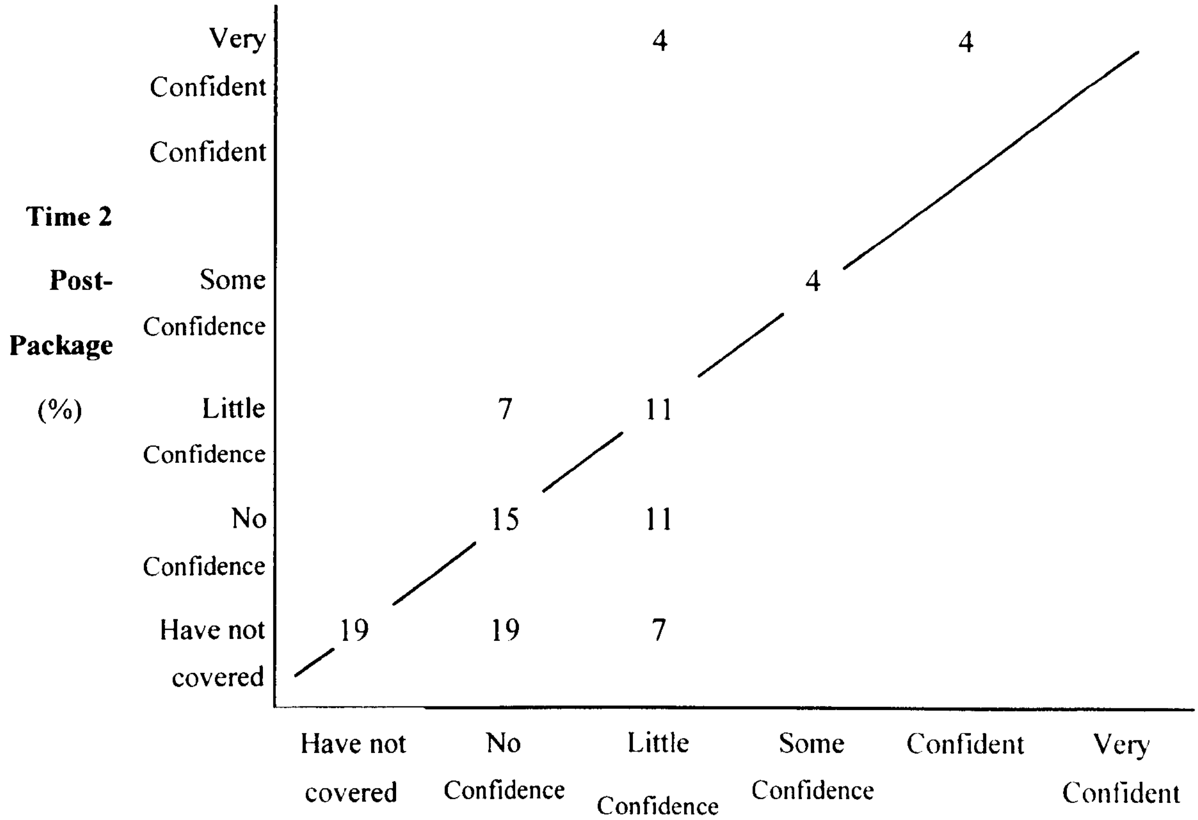


Chart 9.9.2f shows low confidence about fulfilling this objective amongst the sample generally, with 19% of the students not covering the Objective's material during package use. A further 30% did not shift in confidence, while 37% decreased in confidence after using the package.

9.9.5.3 Evaluation episode three - Postgraduate Sociology students

As with the earlier episodes, the students in this evaluation episode did not increase in confidence across all objectives. They were significantly more confident on Objectives 1, 3, 5, 6, 7, 8, 9, and 10, ($p<.05$), but did not show a significant increase in confidence on Objectives 2, 4, 11 and 12. The non-significant results are considered on Charts 9.9.3a, 9.9.3b, 9.9.3c and 9.9.3d. The full sign test results are listed in Appendix 5.13.

Chart 9.9.3a - Objective 2: Interpret a simple frequency table including percentages

Chart 9.9.3a shows 36% of the sample did not shift in confidence, their confidence in fulfilling this objective already being high, while 6% of the sample decreased in confidence after using the package, combining to produce an insignificant result.

Chart 9.9.3b - Objective 4: Interpret a bar chart and a pie chart

Chart 9.9.3b again shows high confidence amongst the group with 52% not shifting after package use, although 6% of the sample decreased in confidence.

Chart 9.9.3c - Objective 11: Explain the construction of a stem & leaf plot

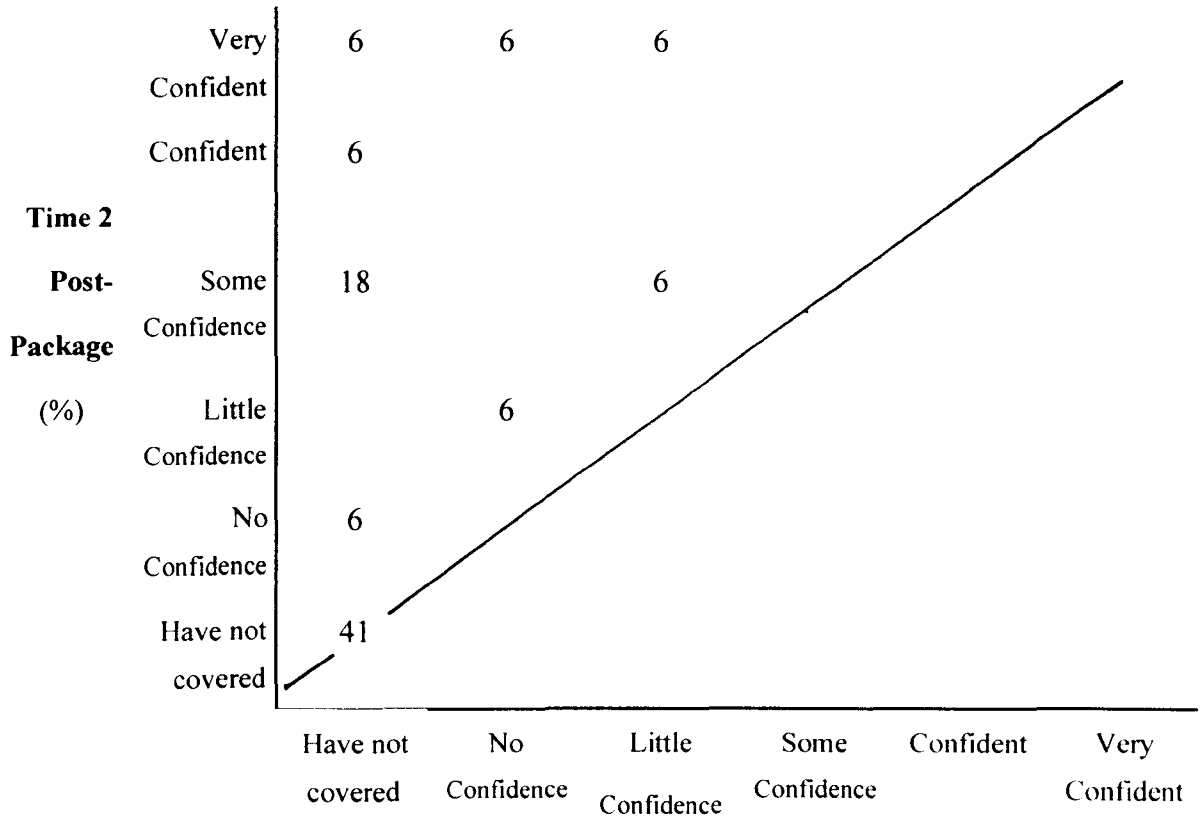


Chart 9.9.3c shows 41% did not cover this objective during package use. Of those who did cover the material, 18% did not increase in confidence, combining to produce and insignificant result.

Chart 9.9.3d - Objective 12: Explain the difference between the cut-point and the midpoint

Finally, Chart 9.9.2d shows 47% of the sample did not cover the objective's material during package use, while 6% did not shift in confidence over time, and a further 6% fell in confidence on this objective after using the package.

The Confidence Log findings indicated what material the students had and had not covered in the package. The results also demonstrated areas of weakness in the students' confidence before package use.

9.9.5.4 Confidence Log Comments

The Confidence Log gave the students an opportunity to add any comments they wished at the end of the measure. The comments that the students made are listed by time and evaluation episode as follows:

Pre-Task Confidence Log

Evaluation Episode 1 - Accountancy and Finance students

Student AC23 - 'I feel I've hardly learned anything from the basic computing tutorials but I think EQL and UA is very useful and is a helpful package.'

Student AC43 - 'Course should be taught at a slower pace.'

Student AC104 - 'Should use computers more.'

Student AC107 - 'I found the introductory computing course to be of little value and could have done with being more intense.'

Evaluation Episode 2 - Undergraduate Sociology students

Student US10 - 'When I am being shown step-by-step stats. I am fine, but I panic when facing them alone.'

Evaluation Episode 3 - Postgraduate Sociology students

Student PG10 - 'I'm probably more familiar with 'discrete & continuous' data etc. but I just don't know the terminology! I could probably guess only.'

Student PG12 - 'My experience of statistics and computers is limited.'

Post-Task Confidence Log

Evaluation Episode 1 - Accountancy and Finance students

No student commented on the Post-Task Confidence Log.

Evaluation Episode 2 - Undergraduate Sociology students

No student commented on the Post-Task Confidence Log.

Evaluation Episode 3 - Postgraduate Sociology students

Student PG12 - 'Found the package easy to understand and very useful. Have learned a lot. By completing this questionnaire I have been able to evaluate my own progress.'

9.9.6 The Quiz

The Quiz was completed by the Sociology students in both the second and third evaluation episodes. This quiz nominally consisted of 10 questions. However, many of the questions had several answers, resulting in what had to be treated as effectively 19 questions. A marking scheme then had to be devised. Each right answer in multiple answer questions was given a sub-category. If the student selected that answer, they were coded as right. If they did not supply a correct answer they were coded as wrong. If they selected the 'don't know' response to the whole question, each sub-section was coded as containing a 'don't know' response from that student.

A matched pairs t-test was performed for the quiz score results on the data from each evaluation episode. Amongst the Sociology undergraduates in the second evaluation study, the pre-task mean number of correct answers was 6.43, while on post-task this rose to 11.68. This difference was found to be highly significant [$t=7.64$, df27, $p<.001$]. The package therefore significantly improved these students' performance on the quiz.

A matched pairs t-test was also performed on the total quiz scores of the postgraduate Sociology students in the third evaluation episode. The postgraduate performed slightly poorer on pre-test than the undergraduates, with a mean of 5.35 correct answers. On the post-task Quiz they performed slightly better than their undergraduate colleagues, with a mean of 12.06 correct answers. As with the undergraduates, the difference in the postgraduates' scores were found to be highly significant [$t=6.87$, df16, $p<.001$], again suggesting the package improved the students' performance on the quiz.

9.10 Discussion

GraphIT! appeared to be successful in helping students increase in confidence and perform better on a related quiz, but only where the students had covered the material. These findings suggest that the teaching staff should ensure enough time is allocated for use of the full package.

The students were generally positive about the package, although only a few used it in their own time.

9.11 Conclusions

The teaching staff's hope that the package would be useful as an open-learning tool was not demonstrated in this study as the students' failed to return to use the package, despite their best intentions reported on the Post-Task Questionnaires. However, as a cross-departmental learning resource, the package did appear to be successful.

The learning objectives may have been too ambitious for the teaching session, as students in all 3 evaluation episodes struggled with the objective relating to material quite far into the package. The fact that all 3 episode produced similar results indicates that one hour was not enough for full and thorough use of the package. However, the staff were hopeful that the students would return to the package and complete it more fully. In that case, only those objectives which were realistically achievable should have been included in the measure.

The measures appeared to be effective in this study despite the differences in the samples. The use of the same package and the production of both unique and similar findings from each sample suggests that TILT-E methods can be useful across a range of student backgrounds. The prompt asking students to predict their reuse of the package was found to produce unreliable results, however, as it failed to correlate with actual reuse.

The Confidence Log was found to be useful in demonstrating student-perceived gaps in their knowledge at pre-test, and in indicating what material the student had failed to cover or was still unsure of. This measure therefore has value despite its lack of relationship with performance, as demonstrated in the Fast Frac case study in Chapter 8.

CHAPTER 10
CASE STUDY 3: NETSEM

10.1 Introduction

In the earlier case studies the evaluation episodes occurred on one day, usually within a morning or afternoon, and fitted neatly into a pre-test and post-test design. However the TILT-E methodology had to cope with different evaluation situations, and the following case study, NetSem, provides an example of a different study design.

10.1.1 The study

The 20th Century Music course in the Department of Music at Glasgow University required students to present a seminar verbally during tutorials, and to participate in discussions about their and their colleagues seminar presentations. Traditionally the presentations had proved successful but the discussions were limited and few students contributed (Duffy et al, 1995). To facilitate the discussions and encourage a more critical perspective amongst the students (Myers 1994), it was decided to use computer-mediated communication (CMC). It was believed this would also resolve the time-tabling problems frequently encountered on this course, as the students came from both the Arts and the Engineering faculties.

10.2 **Aim**

10.2.1 The evaluator's aim

NetSem provided the opportunity to test the adaptability of the TILT-E evaluation framework. It also enabled the evaluation of computer-mediated communication, an opportunity not afforded elsewhere in the TILT Project.

10.2.2 The teachers' aim

The teaching staff hoped the use of NetSem would encourage students to contribute to the discussion of seminars, and so enable them to learn more through discussion with their peers.

10.2.3 Perceived barriers to the success of NetSem

The students were not told that 25% of their coursework mark would be from their participation in NetSem until after they had committed themselves to the course. The course materials circulated prior to the course had not mentioned NetSem, as the concept was developed after this material was produced. These issues and those discussed below were considered by teaching and evaluation staff to be potentially disruptive to the achievement of the study's aims.

From informal discussion with the NetSem administrator and teaching staff, several potential barriers to the success of NetSem were foreseen prior to implementation. Firstly, students may have struggled with the technology. To counter this, 5 hour-long voluntary 'drop-in' training sessions were run by the department. Secondly, computer access may have become a problem, as pressure on available resources increased with student numbers. Thirdly, the students may not have taken to the idea, and could conceivably have boycotted it. However, the students had two important motivators to participate in NetSem. The first was the development of their IT skills. The second was their final course mark.

10.3 The software

NetSem was a conferencing system constructed of existing software on the Music Department's network of NeXT computers. The system required the students to word process a seminar using the WriteNow package, then email it to a general area as an attachment. Discussions were then conducted asynchronously over email. The students only needed basic word processing and email skills to participate in NetSem. The Department already had an integrated multimedia environment on its machines, in the form of NEXTSTEP including NeXTMail, an icon-prevalent mailing package similar to those found on the Web today.

10.3.1 Access to NetSem

The students had access to approximately 25 computers 24 hours a day, 7 days a week. Five of these machines were placed in the departmental library to enable students to access reference materials. The students did not have exclusive use of the machines however, as the department had moved towards computer literacy for 100%

of its students through its IT policy. All students in the Music Department, including the sample in this study, were issued with email addresses early in their career at the University. Before using any software on the Department's NeXT clusters they had to log on to the local network. This then allowed them access to the local area network and the Web without further logging procedures.

10.3.2 - Additional operational resources

All NetSem students were given access to a short on-line dedicated information manual to guide them. Included with this were the requirements for both seminar presentations and contributions, and sample seminar questions and answers. The students also received a generic *Introduction to NeXT* manual developed by the Music Department.

10.4 The Students

Forty students joined the 20th Century Music class in October 1994. The students came from B.Mus, M.A. and B.Eng. degree paths, and from second, third and fourth year.

To handle numbers, the class was split into 8 groups of 5. Intuitively, it seemed sensible to teaching staff and evaluators to divide the groups according to academic experience, so second years were kept together as much as possible, as were third and fourth years. Degree course was perceived as less relevant, as long as maturity of academic argument was similar across the students in each group. Gender and age information was not available for the groups, although at the end of the study this information was collected from about half the sample.

10.5 Administration of NetSem

The Music Department had no direct experience of using CMC for this type of teaching and assessment, and hence could not accurately anticipate how much or how little input would be required from the teaching staff to enable NetSem to run smoothly. The basic administration was planned as follows:

- The student wrote their seminar into a word-processing document.

- They then posted the file in a common area of the network.

- The students debated the issues in the posted seminars using email as the communication medium.

- Seminars and contributions were assessed by teaching staff, the final total being a maximum of 25% of the final mark for the whole course, the remaining 75% of the end mark being listening tests and essays.

The seminar itself was worth 15% of the end-of-course assessments. The contributions (a pre-defined minimum of 2 in response to each of the 5 seminar topics, including the topic written by the contributing student) were worth 10%, breaking down into 2% per seminar topic. Both submitting a seminar and contributing to the discussion were compulsory.

The students were split into 8 small groups of 5, numbered Group 1 to 8 respectively. Three members of teaching staff were allocated to each group, allowing the students to ask questions and engage the staff in the discussions alongside their colleagues. Five seminar periods were developed, one for each student in each group to act as the presenter, with a three-week period for discussions. The seminar periods and topics were as follows:

Period 1: Neo-classicism (Stravinsky)
Presentation due: 31 October 1994
Discussion opened: 31 October 1994 - 21 November 1994
Period ended: 21 November 1994

Period 2: Atonal and 12 note music (Webern)
Presentation due: 21 November 1994
Discussion opened: 21 November 1994 - 12 December 1994
Period ended: 12 December 1994

Period 3: Integrated serialism (Stockhausen)
Presentation due: 16 January 1995
Discussion opened: 16 January 1995 - 6 February 1995
Period ended: 6 February 1995

Period 4: Indeterminancy (Cage)
Presentation due: 6 February 1995
Discussion opened: 6 February 1995 - 27 February 1995
Period ended: 27 February 1995

Period 5: Minimalism (Reich)
Presentation due: 24 April 1995
Discussion opened: 24 April 1995 - 15 May 1995
Period ended: 15 May 1995

Students were given the list of seminar questions (one question per period) and hints to assist them on 20 October 1994 Therefore those presenters who had exams in the third term (and for some it could be their fourth year final exams) could prepare their seminar earlier. By doing this, the students were not disadvantaged by time. The students did not however have choice of question, and had to complete the question for the period they were allocated.

The students were introduced to the concept of electronic seminars at the beginning of the first course lecture on Thursday 13th October 1994. The format of NetSem was explained to them, and they were then asked to sign up for 'drop-in' sessions.

The 'drop-in' sessions ran daily throughout the week beginning 24th October 1994. The first seminar submissions were due the following Monday, 31 October 1994. Group size at the drop-ins ranged from 2 to 10 students, with 32 students in total taking advantage of the sessions. At these sessions it emerged during informal interviews conducted by the author that some students were apprehensive about the forthcoming experience, and one reported asking a colleague 'Why are they doing this to us?' during the introduction to NetSem at the lecture on 13th October.

10.6 Measures

As NetSem would be running for a year it was important to plan the evaluation both proactively and reactively. In other words, while it was possible to plan some evaluation measures and their administration using the TILT-E existing framework of proactive evaluation (i.e. planning and designing the evaluation in advance), the evaluator had to be prepared to construct additional measures and to administer them quickly if it appeared there were problems with NetSem (reactive evaluation).

The one-hour training session could have measures pre-constructed using TILT-E's design, as the students were available in groups for testing. Measures were developed for this purpose and are discussed later. It was recognised and agreed between the staff and the evaluator that some form of post-NetSem measure would have to be developed during the study. Outwith these, only one other measurement technique was proactively chosen before the study commenced, and that was informal discussions with staff and students throughout the evaluation period. To this end, the NetSem administrator and the evaluator were in touch with each almost daily through phone calls, emails and visits.

The measures and methods actually used in the study, both proactively and reactively developed, were as follows:

10.6.1 Pre-Training Questionnaire

The Pre-Training Questionnaire was administered at the training sessions before the students began interacting with the computer, and measured three important aspects - Computer Experience, Seminar Experience and Topic Experience (see Appendix 6.1). The objectives of these components are described in the following subsections.

10.6.1.1 Computer experience

The computer experience component of the Pre-Task Questionnaire aimed to determine:

- Which packages, systems and interfaces the student had prior experience of, if any.

- If the student was using computers as part of any other course, and if so, what course, and whether they had experienced any difficulty using them.

- What hardware and software used by NetSem the student had experience of.

- Whether the student had ever written essays using a word processor before.

- What IT skills required by NetSem the student already had experience of.

- How confident the student was about using a computer.

- How skilled at using a computer the student felt they were.

10.6.1.2 Seminar experience

The seminar experience component of the Pre-Task Questionnaire aimed to determine:

- If the student had ever participated in a seminar before, and if so, whether they were presenter, participant or both.

- If the student had participated in any discussions in the seminar.

- If the student felt more confident about expressing their views verbally or in writing and why.

10.6.1.3 Topic experience

The seminar experience component of the Pre-Task Questionnaire aimed to determine if the student was familiar with 20th century music or if it was new to them.

10.6.2 Post-Training Questionnaire

The Post-Training Questionnaire was administered immediately after the drop-in training sessions (see Appendix 6.2), and was designed to determine:

- Whether the drop-in session helped the student and why/why not.
- If the student felt they needed more information, and if so, what information.
- How the student felt about email seminars.
- Whether the student was concerned about 5 particular components of NetSem and why, including using the computers and exposing themselves to criticism.
- How confident the student now felt about using a computer.
- How skilled the student now believed themselves to be at using a computer.
- Whether the student would have taken the course had they known that email seminars were involved.

10.6.3 Informal Interviews

Throughout the study, informal contact with students and the administrator was important in assessing the issues within NetSem. These interviews were not documented because of their informal nature, but were crucial in the development of the Interim Evaluation Questionnaire, the Focus Group questions, and the Final Evaluation Questionnaire.

10.6.4 Observation

Observations of the students interacting with the computer could only be conducted during the one-hour training sessions, as the students were then free to use the computer 24 hours a day 7 days a week, making unobtrusive evaluation impractical. The course was instead observed informally during the evaluator's frequent visits to the department.

10.6.5 Interim Evaluation Questionnaire

The Interim Evaluation Questionnaire was designed in response to data gathered through the informal interviews, and hence was a reactive measure (see Appendix 6.3). It was administered at the start of a lecture on 10 November 1994, 10 days after the first seminars had opened up for discussion. The measure was a direct consequence of suggestions during the informal interviews that there were problems occurring in some groups. It was therefore a reactive measure, and examined the following issues:

- Whether the students had contributed to an email seminar as either a participant in the discussion or as a presenter.
- Whether they would like to change groups and why/why not.
- Whether they preferred conventional seminars or email seminars and why.
- If they felt that email seminars were taking up more time than conventional seminars.
- How confident they felt about using the NetSem system.
- Whether they would have taken the course if they knew email seminars were involved.
- If they were concerned about anything related to the email seminars

10.6.6 Focus Groups

Focus Groups were conducted in February 1995 to gain deeper insight into the experience of the students participating in NetSem, and particularly into group differences which were emerging from informal discussions with staff and students. This measure was therefore developed reactively.

The list of prompts for the focus groups was developed from the findings of the Interim Questionnaire and from informal interviews conducted frequently with the students and staff. The focus group prompts examined:

- The time taken to present seminars and participate in NetSem.
- Working patterns, specifically whether the students made a contribution as soon as they read the discussion emails, or whether they thought about their future contribution for a longer period.
- How they felt about their group and whether they discussed the material outside the email environment.
- Computer experience, including their confidence and how equipped they felt they were to deal with NetSem.
- Prior seminar experience, and how conventional seminars compared to NetSem.
- NetSem itself, and how they felt it had or had not helped them learn.

The prompts were developed to initiate and guide the discussion in the focus groups, but were considered only to be starting points for the discussion.

10.6.7 Final Evaluation Questionnaire

The items on the Final Evaluation Questionnaire were developed from all the data gathered earlier in the study, including the Focus Groups, the Interviews and the Interim Evaluation Questionnaire (see Appendix 6.4). It was a 31-item measure administered at the beginning of one of the final lectures in the course on 11 May 1995, and examined students' experience during NetSem including questions about the seminars, computers, email, working in a group, contributions and attitudes.

10.6.8 Eysenck's Personality Scales - Revised Short Scales (EPS-RSS)

In an attempt to unravel some of the underlying issues in NetSem, particularly about group differences, the Eysenck Personality Scales - Revised Short Scale (EPS-RSS) were administered (Eysenck and Eysenck, 1991) at the same time as the Final Evaluation Questionnaire. This measure's inclusion was reactive, responding to data emerging from the Focus Groups.

It was emphasised during the administration of the EPS-RSS that completion was entirely voluntary. Students were informed they would not get their results back, and asked if they could put an identifier (matriculation number) on the EPS-RSS so that cross referencing was possible. Two students out of the 23 attending the lecture chose not to complete the measure.

The EPS-RSS is a four-dimension measure, assessing the respondents' extrovertism, neuroticism, psychoticism and the Lie-Scale. The Lie-Scale is a control dimension assessing the honesty with which the respondent completes the measure (Eysenck and Eysenck, 1969). Respondents' results are then compared with averages from the normal population (Eysenck and Eysenck, 1991), and in this case, with each other.

10.7 Method

The administration timetable of the evaluation measures used in the NetSem study was as follows:

<u>Evaluation of Drop-In Sessions (24th-28th October 1994)</u>

Pre-training measure:

- Pre-Training Questionnaire (see Appendix 6.1)

During training measures:

- Informal interviews
- Observation.

Post-training measures:

- Pre-Training Questionnaire (see Appendix 6.2)

10th November 1994

- Interim evaluation questionnaire (See Appendix 6.3)

13th, 15th and 16th February 1995

- Focus Groups

11th May 1995

- Final Evaluation Questionnaire (see Appendix 6.4)
- EPS-RSS

Throughout the study

Informal discussions with staff and students were conducted throughout the study. Observations of the interaction of staff and students and the administration of NetSem were also performed.

10.8 Results

The numbers completing each paper measure in this study varied, as attendance at any of the measurement times was not compulsory. The findings from all the measures are considered in the following sections.

10.8.1 The Pre-Training Questionnaire

Thirty-two students attended the drop-in training sessions (80% of the class), and completed the Pre-Training Questionnaire asking about computer experience, seminar experience and topic experience. The findings from each of these prompts are considered in the following sections.

10.8.1.1 Computer Experience

Computer experience was assessed on a variety of dimensions. Firstly, the students were asked what computer packages, systems and interfaces they had used. Eight students reported no experience of any packages /systems /interfaces, but two of these students reported that they had used computers, one in psychology labs and one for writing up their dissertation. Other findings from this prompt were also found to be inconsistent, and to suggest that the question should not be asked in this way in the future (See Appendix 6.5).

Students were asked if they were taking any other courses which required them to use a computer. Sixteen respondents (50%) reported that they had, and these courses ranged from Computing Science to Psychology Laboratories. Nine of these 16 students (56%) reported experiencing no difficulty with computer use on other courses, while 5 students (31%) reported that they had some difficulty. Those who reported problems stated:

Student 1 – '1 - Learning how to use programs, i.e. what's there and how to use it.
2 - Programs with bugs.'

Student 9 – 'Not computer-minded.'

Student 13 – 'Using the computer to record sound.'

Student 24 – 'Unfamiliarity.'

Student 18 reported that they were not taking a course which used computers, but appeared confused by the question, stating 'I have no knowledge of the course at all.' Two other students (13%) reported they were taking a course requiring the use of computers, but did not state whether they were having difficulty with the computer component or not, commenting 'Don't know yet' (Student 6) and 'Course just started' (Student 7).

Students were asked what hardware and software they had previous experience of. Their responses are shown on Table 10.8.1.

Table 10.8.1 - Hardware and software experience

	Mouse	Floppy disk	Hard disk	NeXT	Word processing	Email
Number of students	29	18	20	18	17	19

Table 10.8.1 shows what the students have used, but not to what extent they have used them. To clarify the level of their skills the students were asked if they had ever done certain tasks on a computer. Their responses are shown on Table 10..8.2a and Table 10.8.2b.

Table 10.8.2a - Reported computer skills

	Save a file to a floppy disk	Use a menu	Delete a program or file	Save a file	Send an e-mail message	Create a new file
Number of students	8	25	11	14	18	10

Table 10.8.2b - Reported computer skills

	Switch between application windows	Make a copy of a file	Create a new directory or folder	Copy & paste text	Drag and drop a file into e-mail	Prepare a new floppy disk for use
Number of students	10	6	5	7	4	4

Students were asked how often they word processed their assessments. Twenty-three students (72% of the respondents) reported doing so 'always' or 'usually'. A further 7 (22%) reported doing so 'sometimes', with only 2 students (6%) reporting they had never done so.

Students were asked how confident they were about using a computer. The findings are shown on Table 10.8.3.

Table 10.8.3 - Confidence in ability

	Very Confident	Confident	Some Confidence	Little Confidence	No Confidence Whatsoever
Number of Students	1	5	13	9	4

Students were also asked to rate how skilled they felt they were at using a computer. The results are shown on Table 10.8.4.

Table 10.8.4 - Skill ratings

	Expert	Advanced	Competent	Novice	Never Used One
Number of Students	1	0	9	19	2

10.8.1.2 Seminar Experience

Students' prior experience of seminars was also assessed. Twenty of the 32 respondents (63%) reported having participated in conventional seminars before. Of these 20 participants, 6 students (30%) reported participating in the discussions only, 6 students (30%) reported presenting only, and 7 (35%) reported both presenting and participating. One student (5%) could not be coded, stating 'Various English Lit. seminars' (Student 7).

Students were also asked if they took part in discussions during the seminars. Twenty students (63%) stated they did take part in the discussion. One of these students (Student 19) stated they had not been involved in other seminars but then indicated that they had participated during the discussions. Student 24 reported they had participated in seminars in the Music Department, but had not contributed to the discussion stating 'I was not particularly familiar with the subjects.'

Students were also asked whether they felt most confident about expressing their views verbally, in writing, or both. Six students (19%) preferred to express them verbally, 15 students (47%) reported preferring to express them in writing, while the remaining 11 (34%) reported they were comfortable doing both. The reasons the students gave for their answers varied depending on their preference (See Appendix 6.6). Those who answered 'Verbally' gave reasons for their answers including dyslexia (Student 1), the 'personal' aspect of discussions (Students 7 & 29), being better at spoken than written English (Student 12), and being able to elaborate (Student 2). Student 18 failed to explain his verbal preference.

Those who stated they were preferred expressing their views in writing stated they were more confident doing so (Students 4, 9, 25 and 32), it gave you more time to organise what was said (Student 3, 13, 15, 19, 20, 28 and 31), and mistakes could be corrected (Students 5 and 32). Student 26 reported preferring expressing their views in writing because they were more experienced in doing so, while Students 17 and 23 failed to explain their written preference.

Students who were confident expressing themselves both in writing and verbally explained their answers as follows:

Student 8 - 'Can participate there and then verbally and converse with others. In writing, sometimes say more.'

Student 10 – 'I probably prefer verbal communication as results/responses appear more imminent!'

Student 11 – 'Because I'm fairly good at getting a point across in whatever way.'

Student 14 – 'Got to do both in English and Scottish Literature.'

Student 16 – 'It depends on where I am and who I am with which one I prefer.'

Student 21 – 'Verbally can be more stimulating as immediate feedback and interaction. Writing - more time to think about what you want to say. Perhaps more coherent argument.'

Student 24 – 'Both have their merits. Time to organise thought when writing. More enjoyable verbally.'

Student 27 – 'I can be articulate in different ways at different times depending on who I'm addressing.'

No explanations were given by Students 6 and 30.

10.8.1.3 Subject Experience

Students were asked about their familiarity with 20th Century Music. Their responses are shown in Table 10.8.5.

Table 10.8.5 - Familiarity with 20th Century Music

	New (not familiar)	**Have played 20th century repertoire**	**Have studied it before**	**Have heard 20th century repertoire**
Number of students	1	23	19	27

Table 10.8.5 shows that almost all students who completed this measure are already familiar with the topic.

10.8.2 Post Training Questionnaire

The Post-Training Questionnaire was administered to ensure the students had received enough information during the training sessions and felt confident about participating in NetSem.

All students reported that the drop-in session helped them, and when asked why most stated that it had taught them basic skills and gave them an understanding of email and/or word processing they did not have before the training session answers (See Appendix 6.7). When asked if they needed more information, 12 students (41% of respondents) reported that they did, all wanting to revise some or all of the material presented in the training session (See Appendix 6.8).

Students were asked how they felt about email seminars. The question was open-ended, allowing students to answer in any way they wished. Their responses are listed in Appendix 6.9. In summary, 22 students (69%) were positive about using the computer, the concept of the email seminars, or both, and 10 students (31%) were anxious or negative about either the medium or the topics. At the extreme ends of each group were the following examples:

Student 4 – 'SCARED!'

Student 11 – 'I loved it. Now I have the power to send messages to whoever I want. Without this session I would never have used the system.'

Students were asked if they were concerned about expressing their views clearly in writing; using the computers; finding something to say about the topic; understanding how the system works; and exposing themselves to criticism. They were also asked to give reasons for their concern. The number of students concerned about each issue are listed in Table 10.8.6.

Table 10.8.6 - Concerns remaining after the training

	Expressing views in writing	Using the computers	Finding something to say about the topic	Understanding the system	Exposure to criticism
Number of students	4	12	5	9	2

Not all students who reported their concerned gave reasons for it. Those who were concerned about expressing their views clearly in writing and gave reasons for it stated:

Student 1 – 'Dyslexic.'

Student 12 – 'I'm miles better orally.'

Student 15 – 'Conciseness.'

Those who were concerned about using the computers and who explained why stated they were inexperienced (Students 3, 4, 5, 8, 13, 14, 17, 21, 22, 25, 26 and 27).

Five students were concerned about finding something to say about the topic, but only 2 explained their answer:

Student 16 – 'Don't know anything about Western.'

Student 25 – 'Its very early in the course to start a seminar - especially with a new format.'

Students 15, 18 and 19 did not give reasons for their concern.

Five students explained why they were concerned about understanding how the system works, all of whom cited lack of experience (Students 1, 8, 14, 17 and 26).

Students 4, 5, 18 and 21 also expressed concern about understanding how the system works, but did not give reasons for their concern.

Only Student 4 was concerned exposing yourself to criticism, stating 'Its easier to deal with criticism face-to-face rather than through a computer.' Again Student 18 expressed their concern but did not explain why.

Students were then asked about their confidence and skill at using a computer, and these results are compared with the students' Pre-Training Questionnaire responses in Tables 10.8.7 and 10.8.8.

Table 10.8.7 - Confidence in ability

	Very Confident	Confident	Some Confidence	Little Confidence	No Confidence Whatsoever
Before training	1	5	13	9	4
After training	1	8	14	3	0

Table 10.8.8 - Skill ratings

	Expert	Advanced	Competent	Novice	Never Used One
Before training	1	0	9	19	2
After training	1	0	14	11	0

Finally, students were asked if they would have taken this option if they had known that email seminars were involved. Answers of possibly, probably and perhaps were coded as 1 – a positive statement alongside answers of 'Yes', while answers of probably not, possibly not, and perhaps not were coded as 2 – a negative statement, alongside 'No'. Answers of 'don't know' and 'not sure' were classified together.

Twenty students (63%) stated they would have taken the course had they known email seminars were involved, 9 (28%) said they would not, 2 (6%) were unsure, and 1 student (3%) did not answer.

10.8.3 Interim NetSem Results

Twenty-nine students completed the Interim Questionnaire, almost all of whom had contributed to the seminars in some way - 20 as participants and 7 as presenters.

Students were asked if they would like to change groups. None reported they wanted to. Only 7 students explained why, and they gave the following responses:

Student 12 - 'No - our group seems fairly jovial so far.'

Student 16 - 'No - I like who I am with.'

Student 20 - 'No - I think things are going well.'

Student 28 - 'No - Except for the fact that most of them have not participated. It has been a bit of a two person conversation.'

Student 38 - 'No - No problems.'

Student 39 - 'No - Because its perfectly alright as it is!'

Student 40 - 'No - I want to learn to use a computer.'

The Interim Questionnaire also asked students if they preferred email to conventional seminars. Fifteen students (52%) reported preferring email to conventional seminars. Students were asked why, and reasons given included that email was easier (Students 13, 17 and 35), and that it gave them more time to contemplate their answer (Students 1, 19, 20, 24, 25, 28, 31 and 37) (see Appendix 6.10). Student 38 reported they were 'no problem', while Student 12 stated 'I like email seminars but I don't think I approach them as seriously as a conventional one. I also think they are more prone to error.'

The students who preferred conventional seminars stated they were better because computers weren't involved (Students 5, 39 and 40), and because they prefer the 'personal' aspect (Students 6 and 16). Several students preferred the spontaneity and immediate responses of conventional seminars (Students 10, 18 and 36). Student 3 felt it is easier to express yourself in conventional seminars, Student 11 felt conventional structures were better, and Student 26 reported that they were more familiar with the demands of conventional seminars (see Appendix 6.10)

Three students selected neither email nor conventional seminars. They stated:

Student 2 – 'Both, they are both advantageous to the student, both nurture skills. one shouldn't be replaced by another but both should maybe be continued.'

Student 21 - 'Both have positive and negative points. With email seminar you don't get the chance to have immediate feedback on discussions.'

Student 33 - 'Don't know, each has its advantages, email gives more time to research, conventional gives more instantaneous feedback.'

Nineteen students (66%) felt that email seminars took up more time than conventional seminars. They were asked how much more, and their answers ranged from 'About an hour' (Student 13) to ' Days & days' (Student 40) (see Appendix 6.11).

The students' were also asked how confident they were in their ability to use a computer. Table 10.8.9 shows the results.

Table 10.8.9 - Confidence in ability

	Very Confident	Confident	Some Confidence	Little Confidence	No Confidence Whatsoever
Number of Students	6	6	14	3	0

To determine the reliability of the prompt in the Post Training Questionnaire which asked the students if they would have taken the course had they known email seminars were involved, the question was repeated on the Interim Questionnaire. Nine students (31%) said 'No', an identical number to the Post Training Questionnaire's finding. The students were not asked for comments on this question, but several chose to add more information. There comments were as follows:

Student 4 - 'Yes - I'm just annoyed that we weren't given time to be shown fully how they work.'

Student 6 - 'No - Probably not but I might have once I really thought about it.'

Student 10 - 'Yes - I didn't want to do P1 or P2.'

Student 17 - 'No - but I am pleased I have since it has enabled me to get some knowledge concerning computing which I doubt I would have received otherwise.'

Student 21 - 'Yes - Probably - but I think we should have been told. For someone with little computer experience its v. daunting.'

Student 36 - *(No selection)* 'Perhaps not. I find it quite time-consuming & time is something I don't have much of. The email itself isn't a problem its just a bit inconvenient.'

Finally, the students were asked if they were concerned about anything related to the email seminars. Their responses were largely concerned with problems with computer use (see Appendix 6.12).

10.8.4 Focus Groups

Focus groups were conducted in the second week of the fourth seminar discussion to ensure there were no difficulties of which the staff were unaware, and to establish why there were differences in discussion levels between groups. It was becoming apparent by this point that some groups were having passionate discussions while others were almost entirely silent.

Three focus groups were conducted, one group exclusively involving students from the B.Mus 2nd year (who comprised the bulk of the class), another was a mixed-year M.A. group, and the third a group with representatives from most years and degree paths.

Eleven students (28% of the total sample) participated in the focus groups, 4 females and 7 males. The average length of the focus groups was 48 minutes, with time ranging from 43 minutes to 52 minutes. With the students' permission, all focus groups were videotaped for later analysis of the students' responses.

The results from the focus group were intended to assist in the construction of prompts for the Final Questionnaire, which they did. They also demonstrated that the similarity in academic years or across degree paths was not the critical factor in the success of their experience of NetSem. Instead, what was influential in the students' perception of success was the discussion group to which the student had been assigned. Each focus group had at least one student from the two most successful groups (Groups 4 and 5), that is, the groups who had the liveliest discussions and greatest number of contributions, and at least one from the poorer groups (Groups 7 and 8). The data generated by the focus groups showed that the students from the most successful groups knew each other outside the email environment. One student described himself as 'lucky' (Student FG2M1: Group 4), because he knew his email colleagues out with NetSem. In an earlier focus group, another member of Group 4 stated his group was 'mad' (FG1M3: Group 4). This student reported that his discussion group had his flatmate and his friends in it. In contrast, a female student from Group 7 wished she knew her group better, stating she didn't know how they would take what she was saying on email (FG3F1: Group 7). In an earlier focus group, a member of Group 7 reported that of his 4 contributions he had made to NetSem (equivalent to only one contribution a seminar), in at least two of them he had been misquoted. When asked directly why he didn't contribute more, he stated he had 'a really bad memory' and needed prompting (i.e. reminding) (FG1M1: Group 7).

The issues arising from the focus groups needed explored in more depth. At this stage, given the novelty of this teaching and assessing method in this course, a central aim was to ensure that no students were disadvantaged by this innovation. The focus group suggested that the group issue was central to success, and therefore those who were in 'quiet' groups had not been given the same experience than those in lively groups. This was taken into consideration by the assessor, so no student who tried to make their contributions was penalised for being in a 'quiet' group.

10.8.5 Final Questionnaire

The primary issue coming out of the focus group was the importance of the discussion groups, and in particular, the discussion group dynamics. This became the focus of one of the dimensions on the Final Questionnaire. Other issues arising in the focus groups and turned into dimensions on the Final Questionnaire included: Email use; Computer skills & training; Attitudes; The seminars; and a 'General' category, asking student about their experience of NetSem. In all, 33 questions were selected out of a list of 72 questions devised from the focus group analysis, the Interim Questionnaire, and the informal interviews.

10.8.5.1 Results from the Final Questionnaire

Twenty-three students (58% of the class) completed the final questionnaire, 12 females, 9 males and 2 who did not provide gender information. The data is reported both within-seminar groups and between-seminar groups to allow comparisons.

10.8.5.1.1 Seminar Preference

Students were again asked whether they preferred email seminars or conventional seminars. Thirteen students (68% of respondents, as 4 failed to answer this question) stated they preferred email seminars. In the Interim Questionnaire, 56% of the sample said they preferred email. The students' responses on the Final Questionnaire are shown on Table 10.8.10 by number of students in that group selecting that response. Note not all students completed the measure, hence some groups only had one representative at this testing time.

Table 10.8.10 - Seminar preference

Seminar	**Seminar Groups**							
Type	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Email	2		2	3	1	2	2	1
Conventional		1	2				2	1

The students were asked once more to explain their selection, and it was found these responses were consistent with the responses gathered on the Interim Questionnaire (see Appendix 6.13)

Students were asked if they had learnt anything from the NetSem seminars. All reported they had, except Student 36 who failed to answer this question. The students were asked to give examples of what they learnt to assess whether the focus was on content or IT skills. Students 1, 21 and 36 did not comment. Nine students responded by mentioning computer skills (Students 3, 5, 12, 14, 19, 22, 23, 25 and 40). Of the remainder, 5 reported learning something about communication in seminars and discussion groups (Students 2, 6, 10, 31 and 32), while only 6 reported learning something about the topics (Students 7, 13, 15, 20, 35 and 39) (see Appendix 6.14).

Students were also asked what they liked most about the email seminars and what they liked least. Their responses are shown in Table 10.8.11.

Table 10.8.11 – Students' likes and dislikes about email seminars

Student number	Liked most	Liked least
1	Lots of time to mull over the issue and then time to give worthwhile responses.	Time scale, had to answer too soon or submit a reply too soon i.e. not enough time to research your replies to other submissions
2	Convenience, time to think	Too informal, time wasting and fun answers etc.
3	You could voice your opinions without being interrupted. There wasn't a set time to contribute e.g. 4pm Wed. or something. -	Starting to use the computers and not understanding the system at first. The debates were never very heated, and tended to avoid the real question.
5	Didn't have to stand up and give a talk	Had to use computers
6	In responding to seminars there is more time to research a constructive reply	It is hard to keep the debate focused and people can avoid your questions amore easily over a computer than if you asked them and insisted on an answer.
7	I quite enjoy getting email messages all the time	I found it quite difficult to get people to respond to MY seminar - except Celia!
10	Flexibility; opportunity to 'throw a spanner in the works' during a discussion	Being a member of a group who were reticent about participating and never really had a 'discussion' as such

Table 10.8.11 – Students' likes and dislikes about email seminars (Cont.)

Student number	Liked most	Liked least
12	I was in a lively group so I enjoyed everything about the seminars i.e. amusing yet informative points. Putting comments together in own time i.e. no hassle of set time to comment.	N/A
13	It was good to have a small group	No Answer
14	Time to consider all issues and change your mind	No spontaneous arguments - arguments dulled after 2 comments
15	Being able to discuss things without feeling self-conscious. The 'unofficial' seminars e.g. the man at Cardiff Uni.	Slight cattiness that arose.
19	freedom to say more of what you really think	People not responding at all
20	Not having to speak directly to people, especially when presenting my own seminar.	There wasn't much difference between presented seminars and essays.
21	Flexibility	No personal contact - Chance to have conversation with immediate feedback. they don't really work when people don't contribute - but that's also true of conventional seminars.
22	That contributions aren't worth much	Disliked that seminar presentation was worth quite a lot.

Table 10.8.11 – Students' likes and dislikes about email seminars (Cont.)

Student number	Liked most	Liked least
23	Detachment. Ease. Time to think and rewrite if necessary.	Replying. lack of response. The topics, especially Cage.
25	The flexibility.	It's not over after one 'session' and your comments are logged/assessed.
31	Replying to everyone's comments	Reading the actual seminar, when a new one is being presented I'm not eager to read it, but once I have it's okay (bizarre I know).
32	Not having to stand up in front of people and think on the spot.	Lack of response. Subjects were sometimes ambiguous.
35	Seminar can be done at any chosen time.	Email abuse.
36	The chance to re-read the main seminar as you go along when making a reply.	No answer
39	No pressure to make comments quickly and don't have to disagree with people face-to-face.	Finding the seminars on the computer!
40	You can do them in your own time. You have longer to think about what you want to say.	They are very impersonal.

The students had expressed some displeasure during the focus group at the delay in returning their results to them. This was rectified immediately after the focus groups, as staff were unaware it was an issue. Although the problem had been rectified, it was felt important by the teaching staff to ask the students whether they felt they had enough feedback. The results are shown in Table 10.8.12.

Table 10.8.12 - Feedback from staff

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes	2		3	4	2		3	1
No		1	1	1		2	1	1

10.8.5.1.2 Email

A question asking students if they were familiar with email before the course started was included in the Final Questionnaire in an attempt to assess the reliability of this prompt by comparing it with responses with those given on the Pre-Training Questionnaire. However, while the Pre-Training Questionnaire measured actual use of email, the Final Questionnaire asked about the students' familiarity with email, which could be interpreted as anything from knowing it existed to being an expert user. The results are therefore not reported here.

This inconsistency issue arose again when the students were asked how confident they felt about using the email system. On the Pre- and Post-Training Questionnaires, the students had been asked how confident they were about using a computer, a more general and hence incomparable prompt. However, the question had value as a measure of students' confidence having been a NetSem participant for an academic year, and so the results are shown in Table 10.8.13.

Table 10.8.13 - Confidence using email

Group	Very Confident	Confident	Some Confidence	Little Confidence	No Confidence
1	1	2			
2	1				
3	1	2	1		
4	4	1			
5	1	1			
6		2			
7			2	2	
8		1			

To determine self-reported differences in behaviour between groups the students were asked how often they checked their email. The findings are shown in Table 10.8.14.

Table 10.8.14 - Frequency of checking email

Group	Every day	Every 2-3 days	Once a week	Once a fortnight	Less than once a fortnight	Less than once a month
1	2					
2		1				
3	1	2	1			
4	4	1				
5	2					
6	2					
7		2	1	1		
8		2				

10.8.5.1.3 Working in a group

After the early informal complaints about groups, the students were asked on the Interim Questionnaire if they would like to change groups, but none wanted to. The dissatisfaction of some members of the focus groups suggested that the question should be included in the Final Questionnaire to establish if the students in the quiet groups viewed the problems as group-based, or as a result of NetSem itself. Their responses are listed on Table 10.8.15.

Table 10.8.15 - Preference for another group

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes			2	1		2	1	2
No	2		2	4	2		3	

Students were asked to give 3 words to describe their group's discussions, and these are listed by student below. Students 13 and 21 did not answer this prompt.

Student 1 - 'Annoyingly accurate.'
Student 2 - 'Fun, thought-provoking, intense.'
Student 3 - 'Informed, interesting, slow-to-start.'
Student 5 - 'Brief and concise.'
Student 6 - 'Limited, timid, strained.'
Student 7 - 'Infrequent, unresearched, forced.'
Student 10 - 'Rather non-existent.'
Student 12 - 'Just completely BONKERS.'
Student 14 - 'Exciting, vitriolic, informative.'
Student 15 - 'Lively, informative.'
Student 19 - 'Brief, honest, serious.'
Student 20 - 'Interesting, light-hearted, digressive (?is that a word??).'
Student 22 - 'Bitchy, informative, lengthy.'
Student 23 - 'Slight to absent.'
Student 25 - 'Procrastinating, undynamic, formal.'
Student 31 - 'Entertaining, lively, interesting.'
Student 32 - 'Very, very minimal.'
Student 35 - 'Average, average, average.'

Student 36 - 'Impersonal, slow, fragmented.'

Student 39 - 'Interesting, light-hearted.'

Student 40 - 'Slow, vague, sometimes interesting.'

The students' comments above are enlightening, and indeed could almost be used to identify the discussion groups the respondents belong to. Of particular interest is the words the students use. For example, Student 25 is negative in their description of their group, and uses the word 'formal' as part of the negative responses. Similarly, those who obviously enjoy their group use words like 'light-hearted' (Student 39), 'fun' (Student 2) and 'exciting' (Student 14). Perhaps then the key to success of email discussion groups is informality and humour, with frequent 'lively' (Student 15) debate.

Students were asked if they ever wanted to see other groups' discussions and seminars during the NetSem period. Their responses are shown in Table 10.8.16.

Table 10.8.16 - Exposure to other groups' seminars and discussions

	Other groups' discussions?		*Other groups' seminars?*	
Seminar Groups	**Yes**	**No**	**Yes**	**No**
1	3		3	
2	1		1	
3	2	1	2	1
4	5		4	1
5	2		1	1
6	2		2	
7	4		4	
8		2	1	1

Students were also asked if they would have liked to meet their group face-to-face. The results are shown in Table 10.8.17.

Table 10.8.17 - Meeting the group

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes	2	1	2	3	2	2	3	1
No			2	2			1	1

The importance of social bonds, particularly friendships, in the successful groups was emphasised in the focus groups. To assess the role of friendship the students were explicitly asked if their group-mates were acquaintances, friends or both. The findings are shown on Table 10.8.18.

Table 10.8.18 - Group-mates, friends and acquaintances

Group	Friends	Acquaintances	Both
1		3	
2		1	
3		2	2
4	1	1	3
5			2
6		1	1
7		2	2
8			2

Feelings of isolation were also investigated to assess group differences, as it was known from the focus groups and informal discussion with the administrator that at least one student was isolated by her group because they didn't agree with her opinions. Table 10.8.19 shows the students' response to the prompt 'Did you ever feel isolated?':

Table 10.8.19 - Isolation in groups

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes	2	1		1				1
No	1		4	4	2	2	3	1

Students were invited to state why they felt isolated. All 5 students who reported feeling isolated commented, and their responses were as follows

Student 2 - 'Because of the nature of putting forward your own ideas - is always one that will be met with conflict - I don't mind.'

Student 10 - 'I TRY and respond to a seminar presentation by leaving the groups with questions relating to opinion - these are usually never answered.'

Student 21 - 'Yes, when people don't reply. If a good discussion is going - no.'

Student 35 - 'Only during the Cage seminar. I claimed I had an anti-Cage attitude, which is not actually true, just to strike up discussion, and found my message attacked from all sides. That didn't bother me though.'

Student 36 - 'I find it harder to disagree with a person or question than on a particular point through the computer than I find it in person.'

Student 35 attempts at controversy to inspire discussion had also been a theme in the focus groups. It is probed later in the following *Contributions* section.

10.8.5.1.4 Contributions

The contributions were the most experimental aspect of this intervention, and hence the majority of the Final Questionnaire addressed issues surrounding the mechanics and construction of contributions.

The students were asked if they had any difficulty finding a discussion point in the seminars. The findings are shown in Table 10.8.20.

Table 10.8.20 - Finding a discussion point

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes		1	1	3		2	2	
No	2		3	2	2		1	2

The students were also asked why, if appropriate, they hadn't contributed to one or more of the seminars. Only 4 students stated they hadn't contributed to at least one seminar discussion, giving their reasons as follows.

Student 1 – 'Three weeks wasn't long enough, some seminars had just got started and had to end, also a longer time frame enables other work to get done.'

Student 22 - 'Had too much other work to do, had nothing to contribute.'

Student 31 - 'Had too much other work to do.'

Student 40 - 'Missed the deadline, had lots of other things on.'

Where there were genuine difficulties in beginning a discussion apparent in a group, the NetSem administrator would intervene and assist the students. Students were asked how important the administrator's contributions were in getting the discussion started. These results are shown on Table 10.8.21.

Table 10.8.21 - Administrator's contribution to discussion

Group	Essential	Important	Helpful But Non-Essential	Not Important	Useless
1	1	2			
2		1			
3	1	3			
4	1	2	1	1	
5		2			
6	2				
7	2	1	1		
8		2			

The students were asked if they discussed the seminars outside the email environment. The results are shown in Table 10.8.22.

Table 10.8.22 - Discussion outside the email environment

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes	2	1	1	5	2	2	1	1
No	1		3				3	1

They were also asked, if they did discuss their contributions, who they discussed it with. Coursemates, groupmates and friends were the most popular choices. No student reported discussing it with staff (see Appendix 6.15).

As mentioned earlier, electronic seminars were perceived to have several benefits conventional seminars did not. Included amongst these were time to discuss the points verbally with colleagues before giving an opinion, looking up resources and checking facts to increase confidence, and editing contributions. Whether the students did exploit these additional benefits was probed on this questionnaire.

Students were asked how important it was to them to contribute and why. Student 13 did not answer. The other students reported varying degrees of importance, most noting that it was important (see Appendix 6.16).

Students were asked if the seminar presentation gave them enough information to allow them to discuss the topic without researching it independently. Table 10.8.23 displays the findings.

Table 10.8.23 - Seminar presentations and independent research

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes	1	1	2	3	1	1	2	2
No	2		2	2	1	1	1	

The students were asked if researching the topic beforehand improved the quality of the discussions. The results are shown on Table 10.8.24.

Table 10.8.24 - Prior research and the quality of contributions

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes	3	1	4	5	2	2	3	2
No							1	

The students were also asked how often they referred to textbooks, listened to the music under discussion, discussed points with friends, and took notes from the seminar presentation to establish how much research they were doing and what it was. The findings are shown in Tables 10.8.25a, 10.8.25b, 10.8.25c and 10.8.25d.

Table 10.8.25a - Refer to textbooks

Group	Always	Usually	Sometimes	Never
1	2	1		
2	1			
3	1	1	2	
4			4	
5		1	1	
6			2	
7		1	3	
8			2	

Table 10.8.25b - Listen to the music under discussion

Group	Always	Usually	Sometimes	Never
1	1	2		
2	1			
3	1		2	1
4	1		4	
5		1	1	
6		1	1	
7		1	2	1
8		1		1

Table 10.8.25c - Discuss with friends

Group	Always	Usually	Sometimes	Never
1	1	1	1	
2		1		
3			3	1
4	2	2	1	
5	1	1		
6			2	
7	1		2	1
8		1	1	

Table 10.8.25d - Take notes from the seminar presentation

Group	Always	Usually	Sometimes	Never
1	2			
2	1			
3	2	1	1	
4	1	1		3
5			1	1
6			2	
7	1	1	1	1
8	1		1	

Unlike conventional seminars, NetSem enabled students to re-read the seminars when discussing the content. Students were asked if they had done so, and the findings are shown on Table 10.8.26.

Table 10.8.26 - Re-reading of seminars during discussions

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes	2	1	3	5	2	2	4	1
No	1		1					1

Students were asked if they edited their contributions. This caused a minority of students some confusion, and they scribbled such in the margins of the questionnaire, saying as they had difficulty with the use of the term 'edit' in this context. The results are shown on Table 10.8.27.

Table 10.8.27 - Editing of contributions

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes	1		1		2		1	1
No			3	5		1	3	1

The focus groups also suggested that the informality of tone in some of the contributions cultivated a climate of fun and familiarity. As a result, students began sending messages which often were intended as ironic or humorous, but which were occasionally interpreted by the recipient as abusive. Smiley faces were soon discovered and regularly employed in the active groups as an indication that the previous statement arose from good or humorous intent, but were reported in the focus groups as often not being adequate to lighten the tone of a statement. To probe this, the students were asked if there was too much humour in the seminar discussions, if they ever felt victimised or had lost confidence because of the tone of the contributions, and if there had ever been any misunderstandings in their group. The findings are shown in Tables 10.8.28a, 10.8.28b, 10.8.28c.

Table 10.8.28a- Excessive humour in the discussions

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes								
No	3	1	4	4	2	2	4	2

Table 10.8.28b - Victimisation in the discussions

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes	1		1	1				
No	2		3	4	2	2	4	2

Table 10.8.28c - Misunderstandings within groups

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes	1			5	2		2	1
No	2		4			1	2	1

Feelings of victimisation and loss of confidence may arise as a result of positive as well as negative criticism. The students were therefore asked how confident they felt about expressing their opinions during the discussions. Table 10.8.29 shows the results.

Table 10.8.29 - Confidence about expressing opinions in discussions

Group	Very Confident	Confident	Some Confidence	Little Confidence	No Confidence
1		2	1		
2		1			
3	1	1	2		
4	3	1	1		
5	1	1			
6			2		
7			2	2	
8		2			

The focus groups found that at least 1 student deliberately attempted to provoke controversy in his group to facilitate the discussion. To investigate if there were other instances of this, the students were asked if they deliberately made their seminar presentation controversial or neutral. Their responses are shown on Table 10.8.30.

Table 10.8.30 - Controversial vs. neutral contributions

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Controversial	1		1	3	1			1
Neutral	2		2	2	1		3	

Students were asked why they had made their seminar controversial or neutral. Those who stated they made it controversial reported they did so to encourage debate amongst the group (Students 2, 7, 10, 12, 14 and 35). Student 15 stated they did so 'To find out other people's views.' (See Appendix 6.17).

Those who reported making their seminar neutral did so for a range of reasons. Several students wanted to protect themselves or their grades (Students 1, 22 and 40), while others didn't realise you could or didn't want to express a controversial opinion (Students 5, 20, 31 and 39). Student 3 reported fluctuating opinion, and not wanting to 'take sides', while Student 21 stated 'I wanted to present both sides of the issues/open up all the relevant issues so that people could comment on them.' (see Appendix 6.17).

Five students opted for neither option, or felt their approach varied depending on the topic (Students 19, 23, 32 and 36). Student 25 stated 'Can't remember my seminar!' (see Appendix 6.15)

There was an implication in the focus groups and the Interim Questionnaire that the time taken to contribute to an email discussions was greater than the contribution time would have been in a conventional seminar. To examine this further, the students were asked if contributing takes up a lot of time. The results are shown on Table 10.8.31.

Table 10.8.31 - Time taken to contribute

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes	2		4	1			1	
No	1	1		4	2	2	3	2

10.8.5.1.5 Assessing the Seminars

The focus groups also found that the students did not feel all seminar topics were equal in discussion opportunities. To determine if this was a general opinion, and to quantify it if it was, the students were asked which of the five seminar topics resulted in good discussions. They could select any number of them, including them all. The findings are shown in Table 10.8.32.

Table 10.8.32 - Topics producing good discussions

Group	Neo-Classicism	Webern	Stockhausen	Cage	Minimalism
1	2		1	3	
2				1	
3		1		3	2
4	5	3	4	4	4
5	1	1	2	2	
6				2	
7	3	2		1	
8	1			2	

10.8.5 1.6 General issues

Students were asked on 3 paper measures, the Post-Training Questionnaire, the Interim Questionnaire and the Final Questionnaire, whether they would have taken this option if they knew if the email seminars were involved. The response option changed from open-ended on the Post-Training Questionnaire to fixed Yes / No on the Interim and Final Questionnaires. Therefore only the latter two Questionnaires are compared. Seven students (32% of the respondents) reported they would not have taken this option if they knew email seminars were involved on the Final Questionnaire. The Interim Questionnaire also returned a finding of 32%, suggesting that the despite the experience of NetSem the students' retrospective belief of whether they would have taken the course was consistent, and that the question was reliable. The results from this prompt on the final Questionnaire are shown by group on Table 10.8.33.

Table 10.8.33 - Course selection and email seminars

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes	1	1	2	4	2	2	1	2
No	1		2	1			3	

The students were asked if they enjoyed participating in NetSem. Their responses are shown on Table 10.8.34.

Table 10.8.34 - Enjoyment in NetSem participation

	Seminar Groups							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Yes	3		4	4	2	2	2	2
No							2	

Finally, students were invited to add comments about their experience of NetSem. Five students chose to add further comments, and their responses are listed as follows:

Student 3 - 'I did object to this way of presenting seminars at first, but having done the course I realise I quite enjoyed it. It took the pressure off to some extent. However, I do not feel this would be a good way to do all seminars. It prevents you meeting others in the class and it takes a long time for someone who is not used to a keyboard to put in their responses. This often leads to them putting off or changing any views they have that would take too long to express.'

Student 13 - 'To be specific, I did the Webern presentation, and the question was, I felt, not really debatable. 'Why did Webern compose such short pieces?' as I found that he had written about, and given extensive, documented lectures, on exactly why he felt this was the way he had to compose. However, I actually began to enjoy the seminars as the year went on; more so than traditional seminars.'

Student 15 - 'If I knew there was a NetSem on another course it would be a strong point in favour of me taking the course.'

Student 19 - 'It is a waste of time if people don't respond at all, or if someone doesn't receive someone else's response. I have seen nothing from anyone else since the second seminar months ago.' *(Group 7 student)*

Student 31 - 'Please, please, PLEASE introduce NetSem for ALL history periods for next year - the thought of standing up in front of a tutorial group isn't nearly so much fun. As long as A) We meet the group; B) Everyone in group is willing to participate; C) Everyone that isn't gives their own in front of a tutorial group.'

10.8.6 Assessment of NetSem

No marks were available for the seminar assessments. Some marks were available for the contributions component of the NetSem course. The students were given a mark on a scale from A to F. Not all students' results were available, but those that were are listed by group in Table 10.8.35.

Table 10.8.35 - Students' contribution marks by group

	Seminar Group							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Available Contributions Marks	A	B	C+	A	A	D	C+	C
		B-	C	A	A		E	D+
				B	D		F	
				E			F	

Table 10.8.35 shows the contrast between the successful groups, Groups 4 and 5, and the poorest group, Group 7.

10.8.7 EPS-RSS Personality Test

Twenty-one students completed the measure (53% of the whole class). The EPS-RSS (Eysenck and Eysenck 1991) has means for the normal population (listed in Table 10.8.36), and these will be used for comparison for the purposes of this analysis.

Table 10.8.36 – EPS-RSS means from the normal population

	E - Scale (Extroversion)		**L - Scale (Lie scale)**		**N - Scale (Neutroticism)**		**P - Scale (Psychoticism)**	
Age	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
16-20	8.16	8.40	2.69	2.75	5.03	6.66	4.16	2.79
21-30	7.42	7.60	2.92	3.34	5.17	5.93	3.57	2.56

(Source: Eysenck H.J. & Eysenck S.B.G. (1991) *Manual of the Eysenck Personality Scales (EPS Adult)* Hodder & Stoughton: London)

The students who completed the measure are listed by group in Table 10.8.37. Their raw score on each of the 4 dimensions is shown, with an indication of whether their score was above population average, below population average, or consistent with the population average. Average is considered in this analysis as being a score within 0.5 of the mean score for that population on Table 10.8.36 above.

Table 10.8.37 - EPS-RSS Results: Student x Group

Group	Age	Gender	Psychoticism	Extrovertism	Neurosis	Lie
1	21-30	Female	Average 3	Average 8	Above 7	Above 9
1	21-30	Male	Above 8	Above 10	Above 8	Below 2
2	16-20	Female	Below 2	Average 8	Above 8	Above 12
3	16-20	Female	Below 2	Above 11	Below 5	Above 7
3	21-30	Male	Below 0	Below 6	Below 3	Below 2
3	21-30	Male	Average 4	Above 11	Below 0	Average 3
4	16-20	Male	Average 4	Above 11	Above 10	Below 0
4	16-20	Male	Above 6	Average 8	Below 4	Above 4
4	16-20	Female	Below 1	Below 3	Above 8	Below 1
4	16-20	Female	Above 4	Above 10	Above 9	Average 3
4	16-20	Female	Below 1	Average 8	Below 3	Average 3

Table 10.8.37 - EPS-RSS Results: Student x Group (Cont.)

Group	Age	Gender	Psychoticism	Extrovertism	Neurosis	Lie
5	16-20	Male	Below 2	Above 12	Below 4	Below 2
5	16-20	Male	Below 3	Average 8	Below 4	Below 0
6	16-20	Female	Below 0	Above 9	Below 6	Below 0
6	16-20	Female	Below 2	Above 10	Average 7	Below 0
7	16-20	Female	Above 4	Below 2	Below 3	Above 4
7	16-20	Male	Below 2	Above 9	Above 9	Average 3
7	16-20	Male	Below 2	Below 5	Average 5	Above 4
7	16-20	Female	Above 4	Below 6	Above 10	Below 2
8	21-30	Female	Below 1	Above 12	Below 2	Above 5
8	16-20	Female	Below 1	Below 1	Below 4	Above 4

A comparison is made between Group 4 and Group 7. Both of these groups had more students completing the EPS-RSS than any other group. These two groups were also considered the most successful (Group 4) and the least successful (Group 7) of groups by both the evaluator and the NetSem administrator. These groups also had 4 of 5 members' contributions marks in Table 3.3.35 earlier, and these marks demonstrate the difference in the success of each group. The two groups' EPS-RSS results are compared on Table 10.8.38.

Table 10.8.38 - Groups 4 & 7 compared by student

Group	Age	Gender	Psychoticism	Extrovertism	Neurosis	Lie
4	16-20	Male	Average 4	Above 11(+3)	Above 10 (+5)	Below 0(-3)
4	16-20	Male	Above 6(+2)	Average 8	Below 4 (-1)	Above 4(+1)
4	16-20	Female	Below 1(-2)	Below 3(-5)	Above 8(+3)	Below 1(-2)
4	16-20	Female	Above 4(+1)	Above 10(+2)	Above 9(+4)	Average 3
4	16-20	Female	Below 1(-2)	Average 8	Below 3(-4)	Average 3
7	16-20	Male	Below 2(-2)	Above 9(+1)	Above 9(+4)	Average 3
7	16-20	Male	Below 2(-2)	Below 5(-3)	Average 5	Above 4(+1)
7	16-20	Female	Above 4(+1)	Below 6(-2)	Above 10(+3)	Below 2(-1)
7	16-20	Female	Above 4(+1)	Below 2(-6)	Below 3(-4)	Above 4(+1)

10.8.7.1 Discussion of EPS-RSS results

For both groups the Psychoticism results were similar - 2 above average, 2 below in each group, with one student returning an average result in Group 4, and the distance from the mean never being more than 2.

Extrovertism was slightly different across groups. Group 4 had 2 extroverts, 2 average students and 1 student tending quite strongly towards introversion. Group 7 had a comparable introvert, plus 2 others tending towards introversion. Only 1 Group 7 student was above average on the introversion scale, and he did not score as highly as the extroverted students from Group 4.

The Neurosis scale found 3 Group 4 students displaying scores above the normal population average, and 2 scoring below the average. Group 7 had 2 students tending towards neuroses, 1 average student, and 1 student below average.

Of those 3 students who felt victimised, 2 were the students who refused to complete the personality questionnaire, and the third was from Group 4, and scored as an above-average neurotic introvert. However, there are other neurotics who did not feel victimised, and in Group 4 there was genuine and active victimisation of one group member identified, documented and curtailed by staff.

To assess the level of honesty in the EPS-RSS the Lie Scale is included and scored in a similar way as the other scales. The Lie Scale found only 1 Group 4 student to be slightly above average, 2 returning average scores and 2 scoring below average. Group 7 returned 2 students slightly above average, 1 student average, and 1 student below average, suggesting the students completed the measure with honesty.

The extroversion scale results suggests that extroverts may make a more successful group than introverts. This cannot be concluded as being the definitive predictor of group success, however, because the sample size was small, and other factors such as topic under discussion and existing friendship with group members appears to have played a part. What is clear is that introverts do not appear to be advantaged by electronic rather than conventional seminars, contrary to the expectation that they would find it easier to state their case and contribute on email.

10.9 Discussion

The NetSem case study generated a considerable volume of quantitative and qualitative data. From the results listed, there does appear to be patterns of issues arising continually. The most recurrent and influential of these appears to involve the groups and their members. There is some evidence that pre-existing friendships outside the email environment and extrovertism may influence the success of this type of CMC.

10.10 Conclusions

It must be concluded that NetSem was of limited success due in part to the problems with the groups. Forcing the students to participate led to some negativity about NetSem amongst some students, while making the intervention count towards final marks did not motivate all students to participate, contrary to expectations of course staff and the evaluator.

10.11 Methodological conclusions

The TILT-E methodology was found to be useful as a basis for the evaluation of NetSem, although measures had to be specifically created for this study. Monitoring of the course through informal discussion with key stakeholders including the teaching staff and students was effective, particularly for later measure development, including the Interim Questionnaire, the Focus Groups and the Final Questionnaire.

Using both a proactive and reactive approach worked well in the NetSem case study. While a proactive approach to evaluation design can be performed at a basic level, more advanced evaluations and reactive approaches must be conducted by a skilled evaluator. A reactive approach demands experience and knowledge of a wide variety of measurement techniques and their application if measures are to be used in a timely and appropriate way. Ideally, in reactive evaluation the evaluator should be on hand to physically conduct such measurements to ensure the best quality data is to collected, as they were in the NetSem case study.

CHAPTER 11
DISCUSSION

11.1 Introduction
The discussion chapter contains four sections:

- A discussion of the Fast Frac case study.
- A discussion of the GraphIT! case study.
- A discussion of the NetSem case study.
- And a general discussion of issues raised by and within this thesis.

11.2 Discussion of the Fast Frac case study
11.2.1 Introduction to the Fast Frac discussion
The Fast Frac case study represented a 'classic' TILT-E design i.e. the package was used once in a taught class by a group of students, and pre- and post-measures were used to assess its effectiveness. The teacher's aim in the Fast Frac study was to determine whether the package could replace the lecture. The aim of the evaluator was to assess whether the methods could sufficiently assist the teacher's aim to allow the teacher to make a decision about the package, and to examine the evolution of the methods over time.

11.2.2 The package replacing the lecture
The Confidence Log was increased in length in the third evaluation episode in order to assess its accuracy as a predictor of performance. However, it found that there was no correlation between quiz performance and confidence in being able to fulfil the learning objectives of the Fast Frac package. Further, the students reported significant increases in confidence after the first intervention regardless of whether it was the package or the lecture. This result does not suggest an automatic increase as a function of exposure to material related to the learning objectives, however, because closer examination of the results finds that in the first evaluation episode, the students significantly increased in confidence on all objectives bar one after each exposure to the teaching material i.e. after the lecture and then again after the package. However, in the third evaluation episode the results became more complicated. The students in the lecture first group only increased in confidence significantly on two objectives on post-test, i.e. after exposure to the package. Conversely, those who had the package

first and then the lecture significantly increased in confidence on seven of the ten objectives between mid-test and post-test. By examining the Confidence Log charts it could be determined whether this phenomenon was caused by a ceiling effect on the data or by a genuine failure of the package to increase confidence. A ceiling effect can occur in the analysis of this data because the response scale is fixed, with 'Very Confident' being the uppermost response the students can select. The sign test considers only shifts in data, positive or negative, and excludes tied cases (i.e. no shift). Hence, a student feeling 'Very Confident' after the lecture whose confidence remains equally high after package use will be excluded from the analysis.

Objective 1 and Objective 7 both showed significant increases in confidence between mid-test (post-lecture) and post-test (post-package) for the lecture first group. Examination of the charts of the remaining objectives shows only one student in five of the remaining objectives and two students in objective 10 had hit the ceiling and not shifted. It appears the non-movers, and hence the tied cases, predominated in the objectives that showed no significant increase in confidence. It can be concluded then that the students in the lecture first group in the third evaluation episode did not report an increase in confidence as a result of using the package. In contrast, the package significantly increased students' confidence when they received it as the first intervention, and the lecture further significantly boosted this confidence on seven of the ten objectives. Those objectives which did not have a significant increase (Objectives 2, 5 and 10) can be examined further by considering their charts. It appears that in Objective 2 the students tended to remain as confident after the lecture as after the package (i.e. remained static) and this was true also for Objective 10. Objective 5's results showed a decrease in confidence by eight of the students.

The Confidence Log has an important diagnostic role (McAteer et al 1995) which is demonstrated in the third evaluation episode. Objective 5's fall in confidence suggests that there was a problem between the students and material during the lecture. The objective asks the students how confident they are that they know what the units are for the stress intensity factor. Fortunately the Quiz questions match the objectives, and by examining the students' responses to the individual quiz questions it is clear that the students actually performed very well on this question, with 81% getting the answer right, the same as the lecture first group. However, the results show that 3 students failed to answer this question on the final post-test, and further that 7 students on mid-test had got the question wrong. In direct comparison, 63% of students in package-first group got the question correct at mid-test (i.e. after package use), while 82% of the lecture first group got the answer right at mid-test, after the lecture. It could be hypothesised that the drop in confidence in fulfilling this objective by the package first group on post-test (i.e. after the lecture) could have been a result of the lecture correcting misinformation they had acquired and interpreted from the package, and so increasing their correct answers while dropping their confidence. Whatever the explanation, the use of both the Quiz and the Confidence Log resulted in a better picture of students' reported confidence and their actual performance. More work needs to be done to examine the relationship between these two phenomena, although it is accepted from the results of the Fast Frac case study's third evaluation episode that as a direct predictor of performance on a matched multiple choice quiz, the Confidence Log is inadequate.

The Quiz results demonstrate a significant increase across time at each testing time in the second and third evaluation episodes. In the first evaluation episode, there was no significant difference across time between the mid-test and the post-test. This can be interpreted as an example of the ceiling effect, where students scored highly on mid-test and could not go much higher. What is clear from the first and second evaluation episodes and Table 8.7.7, is that the students in the first evaluation episode performed better on the Quiz after any intervention than the students in the third evaluation episode did after two interventions. The students in the third evaluation episode did not achieve scores as high as the final scores of the 1994 students, despite one group (package first) starting with a higher average of correct responses than their earlier colleagues. The package first group scored significantly higher than the lecture first students on post-test as well as pre-test, although the effect was lost at the mid-point. While this would suggest that the package was poorer than the lecture, and hence the two groups equalised, it does not explain the excellent performance of the December 1994 students.

To assess if there was a difference in computer experience, or topic experience, which could explain the February 1998 scores, the pre-test is considered. The package first group appeared to use computers more often, were more confident in their use of computers, and had the second highest reported topic experience behind the lecturefirst group in same evaluation episode. These findings therefore do not explain the differences in scores. Nor is there anything in post-test to explain the results, suggesting either the right questions are not being asked during the evaluation, or that the students in the third evaluation episode may simply take longer to learn the information than their earlier counterparts.

11.2.3 Evolution of the methods

The Fast Frac case study shows through the development of the measures used in the evaluation episodes over time that less can be more in evaluation design. The volume of questions on pre- and post-intervention questionnaires lessened as questions were tried and refined or abandoned. The reason for their loss varied, but tended to be either because they did not result in conclusive data or because the item did not add anything to the evaluation situation. Examples of this include the attempts at measuring note-taking in evaluation episode one, which did not allow for writing size, space between lines etc., and asking whether the students found the video useful in the second evaluation episode, when there was no question as far as the teaching staff or earlier evaluation results were concerned about the importance of the video.

The results of the questions on pre- and post-intervention measures are used to explain the problems or issues which arise, as demonstrated earlier when examining the differences in Quiz scores across the evaluation episodes. The post-test questions assist in determining the qualities and faults with the program and the teaching situation. For example, the students liked working at their own pace and appreciated the ease of use of the package, but disliked the platform and the lack of colour. This became more evident in the February 1998 study, as technology had moved on considerably from 1994.

11.2.4 Evaluation issues

The Fast Frac case study clearly demonstrates the need for a reactive component in the evaluation design. Rather than proactively designing the method and measures for the evaluation in its entirety before the study, there appears to be a need for some time to allow the results of the initial pre- and post-test design to be processed and digested, before returning to the participants to verify and seek more detailed explanations for the findings. This would not be true of every case, however, particularly if the evaluation has provided conclusive results. Yet it is likely in most, returning once more to Cronbach et al's (1980) statement 'The hope that an evaluation will provide unequivocal answers...is certain to be disappointed.' [1980:3]. For this reason, it must be concluded that evaluations of interventions designed like Fast Frac should have the facility within them to react to the findings from the initial data, and where that is impossible, should build into their proactive design some sort of debriefing qualitative sessions wherein they can gain insight into issues arising from the pre- and post-results.

Fast Frac clearly demonstrates a role for comparative studies in the evaluation of computer-based teaching and learning, as suggested by Oliver (1997). The study showed that by giving the lecture and the package to both groups of students in the 1998 episode neither group was disadvantaged, yet the aims of comparing the learning resources could be achieved.

11.2.5 Recommendations from the Fast Frac case study

The Fast Frac case study indicated that:

- There appears to be value in the Confidence Log as an indicator of issues, but this value is poorly understood and needs further examination.
- The Confidence Log does not predict performance.
- The Fast Frac package could replace the lecture, though the consequences of such a replacement are not apparent and would require careful monitoring.
- A reactive design in evaluation, or a debriefing session to verify and explain findings, would greatly strengthen one-off evaluation episodes such as Fast Frac.
- There is a role for comparative studies in the evaluation of computer-based teaching and learning.

11.2.6 Theoretical approach

The Fast Frac case study demonstrated a quasi-experimental design in the computer-based teaching and learning situation. A 'control' group was used in the third evaluation episode, but only in the sense that they received the teaching interventions in a different order from the 'experimental' group, who received the package first. There was a suggestion that the lecture then the package improved Quiz performance, but the results are not conclusive, nor reflected in the earlier studies. It was found that the first evaluation episode which had used the lecture-then-package design had similar (even slightly better) results than the third episode, as did the second evaluation episode in which the students only received the package, not the lecture.

Within the Fast Frac study a pluralist approach is evident. The evaluation measures ranged from the empirical (e.g. knowledge quizzes and questionnaires) to the naturalistic/ ethnographical (observation). As with all TILT-E studies, the design was based largely on an inductive approach, because with no adequate model of the computer-based teaching and learning situation available, no hypotheses of the learning situation could be appropriately made. However, the Fast Frac case study did have a specific purpose from the teacher's point of view, and that was to test the hypothesis that the package could replace the lecture. This presents a deductive approach within the evaluation. Whilst the two are apparently contradictory in one study, they are an artefact of the different needs of stakeholders in this evaluation. The Fast Frac case study appears to have successfully combined the demands of both the evaluator and the teacher.

11.2.7 Conclusions

It can be concluded on balance that the package could adequately replace the lecture, as there is no conclusive evidence to the contrary, and there is persuasive evidence from the second evaluation episode which did not use the lecture that the package is a useful resource. This is despite the finding that only 6% of students in the third evaluation episode felt the lecture could be dropped in favour of the package.

The evaluation methods evolved over the testing situation and found that there were further issues not addressed by the methods, specifically the differences across years. While the questions discarded would not have answered these issues, the questions added did not enlighten them either. An interview or discussion group may have been the most appropriate method for obtaining an explanation, and the absence of the qualitative approach leaves the study lacking in what Pawson & Tilley (1997) refer to as 'completeness' or 'closure'.

Even with such 'completeness', Cronbach et al's (1980) statements about evaluation results merely supporting negotiation and never providing definitive answers are true of the Fast Frac case study. The data infers that the package can replace the lecture, and this is certainly evidenced by the second evaluation episode, where the students scored higher on the post-test quiz than either group in the third evaluation episode.

Finally, the Fast Frac case study demonstrates the methodologically pluralist approach of the TILT-E evaluation framework, and shows how studies like this may not necessarily be purely inductive, nor purely deductive. Instead, there is often another form of pluralism in the goals of such evaluations as a function of the stakeholders needs from the investigation.

11.3 Discussion of the GraphIT! case study

11.3.1 Introduction

The GraphIT! case study demonstrated another 'classic' TILT-E design, again the single use of a package monitored by pre- and post-tests. However, it differed from Fast Frac in several important ways. In this study, the GraphIT! package was left online for students to use, and a logging system was constructed to assess any later use by the students. While Fast Frac used students from the same course for its package evaluation across several years, GraphIT! was used in a single academic year with three different student groups.

The teachers' aim in the GraphIT! case study was to assist students to learn statistics, and so it was an add-on rather than a replacement resource. The evaluator's aims were to examine the effectiveness of the same methodology on the same package but with different students from varying backgrounds, and to assess whether students' self-reported reuse of the package correlated with their actual reuse.

11.3.2 Evaluation results

Unlike Fast Frac, where all the evaluations occurred in the same computer room, the GraphIT! evaluation episodes took place in two very different computer labs, specifically an open-plan room for the first evaluation episode, and a boothed computer lab for the second and third episodes. Despite this, the results across all three evaluation episodes were similar, with the students generally working alone, as intended by the package authors and the teachers. The post-graduate students were more confident about using computers and more computer literate, and this may be reflected in the findings that they spent more time concentrating on the content rather than package operation than their undergraduate counterparts.

The post-test measure picked up on the problems the students in the first evaluation episode had with the Minitab section in the package. This finding had been noted during the observation of the class also, triangulating the result and demonstrating the usefulness of the prompt 'What did you particularly like and particularly dislike...' as a means of probing issues from HCI to learning.

The Confidence Log results in the first evaluation episode found no significant difference over time for Objectives 4, 5, 9, 11 and 12. Ceiling effects and high non-movers accounted for Objectives 4, 5, 9 and 11, while Objective 12 also suffered from non-movers across time, but this time they were in the lower end of confidence ratings. Charts 9.9.2f and 9.9.3d from the second and third evaluation episodes show that many students failed to reach the material covering Objective 12. In both the second and third episodes Objectives 2 and 4 showed no significant shift in confidence because they had hit the ceilings and had high non-movers, as had Objectives 5 and 9 in the second evaluation episode. In both the second and third evaluation episodes Objective 11 also suffered from low non-movers. Again the most likely explanation for this finding was that the students had failed to access the material, given that 26% of the students in the second evaluation episode and 41% of students in the third evaluation episode reported they hadn't covered the objective yet. The Log was useful once more in highlighting areas of less confidence amongst the students, and therefore areas of concern for the teaching staff to work on in later classes.

For the Sociology students, both undergraduate and postgraduate, the teacher devised a quiz to go along with the package. The Quiz was nominally a ten-item measure, just as in Fast Frac, but became more complex as the teacher included multiple answers in some questions. Due to the multiple responses, the Quiz effectively became a nineteen-item measure. Matched pairs t-tests found highly significant increases in correct Quiz answers between pre-test and post-test.

11.3.3 Open access use of GraphIT!

As clearly indicated during the reporting of the GraphIT! case study in Chapter 9, there was a substantial discrepancy between students' prediction of reuse and their actual reuse. However, discussion with teachers and informally with the students later found that all three courses moved on swiftly from the material covered in GraphIT!, which had been deliberately kept to an introductory level by the teaching staff. It therefore became apparent it was not something that the students needed to return to once they got further into their course, although this was not anticipated by either the staff or the students when they completed the post-package measure. Without these further discussions, however, this information would not have come to light.

11.3.4 Evaluation issues

As with the Fast Frac case study, there is a clear demonstration in the GraphIT! case study for the need to have a reactive component in the evaluation design. In this case a follow-up discussion with the teaching staff was conducted informally, although a formal design would have been more credible and better documented.

It is becoming clear that the TILT-E measures are useful for several reasons. First, and most important in evaluation terms, they monitor the situation in case something goes wrong or an unexpected result is found, for instance the Minitab example in this case study, or the differences between groups in the Fast Frac case study. The students' responses are gone over in detail to assess the problem or the difference, and an explanation is sought from them. This is then combined with observed issues, and the results can lead to more insight into the teaching and learning situation. However, to best facilitate this, it is recommended that follow-up measures be designed after analysis of the evaluation data to assist in explaining unexpected results, such as the students' failure to return to use the GraphIT! package.

The other important function of the TILT-E measures is to provide evidence of the package's worth to the developer, teaching staff and other stakeholders. By using both positive (particularly liked) and negative (particularly disliked) prompts, it is clear to stakeholders and external observers that the evaluation has not attempted a positive slant to bias the results, and so when the results are good the stakeholders can have confidence in the product. This political function is important and in itself is a justification for the TILT-E measures (Pawson & Tilley, 1997).

11.3.5 Recommendations from the GraphIT! case study

The GraphIT! case study indicated that:

- The Confidence Log is a good diagnostic tool in the classroom when information is sought on which objectives may have been difficult for students, or not covered by them during the teaching session.
- Teachers should have guidelines for developing quizzes, and multiple answers should be avoided in a multiple choice situation as a) it leads to coding difficulties and b) the multiple choice format is traditionally a one-answer structure, hence reducing the likelihood of people realising and selecting more than one correct answer.
- There is a need for follow-up measures in straightforward evaluations such as those demonstrated by the GraphIT! and Fast Frac case studies.
- The use of multiple measures for triangulation purposes was validated in this study by the agreement between the observation data and the 'dislike' data collected on post-test.
- The use of 'particularly liked' and 'particularly disliked' prompt not only generates useful data for triangulation, it also a) highlights everything from HCI to learning issues and b) emphasises impartiality and so may go some way to satisfying stakeholders.

11.3.6 Theoretical approach

Fast Frac and GraphIT! share a pluralistic approach, where observation, an ethnographical or naturalist method, is used in conjunction with the empirical methods of knowledge quizzes and questionnaires. Unlike Fast Frac, the GraphIT! package replaced without comparison a scheduled tutorial on the graphical representation of data. In the GraphIT! case study there was no deductive demands on the evaluation, as this was removed by the teacher's assumption that the package was an adequate replacement for such a tutorial. There was no measure constructed to assess whether this was in fact the case, and the evaluator did not question the teacher's assumption. Under Weiss' (1995) and Chen's (1990) theory-driven evaluation approach, this assumption should have been recognised and highlighted by the evaluator prior to the evaluation study occurring. Where a study is inductive, such as the GraphIT! study, and effectively hypothesis-free, theory-driven evaluation could play a vital role in preventing assumptions which might later be the cause of the failure of the intervention to create an effect.

As shown earlier in Figure 1, GraphIT! also demonstrated an action research approach to package development. The cycle of evaluation and feedback with the learners at its core was used to enhance the package. It is probable that under the traditional formative then summative evaluation and development processes, many developers and teachers use an action research approach. They would do this by giving the package to representatives of the target audience early in its development, obtaining feedback from the users, then improving the product. The next stage in the cycle or spiral would then be a full classroom trial, again evaluating the students' experience, views and learning outcomes, and once more feeding that into improvements to the software. Some, as with TILT-E's evolved approach, may go further and attempt to assess the resources surrounding the learning situation, so that the evaluation is not conducted in isolation (Brown et al, 1996). By doing this, the action research cycle in the computer-based teaching and learning context may go a stage further, and may investigate the role of the package in the whole teaching and learning situation after evaluating the package and feeding back possible improvements to the teachers and developers. Again, feedback would require changes to the teaching and learning situation if necessary, and so the action research cycle would continue.

By explicitly stating that the evaluation approach taken is based on action research, the design of the evaluation and its need for a feedback-change interaction can be more easily understood. It is particularly useful to state the approach to the teaching and development staff at the planning stage, so it can be clear that the evaluation is expected to influence change, and so be a catalyst rather than a conclusion. As Cronbach et al (1980) state:

'What is needed is information that supports negotiation rather than information calculated to point out the 'correct' decision.' (1980: 4)

It is through this negotiation process that change and improvements will occur in computer-based teaching and learning situations.

11.3.7 Conclusions

The GraphIT! package was useful to the students, generally increasing their confidence and improving their Quiz results. The introductory level of the package resulted in high confidence levels on some objectives prior to package use, but its progression to more intensive material showed with no student scoring 100% on the quiz nor reporting being 'Very Confident' about Objective 12 at post-test. Students' comments were generally positive about the package, so its use appears successful. Had there been no explanation sought for the failure of students to reuse the package, the logging figures would suggest otherwise as the students failed to return to it as they said they would.

Once more a pluralist approach was found useful and enlightening. However, the issue of assumptions was raised by the GraphIT! study, and it is recommended that future researchers should also consider the theory-driven evaluation approach (Chen, 1990; Weiss, 1995) before designing their research. It is a flaw in this particular study that there was no deductive component, as the software replaced a conventional tutorial without any assessment of its ability to do so.

An action research approach was found to enhance the explanation of the study by demonstrating the occurrence of the presentation-evaluation-feedback cycle. It also framed the naturally-occurring negotiation about improvement between the evaluator and the teaching and development staff. Unfortunately the study ended after the three classroom episodes described in Chapter 9, and so whether the cycle continued is unknown. This highlights the need for longitudinal approaches to the evaluation of computer-based teaching and learning resources, and illustrates the constraints imposed by the academic year, which often means that the students' next exposure to the computer-based resource and the opportunity to evaluate it will arise only once every twelve months.

11.4 Discussion of the NetSem case study

11.4.1 Introduction

The NetSem case study was very different from the Fast Frac and GraphIT! examples. This study involved evaluating students' reactions to email seminars and assessed contributions over an academic year. There was no single-use package, although the students did attend a one-hour long training course in the basics of using word processing and email. The teachers' aim was to increase the quantity and quality of contributions to the seminar discussions, but NetSem had mixed success in this goal. Some students performed very well and contributed to lively discussions, while others did not contribute at all.

The aim of the NetSem case study for the evaluator was to determine how the measures could adapt to the longitudinal design, and where and when they would be most appropriate. The design was deliberately left open, to enable the evaluator to react to situations as they arose, demonstrating the use of both proactive and reactive approaches to evaluation. Proactively, the design for the evaluation of the training was that the training session would be evaluated in the same way as GraphIT! and Fast Frac, with pre- and post-test measures. Learning objectives could not be used throughout the year in NetSem, as there were five different seminar topics, and the main objective was participation in and contemplation of all the topics. The Confidence Log was therefore abandoned. Also inappropriate was the idea of a quiz. Instead, the marks for the contributions were collected and considered in light of the evaluation findings. These marks demonstrated that the measures used during the NetSem study, including informal discussion with students and staff, focus groups and the final questionnaire, were reliable in their assessment of which seminar groups were successful and which were not.

The reactive evaluations involved a questionnaire (the Interim Questionnaire), and the focus groups and the EPS-RSS. The Final Questionnaire was used to sum up the students' experience of the seminars over the year. The EPS-RSS found that the most successful and least successful groups did have slight differences in the personalities involved, with the successful group having four students rating as average extroverts or higher, while the poorer group had one extrovert and three introverts. The issues arising from the NetSem results are interesting and warrant further investigation in a psychological context, rather than in an evaluation framework.

Steeples' et al (1996) findings that computer-mediated communication advantaged disabled people and the shy, unconfident student, were not replicated in this study.

Here, it was the disabled student who was disadvantaged by his dyslexia, and as shown by the EPS-RSS and the results of Group 7, students who were more introverted did not perform as well as those who were extroverts.

11.4.2 Evaluation issues

Foremost in the evaluation of NetSem was flexibility. The TILT-E pre- and post-test measures were used to evaluate the training component. Both the Interim and the Final Questionnaires were constructed specifically for this situation. However, these measures were a result of dialogue with both the teaching staff and the participants, and were therefore straightforward to construct. The Interim Questionnaire asked questions about pertinent issues, the responses to which then informed the prompts for the focus group, the responses to which then assisted the design of the Final Questionnaire. Whilst this snowballing was very useful, it is difficult to assess how the teaching staff would have achieved this alone. The straightforward evaluations of Fast Frac and GraphIT! show the 'TILT-E Toolkit' at its most efficient. NetSem demonstrates that different designs may not be as straightforward for a teacher to assess. This is not a weakness of the TILT-E method, but is instead a reality of evaluation where even the most versatile and innovative methodologies cannot prepare all people for all eventualities.

NetSem demonstrated the limitations of TILT-E methodologies outside the single-use taught class, raising the issue of appropriate use of methods. It was clear in the NetSem case study that the Confidence Log would not be useful, nor would quizzes. Observations of the students working at the computer while they made their contributions were not possible either, as the students had the facility available to them twenty-four hours a day, seven days a week. Pre- and post-test measures were appropriate and therefore used on the training component of the course. However, when it came to monitoring students' reaction and determining which measures would be appropriate during the reactive component of the evaluation, experience, personal preferences and methodological beliefs of the evaluator were more critical than the TILT-E methods.

11.4.3 Recommendations from the NetSem case study

The NetSem case study indicated that:

- NetSem was of limited success, and factors which influenced success or failure may be influenced by the unchangeable personality traits of the students.

- The use of informal discussion with staff and students was valuable as a tool for method development and monitoring the day-to-day functioning of the intervention.
- Focus groups were very useful in explaining the teaching and learning situation and all its issues.
- The TILT-E methodology was useful to an extent in the proactive stages of the study, but was not helpful in the reactive context.
- The TILT-E method may be aiming too high in prescribing advanced evaluation approaches, with little emphasis on the skills required to perform such tasks.

11.4.4 NetSem's theoretical approach

NetSem demonstrated the value of pluralism, but used the full theoretical and methodological extremes from empirical questionnaire approaches, including the Eysenck Personality Questionnaire, to the ethnographic reliance on informal interview and unstructured discussion. NetSem showed how the influence on a programme can come not only from the programme itself, but also from surrounding factors, such as the group knowing each other beforehand and socialising outwith the teaching environment during the intervention. Patton (1990) proposed that all programmes have their own culture, and that this may affect the programme's processes and outcomes. The external socialising influence in the success of NetSem is evidence of the culture of this teaching intervention, and leads to the conclusion that without the external socialising developed by a minority of groups, the culture of NetSem would not be conducive to its success.

Interestingly, there was a marked discrepancy in NetSem between the empirical findings and the ethnographic findings. This was particularly obvious on the empirically-based Interim Questionnaire, where no student reported wanting to change groups, despite the ethnographic findings through informal discussion that some students were discontent. However this contradiction may simply have been a product of the absence of those who were discontent at the time when the Interim Questionnaire was administered. Later in the study, the Final Questionnaire showed that the ethnographical rather than the empirical approach had picked up the group-change issue accurately, as 38% of respondents to the Final Questionnaire reported that they would rather have been in another group. This triangulates well, suggesting that the finding is reliable.

The Post-Training Questionnaire, Interim Questionnaire, Final Questionnaire, focus groups and the ethnographical approach all found a consistent section of the class reported that they would not have selected the 20th Century Music option if they had known that email seminars were involved, again a strong triangulation of the results. This suggests that such a question can be asked and answered with accuracy retrospectively by the students, something which is important if data collection is to be spread over time.

It is unlikely that as much information could have been gathered and reported with confidence in the NetSem study without all the measures used. Indeed, even the very construction of the measures relied on the different methodological approaches. The value of pluralism in evaluation research is therefore emphasised here, and most certainly advocated in the examination of computer-mediated communication programmes where, by using both empirical (the questionnaires), and ethnographical (the informal discussion) approaches, greater insight was gained. The focus groups sit between the two extremes. Their use was to develop the empirical Final Questionnaire by highlighting issues of concern, both already known through informal discussion, and unknown. As discussed earlier, culture and thus context was important in the NetSem study. The focus group attempted to access this importance, and through this develop measures for quantifying the cultural experience (for example, the prompt on the Final Questionnaire asking 'Did you ever feel isolated?'). The aim of the focus group as a method in this study was therefore to examine the issues surrounding NetSem, its context and culture, and the influence of these factors on the success of the intervention to that point. This is an example of a constructivist approach, as by considering the complexities surrounding the evaluated intervention, more insight is gained into what made the intervention a success or failure. It therefore examines the processes and contexts in which the outcome is or is not achieved, which as demonstrated in the NetSem study in particular, is crucial in an evaluation.

The use of the EPS-RSS in the NetSem study was an explicit example of theory-driven evaluation, in that by its very inclusion in the study the evaluator had assumed that personality may be an important variable in the success of the student's experience of NetSem. Other assumptions were almost certainly made in all three evaluations, but none were as explicit. This suggests that further research using a theory-driven evaluation approach is needed to assess what other assumptions are made when investigating computer-based teaching and learning situations.

The overall design of the NetSem evaluation was another example of an unstated action research approach. The students were monitored and their feedback sought continually throughout the year, both formally through evaluation methods such as focus groups and questionnaires, and through the use of informal discussion. When there was a problem or an improvement could be made, action was taken where possible to effect change. The feedback-change cycle also guided the evaluation itself. For example, the Interim Questionnaire was used earlier than expected, and a question about whether the students would like to change groups was incorporated as a result of feedback from the students. This example demonstrates the fluidity of the evaluation process where a reactive component is allowed, and shows how the action research approach not only allows change to occur in all aspects of the study, from the educational intervention itself through to the evaluation, but in fact encourages it.

11.4.5 Conclusion

NetSem was successful to an extent, but took a lot of staff hours in preparation and maintenance although this did not appear to dampen their enthusiasm (Steeples et al 1996). Not all discussion groups were successful, and some students who wished to have a lively discussion were therefore disadvantaged, although the system administrator would maintain a debate with them for assessment purposes. The question is whether the reasons for having such a course (Steeples et al, 1996) outweigh the problems encountered by the students. NetSem was offered again on a different course the following year, this time as an option. The students overwhelmingly rejected it, even though almost a quarter of the students had participated in NetSem the year before.

On balance, it is concluded that NetSem had its merits, but it was not as effective as predicted and rather than encourage disabled and shy students (Steeples et al 1996), it appeared to disadvantage them. It is recommended that more work be done into computer-mediated communications in higher education. This work might use a pluralistic approach as in the NetSem study, where the spectrum of measures from empirical to ethnographic was found to be enlightening as well as enhancing each measure's validity. An action research approach was found to underlie the design of the study.

11.5 General Discussion

This thesis has attempted to show that there are theories behind the methods employed by TILT-E, and that by understanding and accepting this, more insight into the evaluation of the computer-based teaching and learning situation can be gained. This work demonstrates that the TILT-E research did not find itself driven by a particular theoretical school such as the empiricists, or the constructivists. By using an inductive approach TILT-E were implicitly stating that they did not know what factors in the computer-based teaching and learning situation were important, and so would not predict what may have influenced such a situation. They then adopted a variety of methodological approaches in an attempt to fully evaluate the effects of computer-based resources, and studied these resources in a wide variety of situations and forms.

TILT-E also adopted an action research approach in some of its case studies. In this thesis, GraphIT! and NetSem clearly demonstrate such an approach, but again a glance through the TILT-E literature shows quite clearly that the group did not explicitly specify nor overtly advocate the action research approach. Action research offers a framework attractive to the educational field, as it includes the student in the process of designing, implementing, modifying and hence improving resources and teaching. Yet in the computer-based teaching and learning situation this framework has rarely been explicitly adopted. Whether this is a result of the cost of technology, the continual updating of technological resources, or the lack of rigorous and effective evaluation is unclear. However it does offer a standard for good practice should the possibilities exist for improvement, and is demonstrated in practice in the NetSem and GraphIT! case studies. In both studies, the students were included in changing some aspects of the teaching and learning experience, for example the speed at which assessments were returned to them in Netsem, while in GraphIT!, the students were actively involved in dictating the design of the package as discussed in the formative study in Chapter 9. It was an implicit goal of all the evaluation case studies listed in this thesis to improve the technological resources available to students on the basis of their feedback during the evaluations.

From the discussion above, TILT-E can be said to have adopted an inductive approach to evaluating computer-based teaching and learning, while allowing teachers' and developers' hypotheses to be included in the design of the evaluation. TILT-E used a pluralistic approach to method selection, and adopted an action research approach to some of their studies, while at the same time investigating other possible approaches such as the comparative, quasi-experimental design of the Fast Frac case study. The relationship between TILT-E's approaches and the development of a model of the teaching and learning process is discussed in the next section.

11.5.1 Modelling the computer-based teaching and learning processes

TILT-E worked at the forefront of evaluation research in the computer-based teaching and learning context in the UK. For that reason, hypotheses were not developed prior to each study. There could be no way of predicting the influence of so many factors in the teaching and learning situation, and their importance to the success or failure of each programme, although the hypotheses of teaching and development staff were accepted.

Draper et al (1997) believe that a theory of teaching and learning processes that determines the causal factors influencing learning outcomes is urgently needed, and that such a theory would allow the results of the TILT-E case studies to be better explained and help the advancement of the field. TILT-E worked from an inductive position, where the research comes before the theory, and its outcome is used to guide further investigations. This correlates with Weber's (1949) proposition that research should start with the action and understand that before moving towards models, a stance agreed with by Kuhn (1970) and Shadish and Reichardt's (1987). Therefore the TILT-E work should and will assist in the development of models of the computer-based teaching and learning situation. Today, TILT-E's value has been to guide further investigation into the teaching and learning situation, and so to aid the construction of the computer-based learning research paradigm (Kuhn, 1970). Kuhn (1970) suggested that research is performed in scientific paradigms which provide examples of good practise, and certainly the work of TILT-E is a demonstration of this.

This thesis has shown that the use of pluralist, inductive, action research and quasi-experimental approaches in the evaluation of computer-based teaching and learning situations all provide something valuable. When deriving a model of the teaching and learning process from such results, it is clear that the approaches indicate the potential complexity of the model, as well as variables which should be included in any such theory. In other words, the measurement of the computer-based teaching and learning situation by TILT-E has shown that the situation demands contextual measures, measures of learning, measures of reuse, of attitude, of enjoyment, of interaction with peers and staff etc. The use of an action research approach demonstrates the constant evaluation-feedback-change dynamics of the computer-based teaching and learning situation, and the need for negotiation and participation in decision-making amongst all stakeholders.

Pure, deductive evaluation of the computer-based teaching and learning situation may never be a realistic goal, even once a model is created, as unpredicted and unpredictable influences in the evaluation situation may always be present. However, it is clear that the pluralistic, inductive approach by TILT-E will help inform the development of a model, and that TILT-E, by implicitly embracing a range of approaches, has made a valuable contribution to the field.

While TILT-E's evaluation approach does not conclude that different conceptualisations of knowledge and its acquisition will be important in any model, it does suggest that a pluralist approach to the construction of any model may be required, that is the acceptance that causation of a phenomenon can be multifactorial (Reber, 1986). For example, it could be that the existence of knowledge as a 'fact' independent of the teacher and learner will need to be recognised and/or assumed alongside the belief that the teacher and learner will interpret that knowledge, and construct it themselves in an individualist way. If this is the case, it is not surprising that the use of both quantitative approaches from the empirical school, such as knowledge quizzes, and qualitative approaches examining the context from hermeneutic/ interpretive schools have proven to be insightful and useful in the computer-based teaching and learning situation. Constructivism may have a crucial role in such a model, explaining the contextual influences and the individualism that would lead to the teacher's and learner's construction of knowledge and the computer-based teaching situation. Such a pluralistic approach would also counter Pawson and Tilley's (1997) argument that within the constructivist approach there is a failure 'to grasp those structural and institutional features of society which are in some respects independent of the individuals' reasoning and desires.' (1997: 23).

CHAPTER 12

CONCLUSIONS AND RECOMMENDATIONS

12.1 Conclusions

TILT-E's work has informed the evaluation of computer-based learning not only in methodological terms, but also in theoretical approaches. This thesis has demonstrated that, although largely unaware they were doing so, TILT-E were implicitly using a variety of theoretical approaches to the evaluation of computer-based teaching and learning. The group's literature makes no reference to induction nor talks of a pluralist approach, yet both are central to the TILT-E methodologies. Further, the pluralist approach not only allows the combination of qualitative and quantitative measures, it also advocates the combination of research extremes of empiricism and ethnography. Such a mix of methods and approaches are shown to begin the process of development of a model, particularly in suggesting that a model should itself consider a multifactorial approach and possibly adopt a pluralistic stance.

TILT-E used a quasi-experimental approach to the third Fast Frac evaluation episode, and demonstrated that such an approach does not automatically infer quantitative methods and disadvantage to the participants. Instead it is hoped that it reinforced Oliver's (1997) argument that there is value in comparing contextualised study (i.e. evaluations) of the teaching and learning situation with and without educational technology i.e. comparing the use of computer-assisted learning with a conventional presentation. He proposes that this makes the 'results more generic without losing authenticity' (1997: 18).

There was also evidence of an action research approach to TILT-E's evaluation framework in some situations, in this case in the NetSem and GraphIT! studies. This was useful for framing the design of the evaluations and emphasising the negotiations and dynamics inherent in the evaluation of computer-based teaching and learning resources.

Finally, it was suggested that a model of the teaching and learning process may have to become as pluralistic as the TILT-E approach to the evaluation of the computer-based teaching and learning situation.

In summary, it is concluded that:

- TILT-E adopted a pluralistic approach to evaluation.

- TILT-E developed and used measures ranging across the methodological and theoretical spectrum, from the extremes of empiricism to ethnography.

- TILT-E used both inductive and deductive approaches to their work, although the latter was driven by the teachers in the case studies in this thesis.

- Comparative studies have value in the computer-based teaching and learning situation.

- An action research approach was implicit in some TILT-E studies, and proved useful in describing the dynamics of these studies.

- There is a pressing need for a model of the computer-based teaching and learning process.

- A model of the computer-based teaching and learning process must consider the findings from TILT-E's studies, and by examining the approaches taken by TILT-E and other evaluation researchers in this field, may have to adopt a pluralistic approach.

12.2 Recommendations for future research

There is a pressing need for a model of the computer-based teaching and learning process. The process of developing such a model must consider the findings of a variety of evaluation studies, and give consideration to the methodologies and approaches involved. In this way such studies will not only be viewed critically, but also they may give some insight into the teaching and learning process through their findings and the methods and approaches they use.

The need for an examination of assumptions in the evaluation of computer-based intervention was found in the GraphIT! study. It is recommended that further work should highlight the need for a blend of inductive and deductive approaches, because without a hypothesis of the effectiveness of an intervention (a deductive approach) little can be concluded about its usefulness. Yet it is acknowledged that being too constrictive could prevent the surfacing of issues which had previously been unpredicted or were unpredictable, and which one day may become crucial to the development of a model of the teaching and learning process.

More work needs to be done on the use of a pluralist approach to the evaluation of computer-based teaching and learning by different evaluators, to assess if the use of such an approach is the most valuable and enlightened way of conducting such research.

Future evaluations should consider the theoretical foundations of their approach and their measure selection. There are implications for and assumptions made by the selection of each evaluation method.

The use of a comparative study in this thesis was found to be valuable and to contradict the suggestion that such an investigation would be contrived and disadvantageous in the computer-based teaching and learning context. More studies of this type should be performed to assist the need for 'authenticity' (Oliver, 1997).

More work should also be done on explicitly using an action research approach to the evaluation of computer-based resources, as it may be that action research underpins much evaluation of computer-based teaching and learning. Until it is explicitly referenced, however, it cannot be demonstrated as an example of good practice.

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Appendix 1.1

The Biographical Questionnaire

Please read each question carefully. Take your time and answer all relevant questions as accurately as you can. Please PRINT your written answers. Where you are given a choice of answers, please circle the response or responses relevant to you.

1. Surname ____________ Initials____ 2. Matriculation No. [ ][ ][ ][ ][ ][ ][ ]

3. Date of Birth: D D M M Y Y [ ][ ][ ][ ][ ][ ] 4. Gender: Male / Female (please circle)

5. Is English your first Language? Yes / No 6. If not, what is your first language? ________

7. Who funds you at University? (If relevant, please circle more than one source)

   Grant / Parent / Self / Other (please specify) ____________________

8. What was your last level/year of school (e.g. fourth year)? 9. What year did you leave school? 19____

10. What sort of school did you attend? (Please circle a financial *and* a gender option)

    Fee-paying / Non-fee-paying Co-Educational / Single sex

11. Since leaving school, have you attended any other education institutions? Yes / No

    (If No, go to Q13)

12. If you answered 'yes' to the question above, please follow the instructions and complete the table below.

In the table below, please write the name of the institution you attended, the dates including month and year that you started and finished your course, the subjects you took, and the qualifications you gained as a result of the course you completed. If you did not complete the course, please put 'not completed' in the 'qualifications gained' box.

INSTITUTION	FROM	TO	SUBJECTS TAKEN	QUALIFICATIONS GAINED

13. Year of entry to Glasgow University: 19____

14. Faculty (e.g. Arts/Science/Law) _______

15. Are you a full-time or part-time student? Full-time / Part-time

16. What year are you in? ________________

17. University courses already completed

In the table below, please write in the year you were in when you took the course, the subject you took, and the level of the subject (e.g. first year psychology course = 1). In the 'Outcome' box, please write in the relevant option out of this list: Exemption, Pass, Resit Pass, Class Ticket Only, or Fail.

YEAR OF STUDY	SUBJECT TAKEN	LEVEL	OUTCOME
e.g. THIRD	PSYCHOLOGY	ONE	RESIT PASS

18. Have you ever had to repeat a year? Yes / No

20. Have you ever received a taught course or courses in computing or computing skills? Yes / No

(If no, please go to Q22)

Q21 If you answered 'yes' to the question above, please follow the instructions and complete the table below.

Please fill in the year you started the course, and the title of the computing course. In the 'Length' column, please write the duration of the course (e.g. 6 months). Please then put the number of hours *per week* spent on the course (e.g. '2' for 2 hours per week). Next, if the course was a compulsory part of another course, please write the title of the main course of which this was a part. Finally, please state the name of the institution at which you took this course.

YEAR	COURSE TITLE	COURSE DURATION	HOURS PER WEEK	MAIN COURSE TITLE	INSTITUTION
e.g. 1991	INTRODUCTION TO SPSS-X	6 MONTHS	1.5	JUNIOR HONS. PSYCHOLOGY	ABERDEEN UNIVERSITY

22. Do you own a computer? Yes / No

23. If yes, what make is it? ______________

24. Do you have regular access to a computer? Yes / No

25. Who owns the computer you most frequently use? (e.g. self, University etc.) ______________

26. How often would you say you use a computer ? (please specify) ______________

27. Do you ever use a computer for academic purposes? Yes / No

29. If yes, what do you use it for? ______________________________

30. Do you ever use a computer for non-academic purposes? Yes / No

31. If yes, what do you use it for? ______________________________

32. Have you ever used any computer languages (e.g. Pascal) Yes / No

33. If yes, which languages?____________________

34. Please list any different makes of personal computers you have ever used (e.g. Applemac, BBC, Sega, Amstrad, etc.): ____

35. Please tick any of the following that you have used:-

____ Word-Processing	____ Microsoft DOS
____ Spreadsheets	____ Games
____ Graphics	____ E-mail
____ Statistics	____ Bibliography packages
____ Databases	____ Other (please specify below)

Other____

36. How often would you say you use the library on-line catalogue? (please specify) ____________

37. Did you know that computers would be used on this course prior to you choosing this option? Yes / No

38. If yes, did this influence your decision in any way? Yes / No

39. How?____

____

40. Does it concern you that computers are going to be used? Yes / No

41. Please state why you answered the way you did to the question above:

____

Finally, please list below any comments you have about this questionnaire and/or its content:

Appendix 1.2

The Computer Experience Questionnaire

Please tick the box under the word which best described then extent to which you agree or disagree with each statement below. In each case only mark one box per statement.

	Strongly Agree	Agree	Disagree	Strongly Disagree	Mixed Feelings	Unclear Statement
It is a good idea to use computers to assist in the teaching of the subjects I study	❐	❐	❐	❐	❐	❐
I enjoy working with computers	❐	❐	❐	❐	❐	❐
It takes too long to learn how to use a computer	❐	❐	❐	❐	❐	❐
I find using computers confusing	❐	❐	❐	❐	❐	❐
Using computers as a teaching aid makes learning easier	❐	❐	❐	❐	❐	❐
I feel confident using computers	❐	❐	❐	❐	❐	❐
I would not ask for help if I had a problem while using a computer	❐	❐	❐	❐	❐	❐
Computers make tasks less time consuming	❐	❐	❐	❐	❐	❐
Using computers in class varies the course	❐	❐	❐	❐	❐	❐
The usefulness of computers is over-rated	❐	❐	❐	❐	❐	❐
I have no desire to use computers	❐	❐	❐	❐	❐	❐
There are many areas of computing that I am interested in learning more about	❐	❐	❐	❐	❐	❐
I dislike using unfamiliar computer equipment	❐	❐	❐	❐	❐	❐
I would like to spend some of my spare time using computers	❐	❐	❐	❐	❐	❐

Computers complicate simple tasks	❑	❑	❑	❑	❑	❑
The opportunity to learn about computers and their use is valuable	❑	❑	❑	❑	❑	❑
The use of computers within a course makes the understanding of the course material harder	❑	❑	❑	❑	❑	❑
A knowledge of computing is useful in my degree subject	❑	❑	❑	❑	❑	❑
There should be more opportunity to use computers in my undergraduate studies	❑	❑	❑	❑	❑	❑
Learning about computers is interesting	❑	❑	❑	❑	❑	❑
Using a computer is normally more trouble than it is worth	❑	❑	❑	❑	❑	❑
It is easy to learn the basics of how to operate a computer	❑	❑	❑	❑	❑	❑
You need a mathematical mind to enjoy using computers	❑	❑	❑	❑	❑	❑
It is easy to cause a computer to malfunction accidentally	❑	❑	❑	❑	❑	❑
Computers can make the user appear stupid	❑	❑	❑	❑	❑	❑
I would voluntarily attend a computing skills course	❑	❑	❑	❑	❑	❑
Using computers is most often a frustrating experience	❑	❑	❑	❑	❑	❑
I would not choose computing or computer-related options, if any, in my further studies	❑	❑	❑	❑	❑	❑
I feel anxious at the thought of using a computer	❑	❑	❑	❑	❑	❑
As long as there is help around, I like using computers	❑	❑	❑	❑	❑	❑
It is easier to answer a question truthfully when it is asked by a computer	❑	❑	❑	❑	❑	❑
There is no difference between being taught by a lecturer and being taught by a computer	❑	❑	❑	❑	❑	❑
Using a computer would distract me from what I am supposed to be learning	❑	❑	❑	❑	❑	❑

Appendix 1.3

The Post-Package Evaluation Questionnaire

Surname__________________ Forenames__________________ 2. Matriculation No.

Please answer the following questions on the package you have just used. Use the following scale to answer Questions 1 - 4 below. Please circle the number of the answer you choose in the space provided.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
AA	**A**	**N**	**D**	**DD**

Q1. This package was:-					
a) easy to use	AA	A	N	D	DD
b) enjoyable	AA	A	N	D	DD
c) interesting	AA	A	N	D	DD
Q2. This computer session was useful for:-					
a) Revision purposes	AA	A	N	D	DD
b) Presenting new information	AA	A	N	D	DD
c) New angles on old information	AA	A	N	D	DD
d) Increasing knowledge of the subject	AA	A	N	D	DD
e) Stimulating interest in the subject	AA	A	N	D	DD
Q3. I would like to spend more time using this package	AA	A	N	D	DD
Q4. This package is most suited to students working on their own	AA	A	N	D	DD

Q5. How many different simulations did you run in the final part of the package (i.e. how many different settings of the parameters did you try out)? Please specify number (e.g. 4 runs):

Q6. Please circle all the ways in which you have previously covered the subject:-

Lectures   Practicals   Tutorials   Essay

Textbooks   Personal research on the subject

Q7. How does this package compare to the teaching you have previously encountered?

Q8. Have you *in the last month* done any extra work on Schistosomiasis and its control? Yes / No

Q9. If yes, how often, and what methods did you use (e.g. read references etc)?

Q10. What do you feel you have gained, if anything, from this package?

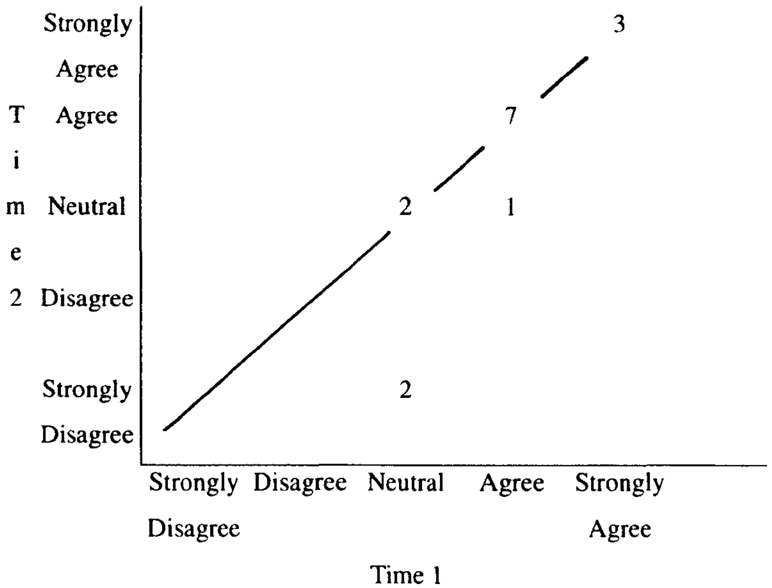
Finally, please list below any comments you have about this questionnaire and/or its content:

Thank You

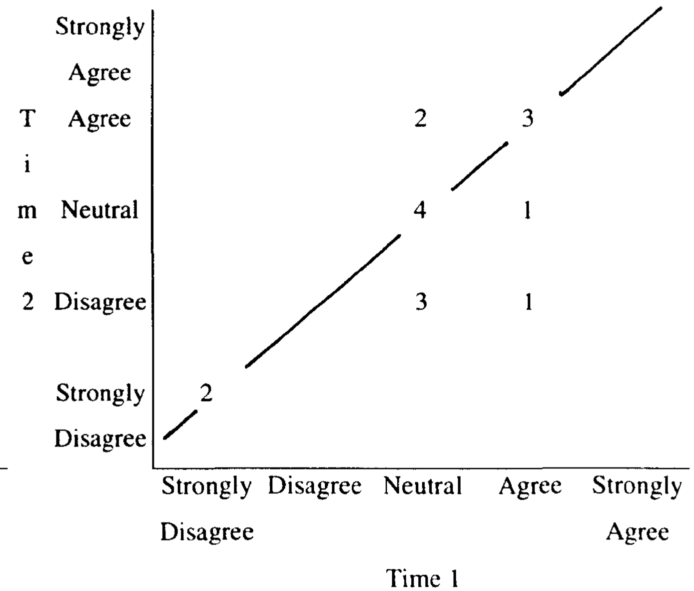
Appendix 1.4

Charts of shifts in reported attitude towards computers over time

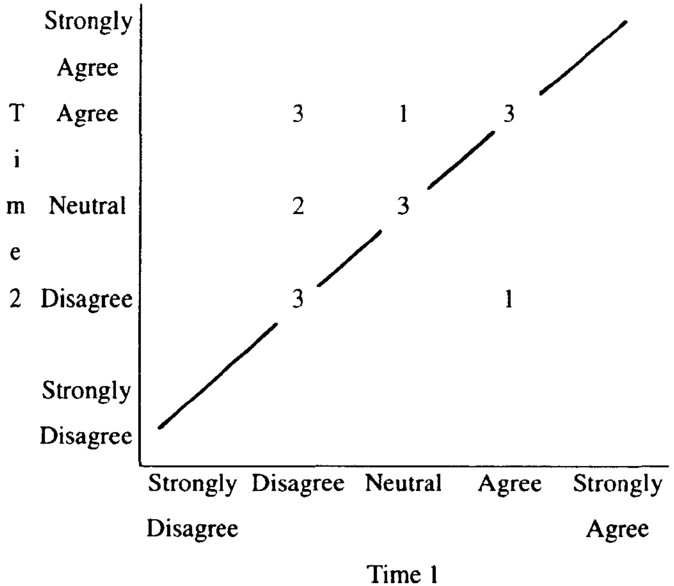
CAQ1 - It is a good idea to use computers to assist in the teaching of the subjects I study (1 missing)



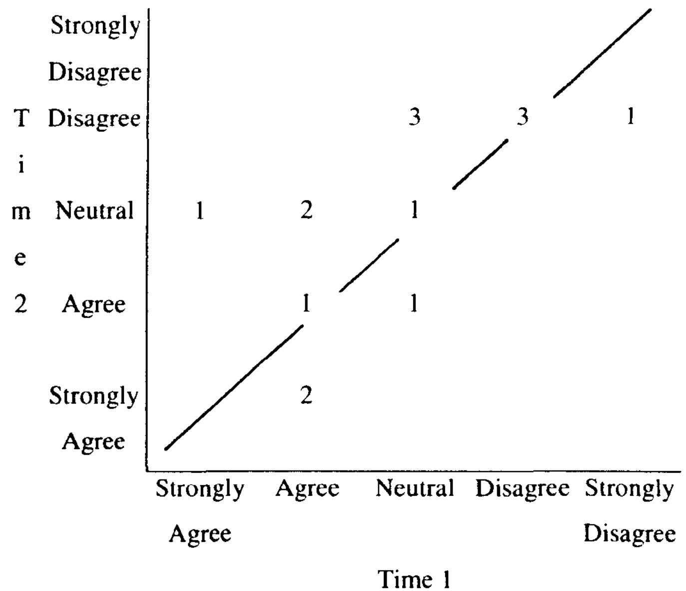
CAQ2 - I enjoy working with computers.



CAQ3 - Computers rarely make mistakes.

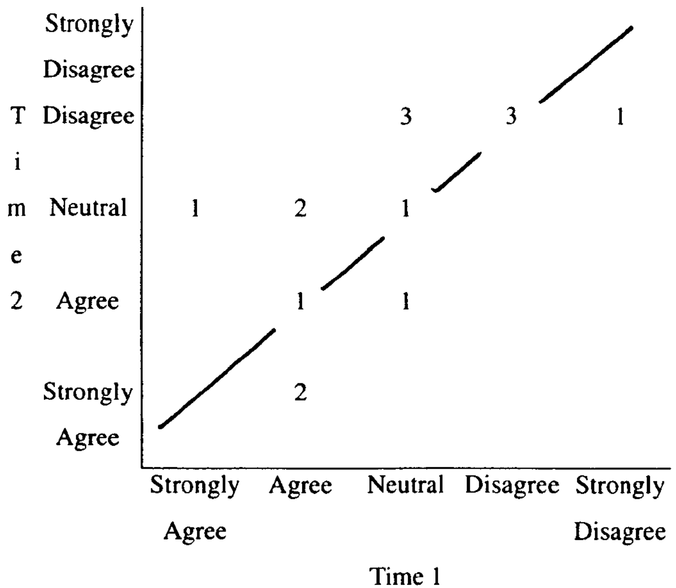


CAQ4 - It takes too long to learn how to use a computer.

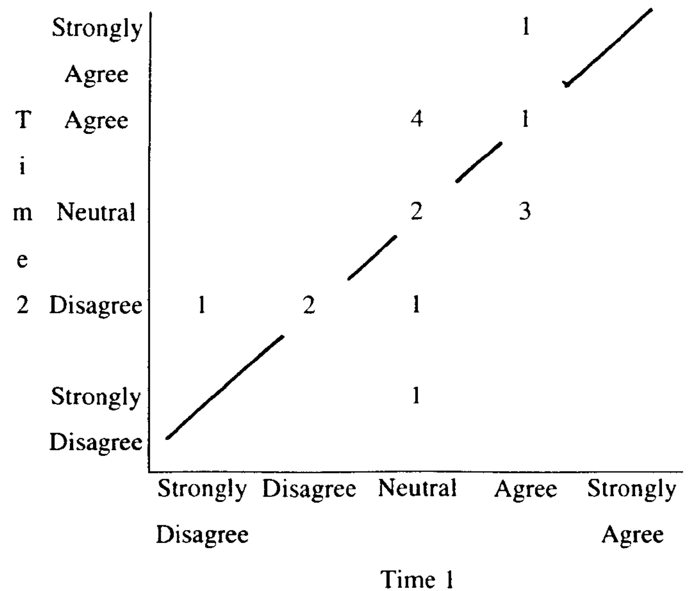


CAQ5 - I find using computers confusing.

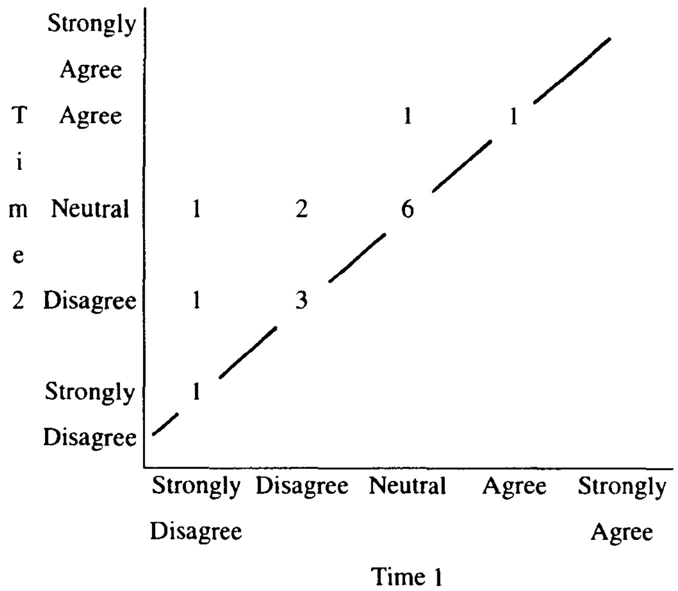
(1 missing)



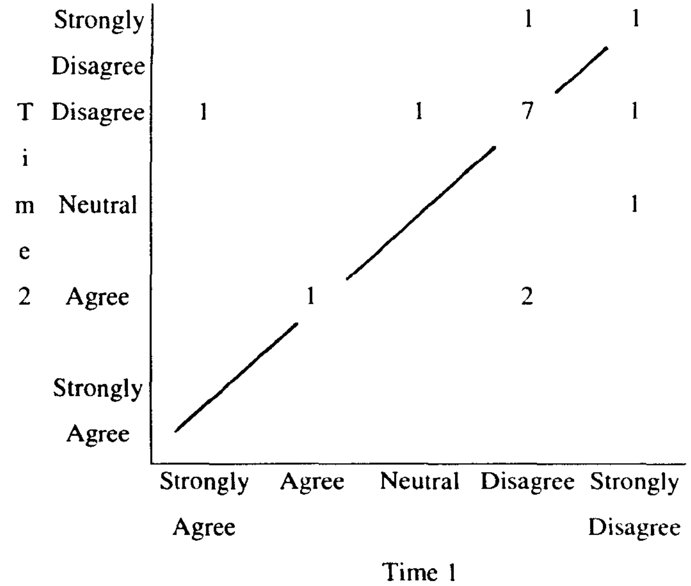
CAQ6 - Using computers as a teaching aid makes learning easier.



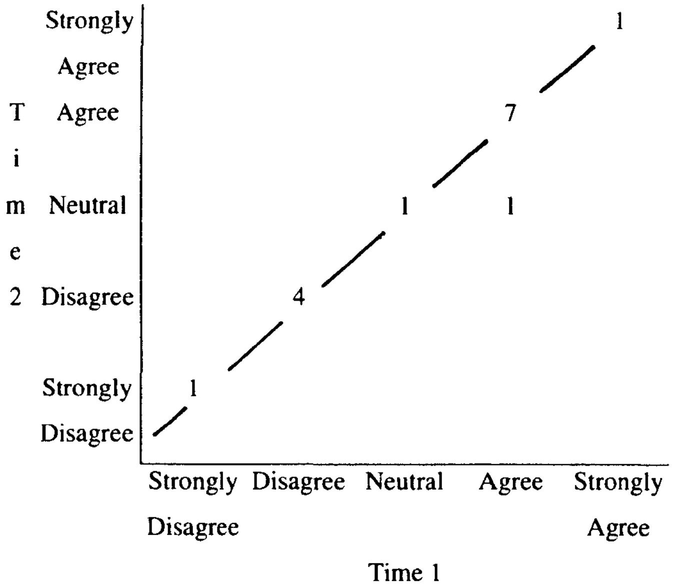
CAQ7 - I feel confident using computers.



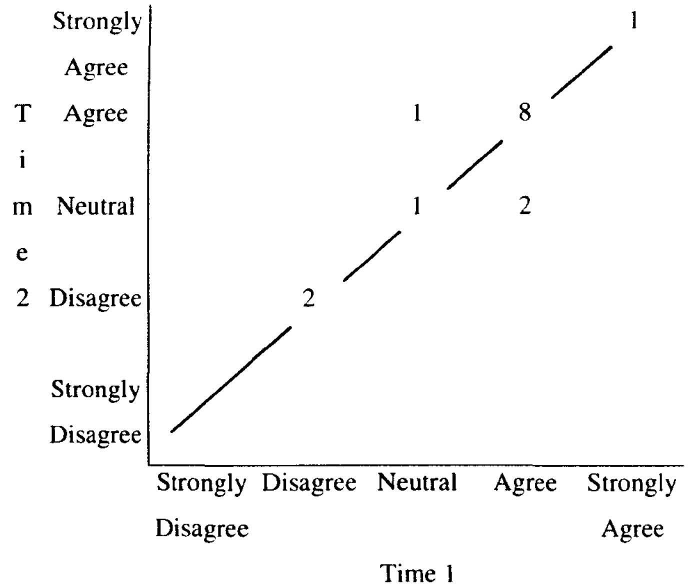
CAQ8 - I would not ask for help if I had a problem while using a computer.



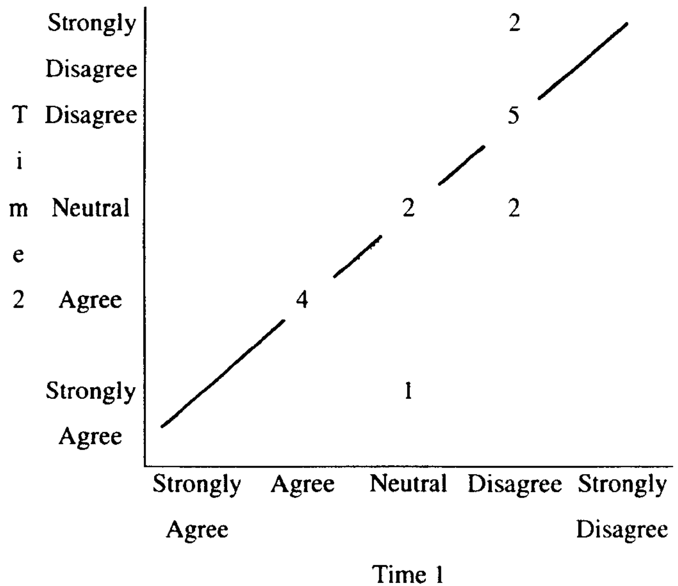
CAQ9 - Computers make tasks less time consuming. (1 missing)



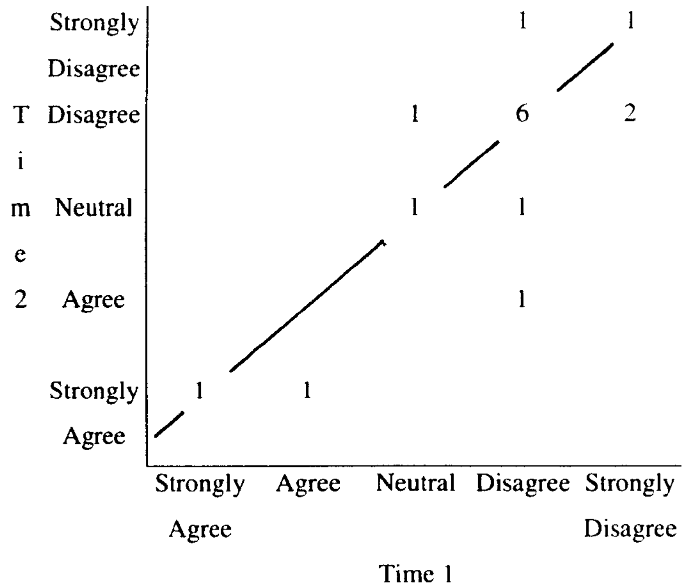
CAQ10 - Using computers in class varies the course.



CAQ11 - The usefulness of computers is over-rated.



CAQ12 - I have no desire to use computers.



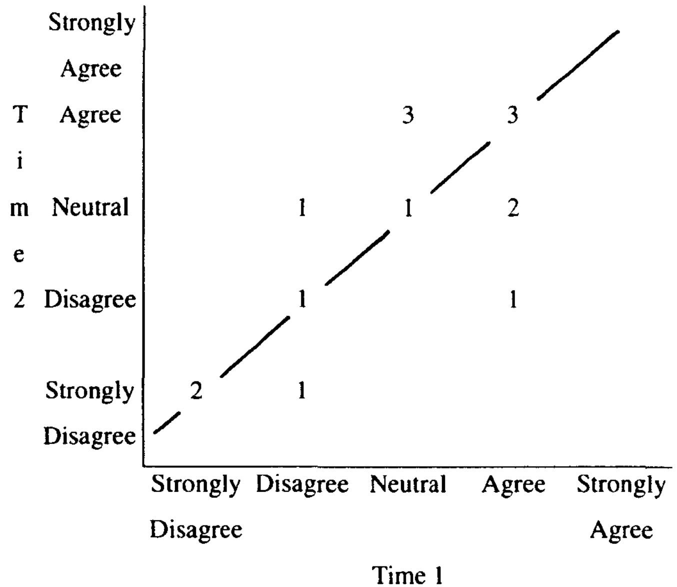
CAQ13 - There are many areas of computing that I am interested in learning more about

Time 2 \ Time 1	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Strongly Agree					
Agree				7	
Neutral		1	1	2	
Disagree		2			
Strongly Disagree	2		1		

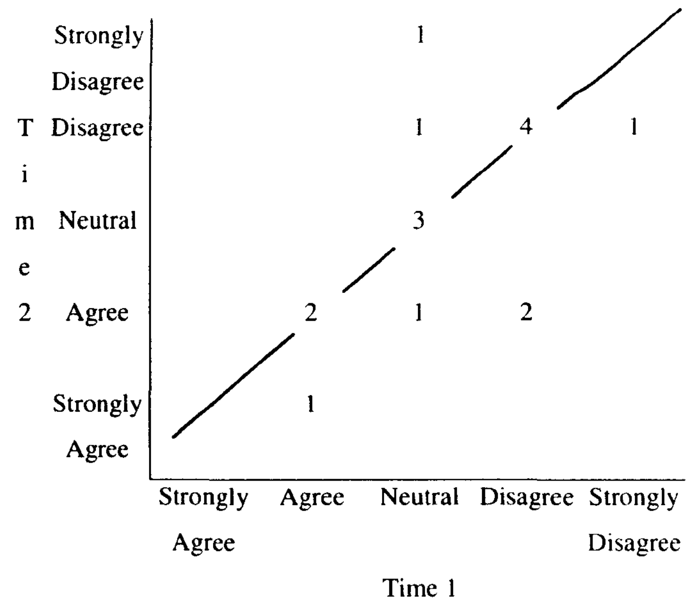
CAQ14 - I dislike using unfamiliar computer equipment

Time 2 \ Time 1	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Strongly Disagree					
Disagree		1	2	1	
Neutral		1	1	1	
Agree	1	4	1	1	
Strongly Agree	1	1			

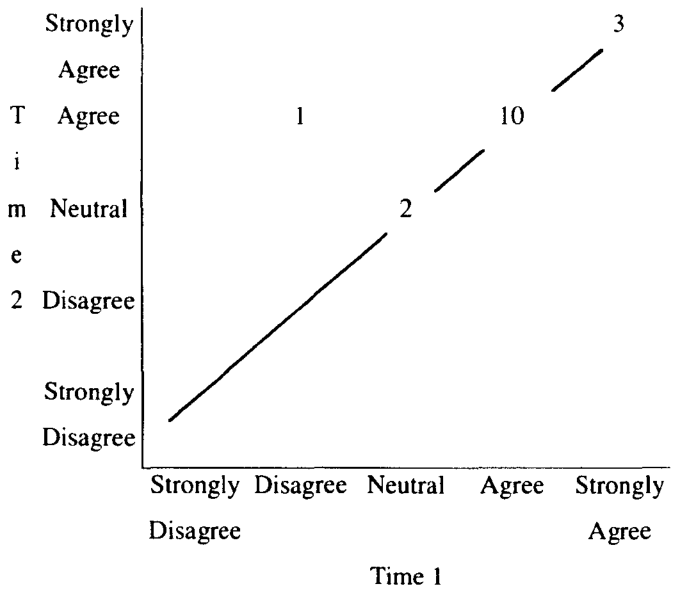
CAQ15 - I would like to spend some of my spare time using computers. (1 missing)



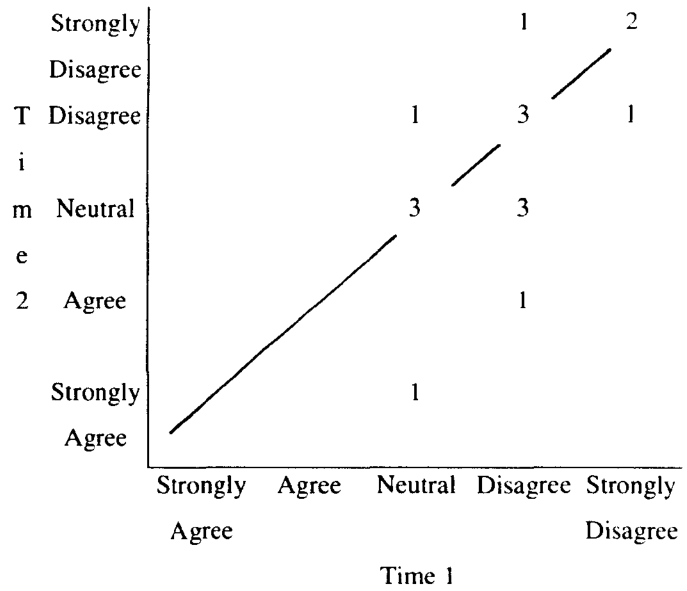
CAQ16 - Computers complicate simple tasks.



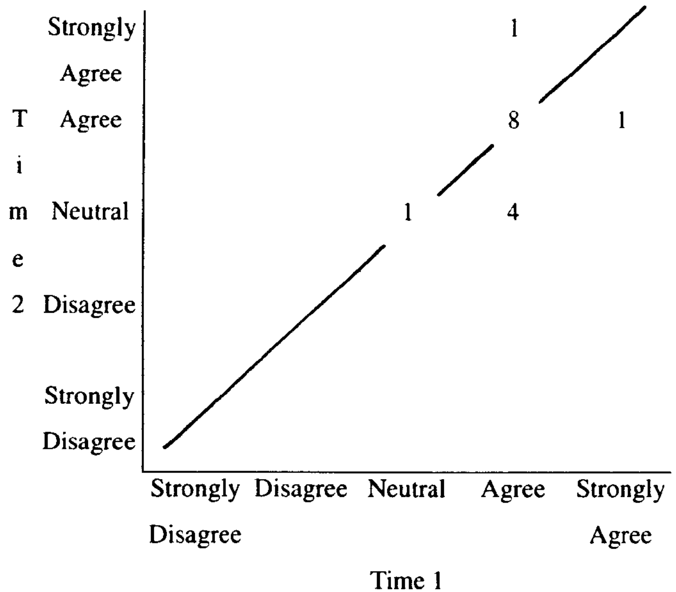
CAQ17 - The opportunity to learn about computers and their use is valuable.



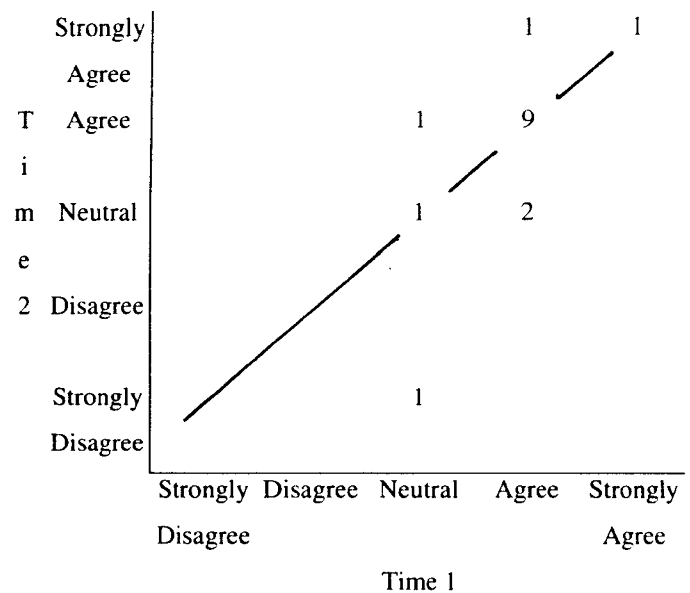
CAQ18 - The use of computers within a course makes the understanding of course material harder.



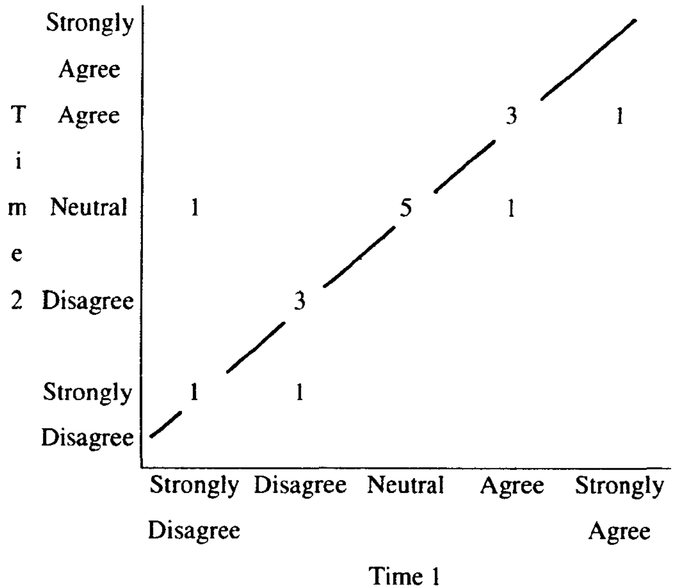
CAQ19 - A knowledge of computing is useful in my degree subject. (1 missing)



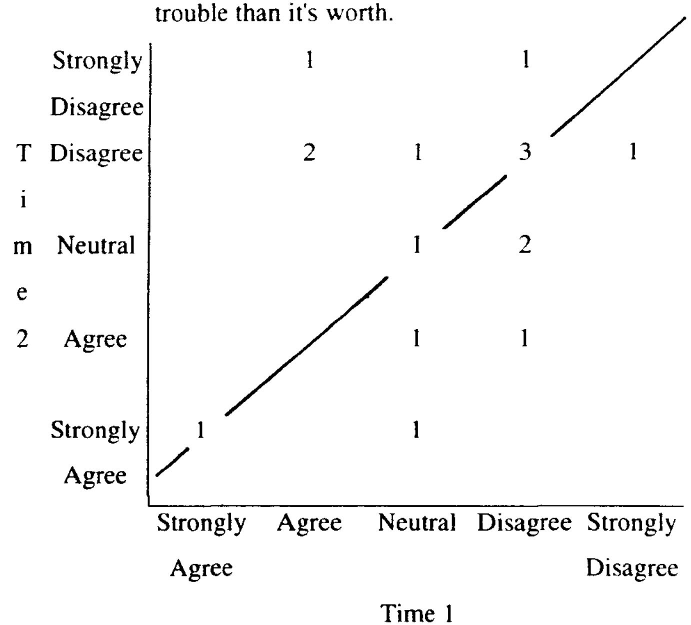
CAQ20 - There should be more opportunities to use computers in my undergraduate studies.



CAQ21 - Learning about computers is interesting.



CAQ22 - Using a computer is normally more trouble than it's worth.



CAQ23 - It is easy to learn the basics of how to operate a computer.

Time 2 \ Time 1	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Strongly Agree					
Agree		1	3	4	
Neutral	1		1	2	
Disagree		1	1	1	
Strongly Disagree			1		

CAQ24 - You need a mathematical mind to enjoy using computers.

Time 2 \ Time 1	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Strongly Disagree				1	1
Disagree				11	
Neutral			1	1	
Agree	1				
Strongly Agree					

CAQ25 - It is easy to accidentally cause a computer to malfunction accidentally.

Time 2 \ Time 1	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Strongly Disagree					
Disagree		2	1	3	
Neutral			1		
Agree	1	5	1		
Strongly Agree	1	1			

CAQ26 - Computers can make the user appear stupid.

Time 2 \ Time 1	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Strongly Disagree					1
Disagree		4		2	
Neutral		2	1		
Agree		3	1		
Strongly Agree	1	1			

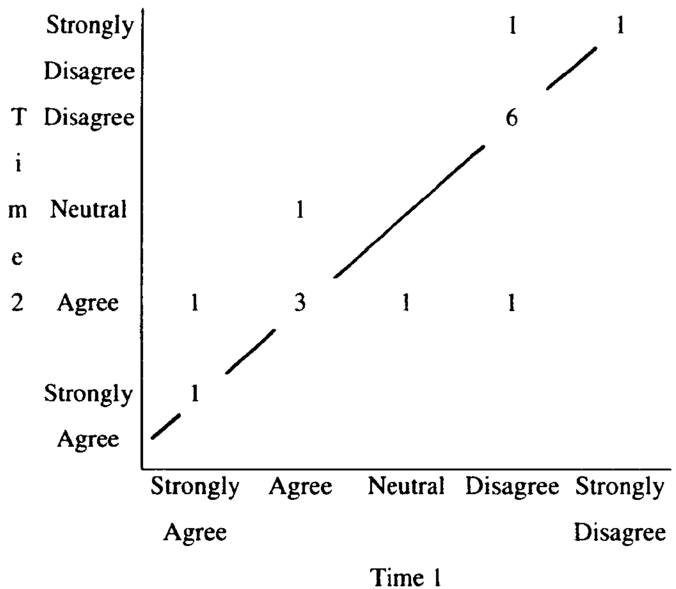
CAQ27 - I would voluntarily attend a computing skills course.
(1 missing)

Time 2 \ Time 1	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Strongly Agree				1	
Agree			1	5	1
Neutral			3	1	
Disagree		2		1	
Strongly Disagree					

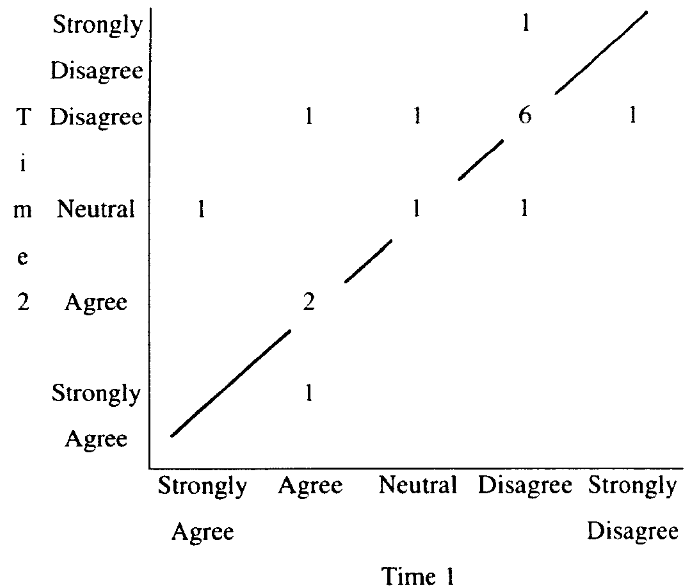
CAQ28 - Using computers is most often a frustrating experience.

Time 2 \ Time 1	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Strongly Disagree					
Disagree			1	2	
Neutral	1	2	2	1	
Agree		3	1	1	
Strongly Agree		2			

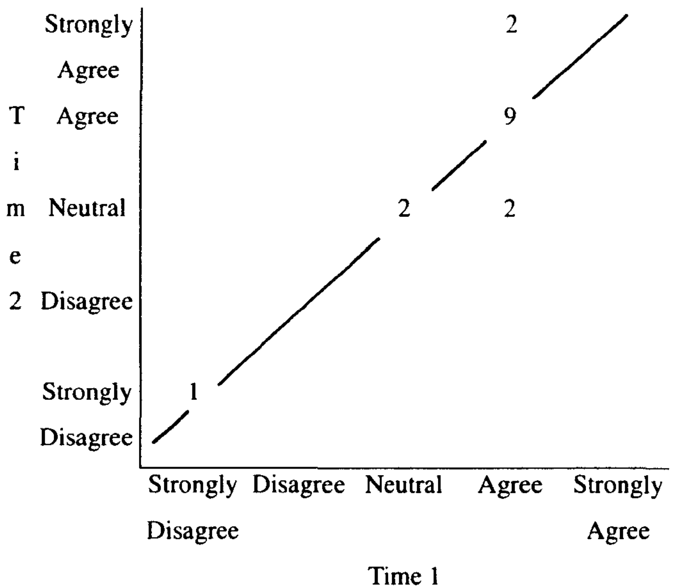
CAQ29 - I would not choose computing or computer-related options, if any, in my further studies.



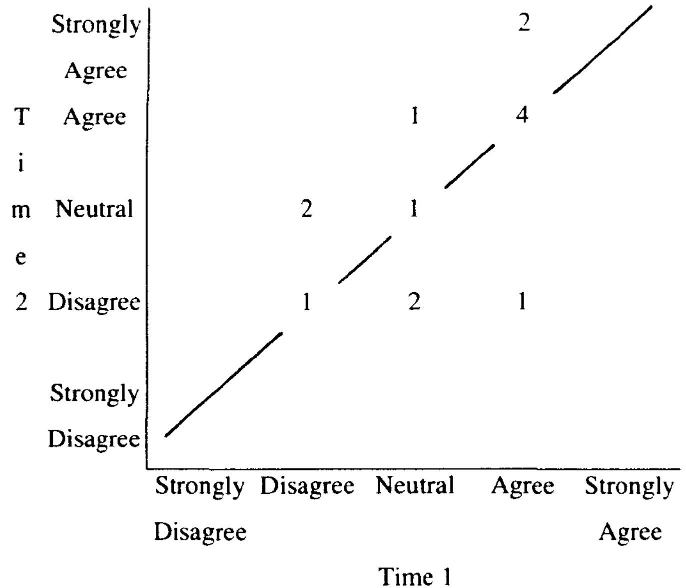
CAQ30 - I feel anxious at the thought of using a computer.



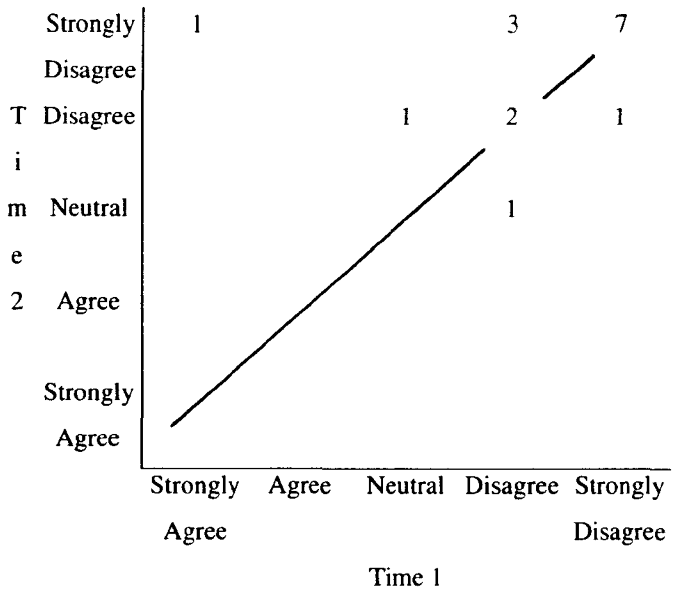
CAQ31 - As long as there is help around, I like using computers.



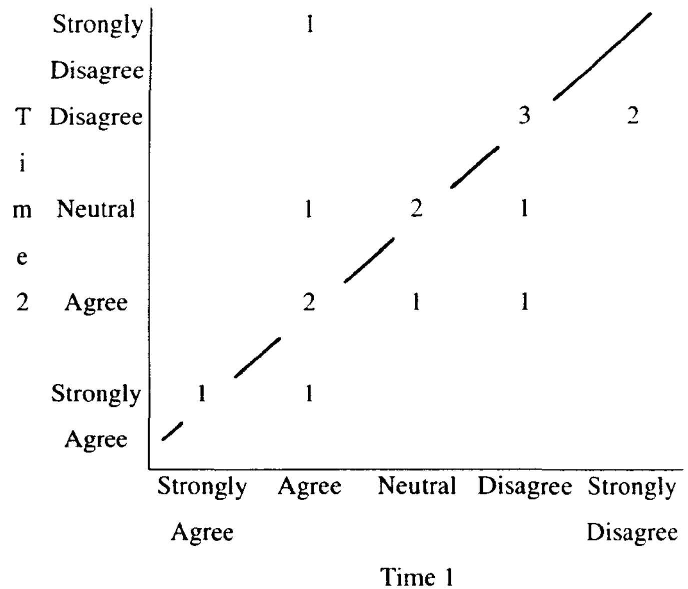
CAQ32 - It is easier to answer a question truthfully when it is asked by a computer. (2 missing)



CAQ33 - There is no difference between being taught by a lecturer and being taught by a computer.



CAQ34 - Using a computer would distract me from what I am supposed to be learning.



Appendix 2.1
The Biographical Questionnaire

Please read each question carefully. Take your time and answer all relevant questions as accurately as you can. Please PRINT your written answers. Where you are given a choice of answers, please circle the response or responses relevant to you.

1. Surname________________ Forenames________ 2. Matriculation No.

3. Date of Birth: D D M M Y Y 4. Gender: Male / Female (please circle)

5. Is English your first Language? Yes / No 6. If not, what is your first language? ________

7. Who funds you at University? (If relevant, please circle more than one source)

Grant / Parent / Self / Other (please specify) ____________________

8. What was your last level/year of school (e.g. fourth year)? ________ 9. What year did you leave school? 19______

10. What was the *last* sort of school you attended and for how long (e.g. 3 years)?

Fee-paying / Non-fee-paying Co-Educational / Single sex ________yrs

Please circle a financial *and* a gender option

11. Since leaving school, have you attended any other education institutions? Yes / No

(If No, go to Q13)

12. If you answered 'yes' to the question above, please follow the instructions and complete the table below.

In the table below, please write the name of the institution you attended, the dates including month and year that you started and finished your course, the subjects you took, and the qualifications you gained as a result of the course you completed. If you did not complete the course, please put 'not completed' in the 'qualifications gained' box.

INSTITUTION	FROM	TO	SUBJECTS TAKEN	QUALIFICATIONS GAINED

13. Year of entry to Glasgow University: 19____

14. Faculty (e.g. Arts/Science/Law) _______

15. Are you a full-time or part-time student? Full-time / Part-time

16. What year are you in? ________________

17. University courses already completed

In the table below, please write in the year you commenced the course, the year you were in when you took the course, the subject you took, and the level of the subject (e.g. first year psychology course = 1). In the 'Outcome' box, please write in the relevant option out of this list: Exemption, Pass, Resit Pass, Class Ticket Only, or Fail.

YEAR OF STUDY	SUBJECT TAKEN	LEVEL	OUTCOME
e.g. THIRD	PSYCHOLOGY	ONE	RESIT PASS

18. Have you ever received a taught course or courses in computing or computing skills? Yes / No

(If no, please go to Q20)

Q19 If you answered 'yes' to the question above, please follow the instructions and complete the table below.

Please fill in the year you started the course, and the title of the computing course. In the 'Length' column, please write the duration of the course (e.g. 6 months). Please then put the number of hours *per week* spent on the course (e.g. '2' for 2 hours per week). Next, if the course was a compulsory part of another course, please write the title of the main course of which this was a part. Finally, please state the name of the institution at which you took this course.

YEAR	COURSE TITLE	COURSE DURATION	HOURS PER WEEK	MAIN COURSE TITLE	INSTITUTION
e.g. 1991	INTRODUCTION TO SPSS-X	6 MONTHS	1.5	JUNIOR HONS. PSYCHOLOGY	ABERDEEN UNIVERSITY

20. Please tick any of the following that you have used:-

____ Word-Processing ____ Microsoft DOS

____ Spreadsheets ____ Games

____ Graphics ____ E-mail

____ Statistics ____ Bibliography packages

____ Databases ____ Other (please specify below)

Other____

21. Do you own a computer? Yes / No   22. If yes, what make is it? ______________

23. Do you have regular access to a computer? Yes / No

24. Who owns the computer you most frequently use? (e.g. self, University etc.) ______________

25. How often would you say you use a computer ?

Daily	3-5 times per week	1-2 times per week	1-3 times per month	Less than once a month (please specify)

26. What do you use a computer for? (please specify) ______________

27. Have you ever used any computer languages (e.g. Pascal) Yes / No   28. If yes, which languages?______________

29. Please list any different makes of personal computers you have ever used (e.g. Applemac, BBC, Sega, Amstrad, etc.): ______________________________

30. How often would you say you use the library on-line catalogue?

Daily	3-5 times per week	1-2 times per week	1-3 times per month	Less than once a month (please specify)

31. Did you know that computers would be used on this course prior to you choosing this option? Yes / No

32. If yes, did this influence your decision in any way? Yes / No

33. How?______________________________

34. Does it concern you that computers are going to be used? yes / no

35. Please state why you answered the way you did to the question above:

____

Finally, please list below any comments you have about this questionnaire and/or its content:

Appendix 2.2

The Post-Package Evaluation Questionnaire

Surname______________ Forenames____________________ 2. Matriculation No.

Please answer the following questions on the package you have just used. Use the following scale to answer Questions 1 - 4 below. Please circle the number of the answer you choose in the space provided.

Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
AA	**A**	**N**	**D**	**DD**

Q1. This package was:-

a) easy to use	AA	A	N	D	DD
b) enjoyable	AA	A	N	D	DD
c) interesting	AA	A	N	D	DD

Q2. This computer session was useful for:-

a) Revision purposes	AA	A	N	D	DD
b) Presenting new information	AA	A	N	D	DD
c) New angles on old information	AA	A	N	D	DD
d) Increasing knowledge of the subject	AA	A	N	D	DD
e) Stimulating interest in the subject	AA	A	N	D	DD

Q3. I would like to spend more time using this package	AA	A	N	D	DD
Q4. This package is most suited to students working on their own	AA	A	N	D	DD

Q5. How many different simulations did you run in the final part of the package (i.e. how many different settings of the parameters did you try out)? Please specify number (e.g. 10 runs):

Q6. Please circle all the ways in which you have previously covered the subject:-

Lectures Practicals Tutorials Essay

Textbooks Personal research on the subject Other_____________

Q7. How does this package compare to the teaching you have previously encountered?

Q8. Have you *in the last month* done any extra work on the package topic? Yes / No

Q9. If yes, how often, and what methods did you use (e.g. read references etc)?

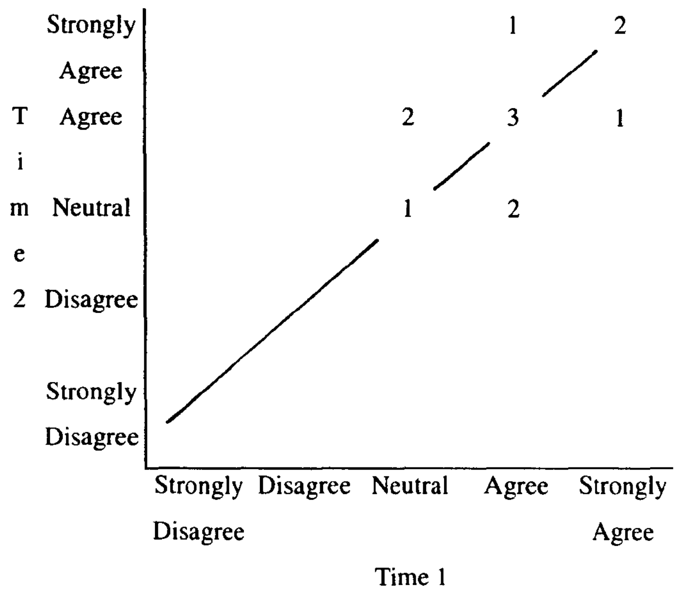
Q10. What do you feel you have gained, if anything, from this package?

Finally, please list below any comments you have about this questionnaire and/or its content:

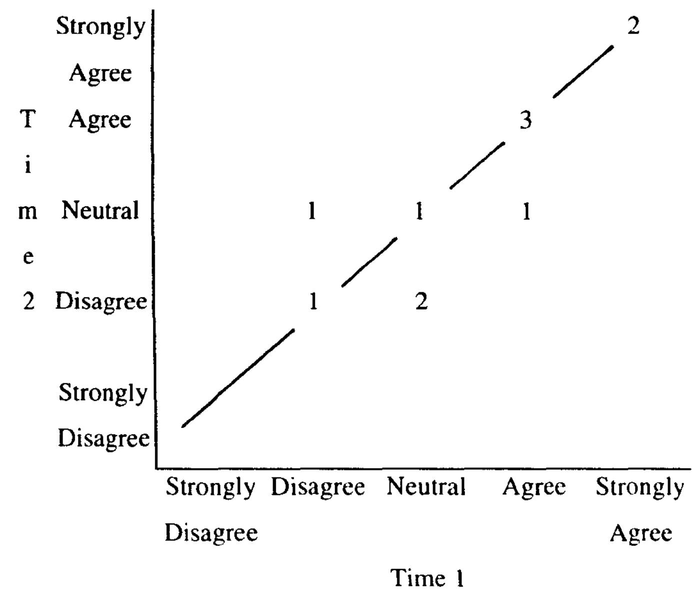
Appendix 2.3

Charts of shifts in reported attitude towards computers over time

CAQ1 - It is a good idea to use computers to assist in the teaching of the subjects I study.



CAQ2 - I enjoy working with computers. (1 missing)



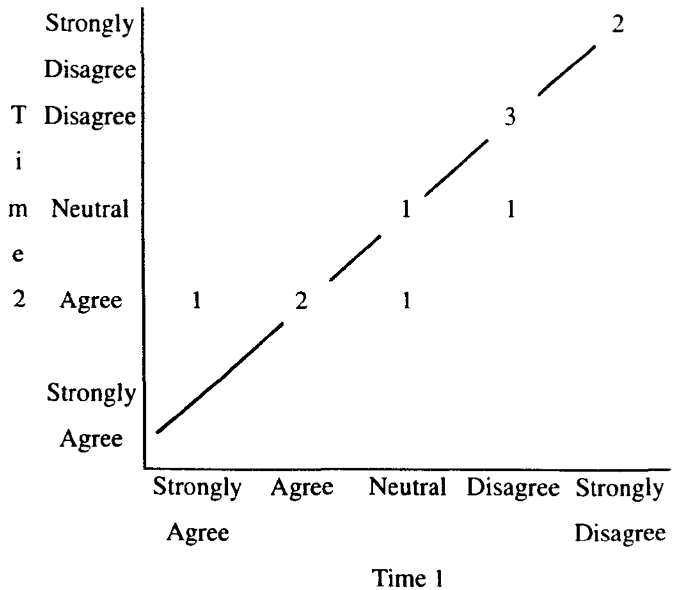
CAQ3 - Computers rarely make mistakes.
(2 missing)

Time 2 \ Time 1	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Strongly Agree					
Agree		1	1	2	1
Neutral				1	
Disagree			2		
Strongly Disagree	1	1			

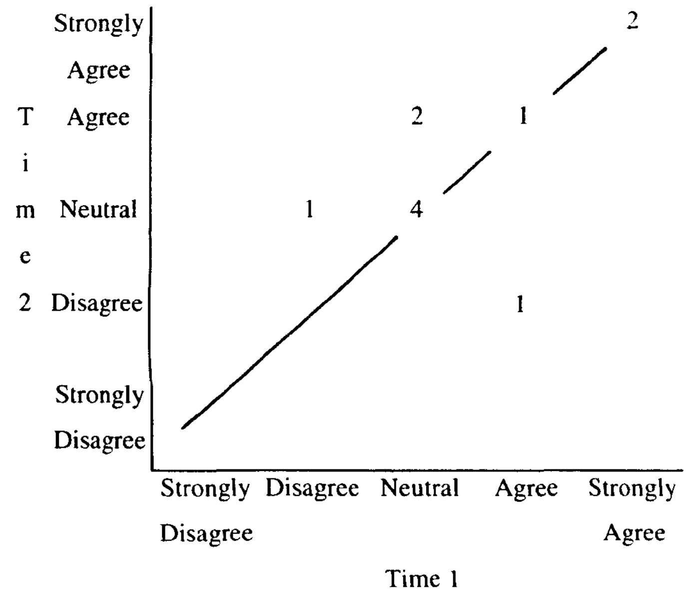
CAQ4 - It takes too long to learn how to use a computer.

Time 2 \ Time 1	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Strongly Disagree					1
Disagree			1	6	1
Neutral			1		
Agree			1	1	
Strongly Agree					

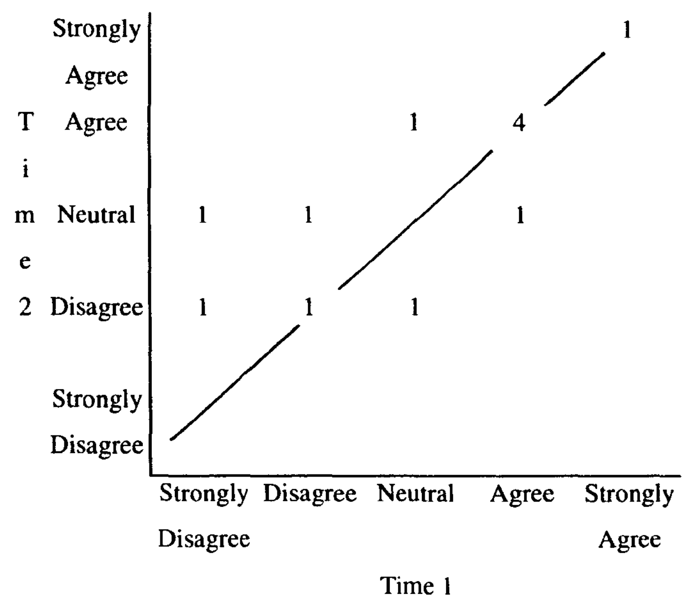
CAQ5 - I find using computers confusing. (1 missing)



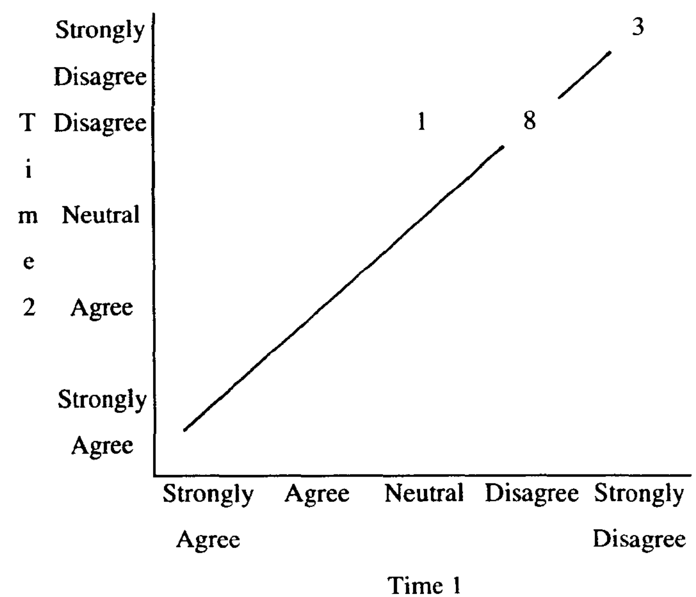
CAQ6 - Using computers as a teaching aid makes learning easier. (1 missing)



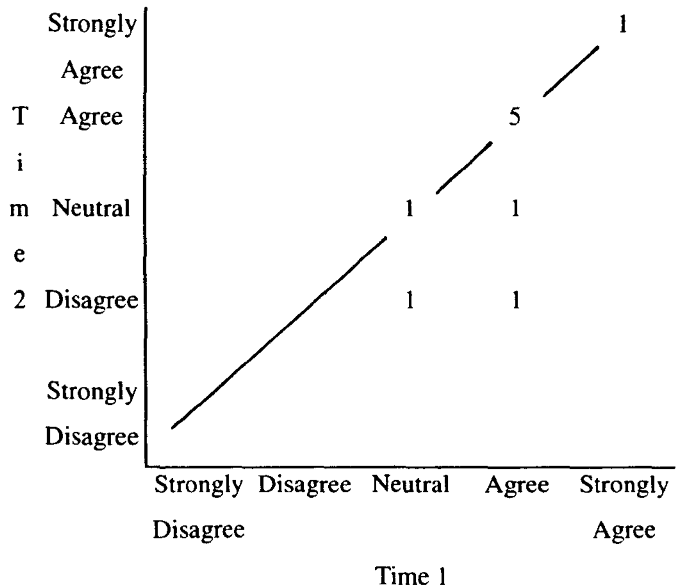
CAQ7 - I feel confident using computers.



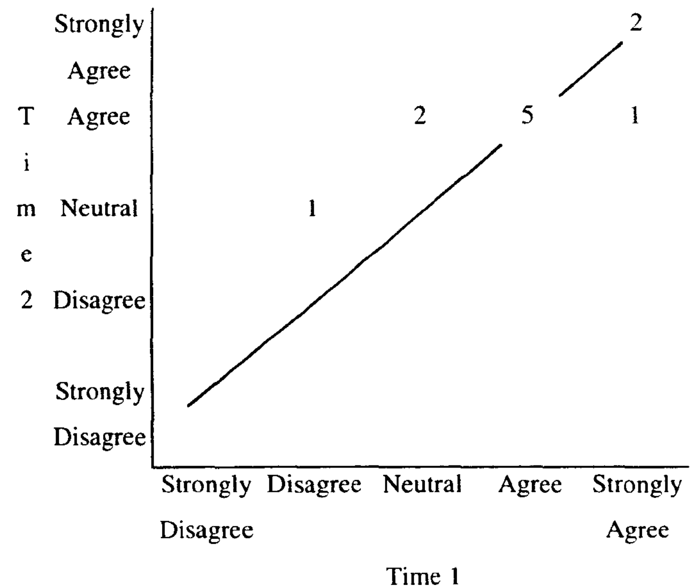
CAQ8 - I would not ask for help if I had a problem while using a computer.



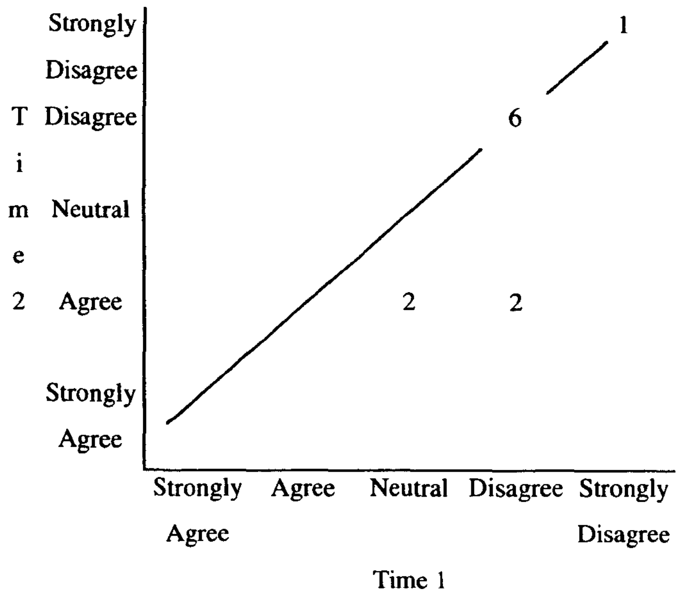
CAQ9 - Computers make tasks less time consuming. (1 missing)



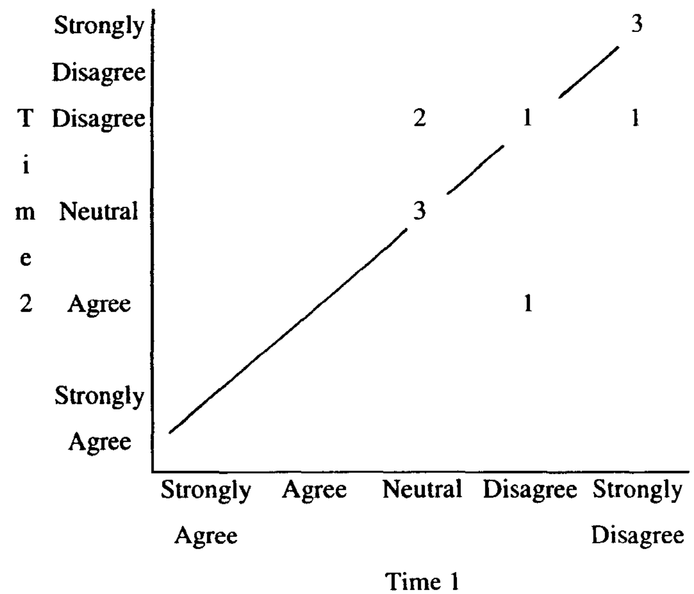
CAQ10 - Using computers in class varies the course. (1 missing)



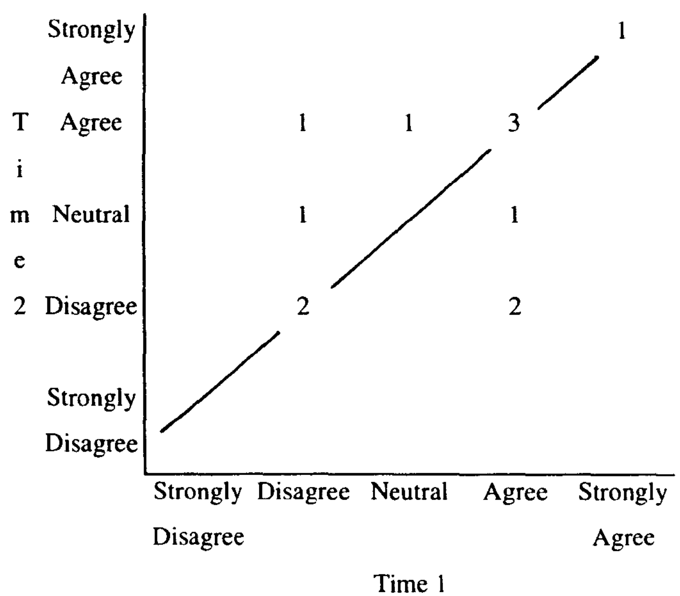
CAQ11 - The usefulness of computers is over-rated. (1 missing)



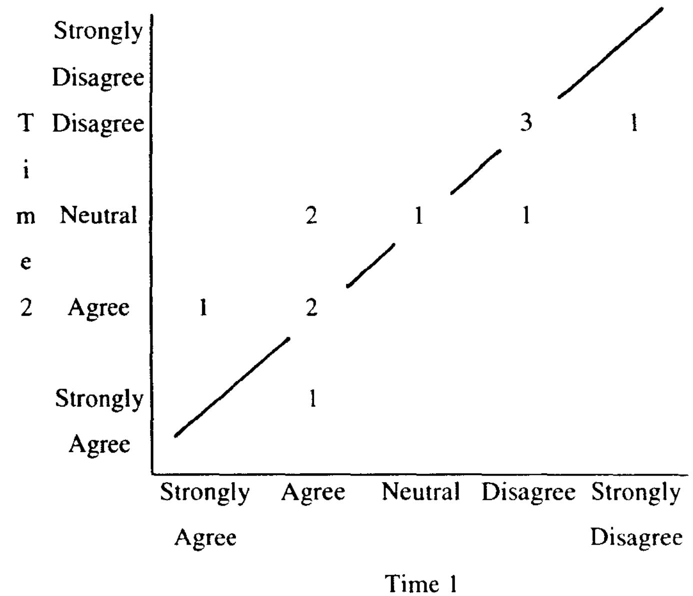
CAQ12 - I have no desire to use computers. (1 missing)



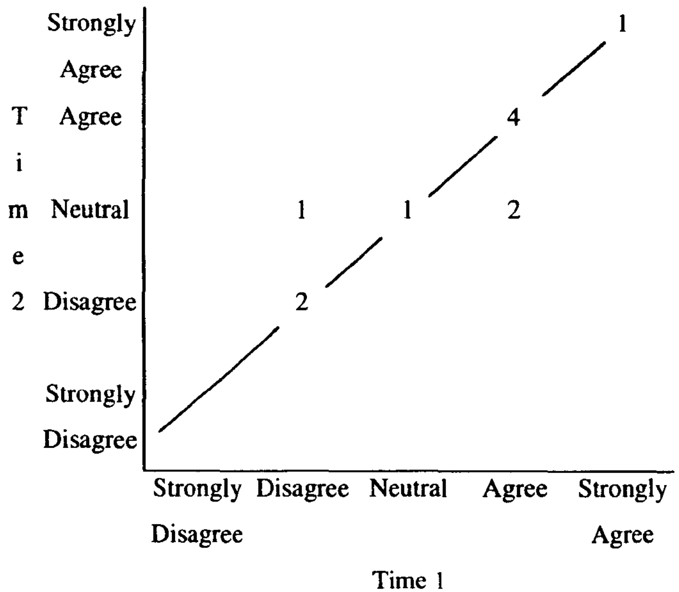
CAQ13 - There are many areas of computing that I am interested in learning more about



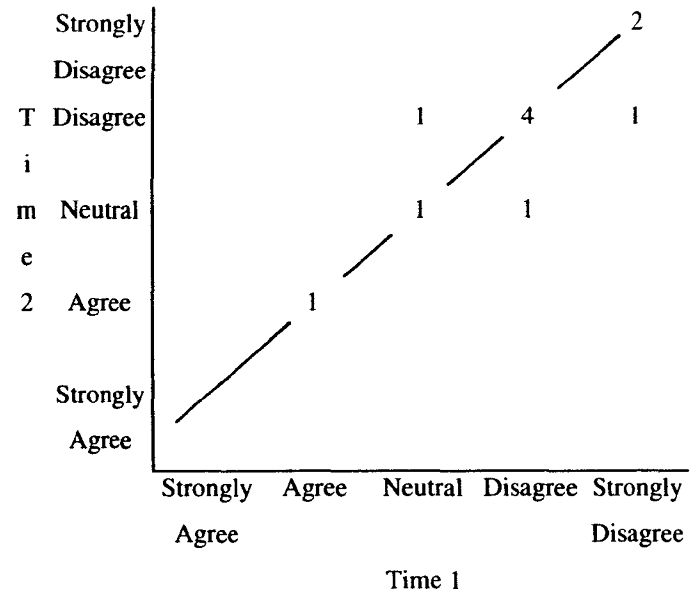
CAQ14 - I dislike using unfamiliar computing equipment.



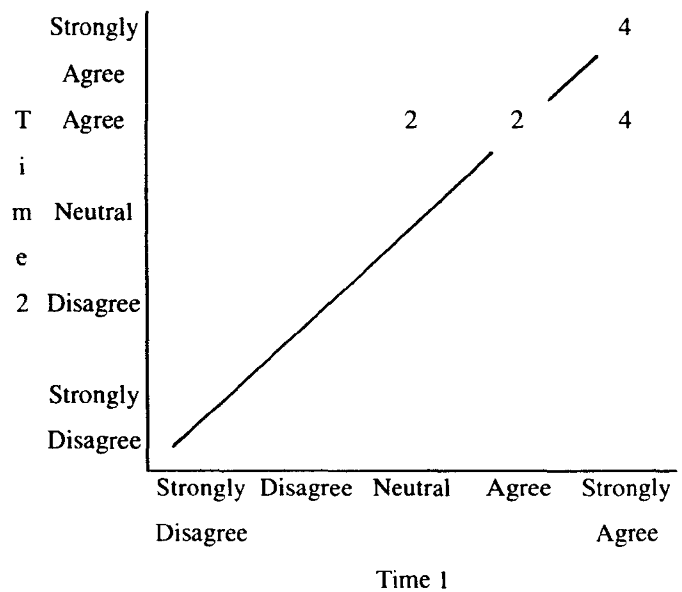
CAQ15 - I would like to spend some of my spare time using computers. (1 missing)



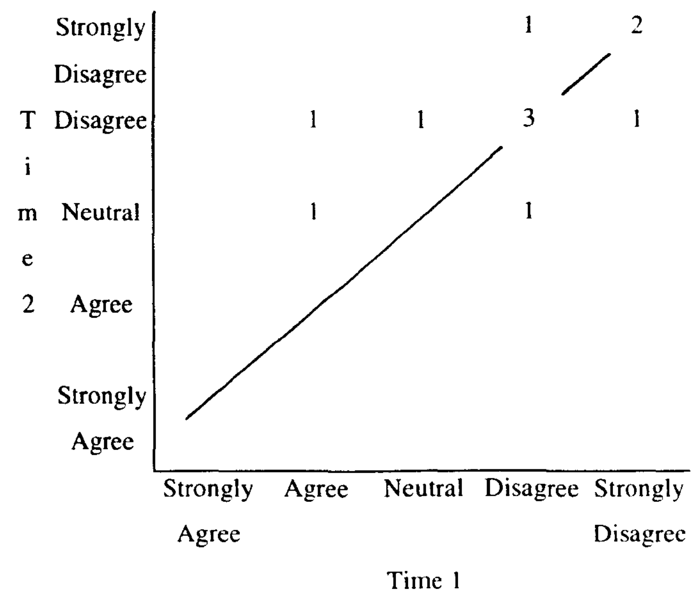
CAQ16 - Computers complicate simple tasks.



CAQ17 - The opportunity to learn about computers and their use is valuable.

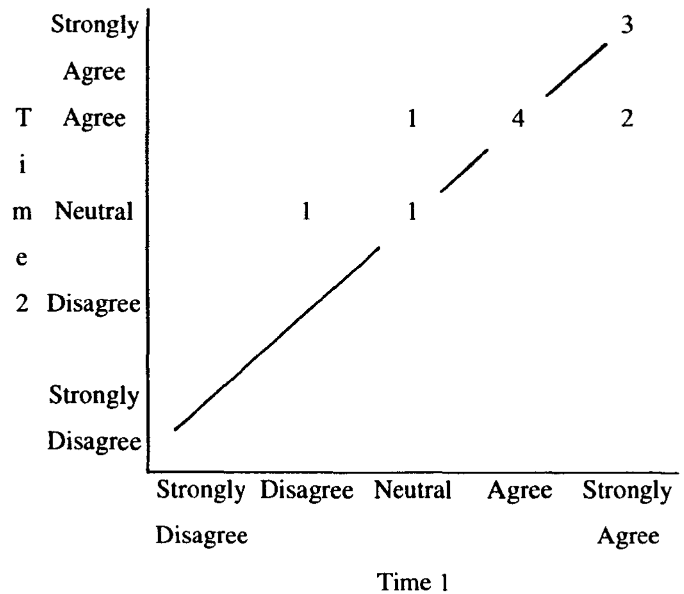


CAQ18 - The use of computers within a course makes the understanding of course material harder. (1 missing)

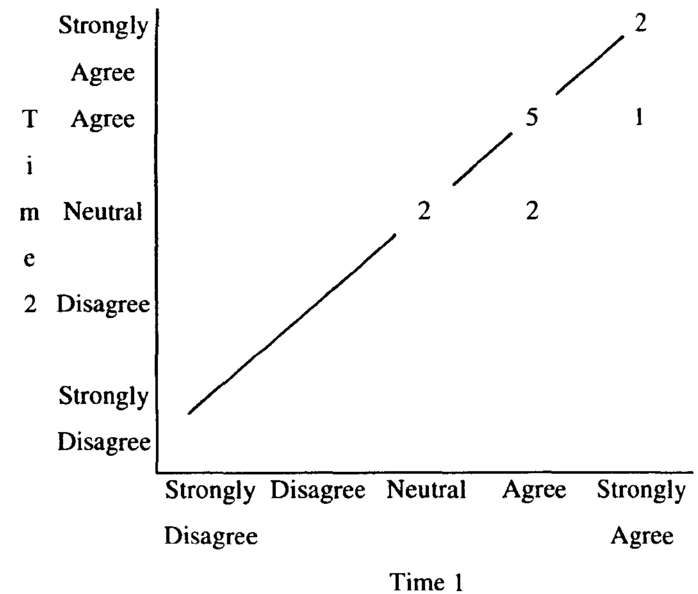


y

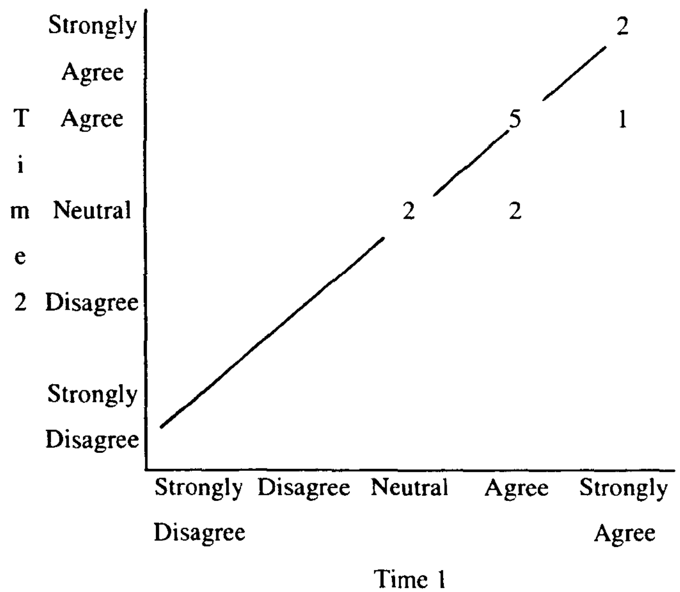
CAQ19 - A knowledge of computing is useful in my degree subject.



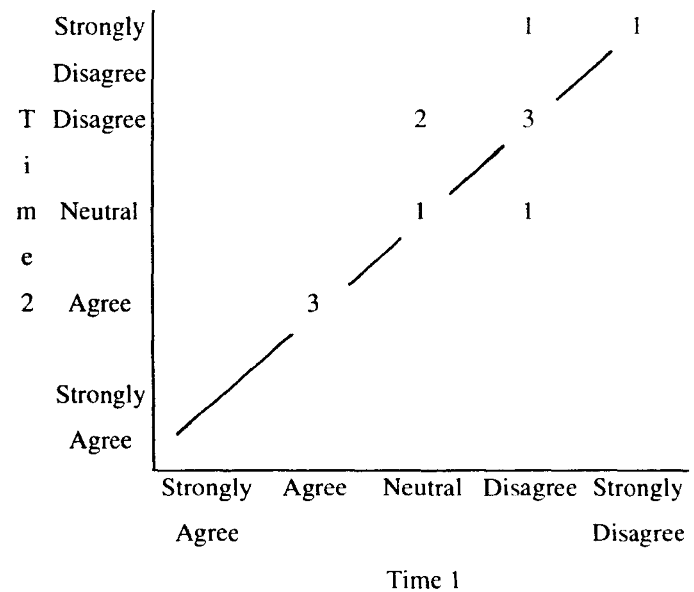
CAQ20 - There should be more opportunities to use computers in my undergraduate studies.



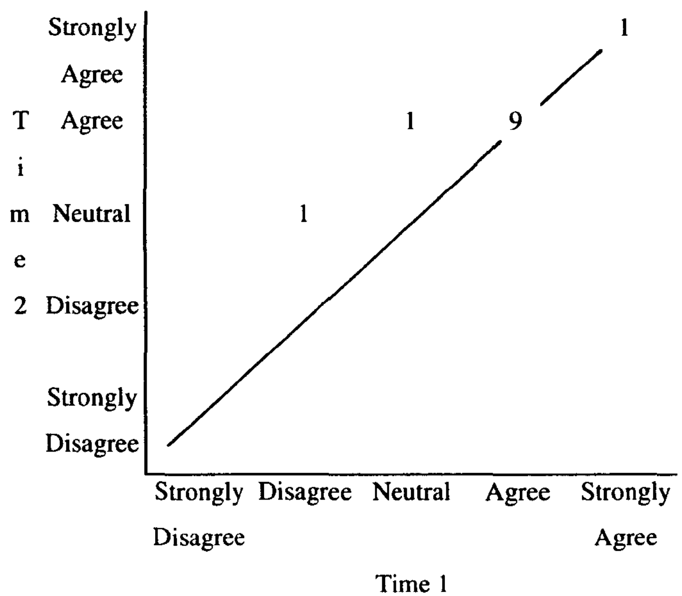
CAQ21 - Learning about computers is interesting.



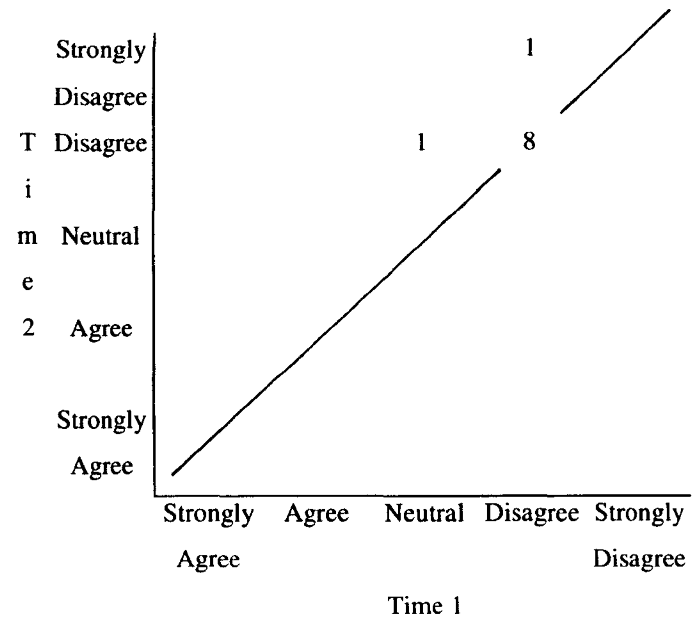
CAQ22 - Using a computer is normally more trouble than it's worth.



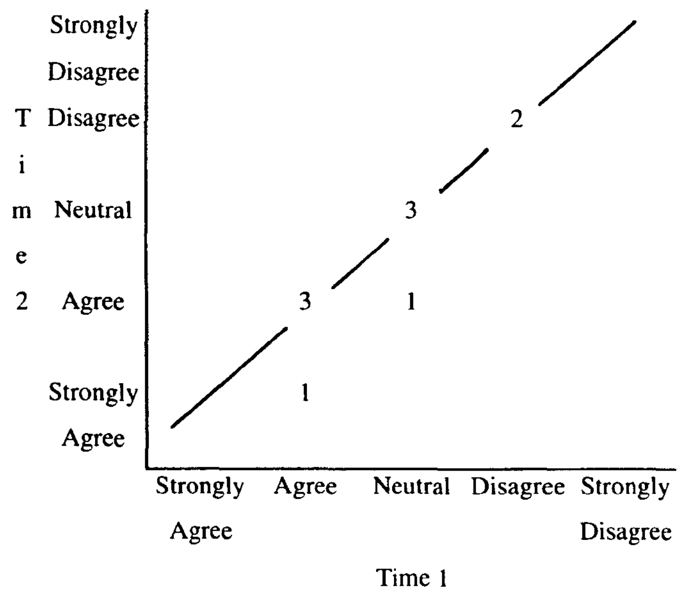
CAQ23 - It is easy to learn the basics of how to operate a computer.



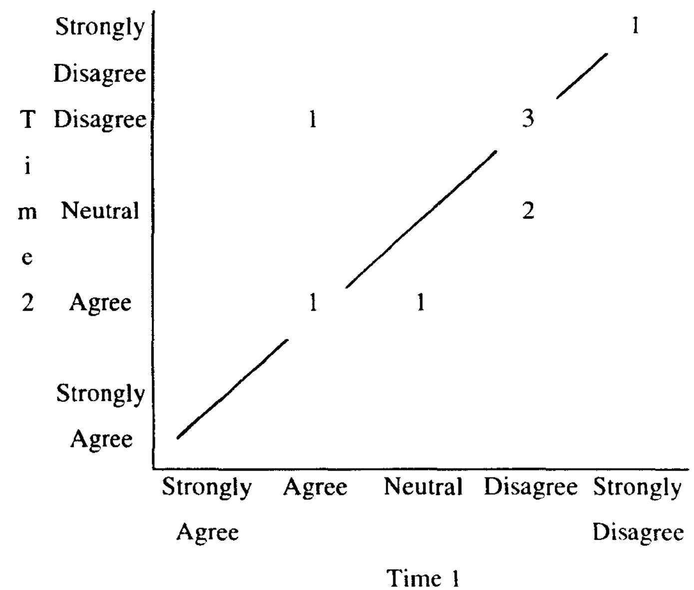
CAQ24 - You need a mathematical mind to enjoy using computers. (2 missing)



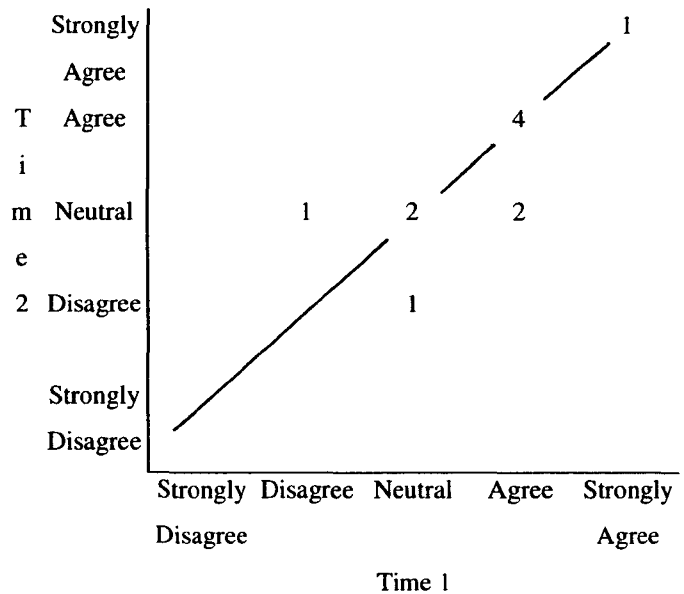
CAQ25 - It is easy to accidentally cause a computer to malfunction accidentally. (2 missing)



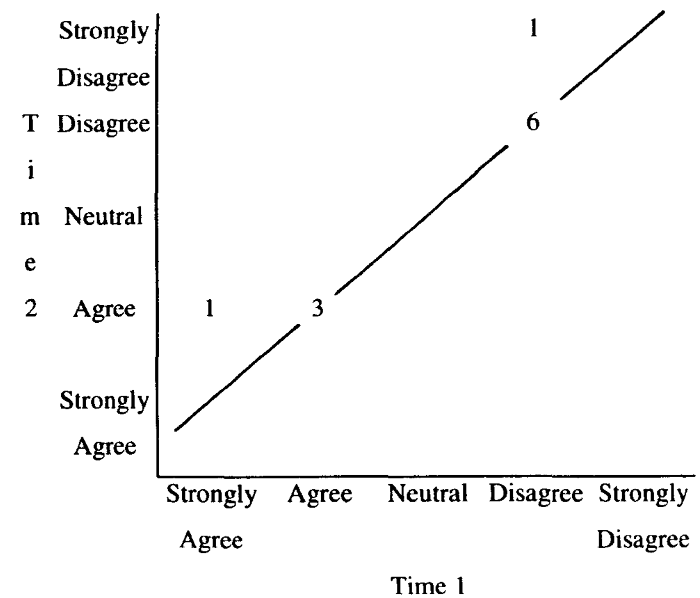
CAQ26 - Computers can make the user appear stupid. (3 missing)



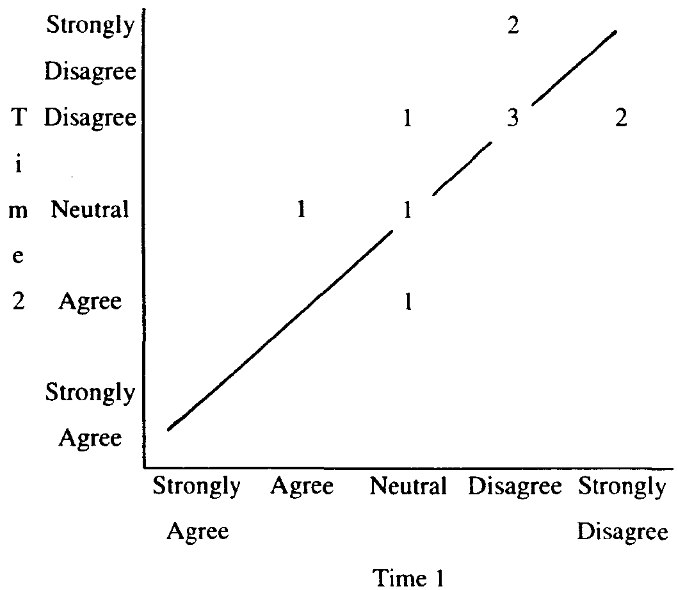
CAQ27 - I would voluntarily attend a computing skills course. (1 missing)



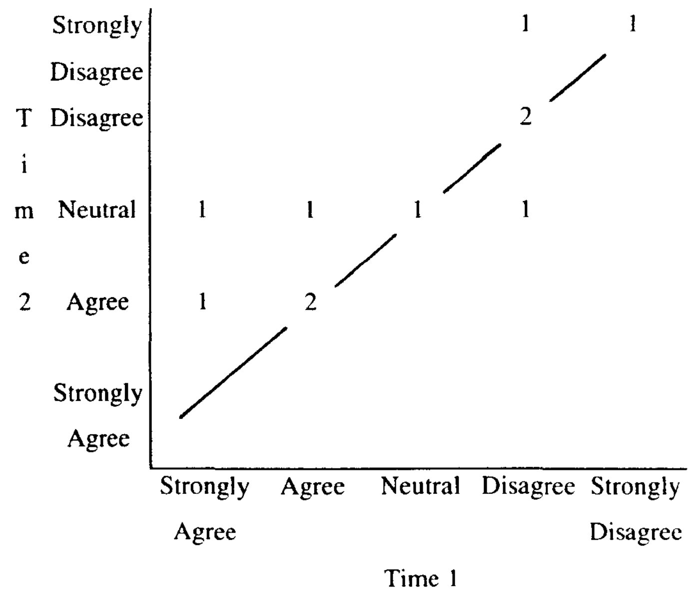
CAQ28 - Using computers is most often a frustrating experience. (1 missing)



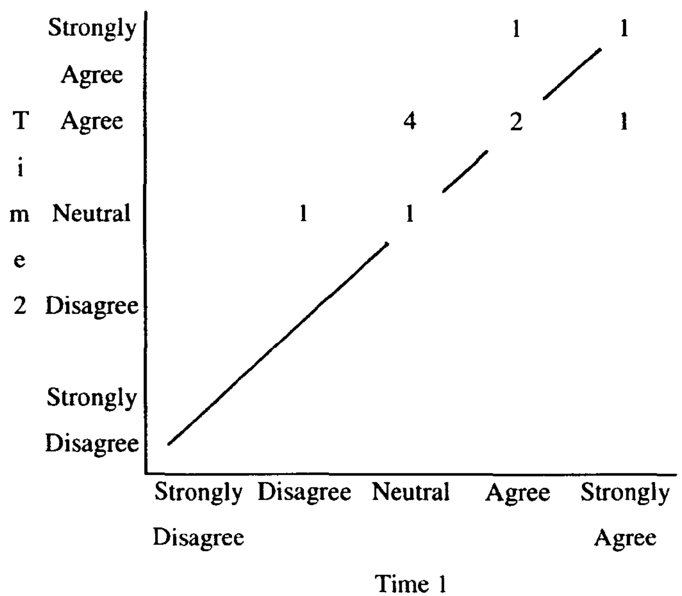
CAQ29 - I would not choose computing or computer-related options, if any, in my further studies. (1 missing)



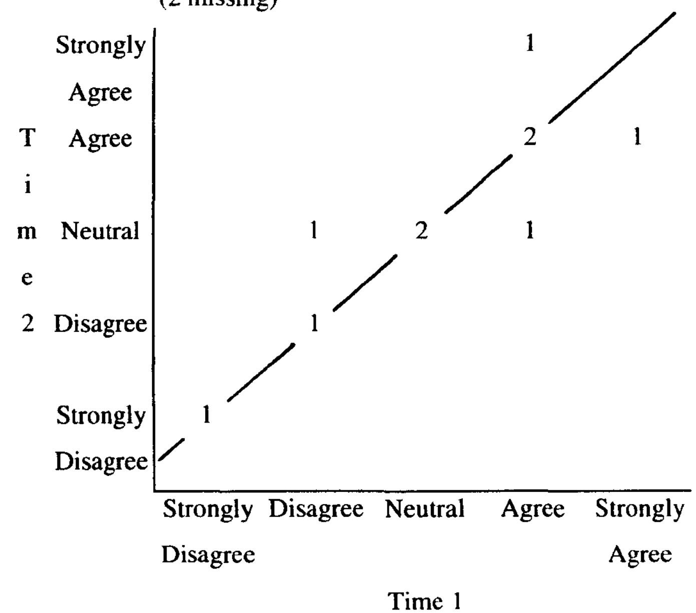
CAQ30 - I feel anxious at the thought of using a computer. (1 missing)



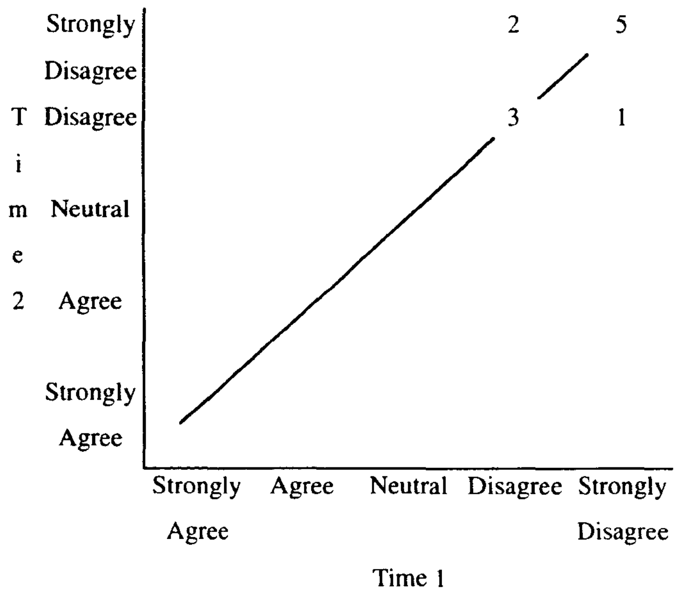
CAQ31 - As long as there is help around, I like using computers. (1 missing)



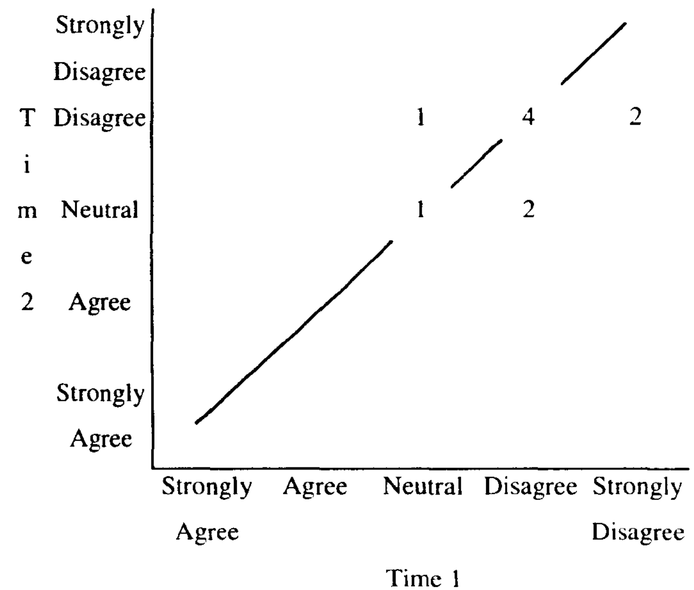
CAQ32 - It is easier to answer a question truthfully when it is asked by a computer. (2 missing)



CAQ33 - There is no difference between being taught by a lecturer and being taught by a computer. (1 missing)



CAQ34 - Using a computer would distract me from what I am supposed to be learning. (2 missing)



Appendix 3.1

The Computer Experience Questionnaire

Please read each question carefully. Take your time and answer all relevant questions as accurately as you can. Please PRINT your written answers. Where you are given a choice of answers, please tick the relevant box or boxes

Name:____________________ **Matriculation No:**____________________

Date of Birth:____________________ **Sex:**____________________

1a. Have you ever received a taught course/s in computing/computing skills/IT?

Yes ❑ No ❑

1b. If you answered 'yes' to the question above (1a), please fill in the details of this course in the table below:-

Year	Course Title	Course Duration	Hours per week	Main Course Title	Institution
e.g. 1991	Introduction to SPSS-X	6 Months	1.5	JH Psychology	Aberdeen University

2. Please tick any of the following packages that you have used

Word-Processing	❑	Spreadsheets	❑
Graphics	❑	Statistics	❑
Databases	❑	Microsoft DOS	❑
Games	❑	Electronic Mail	❑
Bibliography Packages	❑		

Others____

3a. Do you own a computer? Yes ❑ No ❑

3b. If yes, what make is it?____

4. Do you have regular access to a computer? Yes ❑ No ❑

5. Who owns the computer that you most frequently use? (e.g. self, University etc.).

____

6. How often would you say you use a computer?

- Every day ❑
- Every 2-3 days ❑
- Once a week ❑
- Once a month ❑
- Less than once a month ❑
- Never ❑

7. Please tick any of the following computers that you have used

Apple Macintosh	❑	IBM PC	❑
IBM compatible	❑	Sega	❑
Commodore	❑	Amstrad	❑
Sun Workstation	❑		

Other____

8. How often do you use the library 'on-line' catalogue?

- Every day ❑
- Every 2-3 days ❑
- Once a week ❑
- Once a month ❑
- Less than once a month ❑
- Never ❑

Appendix 3.2

The Diary

Please complete a diary as soon as possible after <u>EACH</u> session in which you used the Paradox programme. Feel free to make comments on the diary where appropriate.

Matriculation No:______________________ **Date:**____________________

Session Start time:________________ **Session Finish Time:**_______________

(1a) Since the last time you filled in a diary, have you used a computer to perform any work relating to the Economic History course? (N.B. Leave blank if this is the first time you have filled in a diary).

Yes ❑ No ❑

(1b) If you answered yes to Question 1a, then what work did you do?

____

(2) During this session, did you work at the computer alone or with others?

(Please tick one of the following):-

Worked completely alone ❑

Worked alone but occasionally sought help/advice ❑

Worked with friend using a computer each ❑

Worked in a group (2 or more) using one computer ❑

Comments?____

(3) What did you spend most of your time trying to do during this computer session? (Please indicate using the following scale):-

Discovering details of how to operate Paradox	0	1	2	3	4	5	6	Concentrating on course-work problems and answers

Comments?____

Appendix 3.3

Understanding Logs

The PARADOX Understanding Log

Please tick the box that best matches your understanding of the following topics during this session:-

TOPIC	I fully understand	I mostly understand	I am quite confused	I don't understand at all
Using the keyboard				
What the column names signify				
What the information contained in each column means				
Using the VIEW command to see the table contents				
Knowing what the "F keys" do				
Using the ASK command to make queries about age and birthplace				
Using the ASK command to make queries about occupations				
Using the ASK command to make queries about employment				
Using the ASK command to make queries about status				
COMMENTS:				

The Excel Understanding Log

Please tick the box that best matches your understanding of the following topics during this session:-

TOPIC	I fully understand	I mostly understand	I am quite confused	I don't understand at all	I haven't reached this yet
Selecting active cells and entering text and numbers					
Loading files					
Saving a file to your own disk					
Entering formulas					
Highlighting: Drawing graphs and charts					
Highlighting non-adjacent columns					
Adding texts and legends to graphs and charts					
Moving between charts and worksheet					
COMMENTS:					

Appendix 3.4

Sign Test Results - The PARADOX Understanding Log

PARADOX Diary 1 (T1) vs Diary 2 (T2) - 9 objectives listed Alphabetically from A-I

T1A with T2A
2-Tailed P = .6250

Cases	
1	- Diffs (T2A LT T1A)
3	+ Diffs (T2A GT T1A)
11	Ties
15	Total

T1B with T2B
2-Tailed P = .4531

Cases	
2	- Diffs (T2B LT T1B)
5	+ Diffs (T2B GT T1B)
8	Ties
15	Total

T1C with T2C
2-Tailed P = 1.0000

Cases	
2	- Diffs (T2C LT T1C)
3	+ Diffs (T2C GT T1C)
9	Ties
14	Total

T1D with T2D
2-Tailed P = 1.0000

Cases	
1	- Diffs (T2D LT T1D)
1	+ Diffs (T2D GT T1D)
12	Ties
14	Total

T1E with T2E
2-Tailed P = .6875

Cases	
2	- Diffs (T2E LT T1E)
4	+ Diffs (T2E GT T1E)
9	Ties
15	Total

T1F with T2F
2-Tailed P = .1797

Cases	
2	- Diffs (T2F LT T1F)
7	+ Diffs (T2F GT T1F)
6	Ties
15	Total

T1G with T2G
2-Tailed P = .3750

Cases	
1	- Diffs (T2G LT T1G)
4	+ Diffs (T2G GT T1G)
8	Ties
13	Total

T1H with T2H
2-Tailed P = .1250

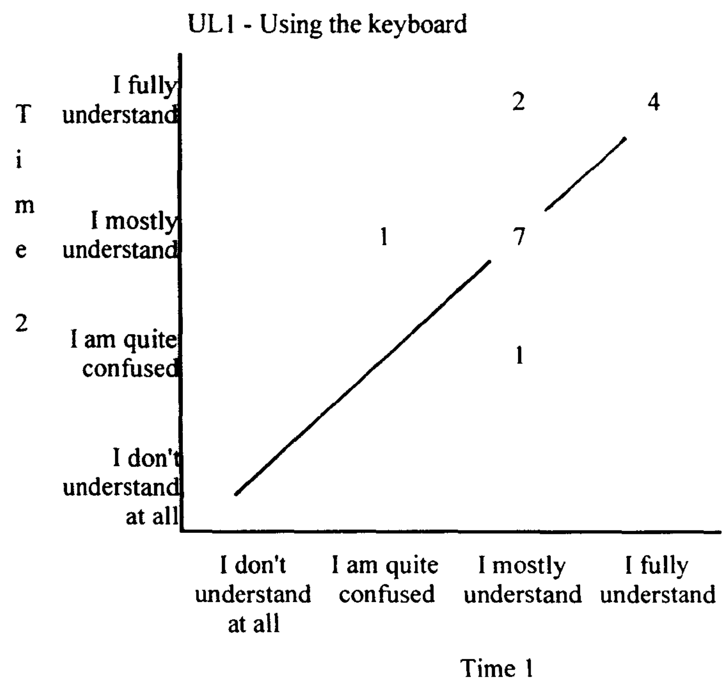
Cases	
1	- Diffs (T2H LT T1H)
6	+ Diffs (T2H GT T1H)
4	Ties
11	Total

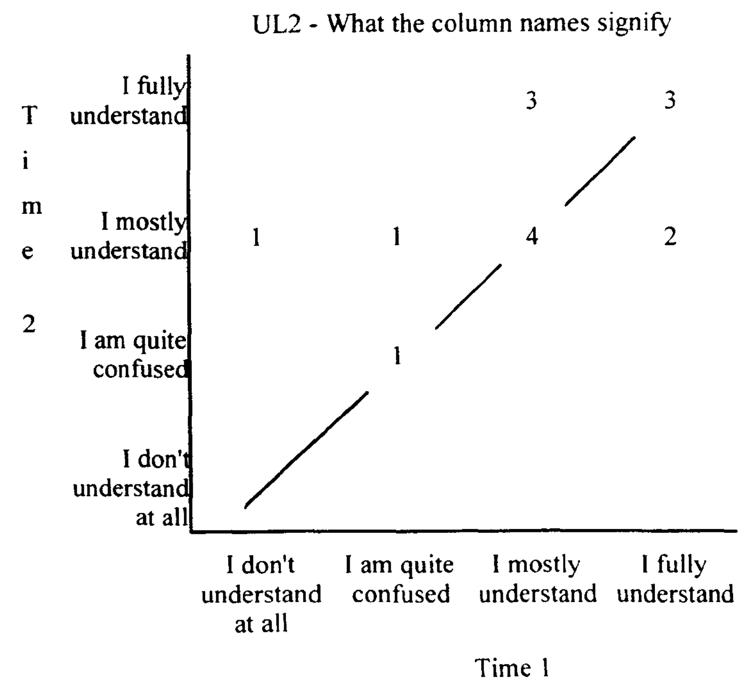
T1I with T2I
2-Tailed P = .3750

Cases	
1	- Diffs (T2I LT T1I)
4	+ Diffs (T2I GT T1I)
4	Ties
9	Total

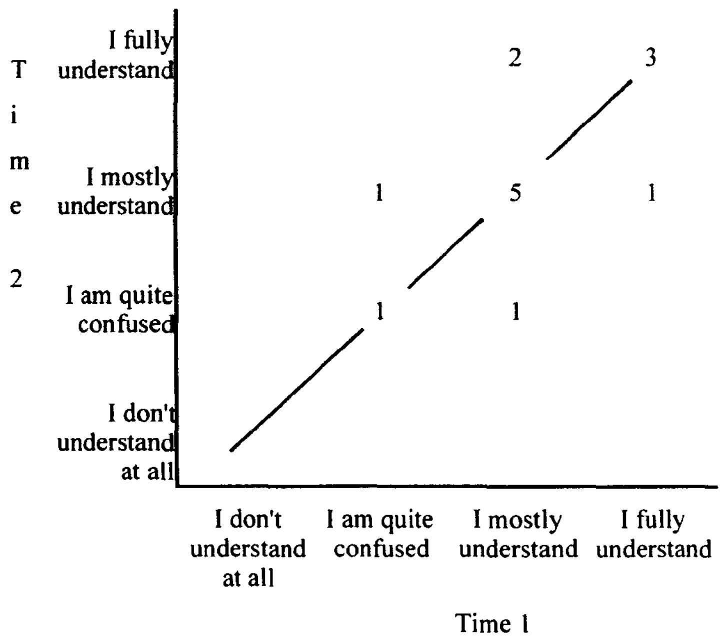
Appendix 3.5

Charts of shifts in understanding over time - PARADOX Log

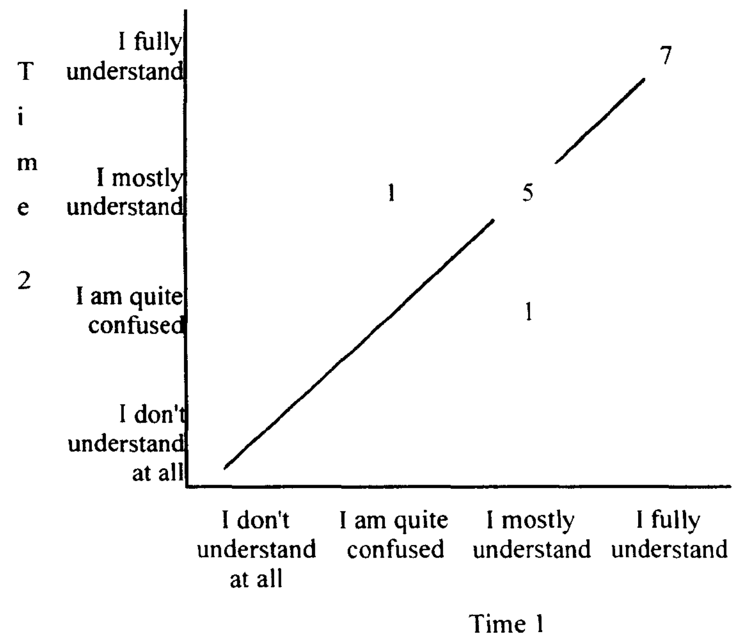




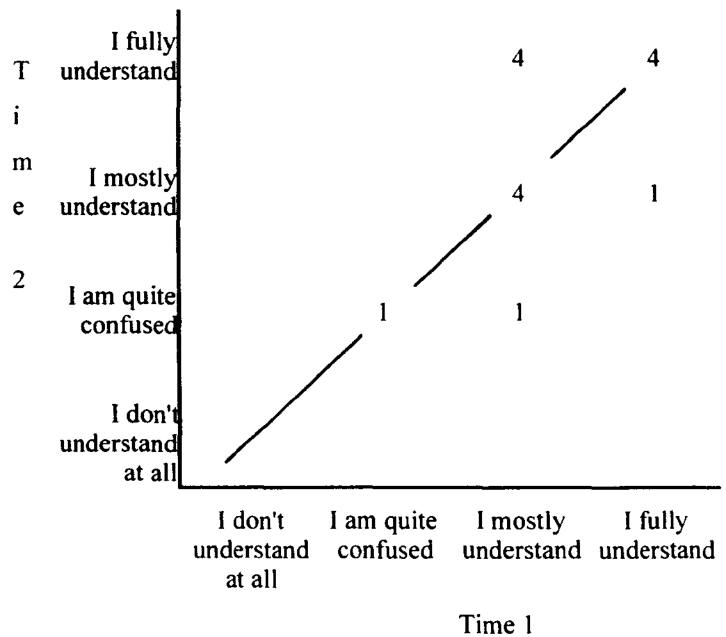
UL3 - What the information contained in each column means



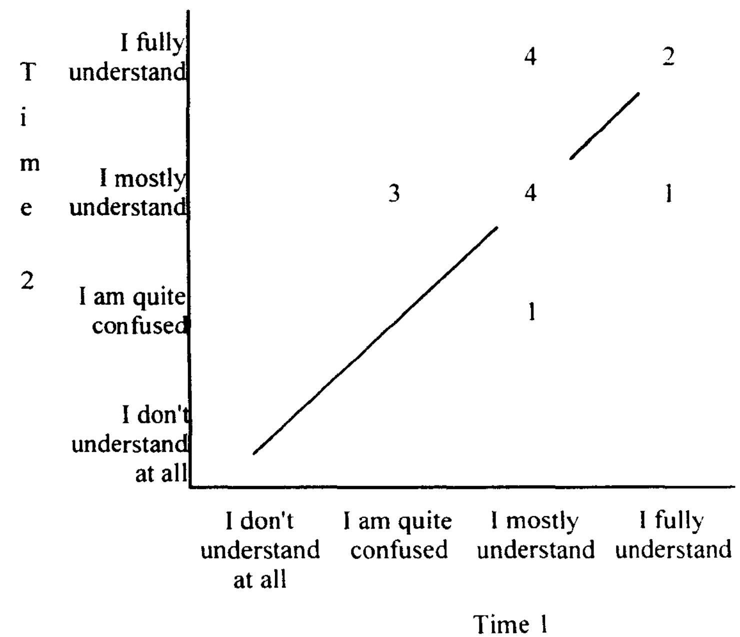
UL4 - Using the "VIEW" command to see the table contents



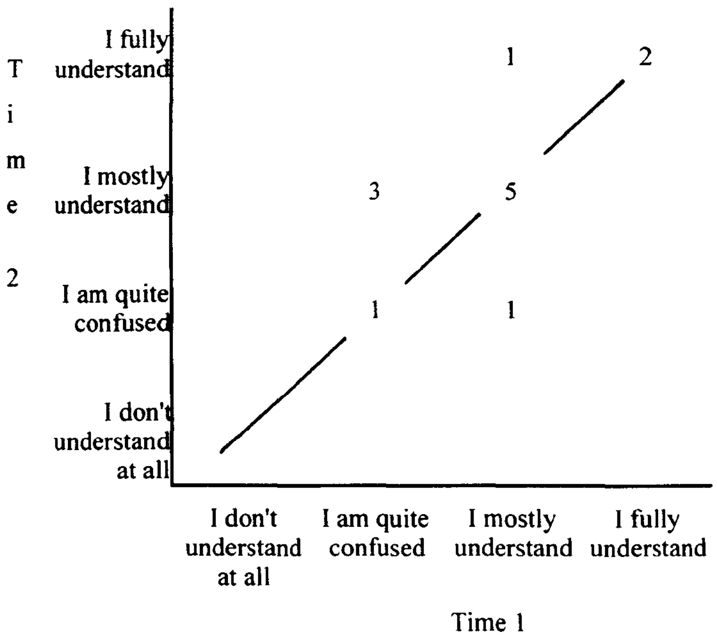
UL5 - Knowing what the "F keys" do



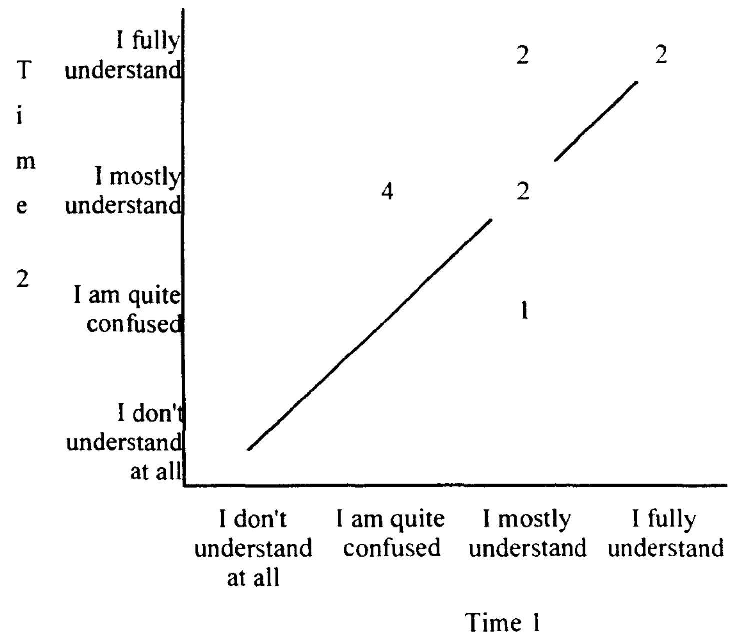
UL6 - Using the "ASK" command to make queries about age and birthplace



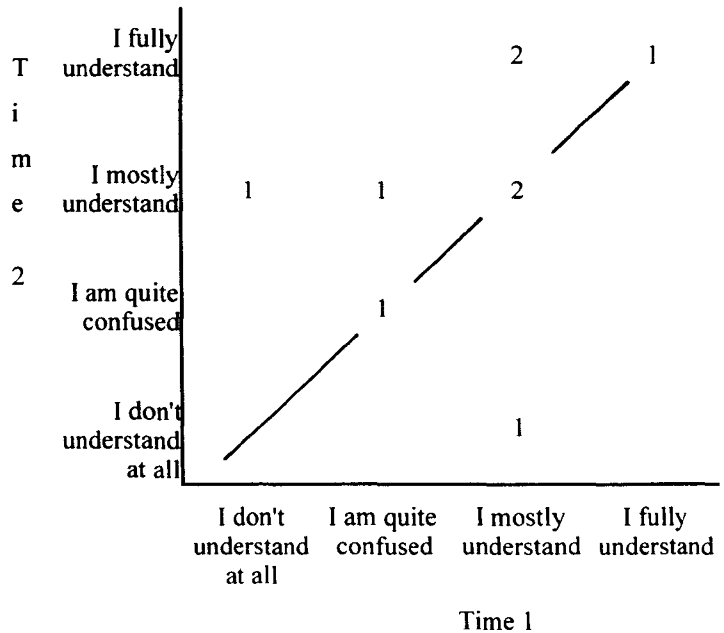
UL7 - Using the "ASK" command to make queries about occupations



UL8 - Using the "ASK" command to make queries about employment



UL9 - Using the "ASK" command to make queries about status



Appendix 3.6

Sign Test Results - The Excel Understanding Log

Excel Diary 1 (T3) vs Diary 2 (T4) - 8 Objectives listed Alphabetically from A-H

T3A with T4A
2-Tailed P = .6875
Cases
2 - Diffs (T4A LT T3A)
4 + Diffs (T4A GT T3A)
10 Ties
16 Total

T3B with T4B
2-Tailed P = .0391
Cases
1 - Diffs (T4B LT T3B)
8 + Diffs (T4B GT T3B)
7 Ties
16 Total

T3C with T4C
2-Tailed P = .0039
Cases
0 - Diffs (T4C LT T3C)
9 + Diffs (T4C GT T3C)
8 Ties
17 Total

T3D with T4D
2-Tailed P = .2891
Cases
2 - Diffs (T4D LT T3D)
6 + Diffs (T4D GT T3D)
8 Ties
16 Total

T3E with T4E
2-Tailed P = .2500
Cases
0 - Diffs (T4E LT T3E)
3 + Diffs (T4E GT T3E)
13 Ties
16 Total

T3F with T4F
2-Tailed P= .0391
Cases
1 - Diffs (T4F LT T3F)
8 + Diffs (T4F GT T3F)
7 Ties
16 Total

T3G with T4G
2-Tailed P = .0156
Cases
0 - Diffs (T4G LT T3G)
7 + Diffs (T4G GT T3G)
9 Ties
16 Total

T3H with T4H
2-Tailed P = .1797
Cases
2 - Diffs (T4H LT T3H)
7 + Diffs (T4H GT T3H)
7 Ties
16 Total

Appendix 4.1

The Computer Experience Questionnaire

Matriculation No.

This questionnaire has two sections:- Computer Experience and Topic Experience. Please answer both. Read each question carefully. Answer all relevant questions as accurately as you can. Please PRINT your written answers..

Computer Experience

1) Have you ever received a taught course in computing, computer-based skills, Information Technology? Yes ❐ No ❐

If you answered 'Yes', please fill in the details of any courses in the table below:-

Year	Course Title	Course Duration	Hours per week	Main Course Title	Institution
e.g. 1991	Introduction to SPSS-X	6 Months	1.5	JH Psychology	Aberdeen University

2) Did you feel you learned a lot from the computer course(s) you listed above? Yes ❐ No ❐
Please give reasons for your answer.

3) What computer packages/networks have you used (e.g. Word 5, Excel, Unix, email etc.)?
Please list them

4) How often would you say you use a computer?

Every day	❐	Once a month	❐
Every 2-3 days	❐	Less than once a month	❐
Once a week	❐	Never	❐

5) What type of computers have you used in the past few years (e.g. Apple Mac, IBM PC etc.)?

6) Have you ever written up your essays/reports on a word processor? Yes ❐ No ❐
If Yes, how frequently do you do this (e.g. always, usually, sometimes etc.) and why (course requirements, easier etc.)?

7) How skilled do you think you are at using a computer? Please circle the most appropriate word below:-

Expert	*Advanced*	*Competent*	*Novice*	*Never used one*

8) How comfortable and confident do you feel about using a computer today?

Very Confident	Confident	Some Confidence	Little Confidence	No Confidence Whatsoever

9) Please tick any of the following you have used:

Mouse	❑	CD-ROM/CD-I	❑
Floppy disk	❑	Laser printer	❑
Hard disk	❑	Computer keyboard	❑
Modem	❑	Dot matrix printer	❑

Topic Experience/Knowledge

Have you ever learnt about failure mechanisms in materials in either coursework or employment?

Yes ❑ No ❑

Appendix 4.2
Quiz Version 1

No.1

Fast Fracture Test

Please tick the appropriate box.

1. The units for Gc - toughness are defined as

- ❐ kJm^2
- ❐ kJ/m^2
- ❐ kJm
- ❐ kJ/m
- ❐ I don't know.

2. The units for 'fracture toughness' are defined as

- ❐ $MNm^{3/2}$
- ❐ $MNm^{1/2}$
- ❐ $MN/m^{3/2}$
- ❐ $M/Nm^{1/2}$
- ❐ I don't know.

3. The units for 'stress intensity factor' are defined as

- ❐ $MNm^{3/2}$
- ❐ $MNm^{1/2}$
- ❐ $MN/m^{3/2}$
- ❐ $M/Nm^{1/2}$
- ❐ I don't know.

4. It will be difficult for a crack to propogate in a material which has:

- ❐ low toughness
- ❐ high toughness
- ❐ low modulus
- ❐ high modulus
- ❐ I don't know.

5. A ductile material has:

- ❐ low toughness
- ❐ high toughness
- ❐ low modulus
- ❐ high modulus
- ❐ I don't know.

6. Cleavage is the:

- ❐ breaking apart of interatomic bonds
- ❐ flow of a crack through the plastic zone
- ❐ breaking up of the elastic zone
- ❐ yielding of the material
- ❐ I don't know.

7. In a vessel made of High Strength Steel, the maximum stress is 200 MPa. The critical stress intensity factor is 50 units. The critical crack length to nearest mm would be calculated to be:-

- ❐ 10
- ❐ 62
- ❐ 26
- ❐ 20
- ❐ I don't know.

8. The mechanism by which a brittle material fracture is known as:

- ❐ cleavage
- ❐ ductile tearing
- ❐ stress cracking
- ❐ yielding
- ❐ None of these.

9. Fracture occurs when:-:

- ❐ $k = G_c$
- ❐ $k = K_c$
- ❐ $G = \sigma\sqrt{\pi a}$
- ❐ $k = \sigma\sqrt{\pi a}$
- ❐ I don't know.

10. Ductile tearing is the:

- ❐ breaking apart of interatomic bonds
- ❐ flow of a crack through the plastic zone
- ❐ breaking up of the elastic zone
- ❐ yielding of the material
- ❐ I don't know.

Appendix 4.3
The Confidence Log

Please indicate by ticking the relevant box how confident you feel that you are able to:-

Topic	Very Confident	Confident	Some Confidence	Little Confidence	No Confidence Whatsoever
Understand what is meant by the term 'fast fracture'					
Know the meaning of the word 'toughness' with respect to fast fracture					
Know the meaning of the term 'fracture toughness/stress intensity factor'					
Know some of the factors that cause fast fracture e.g. as in the Liberty Ships					
Understand the difference between cleavage and ductile tearing					

7) Please add any additional comments or suggestions about this session and/or the evaluation:-

Appendix 4.4

Post Lecture Questionnaire (April 1994)

Matriculation No.

Please answer all relevant questions on this questionnaire. Feel free to make comments about the course or the questionnaire at the end of page two. If you need assistance, please don't hesitate to ask.

(1a) During this session, did you seek help/advice? Yes ❐ No ❐

If yes, from whom (e.g. demonstrator, friend, neighbour etc.), and how often? Please specify both.

(1b) How many times did you find the lecturer/tutors response to other peoples' help requests useful?

(2a) While you were working today did you take any notes? Yes ❐ No ❐

(2b) If you answered yes to Question 2a, how many lines/pages did you write? Please mark the approximate number of **A4** lines and pages on one or more of the scales below:-

Lines: 0 1 2 3 4 5

Lines: 10 15 20 25

Pages: 0 1 2 3 4 5

(3) What did you spend most of your time doing during this lecture? (Please circle the point most appropriate on the following scale):-

Scribbling notes; Losing the thread of the lecture; getting distracted. • • • 50/50 • • • Concentrating on the meaning of the lecture material

Comments:-

Appendix 4.5
Quiz Version 2

No.2

Fast Fracture Test

Please tick the appropriate box.

1. The units for 'stress intensity factor' are defined as

- ☐ $MNm^{3/2}$
- ☐ $MNm^{1/2}$
- ☐ $MN/m^{3/2}$
- ☐ $M/Nm^{1/2}$
- ☐ I don't know.

2. A ductile material has:

- ☐ low toughness
- ☐ high toughness
- ☐ low modulus
- ☐ high modulus
- ☐ I don't know.

3. The units for 'fracture toughness' are defined as

- ☐ $MNm^{3/2}$
- ☐ $MNm^{1/2}$
- ☐ $MN/m^{3/2}$
- ☐ $M/Nm^{1/2}$
- ☐ I don't know.

4. The units for Gc - toughness are defined as

- ☐ kJm^2
- ☐ kJ/m^2
- ☐ kJm
- ☐ kJ/m
- ☐ I don't know.

5. It will be difficult for a crack to propogate in a material which has:

- ☐ low toughness
- ☐ high toughness
- ☐ low modulus
- ☐ high modulus
- ☐ I don't know.

6. In a vessel made of High Strength Steel, the maximum stress is 200 MPa. The critical stress intensity factor is 50 units. The critical crack length to nearest mm would be calculated to be:-

- ❐ 10
- ❐ 62
- ❐ 26
- ❐ 20
- ❐ I don't know.

7. Fracture occurs when:-:

- ❐ $k = G_c$
- ❐ $k = K_c$
- ❐ $G = \sigma\sqrt{\pi a}$
- ❐ $k = \sigma\sqrt{\pi a}$
- ❐ I don't know.

8. Cleavage is the:

- ❐ breaking apart of interatomic bonds
- ❐ flow of a crack through the plastic zone
- ❐ breaking up of the elastic zone
- ❐ yielding of the material
- ❐ I don't know.

9. Ductile tearing is the:

- ❐ breaking apart of interatomic bonds
- ❐ flow of a crack through the plastic zone
- ❐ breaking up of the elastic zone
- ❐ yielding of the material
- ❐ I don't know.

10. The mechanism by which a brittle material fracture is known as:

- ❐ cleavage
- ❐ ductile tearing
- ❐ stress cracking
- ❐ yielding
- ❐ None of these.

Appendix 4.6
Post- Package Questionnaire (April 1994)

Matriculation No.

Please answer all relevant questions on this questionnaire. Feel free to make comments about the course or the questionnaire at the end of page two. If you need assistance, please don't hesitate to ask.

1a) During this session, did you work at the computer alone or with others? (Please tick one of the following):-

- Worked alone ❒
- Worked with friend using a computer each ❒
- Worked in a group (2 or more) using one computer ❒

1b) Did you seek help/advice? Yes ❒ No ❒

If Yes, from whom (e.g. demonstrator, friend, neighbour etc.), and how often? Please specify both.

1c) How many times did you find the lecturer/tutors response to other peoples' help requests useful?

2a) While you were working with the computer today did you take any notes? Yes ❒ No ❒

2b) If you answered yes to Question 2a, how many lines/pages did you write? Please mark the approximate number of **A4** lines and pages on one or more of the scales below:-

Lines: 0 1 2 3 4 5

Lines: 10 15 20 25

Pages: 0 1 2 3 4 5

3) What did you spend most of your time doing during this computer session? (Please circle the point most appropriate on the following scale):-

Discovering details of how to operate the program	• • • 50/50 • • •	Concentrating on course-work problems and answers

4) Would you like to use this package again? Yes ☐ No ☐

Please explain your answer:

5) Would you recommend this package to other students? Yes ☐ No ☐

Please explain your answer:

Appendix 4.7
Quiz Version 3

No.3

Fast Fracture Test

Please tick the appropriate box.

1. A ductile material has:

- ❒ low toughness
- ❒ high toughness
- ❒ low modulus
- ❒ high modulus
- ❒ I don't know.

2. It will be difficult for a crack to propogate in a material which has:

- ❒ low toughness
- ❒ high toughness
- ❒ low modulus
- ❒ high modulus
- ❒ I don't know.

3. The units for 'fracture toughness' are defined as

- ❒ $MNm^{3/2}$
- ❒ $MNm^{1/2}$
- ❒ $MN/m^{3/2}$
- ❒ $M/Nm^{1/2}$
- ❒ I don't know.

4. The units for Gc - toughness are defined as

- ❒ kJm^2
- ❒ kJ/m^2
- ❒ kJm
- ❒ kJ/m
- ❒ I don't know.

5. The units for 'stress intensity factor' are defined as

- ❒ $MNm^{3/2}$
- ❒ $MNm^{1/2}$
- ❒ $MN/m^{3/2}$
- ❒ $M/Nm^{1/2}$
- ❒ I don't know.

6. The mechanism by which a brittle material fracture is known as:

- ❒ cleavage
- ❒ ductile tearing
- ❒ stress cracking
- ❒ yielding
- ❒ None of these.

7. Ductile tearing is the:

- ❒ breaking apart of interatomic bonds
- ❒ flow of a crack through the plastic zone
- ❒ breaking up of the elastic zone
- ❒ yielding of the material
- ❒ I don't know.

8. Cleavage is the:

- ❒ breaking apart of interatomic bonds
- ❒ flow of a crack through the plastic zone
- ❒ breaking up of the elastic zone
- ❒ yielding of the material
- ❒ I don't know.

9. Fracture occurs when:-:

- ❒ $k = G_c$
- ❒ $k = K_c$
- ❒ $G = \sigma\sqrt{\pi a}$
- ❒ $k = \sigma\sqrt{\pi a}$
- ❒ I don't know.

10. In a vessel made of High Strength Steel, the maximum stress is 200 MPa. The critical stress intensity factor is 50 units. The critical crack length to nearest mm would be calculated to be:-

- ❒ 10
- ❒ 62
- ❒ 26
- ❒ 20
- ❒ I don't know.

Appendix 4.8
The Pre-Task Questionnaire (December 1994)

Gender: Female Male **Matric. Number**

This questionnaire has 2 sections - Computer Experience and Topic Experience. Please answer both. Read each question carefully. Answer all relevant questions as accurately as you can. Please PRINT your written answers. Tick where appropriate.

Computer Experience

1) Do you have your own computer? ❒ **Or** constant access to one outside the university? ❒

2) How often would you say you use a computer?

Every day	❒	More than once a month	❒
Every 2-3 days	❒	Once a month	❒
Once a week	❒	Less than once a month	❒

3) How confident do you feel about using a computer today?
Please circle the most appropriate statement below:

Very Confident *Confident* *Some Confidence* *Little Confidence* *No Confidence Whatsoever*

Topic Experience/Knowledge

Have you ever learnt about failure mechanisms in materials either in coursework or employment?

Yes ❒ No ❒

Appendix 4.9
The Post-Package Questionnaire (December 1994)

Matric. Number

The following questionnaire evaluates the session on fast fracture Read each question carefully. Answer all relevant questions as accurately as you can. Please PRINT your written answers.

i) Did you find the video useful? Yes ❐ No ❐

The following questions refer to the Fast Frac computer package only

1a) During this session, did you work at the computer alone or with others?

Worked alone ❐

Worked with friend using a computer each ❐

Worked in a group (2 or more) using one computer ❐

1b) Did you seek help/advice? Yes ❐ No ❐

If **Yes**, from whom (e.g. demonstrator, friend, neighbour etc.), and how often? Please specify both.

1c) What type of help did you require?

Help related to the subject material ❐

Help related to the operation of the package ❐

2) What did you spend most of your time trying to do when you were using **Fast Frac**?

Please indicate by circling a point on the following scale:

Discovering details of how to operate the package	• • • 50/50 • • •	Concentrating on subject-related problems and answers

Please complete the other side ☞

3) Will you use the **Fast Frac** package again? Yes ☐ No ☐

Why/Why not?

4) Did you learn anything from the **Fast Frac** package? Yes ☐ No ☐

If **yes**, please give one or two examples:

5) Please list the things you particularly liked and particularly disliked about the **Fast Frac** package:

Liked:

Disliked:

Appendix 4.10

The Pre-Task Questionnaire (February 1998)

Age _____yrs ____mths **Gender:** Female Male **Matric. Number**

This questionnaire has 2 sections - Computer Experience and Topic Experience. Please answer both. Read each question carefully. Answer all relevant questions as accurately as you can. Please PRINT your written answers. Tick where appropriate.

Computer Experience

1) How often would you say you use a computer?

Every day	❐	More than once a month	❐
Every 2-3 days	❐	Once a month	❐
Once a week	❐	Less than once a month	❐

2) How confident do you feel about using a computer today?

Please circle the most appropriate statement below:

Very Confident *Confident* *Some Confidence* *Little Confidence* *No Confidence Whatsoever*

Topic Experience/Knowledge

Have you ever learnt about failure mechanisms in materials either in coursework or employment?

Yes ❐ No ❐

If **Yes**, please give details below:

Appendix 4.11
The Confidence Log (February 1998)

Please indicate by ticking the relevant box how confident you feel that you:

Topic	Very Confident	Confident	Some Confidence	Little Confidence	No Confidence Whatsoever	Have not covered this yet
Know the association between crack propogation and material toughness						
Know when fast fracure occurs						
Know what the units of fracture toughness are						
Can tackle problems calculating crack length in materials						
Know what the units are for the stress intensity factor						
Know what cleavage is						
Know what ductile tearing is						
Know what type of material is tough						

Comments:

Appendix 4.12

The Post-Package Questionnaire (February 1998)

Matric. Number

The following questionnaire evaluates the computer package you have just received Read each question carefully. Answer all relevant questions as accurately as you can. Please PRINT your written answers.

The following questions refer to the Fast Frac Computer Package only

1a) Did you seek help/advice? Yes ❐ No ❐ (Go to Q2)

1b) If **Yes**, who helped you? (please circle) *Demonstrator* *Other Student*

1c) How many times did you get help from each source? (Please specify)

Demonstrator _____times Other Student _____times

1d) What type of help did you require?

Help related to the subject material ❐

Help related to the operation of the package ❐

2) What did you spend most of your time trying to do when you were using **Fast Frac**?

Please indicate by circling a point on the following scale:

Discovering details of how to operate the package	• • • 50/50 • • •	Concentrating on subject-related problems and answers

3) Will you use the **Fast Frac** package again? Yes ❐ No ❐

Why/Why not?

4) Did you learn anything from the **Fast Frac** package? Yes ❒ No ❒

If **yes**, please give one or two examples:

5) Please list the things you particularly liked and particularly disliked about the **Fast Frac** package:

Liked:

Disliked:

Appendix 4.13

The Post-Package Questionnaire (February 1998)

Matric. Number

The following questionnaire evaluates the lecture you have just received Read each question carefully. Answer all relevant questions as accurately as you can. Please PRINT your written answers.

The following questions refer to the Fast Frac Lecture only

1a) Did you seek help/advice? Yes ❐ No ❐ (Go to Q2)

1b) If **Yes**, who helped you? (please circle) *Lecturer* *Other Student*

1c) How many times did you get help from each source? (Please specify)

Lecturer _____times Other Student _____times

2) Did you learn anything from the **Fast Frac** Lecture? Yes ❐ No ❐

If **yes**, please give one or two examples:

3) Please list the things you particularly liked and particularly disliked about the **Fast Frac** Lecture:

Liked:

Disliked:

Appendix 4.14
The Final Questionnaire (February 1998)

Matric. Number

This questionnaire asks you to evaluate the teaching sessions you have encountered. Read each question carefully. Answer all relevant questions as accurately as you can. Please PRINT your written answers.

1a) In your opinion, could the lecture replace the computer package? Yes ❐ No ❐

1b) Why/Why not?

2a) Which teaching method do you think taught you most? *(Please circle)*

Lecture Package Video A Combination *(Please state which and why)*

2b) Why did this method(s) teach you better than the others?

3) Finally, please add any comments, criticisms or observations about your experience during this evaluation:

Thank You

Appendix 4.15

Sign Test Results - December 1994

Objectives (CL) analysed by time

T1CL1 with T2CL1
2-Tailed P = .0000
8 Valid Cases
8 + Diffs

T1CL2 with T2CL2
2-Tailed P = .000-
8 Valid Cases
8 + Diffs

T1CL3 with T2CL3
2-Tailed P = .0000
5 Valid Cases
5 + Diffs

T1CL4 with T2CL4
2-Tailed P = .0000
9 Valid Cases
9 + Diffs

T1CL5 with T2CL5
2-Tailed P = .0000
6 Valid Cases
6 + Diffs

Appendix 4.16

Sign Test Results - Package first group

Objectives (CL) analysed by time

T1CL1 with T2CL1
2-Tailed P = .0034
Cases
1 - Diffs
12 + Diffs
5 Ties
18 Total

T1CL1 with T3CL1
2-Tailed P = .0001
Cases
0 - Diffs
14 + Diffs
2 Ties
16 Total

T2CL1 with T3CL1
2-Tailed P = .0156
Cases
0 - Diffs
7 + Diffs
9 Ties
16 Total

T1CL2 with T2CL2
2-Tailed P = .0001
Cases
0 - Diffs
14 + Diffs
4 Ties
18 Total

T1CL2 with T3CL2
2-Tailed P = .0002
Cases
0 - Diffs
13 + Diffs
3 Ties
16 Total

T2CL2 with T3CL2
2-Tailed P = .2188
Cases
1 - Diffs
5 + Diffs
10 Ties
16 Total

T1CL3 with T2CL3
2-Tailed P = .0129
Cases
2 - Diffs
12 + Diffs
3 Ties
17 Total

T1CL3 with T3CL3
2-Tailed P = .0001
Cases
0 - Diffs
15 + Diffs
1 Ties
16 Total

T2CL3 with T3CL3
2-Tailed P = .0313
Cases
0 - Diffs
6 + Diffs
9 Ties
15 Total

T1CL4 with T2CL4
2-Tailed P = .0018
Cases
1 - Diffs
13 + Diffs
4 Ties
18 Total

T1CL4 with T3CL4
2-Tailed P = .0001
Cases
0 - Diffs
15 + Diffs
1 Ties
16 Total

T2CL4 with T3CL4
2-Tailed P = .0005
Cases
0 - Diffs
12 + Diffs
4 Ties
16 Total

T1CL5 with T2CL5
2-Tailed P = .0002
Cases
0 - Diffs
12 + Diffs
3 Ties
17 Total

T1CL5 with T3CL5
2-Tailed P = .0002
Cases
0 - Diffs
13 + Diffs
2 Ties
15 Total

T2CL5 with T3CL5
2-Tailed P = .1250
Cases
0 - Diffs
4 + Diffs
10 Ties
14 Total

T1CL6 with T2CL6
2-Tailed P = .0063
Cases
1 - Diffs
11 + Diffs
6 Ties
18 Total

T1CL6 with T3CL6
2-Tailed P = .0001
Cases
0 - Diffs
14 + Diffs
2 Ties
16 Total

T2CL6 with T3CL6
2-Tailed P = .0078
Cases
0 - Diffs
8 + Diffs
8 Ties
16 Total

T1CL7 with T2CL7
2-Tailed P = .0002
Cases
0 - Diffs
13 + Diffs
4 Ties
17 Total

T1CL7 with T3CL7
2-Tailed P = .0001
Cases
0 - Diffs
14 + Diffs
2 Ties
16 Total

T2CL7 with T3CL7
2-Tailed P = .0039
Cases
0 - Diffs
9 + Diffs
6 Ties
15 Total

T1CL8 with T2CL8
2-Tailed P = .0005
Cases
1 - Diffs
15 + Diffs
2 Ties
18 Total

T1CL8 with T3CL8
2-Tailed P = .0001
Cases
0 - Diffs
15 + Diffs
1 Ties
16 Total

T2CL8 with T3CL8
2-Tailed P = .0078
Cases
0 - Diffs
8 + Diffs
8 Ties
16 Total

T1CL9 with T2CL9
2-Tailed P = .0020
Cases
0 - Diffs
10 + Diffs
6 Ties
16 Total

T1CL9 with T3CL9
2-Tailed P = .0002
Cases
0 - Diffs
13 + Diffs
2 Ties
15 Total

T2CL9 with T3CL9
2-Tailed P = .0020
Cases
0 - Diffs
10 + Diffs
5 Ties
15 Total

T1CL10 with T2CL10
2-Tailed P = .0923
Cases
3 - Diffs
10 + Diffs
5 Ties
18 Total

T1CL10 with T3CL10
2-Tailed P = .0034
Cases
1 - Diffs
12 + Diffs
3 Ties
16 Total

T2CL10 with T3CL10
2-Tailed P = .0709
Cases
1 - Diffs
7 + Diffs
8 Ties
16 Total

Sign Test Results - Lecture first group

Objectives (CL) analysed by time

T1CL1 with T2CL1
2-Tailed P = .0001
Cases
0 - Diffs
15 + Diffs
2 Ties
17 Total

T1CL1 with T3CL1
2-Tailed P = .0000
Cases
0 - Diffs
16 + Diffs
0 Ties
16 Total

T2CL1 with T3CL1
2-Tailed P = .0386
Cases
2 - Diffs
10 + Diffs
4 Ties
16 Total

T1CL2 with T2CL2
2-Tailed P = .0000
Cases
0 - Diffs
17 + Diffs
0 Ties
17 Total

T1CL2 with T3CL2
2-Tailed P = .0000
Cases
0 - Diffs
17 + Diffs
0 Ties
17 Total

T2CL2 with T3CL2
2-Tailed P = .4531
Cases
2 - Diffs
5 + Diffs
10 Ties
17 Total

T1CL3 with T2CL3
2-Tailed P = .0000
Cases
0 - Diffs
16 + Diffs
0 Ties
16 Total

T1CL3 with T3CL3
2-Tailed P = .0000
Cases
0 - Diffs
17 + Diffs
0 Ties
17 Total

T2CL3 with T3CL3
2-Tailed P = .4531
Cases
2 - Diffs
5 + Diffs
9 Ties
16 Total

T1CL4 with T2CL4
2-Tailed P = .0003
Cases
1 - Diffs
16 + Diffs
0 Ties
17 Total

T1CL4 with T3CL4
2-Tailed P = .0003
Cases
1 - Diffs
16 + Diffs
1 Ties
17 Total

T2CL4 with T3CL4
2-Tailed P = 1.0000
Cases
3 - Diffs
4 + Diffs
10 Ties
17 Total

T1CL5 with T2CL5
2-Tailed P = .0000
Cases
0 - Diffs
16 + Diffs
1 Ties
17 Total

T1CL5 with T3CL5
2-Tailed P = .0000
Cases
0 - Diffs
16 + Diffs
1 Ties
17 Total

T2CL5 with T3CL5
2-Tailed P = .0654
Cases
2 - Diffs
9 + Diffs
6 Ties
17 Total

T1CL6 with T2CL6
2-Tailed P = .0001
Cases
0 - Diffs
15 + Diffs
1 Ties
16 Total

T1CL6 with T3CL6
2-Tailed P = .0001
Cases
0 - Diffs
14 + Diffs
2 Ties
16 Total

T2CL6 with T3CL6
2-Tailed P = .5488
Cases
4 - Diffs
7 + Diffs
6 Ties
17 Total

T1CL7 with T2CL7
2-Tailed P = .0074
Cases
2 - Diffs
13 + Diffs
2 Ties
17 Total

T1CL7 with T3CL7
2-Tailed P = .0001
Cases
0 - Diffs
14 + Diffs
3 Ties
17 Total

T2CL7 with T3CL7
2-Tailed P = .0225
Cases
2 - Diffs
11 + Diffs
4 Ties
17 Total

T1CL8 with T2CL8
2-Tailed P = .0000
Cases
0 - Diffs
17 + Diffs
0 Ties
17 Total

T1CL8 with T3CL8
2-Tailed P = .0000
Cases
0 - Diffs
17 + Diffs
0 Ties
17 Total

T2CL8 with T3CL8
2-Tailed P = .5078
Cases
3 - Diffs
6 + Diffs
8 Ties
17 Total

T1CL9 with T2CL9
2-Tailed P = .0000

Cases	
0	- Diffs
16	+ Diffs
0	Ties
16	Total

T1CL9 with T3CL9
2-Tailed P = .0000

Cases	
0	- Diffs
17	+ Diffs
0	Ties
17	Total

T2CL9 with T3CL9
2-Tailed P = 1.0000

Cases	
4	- Diffs
4	+ Diffs
8	Ties
16	Total

T1CL10 with T2CL10
2-Tailed P = .0005

Cases	
0	- Diffs
12	+ Diffs
4	Ties
16	Total

T1CL10 with T3CL10
2-Tailed P = .0002

Cases	
0	- Diffs
13	+ Diffs
4	Ties
17	Total

T2CL10 with T3CL10
2-Tailed P = .6875

Cases	
2	- Diffs
4	+ Diffs
10	Ties
16	Total

Appendix 4.17

Correlation of Quiz & Confidence Logs - Results (February 1998)

Confidence Log Objectives	Package first	Lecture first
Objective 1	T1CL1 x T1Quiz Spearman correlation coefficient coefficient - -.5039, n=18, sig = .016 T2CL1 x T2Quiz coeff.=-.4024 n=18 p=.049 T3CL1 x T3Quiz = not signif.	T1CL1 x T1Quiz not signif T2CL1 x T2Quiz coeff.=-.4114 n=17 p=.05 T3CL1 x T3Quiz = not signif.
Objective 2	T1, 2, & 3CL2 x Quiz T1, 2, & 3 none were significantly correlated	T1CL2 x T1Q2 could not be calculated (all students answered don't know) T2 & 3CL2 x Quiz T2, & 3 were not significantly correlated
Objective 3	T1CL3 x T1Quiz = not signif. T2CL3 x T2Quiz Coeff. = -.4429 n=17 p=.037 T3CL3 xT3Quiz coeff. = .5164 n=16 p=.02	T1CL3 x T1Quiz coeff.=-.5085 n=17 p=.019 T2 & 3CL3 x Quiz T2, & 3 were not significantly correlated
Objective 4	T1, 2, & 3CL4 x Quiz T1, 2, & 3 none were significantly correlated	T1CL4 x T1Q2 could not be calculated (all students answered don't know) T2CL4 x Quiz T2 Coeff=-.6891 n=16 p=.002 T3CL4 x T3Quiz = not signif
Objective 5	T1, 2, & 3CL5 x Quiz T1, 2, & 3 none were significantly correlated	T1CL5 x T1Quiz Coeff=-.5085 n=17 p=.019 Time 2 & 3 CL5 not signif
Objective 6	T1, T2CL6 x T1, T2 Quiz not signif T3CL6 x T3Quiz Coeff = -.5816 n=16 p=.009	Time 1 CL6 = not signif T2CL6 x T2 Quiz Coeff = -.5448 (n=16) p=.012 T3CL6 x T3 Quiz n/s
Objective 7	T1, T2CL7 x T1, T2 Quiz not signif T3CL7 x T3 Quiz Coeff = .5163 n=16 p= .020	Confidence Log 7 - none signif
Objective 8	T1, T2CL8 x T1, T2 Quiz not signif T3CL8 x T3Quiz Coeff = .4420 n=15 p=.05	Confidence Log 8 - none signif
Objective 9	Confidence Log 9 - none signif	Confidence Log 9 - none signif
Objective 10	Confidence Log 10 - none signif NB: T3CL10 x T3Quiz could not compute the coefficient. All students' answered this question correctly, and this maybe something to it.	Confidence Log 10 - none signif

Appendix 5.1

Comment Sheet from the formative study

Matric. Number

Page Number:-

Problem:-

Page Number:-

Problem:-

Page Number:-

Problem:-

Page Number:-

Problem:-

Appendix 5.2

The Pre-Task Questionnaire (Accounting & Finance)

Gender: Female Male **Matric. Number**

Read each question carefully. Answer all relevant questions as accurately as you can.
Please PRINT your written answers.

1) How often do you use a computer for the B. Acc. degree course?

Every day	❒	More than once a month	❒
Every 2-3 days	❒	Less than once a month	❒
Once a week	❒	Never	❒

2) What do you use it for (e.g. word processing, EQL, spreadsheets, SPSS etc.)?

3) How confident do you feel about using a computer today?

Please circle the most appropriate statement below:

Very Confident	*Confident*	*Some Confidence*	*Little Confidence*	*No Confidence Whatsoever*

Appendix 5.3

The Confidence Log

Please indicate by ticking the relevant box how confident you feel that you are able to:

Topic	Very Confident	Confident	Some Confidence	Little Confidence	No Confidence Whatsoever	Have not covered this yet
Define discrete and continuous data and discriminate between them						
Interpret a simple frequency table including percentages						
Name 2 charts or plots relevant to discrete data						
Interpret a bar chart and a pie chart						
Explain the construction of a bar and a pie chart						
Discriminate between nominal and ordinal data						
Explain how bar charts and pictograms can be constructed in ways which distort the impression						
Define the difference between ordinal and interval scales						
Discriminate between the mean, median and mode						
Name 2 graphs or plots appropriate for continuous data						
Explain the construction of a stem & leaf plot						
Explain the difference between the cut-point and the midpoint						

Please add any comments you have about the course or this questionnaire below:

Appendix 5.4

The Post-Task Questionnaire (Accounting & Finance)

Where did you get to in the package? **Unit:** **Page:** **Matric. Number**

The following questionnaire evaluates the GraphIT! package. Read each question carefully. Answer all relevant questions as accurately as you can. Please PRINT your written answers.

1a) During this session, did you work at the computer alone or with others?

- Worked alone ❐
- Worked with friend using a computer each ❐
- Worked in a group (2 or more) using one computer ❐

1b) Did you seek help/advice? Yes ❐ No ❐

If **Yes**, from whom (e.g. demonstrator, friend, neighbour etc.), and how often? Please specify both.

1c) What type of help did you require?

- Help related to the subject material ❐
- Help related to the operation of the package ❐

2) What did you spend most of your time trying to do when you were using **GraphIT!**?

Please indicate by circling a point on the following scale:

Discovering details of how to operate the package	• • • 50/50 • • •	Concentrating on subject-related problems and answers

Please complete the other side

3) Will you use the **GraphIT!** package again? Yes ☐ No ☐

Why/Why not?

4) Would you recommend the **GraphIT!** package to other students? Yes ☐ No ☐

Why/Why not?

5) Did you learn anything from the **GraphIT!** package? Yes ☐ No ☐

Please explain your answer:

6) Please list the things you particularly liked and particularly disliked about the **GraphIT!** package:

Liked:

Disliked:

Comments:

Appendix 5.5

The Pre-Task Questionnaire (Undergraduate Sociology)

Gender: Female Male

Matric. Number ☐☐☐☐☐☐☐

Read each question carefully. Answer all relevant questions as accurately as you can.
Please PRINT your written answers.

1) How often do you use a computer for your University course(s)?

Every day	☐	More than once a month	☐
Every 2-3 days	☐	Less than once a month	☐
Once a week	☐	Never	☐

2) What do you use it for (e.g. word processing essays, statistics using SPSS etc.), which subject & year?

3) How confident do you feel about using a computer today?
Please circle the most appropriate statement below

Very Confident *Confident* *Some Confidence* *Little Confidence* *No Confidence Whatsoever*

4) Have you done statistics on any other course? Yes ☐ No ☐
If **Yes**, give details of the course including - Course Title & year you took the course; What was covered; Whether a computer was used or not):

Course title & year taken (e.g. 1993)	**Content**	**Computer used?**

5) Tick any of the following you are sure you can do:

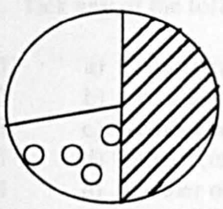
Save a file to a floppy disk	☐	Print out a file or document	☐
Prepare a new floppy disk for use	☐	Make a copy of a disk	☐
Switch between application windows	☐	Use a scroll bar	☐

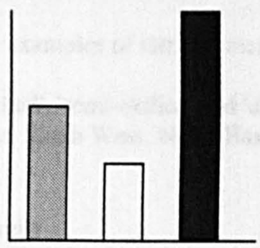
Appendix 5.6

The Quiz

Matric. Number

1) **Which one of these is a pie chart and which a bar chart? Write in the boxes below, or tick c)**





a) b) c) Don't know

2. Tick **any of** the boxes which apply:
Discrete Data can be represented by a

❒ a) Dotplot
❒ b) Bar Chart
❒ c) Stem & Leaf Plot
❒ d) Don't know

3. The **one** sentence below which best defines the interval scale of measurement:

❒ a) The categories have no natural order
❒ b) The data are measured on a scale of equal steps
❒ c) The data have a natural order but the steps between cannot be measured
❒ d) None of these
❒ e) Don't know

4. Tick **one** sentence below which best defines the median

❒ a) The midpoint in an ordered range of recorded values
❒ b) The average value
❒ c) The most commonly occurring value
❒ d) None of these
❒ e) Don't know

5. Tick **any of** the following statements if you think they are correct:

❒ a) The median is the most useful for summarising a dataset containing outliers
❒ b) The median is useful for summarising interval data
❒ c) The mean is particularly useful for summarising interval data
❒ d) None of these
❒ e) Don't know

6. Tick **any of** the following which could distort the impression of the data:

❒ a) Quoting the mean as a summary statistic for a large dataset
❒ b) Different lengths in a bar chart
❒ c) Pictograms
❒ d) Bars of a varying width in a bar chart
❒ e) None of these
❒ f) Don't know

7. Tick any of the following which are examples of interval measurement:

❒ a) Classifying workers as 'skilled', 'semi-skilled' and 'unskilled'
❒ b) Location (as in North West, South West, North East, South East...)
❒ c) Number of employees
❒ d) Length (in cms)
❒ e) Number of children in a family
❒ f) None of these
❒ g) Don't know

8. Tick **any of the following** which are example of discrete data:

❒ a) Preferred newspaper
❒ b) Numbers of passengers on a train
❒ c) Weight of newborn babies (lbs/oz)
❒ d) Method of travel to work
❒ e) None of these
❒ f) Don't know

9. Cumulative percentages can be used with which of these: (Tick **any** which are appropriate)

❒ a) Nominal data
❒ b) Ordinal data
❒ c) Interval data
❒ d) None of these
❒ e) Don't know

10. How is a frequency table constructed?

❒ a) By adding the number of values in a dataset and dividing the total
❒ b) By creating a tally or count of the number of responses in each category
❒ c) By comparing the number of occurrences of two values in a data set and creating a ratio
❒ d) None of these
❒ e) Don't know

Appendix 5.7

The Post-Task Questionnaire (Accounting & Finance)

Where did you get to in the package? **Unit:** **Page:** **Matric. Number**

The following questionnaire evaluates the GraphIT! package. Read each question carefully. Answer all relevant questions as accurately as you can. Please PRINT your written answers.

1a) During this session, did you work at the computer alone or with others?

- Worked alone ❐
- Worked with friend using a computer each ❐
- Worked in a group (2 or more) using one computer ❐

1b) Did you seek help/advice? Yes ❐ No ❐

If **Yes**, from whom (e.g. demonstrator, friend, neighbour etc.), and how often? Please specify both.

1c) What type of help did you require?

- Help related to the subject material ❐
- Help related to the operation of the package ❐

2) What did you spend most of your time trying to do when you were using **GraphIT!**?

Please indicate by circling a point on the following scale:

Discovering details of how to operate the package	• • • 50/50 • • •	Concentrating on subject-related problems and answers

3) Will you use the **GraphIT!** package again? Yes ❐ No ❐

Why/Why not?

4) Would you recommend the **GraphIT!** package to other students? Yes ❐ No ❐

Why/Why not?

5) Did you learn anything from the **GraphIT!** package? Yes ❐ No ❐

Please explain your answer:

6) Please list the things you particularly liked and particularly disliked about the **GraphIT!** package:

Liked:

Disliked:

Comments:

Appendix 5.8

The Pre-Task Questionnaire (Postgraduate Sociology)

Course: M.Phil Research Student Other **Gender:** Female Male **Matric. Number**

Read each question carefully. Answer all relevant questions as accurately as you can.
Please PRINT your written answers.

1) How often do you use a computer?

Every day	❒	More than once a month	❒
Every 2-3 days	❒	Less than once a month	❒
Once a week	❒	Never	❒

2) What do you use it for (e.g. word processing, statistics using SPSS etc.)?

3) How confident do you feel about using a computer today?
Please circle the most appropriate statement below

Very Confident *Confident* *Some Confidence* *Little Confidence* *No Confidence Whatsoever*

4) Have you done statistics on any other course? Yes ❒ No ❒

If **Yes**, give details of the course including - Course title & year you took the course; What was covered; Whether a computer was used or not:

Course title & year taken (e.g. 1993)	**Content**	**Computer used?**

5) Tick any of the following you are sure you can do:

Save a file to a floppy disk	❒	Print out a file or document	❒
Prepare a new floppy disk for use	❒	Make a copy of a disk	❒
Switch between application windows	❒	Use a scroll bar	❒

Appendix 5.9

The Post-Task Questionnaire (Postgraduate Sociology)

Matric. Number

The following questionnaire evaluates the GraphIT! package. Read each question carefully. Answer all relevant questions as accurately as you can. Please PRINT your written answers.

1a) During this session, did you work at the computer alone or with others?

- Worked alone ❒
- Worked with friend using a computer each ❒
- Worked in a group (2 or more) using one computer ❒

1b) Did you seek help/advice? Yes ❒ No ❒

If **Yes**, from whom (e.g. demonstrator, friend, neighbour etc.), and how often? Please specify both.

1c) What type of help did you require?

Help related to the subject material ❒
Please give details

Help related to the operation of the package ❒
Please give details

2) What did you spend most of your time trying to do when you were using **GraphIT!**?

Please indicate by circling a point on the following scale:

Discovering details of how to operate the package	• • • 50/50 • • •	Concentrating on subject-related problems and answers

Please complete the other side ☞

3) Will you use the **GraphIT!** package again? Yes ❐ No ❐

Why/Why not?

4) Would you recommend the **GraphIT!** package to other students? Yes ❐ No ❐

Why/Why not?

5) Did you learn anything from the **GraphIT!** package? Yes ❐ No ❐

Please explain your answer:

6) Please list the things you particularly liked and particularly disliked about the **GraphIT!** package:

Liked:

Disliked:

Comments:

Appendix 5.10 - Reuse, Recommendation and Learning

Accounting & Finance Students

	Use it again?	Recommend?	Learn anything
1	It has helped me learn the subject	It does help your knowledge of QM	I understand the work more clearly than I had before using the package
2	-	-	-
3	It's helpful in explaining QM	-	It was like studying, going over what I knew already
4	Informative	-	Helps with studying
5	Because it helped me to understand terms etc. It made it much clearer	Useful and very helpful, easy to understand	Explained important terms and how to differentiate between them
6	Was extremely helpful	Would be helpful in revision	Explained key terms
7	It is quite helpful	It is quite helpful	It is quite helpful
8	As it is a quick test of what you know	It's quick and easy	It confirmed what areas I was good/bad in and helped me improve on them
9	Seems useful	Easy to understand and not too many long pieces of information	What methods are used for displaying discrete and continuous data
10	It was very helpful	It explains things very clearly	I now know how to classify discrete and continuous data
11	Because I didn't finish it	Very helpful for learning how to deal with data and how to present it properly	Differences between discrete and continuous
12	Less daunting that ASW book but covers the basics effectively	-	Use of this package will definitely effectively back-up the coursework
13	Informative	Informative	Clamped scales
14	Follows on from lecture material and helps towards a better overall understanding	It's useful	Difference between discrete and continuous data, difference between ordinal and nominal data
15	-	-	What discrete data is
16	It provides a good method of learning, where I can go at my own pace and revert back to previous sections if I want to	It provides a good method of learning, where I can go at my own pace and revert back to previous sections if I want to	I am more confident now about data classification
17	-	Easy to use	-
18	It was easy to follow and understandable	It was easy to follow and understandable	I learnt about the subjects which I didn't have a strong grip on through lectures
19	-	-	-
20	It clearly explains the subjects	It gives the chance to solve problems and have difficulties explained	-
21	To finish it	Because it helps you to understand and gives you a chance to do examples	I learned about the classifications for data which previously I didn't understand
22	It gives clear explanations for basic problems	It is helpful in gaining basic knowledge	I think that many basic concepts are clearer now

23	Clear and easy to understand	-	Definitions for various things - package explains it better than the book
24	To finish it	It is very explanatory on subjects which I didn't have a clue	-
25	Is quite good	Better than lectures and books	Difference between types of data - discrete, continuous, nominal etc
26	Because it is helpful and lays work out in a sensible descriptive order	Because it is not confusing and you can learn all the information easily with it	With reading Sweeney you get confused with all the jargon, whereas on the computer you are at ease
27	To complete it	Interesting	Clear cut definitions of certain words
28	Good explanations and easy to operate	Good explanations and easy to operate	Covered certain areas which I did not know about before use of package
29	Because it gives more detailed explanations on subject matters and allows time and errors	It aids with learning the subject in a simple way	I learnt the relevance and connection between each topic and why they are brought together
30	Helps to understand coursework	-	Gave me more understanding as to what different data was, i.e. how it is classified
31	Very informative and easy to use	Easy way of learning QM	Reinforcement of what already learnt from book and lectures
32	Gives precise information, is easy to follow/use	Gives precise information, is easy to follow/use	Was able to see the usefulness of computers in dealing with statistics
33	Makes QM easier to understand	-	-
34	Helpful in learning about the subject and techniques involved	Helps clarify data display etc.	It illustrated more concisely the differences between discrete and constant data
35	-	Information is very clearly expressed and helped me to understand certain concepts which were unclear from using textbooks and from lectures	I learned about the different types of data and how it can be summarised
36	Don't need to	Easy to understand	Understood the section more clearly
37	It was helpful	-	Added to vague knowledge learned from textbook
38	Provides good introduction to QM and gives clearer info than textbook and lectures	Provided they were studying QM. Otherwise, no	I learnt that my knowledge of the subject is not what it should be
39	Easier to read book and extract exact information required	Easier than reading large amount of text from book and has questions	Reminded me
40	Very useful and gives clear concise explanations	Very useful and gives clear concise explanations	I learnt clearer definitions to key words and a greater understanding of the subject
41	Helped me to understand things in the course	-	-
42	To finish it	Helpful to learning	Learnt about ordinal/nominal, discrete, interval data

43	It is good as a revision aid. It has definitions that are clearer than the textbook Anderson, Sweeny & Williams	It is very useful in understanding the fundamentals of QM	That intnerval data can be continuous. Simple use of minitab commands
44	Takes you through everything step by step. Easy to understand, has an ending summary to each unit	Takes you through everything step by step. Easy to understand, has an ending summary to each unit	I wasn't too confident about all the main areas before: such as ordinal, discrete data - but now I know all about them
45	Because I need to know more about the subject and try and remember it, also I didn't finish	Because it explains the information clearly and backs up what was taught in lectures	Some of the information from lectures I did not understand, this made information more clear
46	It is a more interesting way of learning the basics of QM than reading and rereading the textbook	It is a pleasant change and is easy to learn from	It made the scales of measurement clearer and easier to understand/remember
47	It was a lot easier to understand compared to the textbook	It was a lot easier to understand compared to the textbook	I understood things which I was confused about during lectures and readings
48	Helps understanding	Helps understand basics	Definitions of ordinal, etc.
49	Help me understand figures when I decide to do graphs and if I get confused I can refer to it	Easy to follow complicated and confusing data	Done this before, SYS Maths III, although I feel more confident about the various types of data
50	-		I learned a lot of the meanings of certain terms and it helped me to understand the differences between the different scales
51	It gave a clear description of all the different terms. The examples are helpful as they show you how to relate the information you know to practical problems. It gave me a clear understanding of the work	It gives good explanations of things, could help you to revise	Didn't learn anything new but made what we had already been taught, clearer
52	It was interestingly laid out and I found it easy to use and understand	It was interestingly laid out and I found it easy to use and understand	I now have a better knowledge of different types of data. I was having difficu;ty choosing between nominal and ordinal data. Graph It has helped me understand this
53	-	Interesting and easy to use. Helps understand the lectures.	-
54	Clarified lectures, clearly explain, easier to read than books	-	Explained about detail more clearly
55	It was straightforward and easy to go back if you didn't understand.	The package is useful to use for making sense of lectures and information in books on the subject.	I learnt more about the topics I had already gone over in quantative methods.
56	Good definitions and explanations of the terms used in QM. Helpful and aids understanding.	As before.	Defined terms more clearly-I wasn't sure before.

57	Interesting explanations to terminology used in the lectures, easy to understand and well explained package	As before.	I learned the definitions to key terms used in the QM lectures.
58	Good graphics, easily understood definitions.	As before.	Reinforced lecture material
59	For my project	It's fun	Explanations
60	It's pretty good	It's good	About discrete, interval, ordinal and nominal
61	Continue learning	-	Discrete/continous
62	Most of the information taught I have already learned in textbook	Explained difference between continuous and discrete data	Previously I had not known about the differenc between continuous and discrete data
63	Explains clearly a lot of terms within QM course e.g. median	"User friendly'	What median etc was
64	To complete the package	It is easy to use and it explains things well	There were one or two areas I was not sure about but Graphit explained them well
65	Simple explanations	Easy to use, reasonable clarity in explanations	-
66	Because it helps with the study of the QM course, more so than the lectures as you can go at your own pace.	As before.	Learnt about chpt. 2 of Asw book
67	It's easy and useful	It's easy and useful	That can help me in QM related matters
68	Didn't finish it, found it useful	Easy to use and understand	More confident in categorising data
69	I found it very useful in explaining material, It is made easier to understand, and the package is well illustrated. A very good aid to learning. I found it very helpful.	As before	The material seems a lot clearer now and I understand the basic concepts more
70	It was very informative and I liked using it	It is easy but discloses a lot of information	It was a lot clearer than the book and I "followed" a lot more things
71	It is a very good clear and descriptive package which has helped me overcome certain problems I had in understanding lectures/ reading material	As before plus it provides the opportunity to go over particular points and skip those which a student possibly has good knowledge of	Clear explanations of certain terms of scales and measurement and how to distinguish between them
72	-	This package is quite helpful	Difference between discrete, nominal and ordinal also interval
73	-	Helps to clarify what has been covered in lectures	Well, it reminded me of certain things I'd forgotten
74	Because it explained things well	It helps understanding	Explained some of the points I wasn't sure on
75	It is helpful in understanding statistics	as before, it is set out and explained so it is easy to understand	I learned about how to distinguish between nominal and ordinal, and discrete and continuous data. Reinforced frequency distribution etc
76	-	Explained things well	Difference between scales of measurement made more clear

77	Definitely! It has been a huge help in understanding the new terms	Helps to explain the basics very simply and easily	The meaning of a lot of terms
78	Because it is useful for the project	As before(useful)	To use it
79	Because I find it useful	Its easy to follow & learn	-
80	Easy to use & also easy to understand	(see Q3)	Made definitions a lot clearer
81	Because it is useful for the QM course	-	More lengthy descriptions and explanations of discrete and continuous data
82	It helps my understanding of statistical analysis	It could help them if they're having problems with the QM course	I learned more about discrete and continuous data dna nomianal and ordinal and interval measurements
83	To find out more about continuous data	User-friendly; Take at your own pace	Cleared up doubts about discrete data
84	It helps give the user a basic understanding of the subject	I learnt the difference between discrete and continuous	The basic method of teaching, straight to the point
85	It is a good method of learning the course. It has things explained in a simple manner so it makes it more easy to understand than the book.	See Q3	I learnt things that I should have learnt in lectures
86	It revised what was covered in the lecture e.g. discrete, continuous data etc.	It makes more of an impact than an ordinary lecture. You can take your time going over certain areas, taking notes etc. It acts as a reminder to things you have already learned.	I now understand difference between continuous and discrete
87	It explains and revises work we have done. Makes you think about it and so helps memorisation.	Goes over the work we have covered	More concise explanations
88	Very useful - simple, clear explanations and examples	May reinforce areas of the subject which they had been unsure of	I have a clearer understanding of "interval" data, and the differences between "continuous" and "discrete" data
89	I found it gave good definitions of data terms and the graphs and colour made it interesting to use. I learned a lot	It helped me understand terms I previously wasn't sure of. I enjoyed using it and am sure others would too	Although most of it was refreshing my memory, it defined terms in a more easy to understand way
90	It helped me with QM and made it easier to understand	It is a good way of self learning	It just refreshed my memory about lectures
91	Far too boring and tedious	For a basic introduction it's fine, but for revision it's boring	Everything on Graphit I already knew, it's a very basic introduction
92	It gave good definition of words and phrases that were easy to understand and remember. It was a simple package to understand	Easy to understand, easy to use, reasonably interesting	Words and phrases which I didn't quite understand - gave clear understanding
93	Interesting and helpful	Helps you to work with data, more interesting than book	Difference between nominal and ordinal data
94	To help explain specific areas of the course	It explains things in a very simple way, easily understood	It helped my understanding of certain areas of the course
95	Helps check that I have understood	You can go at your own pace	Parts of course of which I was unsure

96	Easy to use, makes learning fun - not stressful, quizzes throughout the package to test yourself are great	As before	Clarified some new terms for me
97	To learn more about subject and to gain more experience in the use of computers	You can go through package at your own pace and it describes subject matter in very simple terms	The difference between discrete and continuous data
98	It is helpful	Because it is helpful	-
99	I learned the information in more detail	-	Some material in the programme was new to me
100	It is very useful - clear explanations etc	It is really useful - simple to understand	Learned meanings of terms eg nominal etc
101	Part of course	Easy to follow, tests your knowledge and understanding of work	Learn QM
102	Finished	It is good for basic knowledge	Basic terms
103	It is easy to understand	-	Mainly it consolidated my knowledge on discret/continuous data
104	If I can't remember some detail on using Minitab	Helpful	How to use Minitab and better understanding of some QM terms
105	To revise certain areas	Aids learning	-
106	Useful in defining terms	Helpful	Some terms which caused confusion
107	Ease of use	Ease of use	It covered the books material far better and was easily understandable
108	Its usefulness at this stage of my course	Because of its usefulness and user friendliness	I knew it already but it gave me more insight and understanding
109	It means I can work at my own pace and take notes as I feel appropriate	It's interesting	I really didn't understand nominal/ordinal. I do now!
110	-	Back up to lecture material and shortage of tutorials	More understanding on types of data

Undergraduate Sociology students

	Use it again?	Recommend it to other students?	Learn anything
1	For more info. on graphs - for research project.	Why not!	Most things on the package were new knowledge to me
2	I know very little about computers and I found it easy to follow on my own	I felt I was learning something about data etc.	I now clearly understand the differences between discrete data and continuous data
4	To find out information about different sorts of data - Nominal/ordonal etc.	Because it explains what different sorts of information & data are available	About different sorts of data
5	Because it is useful for my course	Because it may be useful to them	Yes, I learnt about different types of data, though I am not sure how long I'll remember it all for
6	Did not finish it. There is a lot of information to take in and remember in one go. (Got confused by the time I answered the quiz)	Comprehensive. Easy to use.	Reinforced existing knowledge esp. nominal/ordinal, discrete/continuous
7	Yes as I haven't finished it	If they wanted to know about graphs	Different types of data. Different tables/charts
8	I may if I need to code or define some information e.g. for a project	If they want to find out about statistics etc. its at least more interesting than a book	E.g. difference between nominal/ordinal, discrete/continuous
9	Easy explanations	Anybody who would need to know is here!	Bits and bobs about stats
10	Because I have difficulty grasping the concept of stats and I found it simple to understand	For the above reasons	It explained clearly - step-by-step
11	-	-	-
12	For research projects	Simple progression - pick up easily	Discrete/continuous data
13	The information is useful and well-presented. The use of questions & pictures help keep one interested.	It does the job	Info. on graphs and statistics etc.
14	Dislike packages like this	Above reason (i.e. dislike packages like this)	I did learn things, but must admit to forgetting them almost immediately due to having to go straight onto something else - should've written it down I suppose
15	To go over information relevant to my course	Useful info, easy to follow	I knew extrememly little about any of the info. contained in the package
16	When needing to analyse data, good way of refreshing my memory	Depends on use, good as a reminder of information already known, helps clear it up. To leanr new statistics not very good	Stem and leaf plot - but not very clear. And dot plot - clearer but still slightly confused
17	To reinforce what has been taught	Explained statistical terms & how graphs/tables are constructed	Meanings of statistical terms
18	To clarify what you can do with data & defintions/explanations of terms	See above (i.e. To clarify what you can do with data & defintions/explanations of terms)	Terms ...[illegible]

19	It helps to give a learer explanation of the subjects	It very basically & simply explains the reason & points of using certain things as opposed others	It helped to clarify the points I already had in my head but where a little vague. It is much clearer than just listening or reading the information
20	Useful for learning and reminding on basics	See 3 (i.e. Useful for learning and reminding on basics)	Learnt how to follow procedure, but will have to go through again!
21	Looks like it will help me with coursework	Easy to use	Understanding of discrete info/continuous etc.
22	When coming to construct own project, basic info will help	Clearly laid out and described	What graphs should be used for certain types of data
23	Maybe if I get stuck doing some statistics	Because it is easy to understand	Yes but I am not sure how much I learnt
24	-	-	Learned about continuous data and could learn more given time
25	I learned a lot, and believe it could be useful to me in the future	See answer to question 3 - could be useful to them too, and is very easy to understand	Discrete, continuous data; interval data; nominal/ordinal data
26	Have just been trained in SPSS & its confusing using a different system which does exactly the same thing (meaning the use of minitab)	-	-
27	-	-	Nominal data, ordinal data, mean, median, mode
28	Didn't finish it	-	-

Postgraduate Sociology students

	Use it again?	Recommend?	Learn anything
1	Yes, quick ref. point/user friendly	Yes, quick ref. point/user friendly	Yes, variety of definitions and uses
2	Yes, useful	Yes, useful, hands on experience of statistics/computers	Yes (no elaboration)
3	Yes (no elaboration)	Yes (no elaboration)	Generally . I have only experienced SPSS as a non-W/P package
4	Yes, excellent reference and teaching aid	Yes, user friendly, easy to access seperate aspects	Clearer understanding terms while working with package - would need to use a few times to assimilate information
5	Yes, very easy to use & gives simple definitions & explanations of terms I find difficult to remember. The repition involved in the exercises helps to 'drill' this in, together with the graphics.	Yes, for reason given in 'Use it again'	Yes, clarified the principle terms
6	Yes, for a simple overview as a refresher	Yes, see response above - easy to use alone, and can go over things until it is clear, can work at own pace. Very detailed explanation	Yes, meanings of words - nominal, ordinal, discrete etc. & how this relates to the presentation of data
7	Yes, to finish it	No, because I haven't finished it	Yes, basic classifications of data - but may be forgotten if not used on regular basis

8	Yes, because I don't think I have remembered the information in it	Yes - a quick way to learning to use different measurements BUT would be glad of a summary to retain information	Yes - covered by answers above. I learned a lot - much of this I have been told before, but couldn't remember it. But I don't know that I will remember this either.
9	Yes, easy to use. Clear. Fairly quick.	Yes, same reasons as above	Yes - hadn't understood stem & leaf plots previously. Clear explanation of interval/ratio data. Also more sure of dotplot, histogram etc.
10	Yes, didn't complete Unit 5	Yes, useful introduction to data types	Yes, the 'terminology' - I knew the types of data, but didn't know what they were called!
11	Yes - easy in operation and understandable	Yes, an interesting way of learning	Yes
12	Yes, simple exaplanation of statistics & their practical use. Could also be used for reference	Yes, can work on them on their own	Yes, practical appreciation of statistics
13	Yes, useful for deciding the best method to interpret data gained from research	Yes, see Q3	Yes, have forgotten the difference between mean; medium; and mode and when best to use them.
14	Maybe, if I am using SPSS or an alternative and can't remember a particular definition	Yes, quite useful	Yes, different data types
15	Yes, I haven't finished it yet	Yes	Yes
16	Do not know	Yes, because it is straightforward	Yes, it was a refresher of basic math
17	Yes	Yes	Yes

Appendix 5.11 - Students' likes and dislikes

Accounting and Finance Students

	Liked	Disliked
1	Work was relevant, well presented	Calculations (difficult ones) since I don't have a calculator (there were only a few though)
3	Format	-
4	Easy to understand	-
5	Explained key terms, gave useful examples, easy to understand and use	-
6	Simple definitions to key terms. It made sure you understood information by asking questions	-
7	Pictures (the elephant was very good)	Words
8	The layout	The speed it went at
9	Layout	The fact that the pie charts were only in one colour
10	Tables, graphs, presentation	-
11	Use of graphical and tabular help	-
12	Windows - 'idiot-proof' environment, clear, concise, offers 'back' facility	-
13	Layout	Time allowance
14	Simple to follow	Drawing of bar and pie charts would be quicker if they just appeared on the screen
15	The explanations	The speed
16	Presentation	-
17	Easy to use	-
18	It was easy to follow and understandable	-
19	Simplicity, design, colours	-
20	Clear explanations	-
21	Animations	Lot of reading
22	The layout	It moved fairly quickly
23	Clear, easy to understand	-
24	Content, presentation and assistance	-
25	Ease of use	-
26	The highlighted words because you can obtain clear definitions	The colours were too bright for my eyes
27	Graphics	-
28	Ease of use, explanations	Some charts used only one colour. Would have been easier to read if different colours were used
29	The simplicity and the ability to take your time	The ambiguity as to the order or sequence of topics we have learnt
30	Easy to read and follow, reminders	-
31	Good explanations of terms, units not too long	-
32	Very user friendly, could skip through the package - backwards as well as forwards	-
33	User friendly interface, style of the window, 'Hot Words'	-
34	Layout, simplicity, content	-
35	Presentation	-
36	Examples	-
37	Good explanations, good access to previous/main pages, easy	-

38	Layout and the fact that you can work at your own pace	Patronising responses
39	Clear layout	Syntax problems
40	Graphics, explanations, problems, the order the package covered subject matters, organisation	-
42	Window application	-
43	User friendly, easy to use, informative	-
44	The whole package (from what I've used), easy to use, user friendly	-
45	The layout was clear and easy to understand	Sometimes seemed tedious working through all the information
46	Presentation - clear and easy to understand. Continuity was good and easy to follow	The problem in Unit 2 with bar charts
47	How it explains items and made you answer questions on which did encourage you to learn them	How every command had to be typed in exact and can't make up for simple errors
48	Easy to use, could jump questions	-
49	Explanations of discrete data	-
50	The way it explained everything in simple terms as this helped me to understand it	The way in which you had to click on buttons that weren't always indicated to click on. It could lead to people missing certain things out
51	Clear explanations, chance to try things	-
52	I liked the set up. It was colourful and interesting. It was able to keep my attention	-
54	easy to use	-
55	Questions checking you understood, diagrams, summaries.	-
56	Layout. Clear, fun, but also useful/educational. The elephant was clever! Good to try questions, get answers and have the option to do more if unsure, but it's not necessary.	-
57	Pictorial examples, the fact it was on windows (making it user-friendly)	-
58	Graphics, colours, summary points.	-
59	Graphics, pie charts	-
60	It went slowly and it was easy to understand	-
61	-	Too boring, easy and patronising
62	Explanation of subject was clear	The number of icons cause some confusion
63	-	Patronising
64	The flow diagram and explanation of terms	The drawing of all the graphs
65	Easy to read and understand	Animation of data conversion could not be bypassed
66	Layout of package, use of "layman" terms	-
67	Presentation (graphic), definitions	-
68	Presentation, ease of use, content	Animations
69	The boxes explaining concepts, its use of diagrams, the easy to follow package	-
70	User interface, ease of use, content	Waiting on some animations
71	Clear explanations of terms, detailed working of examples	-
72	The extra examples given relating to the questions and information	-
73	The way it was laid out, easy to understand and follow	-
74	Didn't use complicated words to describe things	Some sections too long

75	All. The way in which it was set out was very helpful and easy to understand. Explained all meanings clearly.	-
76	Wasn't complicated	Some sections were too long (i.e. 30 pages when 15-20 would have done)
77	Easy, simple and very informative	Nothing
78	The design, the structure and also because it seems easy to use	The syntax
79	The way the information are explained and presented	-
80	Ease of use and explanations	Nellies handy tips
81	Graphs, bar chart and pie charts	-
82	The windows layout, making it far easier to use than EQL for example	The pace of it is a little slow
83	Questions; Flow chart seperating discrete and continuous and showing how you would represent each	Lack of participation
84	-	A good help but found myself flicking back to remind myself
85	The simple defintions and explanations	-
86	Graphics: They helped to explain construction of pie charts etc.	-
87	The way you can go back and forward within the package. Tests on areas	-
88	Easy to follow, clear instructions, the fact you can easily go back a page	Should have more examples for students to attempt themselves - more difficult questions needed
89	The definitions were easy to understand, the graphs and colours were nice	-
90	Animation of graphs, easy to use, easy to understand	-
91	Colours	Having to use mouse for nearly an hour
92	Presentation	-
93	Presentation	Steps were very small when you knew the information, had difficulty typing in commands
94	It explained everything very well	-
95	How you can go back and forth	-
96	Self-tests, presentation	-
97	For reasons mentioned in 4, it was also a very bright and colourful package	-
98	Explains things simply	-
99	Lay-out	Too slow
100	Relating terms to everyday surveys etc	-
101	Simple to use, explained things well	-
102	Simplicity	Slow animations
103	-	-
104	Functional layout, lots of help	Animations quite slow
105	Presentation	Too easy
106	Explains in detail	-
107	All	-
108	User friendliness	Bar charts were distorted
109	Easiness to understand	Some of the graphs were a bit strange
110	Easy to use	-

Undergraduate Sociology students

	Liked	Disliked
1	Easy to use	Bit too easy - patronising
2	Clearly laid out	-
4	The simple structure and graded progression through easy to hard questions	The boxes which you were supoosed to press using the mouse did not have clear labels because the colours seemed to obscure or make the command difficult to read (by the way, my eyesight is 100%!)
5	Graphics, easily available information, ability to return back thru. icons & pages & redo	-
6	Simple to use	It gets a bit boring after a while, so it is hard to take it all in in one sitting
7	-	A bit too many basic steps
8	Simple to use	Too much information at once
9	It makes a boring subject kind of bearable	-
10	Simple	?
11	Everything	-
12	Easy to understand and follow. Clear instructions. Helpful explanations.	-
13	-	-
14	Presentation and content	-
15	-	Prefer reading books - less bright. Questions which ask you whether or not the answer is one thing or another then gives answer box 'yes' or 'no'
16	Examples - answering questions makes things easier to remember	-
17	Self-tests, animated examples of how things done. Basic lanaguage in small sits.	Almost too simple, where is Unit 4? Some questions ambiguous - either/or question, Yes/No answer
18	Graphs	-
19	Quite easy to use. [Illegible] good	-
20	Examples were given after an explanation which made it easier to follow through the logic	-
21	Presentation	Size of presentation window
22	Easy to use. Relevant to Methods of Sociology	Maybe one or two more examples to try out - getting harder as you go along
23	Descriptions of graph - when to use etc.	-
24	It is easy to use	Boring and uninspiring
25	Informative and easy to use	Quite unclear when distinguishing between continouous and discrete
26	Easy to use; informative; Didn't treat you as a dunce but was easily comprehensible at same time; taught me a lot in short time. Can work at own pace	Nothing
27	-	-
28	Simple way of presentation	There wasn't that information in the package [?]

Postgraduate Sociology Students

	Liked	Disliked
1	Ease of use; clarity and brevity of info.; interactive dimension	-
2	Learning at own pace, being able to go back over anything I'd forgotten etc. Graphics were good, exercises useful. I know very little about statistics and found this non-threatening	-
3	Simple to use	None-no experience of similar material
4	Easy to use - user friendly; really good way to get the information over to students	A little tiring working through the package in one go; This would probably not be so after using the package a few times
5	Very user friendly; you don't need to know anything about computers to work with it; the range of types of survey/data sets made it interesting	No dislikes
6	Easy to use, clear instructions; option for more information and being able to go back a page; step by step instruction	-
7	Windows based, asked questions along the way	-
8	Getting answers right! 1-Very encouraging, 2-Answers are not too easy or too difficult so have to think what it means, 3-useful way to START learning this	-
9	As Question 3	-
10	Systematic manner in which it dealt with each type of data. Good examples.	Not enough opportunity to answer questions, questions perhaps too easy?
11	The way it presented the theory, the small exercises and the examples	-
12	Plenty of clear instructions	Nothing
13	Very easy to operate. simple explanations offered.	-
15	Its methodology. From the theoretical points it goes straight to examples	-
16	Easy to use. Straightforward presentation of information	The red colored screens were difficult to see
17	Easy to use with clear definitions	Reference to Minitab

Appendix 5.12 - General comments

Accounting & Finance students

	Post-Package Questionnaire - General comments
1	Comments
2	Good package
6	Useful package
7	I found it helpful and interesting
8	Quite helpful
11	This is a worthwhile package
25	I'll come back for more
27	Overall, the package is of good benefit
32	Very useful for the QM course
34	A very helpful package
36	It's comprehensive and the presentation helps to keep you interested, especially the graphics
38	Very helpful. Should have one accompanied with every chapter. It would aid learning and make it easier
39	Useful package that I found helpful and will use again
41	A very worthwhile programme for all QM students
43	OK
45	Very good package, easy to understand and user friendly
57	Good!
61	Very good, worthwhile
70	A very good package, aids learning easily and very well
75	Good package
76	Graphit helped reinforce statistics and was easy to follow
78	Very Helpful
82	Useful
83	Quite good on the whole
86	A very good package
90	I thought it was brill and will use it again
92	The mouse is tiring - it should be automatic ie. Only use mouse when you have difficulty
97	Very helpful
98	Has enabled me to learn a little more on subject matter and given me more personal experience in the use of computers
108	Very good package
109	Recommendable
110	Generally a good package

Undergraduate Sociology students

	Post-Package Questionnaire - General comments
2	I liked using this package. Instructions were clear and I didn't have to ask for help - this made me feel more confident. The explanations of discrete and continuous data were clearly laid out. Given more time I would have covered more of the package.
7	Overall v. beneficial
11	Good concept
15	More confused than I was before - Hmmm!
17	Good idea, is very useful
18	Pie charts would have been better multicoloured. Why employees in firm all male?
21	Possibly more animation
25	Generally easy to use, and ver useful for analysing data
27	Too easy to continue through the package without actually learning anything - too simplistic. Confusing when has been explained already through SPSS
28	The package could be improved more information on statistical packages

Postgraduate Sociology Students

	Post-Package Questionnaire - General comments
5	The package could be a bit more challenging - could include more exercises to work through (optional) of varying degrees of difficulty at each stage. I think the chance to repeat things helps the learning process.
6	Does this mean we no longer need lectures?????
7	Haven't finished yet - but - could have suimmary questions at end and/or beginning
8	This is a good introduction. Would like something in writing to refer to later
9	Could do with an index/glossary. One or 2 questions need to be rephrased - the answer is yes where the question is x or y
10	Difficult to comment because I'm unsure at what level this package is aimed at. Although unfamiliar with some aspects of it, I knew Minitab, so perhaps if you have no experience in either it is very useful
12	Should be able to find this useful

Appendix 5.13

Sign Test Results

Accounting & Finance students

T1CL1 with T2CL1
2-Tailed P = .0000
98 Cases
93 students increased

T1CL2 with T2CL2
2-Tailed P = .0000
110 Cases
83 students increased

T1CL3 with T2CL3
2-Tailed P = .0000
105 Cases
92 students increased

T1CL4 with T2CL4
2-Tailed P = .9239
110 Cases
47 students increased

T1CL5 with T2CL5
2-Tailed P = .3154
108 Cases
56 students increased

T1CL6 with T2CL6
2-Tailed P = .0000
110 Cases
83 students increased

T1CL7 with T2CL7
2-Tailed P = .0000
106 Cases
84 students increased

T1CL8 with T2CL8
2-Tailed P = .0015
110 Cases
70 students increased

T1CL9 with T2CL9
2-Tailed P = .9995
109 Cases
37 students increased

T1CL10 with T2CL10
2-Tailed P = .0000
107 Cases
79 students increased

T1CL11 with T2CL11
2-Tailed P = 1.0000
106 Cases
19 students increased

T1CL12 with T2CL12
2-Tailed P = .9869
90 Cases
34 students increased

Undergraduate Sociology students

T1CL1 with T2CL1
2-Tailed P = .0000
27 Cases
25 students increased

T1CL2 with T2CL2
2-Tailed P = .1239
27Cases
16 students increased

T1CL3 with T2CL3
2-Tailed P = .0000
26Cases
25 students increased

T1CL4 with T2CL4
2-Tailed P = .3451
25 Cases
13 students increased

T1CL5 with T2CL5
2-Tailed P = .1239
27 Cases
16 students increased

T1CL6 with T2CL6
2-Tailed P = .0000
26 Cases
23 students increased

T1CL7 with T2CL7
2-Tailed P = .0000
27 Cases
23 students increased

T1CL8 with T2CL8
2-Tailed P = .0002
27 Cases
22 students increased

T1CL9 with T2CL9
2-Tailed P = .3451
25 Cases
13 students increased

T1CL10 with T2CL10
2-Tailed P = .0003
26 Cases
21 students increased

T1CL11 with T2CL11
2-Tailed P = .9739
27 Cases
8 students increased

T1CL12 with T2CL12
2-Tailed P = 1.0000
27 Cases
4 students increased

Postgraduate Sociology students

T1CL1 with T2CL1
2-Tailed P = .0012
17 Cases
14 students increased

T1CL2 with T2CL2
2-Tailed P = .1662
17 Cases
10 students increased

T1CL3 with T2CL3
2-Tailed P = .0000
17 Cases
16 students increased

T1CL4 with T2CL4
2-Tailed P = .5000
17 Cases
8 students increased

T1CL5 with T2CL5
2-Tailed P = .0385
16 Cases
11 students increased

T1CL6 with T2CL6
2-Tailed P = .0385
16 Cases
11 students increased

T1CL7 with T2CL7
2-Tailed P = .0000
17 Cases
16 students increased

T1CL8 with T2CL8
2-Tailed P = .0012
17 Cases
14 students increased

T1CL9 with T2CL9
2-Tailed P = .0064
17 Cases
13 students increased

T1CL10 with T2CL10
2-Tailed P = .0064
17 Cases
13 students increased

T1CL11 with T2CL11
2-Tailed P = .1662
17 Cases
10 students increased

T1CL12 with T2CL12
2-Tailed P = .6855
17 Cases
7 students increased

Appendix 6.1

NetSem Pre-Training Questionnaire

Gender : F M **Degree:** B. Mus. B. Eng. M.A. **Year:**______ **Matric. Number**

This questionnaire is about your computer experience. Read each question carefully. Answer all relevant questions as accurately as you can. Please PRINT your written answers.

1) Which, if any, computer packages/systems/interfaces have you used (e.g. Word 5, NeXT, Windows)? *Please list them below.*

2a) Do any other courses you are taking, or have already completed, require you to use a computer? Yes ❒ No ❒

Please give details below (i.e. course, type of use, when you did the course etc.):

2b) Did you have any difficulty with the computing component of the course(s)? Yes ❒ No ❒

If yes, please explain why:

3) Please tick any of the following you have used:

Mouse	❒	NeXT	❒
Floppy disk	❒	Word-processing package	❒
Hard disk	❒	Electronic mail	❒

4) Tick any of the following you are sure you can do:

Save a file to a floppy disk	❒	Switch between application windows	❒
Use a menu	❒	Make a copy of a file	❒
Delete a program or file	❒	Create a new directory or folder	❒
Save a file	❒	Copy and paste text	❒
Send an e-mail message	❒	Drag and drop a file into an e-mail message	❒
Create a new file	❒	Prepare a new floppy disk for use	❒

5) Have you ever participated in any sort of seminar before? Yes ❐ No ❐

If Yes, please give details about the seminar(s) and your role in them (i.e. Presenter, Participant)

6) Did you take part in discussions during the seminars? Yes ❐ No ❐

If not, why not?

7) Do you ever write-up your essays/reports on a word processor?

Always *Usually* *Sometimes* *Never*

8) How confident do you feel about using a computer?

Circle the most appropriate word(s) below:

Very Confident	*Confident*	*Some Confidence*	*Little Confidence*	*No Confidence Whatsoever*

9) How skilled do you think you are at using a computer? Please circle the most appropriate word below:-

Expert *Advanced* *Competent* *Novice* *Never Used One*

10a) Do you feel more confident about expressing your views verbally or in writing?

Verbally *In Writing* *Both*

b) Why?

11) Are you familiar with much 20th Century music or is it mostly new to you?

New	❐	Have studied it before	❐
Have played 20th century repertoire	❐	Have heard 20th century repertoire	❐

Appendix 6.2

NetSem Post-Training Questionnaire

Matric. Number

Read each question carefully. Answer all relevant questions as accurately as you can. Please PRINT your written answers.

1) Did the drop-in session help you? Yes ❐ No ❐

Please explain how it did and/or did not help you:

2) Do you feel you need more information? Yes ❐ No ❐

If you answered 'Yes', what sort of information do you feel you need?

3) How do you feel about email seminars?

4) Are you concerned about any of these? Please tick those that concern you and give an indication why.

Reason

Expressing your views clearly in writing ❐

Using the computers ❐

Finding something to say about the topic ❐

Understanding how the system works ❐

Exposing yourself to criticism ❐

5) How confident do you now feel about using a computer?

Circle the most appropriate word(s) below:

Very Confident	*Confident*	*Some Confidence*	*Little Confidence*	*No Confidence Whatsoever*

6) How skilled do you now think you are at using a computer?

Expert	*Advanced*	*Competent*	*Novice*	*Never Used One*

7) Would you have taken this option if you knew that email seminars were involved?

Appendix 6.3

Interim Questionnaire

Matric. Number

Read each question carefully. Answer all relevant questions as accurately as you can. Please PRINT your written answers. Add any comments you have about the course or questionnaire overleaf.

1) Have you contributed to an email seminar:

   As a participant in the discussion? ❐

   As a presenter? ❐

2) Would you like to change groups? Yes ❐ No ❐

   Why?

3) Which do you prefer: Email seminars ❐ **OR** Conventional seminars ❐

   Why?

4) Do you think email seminars take up more of your time than a conventional seminar? Yes ❐ No ❐

   If so, how much more?

5) How confident do you now feel about using the email seminar system (using email, word-processing etc)? Circle the most appropriate statement below:

Very Confident	*Confident*	*Some Confidence*	*Little Confidence*	*No Confidence Whatsoever*

6) Would you have taken this option if you knew that email seminars were involved? Yes ❐ No ❐

7) Are you concerned about anything related to the email seminars (please continue overleaf)?

Appendix 6.4
TILT NetSem Questionnaire

Please read each question carefully. Please PRINT your written answers. Add any comments overleaf. Your answers are confidential.

General
Which do you prefer: Email seminars ❑ **OR** Conventional seminars ❑
Why?

Have you learnt something from the seminars? Yes ❑ No ❑
If yes, please give some examples of the sort of things you have learnt:

What do you like most about email seminars? And least?
Liked most:

Least:

Do you feel you have had enough feedback? Yes ❑ No ❑

Does researching the topic beforehand improve the quality of the discussions? Yes ❑ No ❑

Do seminar presentations give you enough information for you to then discuss the topic without researching it independently? Yes ❑ No ❑

Computers
How confident do you now feel about using the email seminar system? Circle the appropriate statement below:

Very Confident	*Confident*	*Some Confidence*	*Little Confidence*	*No Confidence Whatsoever*

Email
How often do you check your email?

Every day	❑	Once a fortnight	❑
Every 2-3 days	❑	Less than once a fortnight	❑
Once a week	❑	Less than once a week	❑

Were you familiar with email before the course started? Yes ❑ No ❑

Would you have taken this option if you knew that email seminars were involved? Yes ❑ No ❑

Working in a group
Would you rather have been in another group? Yes ❑ No ❑

If you had to give 3 words to describe your group's discussions what would they be?

Would you describe your group-mates as: Friends ❑ Acquaintances ❑ Both ❑

If it's a mix, how many of them are friends? (please circle) 1 2 3 4

Do you ever feel victimised/lose confidence because of the tone of the contributions? Yes ❑ No ❑

Have there been misunderstandings in your groups (e.g. you were misquoted?) Yes ❑ No ❑

Would you like to see: Other groups' seminars? Yes ❑ No ❑
Other groups' discussions? Yes ❑ No ❑

Would you have liked to meet with your group face-to-face? Yes ❑ No ❑

Do you ever discuss the seminars outside the email environment? Yes ❑ No ❑
If Yes, with whom? (e.g. group members, course mates, friends on other courses etc,)

Contributions
Do you have any difficulty finding a discussion point in the seminars? Yes ❑ No ❑

Does contributing take up a lot of time? Yes ❑ No ❑

If you haven't contributed to one or more of the seminars, why not?

Is there too much humour in the seminar discussions? Yes ❑ No ❑

Do you usually edit your contributions? Yes ❑ No ❑

How important are Celia's contributions to getting the discussions going?

Essential	*Important*	*Helpful but Non-essential*	*Not important*	*Useless*

How important is it to you to contribute and why?

How often do you do the following before you make your contributions?

Refer to textbooks	*Always*	*Often*	*Sometimes*	*Never*
Listen to the music under discussion	*Always*	*Often*	*Sometimes*	*Never*
Discuss with friends	*Always*	*Often*	*Sometimes*	*Never*
Take notes from the seminar presentation	*Always*	*Often*	*Sometimes*	*Never*

Seminars

Do you re-read any seminars in light of the discussion / while the discussion is underway? Yes❑ No ❑

Which of the following seminar topics resulted in good discussions?

Stravinsky & Ne-Classicism	❑	Webern	❑	Stockhausen	❑
Cage	❑	Minimalism	❑		

Did you try to make your seminar presentation controversial or neutral? Controversial ❑ Neutral ❑

Attitudes

Did you enjoy participating in NetSem? Yes ❑ No ❑

How confident do you feel on average about stating your point of view in the discussion?

Very Confident	*Confident*	*Some Confidence*	*Little Confidence*	*No Confidence Whatsoever*

Do you ever feel isolated? Yes ❑ No ❑

If yes, please give details:

Thank you for your help this year. We have attempted to cover every possible issue relating to your experience of NetSem on this questionnaire. However, everyone's experience is unique, and if you feel that you have something more to add, please do so overleaf. All information helps us.

Appendix 6.5

Students' Self-Reported Computer Experience

	Which, if any, computer packages/systems/interfaces have you used	Do any other courses you are taking, or have already completed, require you to use a computer?
1	Wordsworth; Notator Logic; Pagestream; Protect; Calamus	Acoustic. & Studio; E. Comp.; Music & Tech.
2	Macintosh; Z88; Archimedes	Acoustic and Studio Techniques
3	None	-
4	Amiga system; Apple Mac	-
5	None	-
6	Windows	Acoustics & Studio Techniques - Starting the course this year
7	Word 3.1	Acoustics & Studio Techniques
8	None	Dissertation this year. 12 Tone.
9	NeXT	Dissertation; Acoustics and Studio
10	Amstrad 'Interword'	Psychology Ordinary; Eng. Lang H.O.; Eng. Lang. J.H.; Email and Labs Year 2; Windows Apple Mac; Phonetics software; Lang. Course Year 2
11	Microsoft Word; Windows	-
12	NeXT; Windows	-
13	NeXT	Acoustics and Studio Techniques (level 1 music course) completed 1992/1993; Music and Technology (level 2 music course) taking course at the moment.
14	None	-
15	Word processor; Spreadsheet; Database	-
16	NeXT; Apple Mac; Clarisworks	94/95 Acoustics and studio techniques - Finding out class documentation; Sending Email
17	None	-
18	NeXT (slightly)	-
19	NeXT (min!)	-
20	NeXT; Windows (Atari/Apple Mac)	-
21	None	-
22	None	-
23	NeXT	H1P6 seminars
24	Atari ST - Notator	A & ST ('92); Diss ('94)
25	Clarisworks (Apple Mac)	-
26	Cocoscript II	Management studies - Lotus 1,2,3 spreadsheet package last year
27	None	1st & 2nd year psychology, involved computer lab course included doing experiments on computer
28	NeXT (Psychology Dept. also)	Ordinary psychology
29	NeXT; Unix; Mac; Windows	CS1A; CS2B; CS3H
30	NeXT	Philosophy Jun Hons. - Logic
31	Windows	-
32	None	-

Appendix 6.6

Students' Preference for Written or Verbal Seminars

	Preference	Why
1	Verbally	Dyslexic
2	Verbally	Because it gave me a chance to elaborate or use slang that I would not usually use in writing. It does not have to be quite so concise.
3	In writing	Because you can revise your text to exactly how you want before you hand it in.
4	In writing	I'm more confident expressing myself in writing rather than speaking because I get nervous speaking to a group of people
5	In writing	If you make a mistake you can score it out.
6	Both	-
7	Verbally	I enjoy the personal approach whereby you can change your presentation according to other people's reactions. I like talking.
8	Both	Can participate there and then verbally and converse with others. In writing, sometimes say more.
9	In writing	I lose confidence when have to speak
10	Both	I probably prefer verbal communication as results/responses appear more imminent!
11	Both	Because I'm fairly good at getting a point across in whatever way.
12	Verbally	I'm much better at spoken English than written English
13	In writing	Easier to get exact message across.
14	Both	Got to do both in English and Scottish Literature
15	In writing	More time to organise thoughts
16	Both	It depends on where I am and who I am with which one I prefer
17	In writing	
18	Verbally	-
19	In writing	Because you have more time to think about what you say and how to put it
20	In writing	You have the chance to think about how to phrase things, and explain, without being 'thrown in at the deep end'.
21	Both	Verbally can be more stimulating as immediate feedback and interaction. Writing - more time to think about what you want to say. Perhaps more coherent argument.
22	Both	
23	In writing	-
24	Both	Both have their merits. Time to organise thought when writing. More enjoyable verbally.
25	In writing	I'm nervous in a discussion group situation and never say exactly what I want
26	In writing	Probably due to the fact that I have had less experience of expressing my views verbally
27	Both	I can be articulate in different ways at different times depending on who I'm addressing.
28	In writing	Can take time to formulate them
29	Verbally	Its just plain human. Its more personal, and one receives a reply immediately
30	Both	-
31	In writing	Because you have time to change anything at any time.
32	In writing	Its easier to correct mistakes and doesn't make me nervous.

Appendix 6.7

The Assistance of the Drop-In Session

	How the Drop-In Session assisted the students
1	-
2	It made everything more understandable.
3	It showed me how to actually work the system.
4	Gave me the basis of how the NeXT works
5	I didn't have a clue where to start before.
6	Shown how to use email
7	Because I didn't know how to work email before.
8	Introduced me to the system and showed me how to use it.
9	I think I could now get past the password stage
10	Introduction to 'Next'
11	It was made very simple and helped my basic knowledge on.
12	I at last know how to use the word processor and also how to drag files from one place to another.
13	I learnt how to use email.
14	Increased confidence.
15	Cleared things up generally
16	It got me more familiar with the system and helped me understand how to use it
17	-
18	It worked through write now systematically - without jargon
19	Practise in using the system
20	Cleared up some details over email and pasting files
21	Practical info. on how to work computer
22	-
23	Explained the things I wasn't sure about, such as saving etc.
24	Helps you get to know the basics
25	I now know what to do after logging in!
26	It was helpful because it enabled me to investigate the software at my own pace but under supervision
27	I became more confident with use of the computer.
28	More detailed than handouts - practical with on the spot answers
29	Yes - I now understand how the seminars work. No - the computer work was redundant for me
30	Clarified email
31	I wasn't sure how to get from one thing to another i.e. Document -> email etc.
32	I learned how to use the WriteNow facility.

Appendix 6.8

Further information the students felt they needed

	Further information the students felt they needed
1	After working on what was taught problems might arise
2	Maybe more practise.
3	Just more instruction or another seminar.
4	I guess that until I come to grips with how this works I could do with a 'stupid person's' guide to show me because there is no way that I took in everything today.
6	How to use word processing package
7	I'll probably work it out by trial and error
8	A reminder of how it all works step by step.
9	Everything
11	Just in case of a memory lapse. printouts next to the machines would be good.
13	A few more ideas on getting into files.
16	no answer
17	No answer
18	Perhaps more advanced things - once I've totally got the hang of the basic
19	But I'll probably need reminding when the time comes to use it myself!
21	Using computers
22	Copy of NetSem H1P6 Intro.
23	Taking untitled files and putting in email
32	More user information for other facilities e.g. writing music onto the computer.

Appendix 6.9

Students' views on NetSem before system use

	How do you feel about email seminars?
1	Confident
2	It may be more efficient but the discussion may become stale over a period of time if there isn't actual personal contact.
3	Very helpful
4	SCARED!
5	I would prefer just normal seminars as its bad enough having to do one without worrying about how to use the computer.
6	Better now after drop-in session. I would still rather give the seminar directly to the group but it should be an interesting experience
7	I'm looking forward to them
8	Slightly anxious as I'm not used to them.
9	better than standing up and talking
10	Sceptical!
11	I loved it. Now I have the power to send messages to whoever I want. Without this session I would never have used the system.
12	A fairly good idea but I'd be interested to see how much input there is in the seminars
13	I think I'll be more confident when I've actually done one.
14	Destroys spontaneity but good for coming back to points 1 or 2 weeks later after researching subject
15	The email is okay, its just writing the essays because the questions are difficult
16	A bit happier now
17	I think they are a good idea since they take away the stress involved in actual 'verbal' seminars
18	I do feel they will lose a lot of the discussion
19	They give you a bit more confidence
20	Quite confident, and looking forward to it!
21	Not confident about using computers
22	Interesting idea - not sure if it will work
23	They will be informative
24	Interested. I may enjoy it (though it is more work if you are a slow typer).
25	Apprehensive about the time needed to type in the essays
26	Good idea but quite daunting at first! Think its a good idea because it introduces us to technology available and encourages debate.
27	It will be interesting to see what happens. I think its a good idea, but my word processing skills are so minimal that this method of delivering seminars will be very time-consuming - more so than if verbal.
28	Much more confident. I think they are quite a good idea.
29	Fine
30	Look forward to finding out
31	Quite happy!
32	I prefer them to spoken ones.

Appendix 6.10

Preference for seminar type

	Which do you prefer & why?
1	Email - More time to make thoughtful replies, greater discussion takes place (Presented already)
2	Both - they are both advantageous to the student, both nuture skills. one shouldn't be replaced by another but both should maybe be continued (Participant)
3	Conventional - It is a lot easier to express yourself in person plus unlike my email seminar we are given plenty of time to prepare conventional seminars (Presented already)
5	Conventional - You don't have the extra worry of how to work the computer (Participant)
6	Conventional - I find it easier to discuss something face to face with someone and question them as points arise rather than having to wait for an answer whenever they get round to reading my question (Participant)
10	Conventional - Responses are more imminent (supposing everyone's done the appropriate reading!). People can bounce ideas off each other more satisfactorily (participant).
11	Conventional - Because conventional seminars are structured better and its not so hard to forget about them. Actually I am not that bothered. Email is good fun but I'm just worried I'll miss something (not participated yet)
12	Email - I like email seminars but I don't think I approach them as seriously as a conventional one. I also think they are more prone to error (Participant)
13	Email - Easier to say what you want without getting nervous (participant)
16	Conventional - Happier face to face rather than typing in comments. Like talking to people and having immediate discussion and feedback (Participant)
17	Email - It is less stressful than having to think there and then and having yourself graded by a 'performance' (Participant)
18	Conventional - You get more feedback - more spontaneous ideas, whereas with email its all pre-planned (Presented)
19	Email - You have more time to think about your responses, and do not have to answer every point at one go (Participant)
20	Email - You get a chance to stop and think about what to say, also how to say it (Participant)
21	Neither specified - Both have positive and negative points. With email seminar you don't get the chance to have immediate feedback on discussions (Participant)
22	Conventional - (no reasons given) (Participant)
24	Email - Time to prepare your replys and express yourself as well as possible (Participant & Presented)
25	Email - They give you time to think things out more (changing things). No problem with nerves (Presented)
26	Conventional - Conventional seminars because I am more familiar with what is expected of me (Not participated nor presented)
28	Email - No embarrassment of standing up in front of people. More time to formulate thoughts during debate and proper references etc (Participant & Presented)
31	Email - It's less of a rush, in a way and I feel people are more likely to respond this way rather than putting the presenter 'on the spot' (Presented)
33	None selected - Don't know, each has its advantages, email gives more time to research, conventional gives more instantaneous feedback (neither presented nor participated)
34	Email - No reason (neither presented nor participated)

35	Email - They are very easy to use, especially since I can type very fast (Participant)
36	Conventional - The response is more immediate also people are more likely to ask open-ended questions or raise topics which could be picked up on for questioning. With email everyone tends to make statements - also you don't have much idea as to whether you have went off completely at a tangent. With email people are less likely to be as direct with the truth since it isn't a face-to-face situation (Participant)
37	Email - They can be done in your own time => less pressure (Participant)
38	Email - No problems (Participant)
39	Conventional - Talking to a computer screen is a false atmosphere and you DO answer differently to if you were just in a group discussion. There is a tendency towards banal humour - ?! (But is this a bad thing...) (Participant)
40	Conventional - Have no experience with computers (Participant)

Appendix 6.11

Time taken to contribute to email vs. conventional

	Do you think emails take up more time? How much more?
1	About double
2	1 hour a week - more.
4	Because you cannot use visual aids or musical recordings so a lot more time has to be taken in deciding which extracts to use
13	About an hour more
16	Reading all the items and replying
18	As long as it takes to learn how to handle the computers, and you have to check every day for feedback
21	Background reading - same amount of time, but actually discussing arguments, definitely more than conventional 'hour'. This may be because I'm so slow with using computers (cannot type fast)
22	A lot
24	Typing time only
25	A few hours for the typing
26	Takes longer as need to become accustomed to computers
28	Not too much more. Going back to check if people have contributed to debate etc.
33	I'm not sure (I haven't been involved in any seminars previous to this)
36	Quite a bit, you have to find time regularly to go and look in the computers, having a very busy timetable this is sometimes more difficult than finding one sole hour say in which to concentrate solely on the topic in hand. The background work consumes the same amount of time but the seminar in itself seems to eat your other time up
38	Don't know
39	About 2x as long (slow typer!)
40	Days & days

Appendix 6.12

Other concerns about email seminars

	Are you concerned about anything related to the seminars?
1	No choice in which question you are set
10	I wish I'd kept a copy of my contribution but I don't know how
11	Only about forgetting about them
12	The computer lab is often full which can often cause time problems. I can't be in the lab all the time it is free and as its booked I miss out on some things
13	Only that people aren't getting things I send to them, but I think I'm beginning to trust the computer now!
16	Mail going to other people when it shouldn't
17	No
18	It is fairly impersonal, and despite your research, I'm sure it isn't the most effective way of learning
19	Not now!
20	No comment, but a nice smiley face - a big huge grin actually!
24	Nope
25	No
26	Unsure of nature of response required
31	Once you have sent something you can't change it unless you send another email whereas if you're planning a seminar you can
33	Overuse of the system
35	I find that the NeXT system is used by so many people anyway that it isn't reasonable to have seminars done electronically that could be done personally anyway. If the system were larger that would be fine, but those people using the machines for their applications for certain courses (e.g. Emus, Ecomp) need to have as much access as possible to the system. I do actually like email seminars, I just don't think the system is large enough for all the students using it now.
36	I worry that what I am saying is not relevant but its hard to judge immediately how people think of your view.
37	I worry that what I am saying is not relevant but its hard to judge immediately how people think of your view.
39	No
40	Just learning to use the computer and crashing the system

Appendix 6.13

Email seminars vs. Conventional seminars

	Preference	Reason
1	Email	More thinking time. However, having the choice to do either of the above (or both) would be nice.
2	Email	More suitable in terms of convenience
3	Email	At first I preferred conventional seminars but email ones became easier to contribute to e.g. you could fo it anytime.
5	Conventional	Don't like using computers
6	Conventional	I think that you can express yourself better with a live audience and get spontaneous reactions with which you can form a good question/answer debate.
7	Conventional	I like talking to people: computer screens have no body language that one can interact with.
10	Conventional	Actually, I like them both, but email seminars still don't seem to be the 'real thing'; their deficiencies include lack of spontaneity
12	Wrote 'both'	Each is unique and fun in its own way
13	Email	You can consider comments, and your own answers, and probably make more valid, thought out points.
14	No Answer	Don't know - both have advantages & disadvantages (spontaneity with conventional, time to rethink ideas with email, for example)
15	Email	No answer
19	Email	More informal, less intimidating.
20	Email	Take time to think about what to say, and how to say it. You can do it in your own time.
21	Email	I've got more out of them and put more work into them. I sometimes find it difficult to speak in conventional seminars.
22	No Answer	Haven't decided which I prefer - conventional seminars COULD be intimidating if you don't know much about the topic but email seminars are very time-consuming & rely on you checking mail each day etc.
23	Email	Not as nerve-making
25	Conventional	Your seminar is over after one session - email seminars 'drag' on.
31	Email	No answer
32	Email	Gives you more time to think up comments and responses
35	Wrote 'never had one' (a conventional seminar)	No answer
36	Conventional	Its over more quickly instead of taking over 3 weeks.
39	Email	Because you can take time to think over what has been said and how you answer. Also, everyone has an equal opportunity to participate.
40	Email	No answer

Appendix 6.14
Learning from the seminars

	Learnt anything	What the student has learnt
1	Yes	No Comment
2	Yes	How to communicate on topics that I have had time to consider
3	Yes	How to use the NeXT system email etc.
5	Yes	I learnt how to use email
6	Yes	How difficult it is to say something constructive & relevant without writing a boring reply
7	Yes	They have encouraged me to research the topic being discussed - this would happen in a conventional seminar too if we were to be marked on our class participation.
10	Yes	Seminar presentations were good factually - i.e. info. about composers and works etc. One also learns about other people's points of views and whether they are excessively opinionated or not!
12	Yes	How to use word-processors, email etc. How to defend myself.
13	Yes	A bit more on the topics within the seminars
14	Yes	Email is a viable form of seminar presentation
15	Yes	About the subjects covered
19	Yes	How to use NeXT network. The ease with which work can be done on the computer.
20	Yes	I've learnt a lot more about C20th music in these seminars, over and above lectures.
21	Yes	No answer
22	Yes	Apart from about the music etc. - computers are good for seminars and I was surprised that they worked in this medium.
23	Yes	How to write essays/seminars on the computer. Got to know the computer quicker.
25	Yes	That I'm computer illiterate (or at least more than I thought). That I should read my email more often.
31	Yes	That you say much more & hence learn more in a conversational situation
32	Yes	How to write seminars and how the computer can be useful for discussion groups.
35	Yes	More about the subject under discussion. Different points of view (those of other students/lecturers).
36	No answer	No comment
39	Yes	Things which were seminar topics.
40	Yes	To use a computer

Appendix 6.15
Discussion outside about NetSem topics outwith email

	Discussion of NetSem topics outside email with:
1	Course mates, friends
2	Group members, course mates, friends on other courses.
3	No comment (not applicable)
5	Friends on the course and friends on other courses
6	No comment (not applicable)
7	The 'friend' from my group
10	No comment (not applicable)
12	Group members
14	Group members and course mates
15	Group members, course mates
19	Course mates
20	Group members and course mates
22	Group members, course mates.
23	Friends, group members
31	Group members, course mates, friends on other courses.
32	Friend in group
35	Course mates, friends in general
36	Friends on other courses, some course mates, not my group.

Appendix 6.16
The importance of contributions

	How important is it to you to contribute and why?
1	Essential. However its sometimes difficult to submit when all you can say is 'yes, I agree'
2	I'm part of the group. Obligation and a desire for my opinion to be heard.
3	Important but only to get marks and if there is something I feel strongly about.
5	Depends on the seminar - If I have anything to add to what has already been said
6	It is important first and foremost to obtain marks
7	I try to say controversial things from time-to-time to create a good polemic, but people seem to prefer to agree than disagree - I suppose its an easier option.
10	Necessary for assessment purposes
12	Very important as it can often spark a chain reaction of other comments
14	Very - you can gauge how ell you are doing with work depending on reactions to your comments
15	Fairly important - I enjoy the discussion
19	Not very - I do it because I think I have to - is that correct!?
20	I try really hard to get points across, and there are marks at stake after all.
21	Very important - 1) I'm being assessed 2) It's an interesting exercise. I like talking about music.
22	Not very important. Contributions are only worth small % of final mark, so if I have other work to do I'd rather concentrate on that.
23	Marks. Also to help any (?) discussion move on a bit.
25	It's important but very much secondary to other course work [not in the top ten of priorities].
31	I only feel like contributing if I have something to say even if it's just 'I agree with _______'
32	Important for marks
35	Quite important - more is learned that way.
36	Important, am I not being assessed upon it, I want to seem interested, to some extent informed.
39	Feel I must make an effort, but prefer reading other people's comments.
40	Not very, I keep forgetting to do it, although I do read other people's comments.

Appendix 6.17

Controversial vs. neutral seminars

	Choice of seminar	Why? Please give details
1	Neutral	Safer, in light of the grade you'll get at the end
2	Controversial	It makes for more intense discussion
3	Neutral	My opinion kept changing and I didn't want to take sides.
5	Neutral	I didn't know if we were meant to express our own opinions in the presentation
6	Neutral	No answer
7	Controversial	As I said above - it is very boring if everyone agrees with the original seminar.
10	Controversial	Controversial presentations are the most likely to provoke lively discussion from people who feel they MUST respond, either to endorse viewpoints or shout out against what they consider to be totally wrong.
12	Controversial	Gives more to comment on and often provokes fiery responses which improve discussion
13	No answer	No answer
14	Controversial	Encourage a livelier debate
15	Controversial	To find out other people's views
19	No answer	Neither - I just gave my opinions regardless of what they were.
20	Neutral	I made controversial SUGGESTIONS, but wanted to cover my back for the later debate.
21	Neutral	I wanted to present both sides of the issues/open up all the relevant issues so that people could comment on them.
22	Neutral	So that I wouldn't get any slander from the group!
23	No answer	It depended on which seminar and my views on the subject as well as how any arguments were put forward in the seminar.
25	No answer - wrote 'Can't remember my seminar!'	See previous column
31	Neutral	It was obvious what the question 'asked' for & I agreed with it.
32	No answer	It varied depending on my views on the subject
35	Controversial	An opinionated seminar makes for more discussion. I was merely following the instructions given to us that we had to present our own opinions.
36	No answer	I would not aim to be controversial. However I would give my opinion, if that is controversial or neutral is for the group to decide.
39	Neutral	Because I did not have controversial views on my topic.
40	Neutral	I feel that I don't know enough about the subject(s) to enforce my opinions on people.