COMPUTER ANXIETY:

ASSESSMENT AND TREATMENT

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B.A., Dip.Ed., M.Ed (Sydney)

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The University of Western Sydney Macarthur
in fulfilment of the requirements for the degree of
Doctor of Philosophy

1997

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Statement of Authentication

The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either in whole or in part, for a degree at this or any other institution.
Acknowledgements

Many individuals contributed to the production of this thesis through their moral support, advice or participation.

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DEDICATION

Thank you to my dearest friend and husband

Dennis Michael McInerney

without whose support on so many levels

I would still be trying to finish this opus
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ABSTRACT

This Dissertation represents the results of a series of studies designed to investigate a specific manifestation of the technostress that is so prevalent in Western society today (Weil & Rosen, 1997): computer anxiety among adult learners undertaking an introductory university computer training course.

In the first of these studies, the existence, nature and degree of computer anxiety was investigated with a sample of teacher trainees undertaking a semester-long introductory computer training course (n = 101). The impact of this course on the anxiety and cognitions of these students was a second significant area of interest. A third study focussed on the evaluation of the measure of computer anxiety used in this study in relation to the relevant theoretical literature with a view to the design of a new computer anxiety instrument.

This study demonstrated that anxiety and associated negative cognitions with regard to computing were not necessarily dissipated by completing a computer course and were correlated with gender, computer ownership and previous computer experience, as in previous research. A number of questions raised as a consequence of the findings of this pilot study included: a) Could a reliable measure for assessing such anxiety amongst adult learners in a university setting be designed? b) Using this measure, what is the extent and nature of this anxiety among undergraduates in general? and, c) What is the relationship between the way that computing skills are taught and anxiety alleviation or exacerbation?

To address the first question, the Computer Anxiety and Learning Measure (CALM) was designed as a multidimensional instrument comprising eleven factors subsumed into four scales: Gaining Initial Computing Skills; Sense of Control; Computing Self-Concept; and State Anxiety in Computing Situations. This measure was shown to have both high validity and reliability, and to be factorially invariant for undergraduate groups from dissimilar faculties.

To better understand the nature and extent of computer anxiety and related negative cognitions, a number of faculties with different student populations were studied: Education, Health, Arts and Social Sciences, and Business and Technology
(total \( n = 794 \)). Using the CALM measure, it was demonstrated that anxiety and cognitions relating to learning computing skills (namely, perceptions of control and mastery as well as self-concept of ability in computing situations) were high within each of the faculties, but in significantly different ways. Furthermore, the correlates of these constructs also varied from one faculty to the other.

In-depth interviews conducted with computing course coordinators at this time indicated a range of approaches to instructional design, beliefs about the extent and causes of computer anxiety, and the appropriate ways of alleviating it. Among the instructional methods used were a traditional transmission approach and a relatively unstructured cooperative learning approach. While there were strengths reported for each of the methods in terms of anxiety reduction and achievement gains, there was no empirical evidence of the comparative efficacy of either. In order to examine the potential effects of these approaches on computer anxiety and cognitions, and their potential interactions, a quasi-experimental aptitude-treatment-interaction (ATI) study was designed and implemented.

Two approaches derived from the faculty interviews formed the basis of the design of this study, with instructional methods (direct instruction and direct instruction plus structured cooperative groupwork incorporating metacognitive strategy training) as the treatments, and levels of computer anxiety and negative cognitions as the aptitudes.

The theoretical literature strongly suggests that both direct instruction and structured cooperative groupwork should effectively alleviate anxiety for different reasons: information processing reduction in the former, and social support and the cognitive benefits of explaining in the latter. Furthermore, on the basis of self-efficacy theory and the literature relating to the positive outcomes of cognitive-behavioural training, the author theorised that metacognitive strategy training in self-questioning within the context of a structured cooperative group should enhance positive cognitions (sense of control and computing self-concept). A consequence of this intervention was anticipated to be improved achievement.

The sample for this study comprised two equivalent groups of undergraduate students (total \( n =31 \)) undertaking a computer training course in which a range of applications were to be taught over a semester. The same instructor taught both groups. Two alternative approaches to computer instruction were examined. The
first group received traditional teacher-led direct instruction (this was the comparison group), while the second group received direct instruction plus metacognitive strategy training in self-questioning within a cooperative learning context (this was the intervention group).

The results of this quasi-experimental study indicated that there were significant ATI effects: some aspects of anxiety related to learning computing skills remained for initially anxious students receiving the cooperative learning intervention but not for those in the direct instruction group. For those with low positive cognitions, however, there was a significant advantage in being in the cooperative learning group rather than the direct instruction group. Both groups achieved equally well.

To further explore the comparative usefulness of the two approaches, qualitative data were simultaneously collected from a number of sources: in-depth interviews with two high and two low anxious students from each group; student logbooks in which details of thoughts and feelings following each computing tutorial were recorded; and an instructor tutorial diary.

Potential limitations in the methodology of the first ATI study revealed through analyses of the qualitative data, namely, the forming of spontaneous collaborative groups in the direct instruction treatment, and the development of self-regulatory behaviours in both groups, led to the redesign of the research to reinforce the contrast between the treatments. A second ATI study was designed to minimize the effects of the limitations of study one. In this second study, the metacognitive strategy intervention was strengthened to ensure that students received earlier and more extensive training in the use of higher order self-questioning than had occurred in the previous study and regular practice in self-regulation through the use of a “reflective folder”. This redesigned study was conducted with two new groups undertaking the same introductory computer course as previously (n = 30) with the same instructor as in the first study.

The results of this second aptitude-treatment-interaction study yielded clearer outcomes while confirming some of those of the first study. Achievement was significantly enhanced for those receiving the metacognitive strategy training intervention. An additional outcome was the reduction of fear in computing situations for the initially anxious in this group. Initially low anxious students in the
direct instruction group experienced greater levels of posttest anxiety than low anxious students in the cooperative group. Positive cognitions (perceptions of control and mastery as well as self-concept of ability in computing situations) were increased for those with initially low levels in the cooperative learning group. On the basis of these findings, it was felt that considerable confidence could be placed in the ATI effects and in the value of metacognitive training in self-questioning within a structured cooperative learning context as a means of enhancing achievement and positive cognitions with regard to learning computing for the highly anxious and those with low positive cognitions.

One paradoxical outcome of the cooperative learning intervention remained, however. Despite significantly improved achievement, some aspects of anxiety relating to learning computing skills in an evaluative situation remained for students with initially high levels of anxiety in these areas, while their perceptions of control and mastery as well as self-concept of ability in computing situations were enhanced. This raised two possibilities: that computer anxiety in this learning context was not debilitating but, rather, that it was facilitating; and that positive cognitions with regard to computing might be more highly correlated with achievement than was anxiety. In other words, it appears likely that any anxiety about learning computing at the end of the computer course did not reduce performance for those whose sense of control and self-concept were increased as a consequence of metacognitive strategy training in self-questioning within a cooperative learning environment.

In terms of future directions, three important avenues can be followed on the basis of the research conducted for this Dissertation: Further evaluation of the CALM in terms of its usefulness in identifying those individuals whose negative affect and cognitions in computing computer training situations are impediments to motivation and learning; replication of the intervention used in the second ATI study within a different learning context where external, normative evaluation is not a potentially compounding factor; and, an examination of additional qualitative data collected longitudinally and developmentally from students in computer training situations, as well as from their instructors, in order to further investigate the interplay between anxiety and the cognitive processes involved in perceptions of control and ability in computing situations, especially where these extend over a period of time.
In conclusion, the research encompassed in this Doctoral Dissertation is strongly suggestive that computer anxiety and associated cognitions exist as multidimensional constructs, and that the CALM is an effective measure of these for adults in computer training contexts. Furthermore, it would appear that instructor-mediated computer training interventions for students assessed as high in anxiety and low in positive cognitions with regard to learning computing skills can be designed and implemented. Those responsible for the design and implementation of computer training programs for adult learners in the future, therefore, have been provided with potentially effective tools for instructional practice.

Have had a computer phobia since high school - a fear of wiping a whole lot of information. Scared stiff this week in computing class - making silly mistakes (Nathan, high anxious)

Being embarrassed to ask for help - that's what makes people more tense about computers (Michael, low anxious)

For some reason this computer class seems to remind me of the great secretarial typing pools of the 40s and 50s that you see in the movies, especially when we're all bashing away. (Terry, low anxious)

Laughing between students in our group in class is good; you can laugh at your mistakes - it helps relaxation and builds up confidence seeing someone else's mistake. I like having people next to me to talk to in case I make a mistake. I am not afraid of people finding out that I can't do things then, nor embarrassed (Yonneka, high anxious)

---

1 These extracts from student interviews form part of the qualitative research conducted in this Dissertation. Full details are given in Chapter Seven B and Appendix B4.
CHAPTER ONE

Anxiety and its Implications for Computer Training

Computers are a significant presence in modern Western society today and are likely to remain so in the future. This is not to say, however, that reactions to computers are uniformly positive. The introduction of computers into the workplace and educational settings has brought with it a range of responses from eager adoption, through hesitant “waiting on the sidelines” until the benefits of computers are clearly demonstrated, to outright resistance to the use of computers (Rosen & Weil, 1996). The latter two of these responses may be triggered by negative psychological reactions such as lack of self-confidence in the use of computers, anxiety or even fear. The focus of this Dissertation is an exploration of such negative psychological reactions in the context of an educational setting in which proficiency in computer use is expected. That setting is the university campus where undergraduates from all faculties are informed on enrolment that demonstrable computer competency is a requirement of graduation.

Computer Anxiety and Student Achievement

A large body of research has demonstrated that computer anxiety is an important predictor of student achievement in computing skills. For example, Marcoulides (1988) concluded that computer anxiety significantly influences the degree to which computers can be utilized effectively by tertiary students and that although computer experience does diminish the anxiety to some extent, varying degrees of computer anxiety remain. Furthermore, the higher the initial level of computer anxiety, the lower the computer achievement. In developing a standardized test of computer anxiety (Computer Anxiety Index - CAIN), Simonson, Maurer, Montag-Torardi and Whitaker (1987) similarly demonstrated that students with higher computer anxiety scores had lower scores on an achievement test of computer literacy.

Many computer education courses offered at tertiary institutions throughout Australia either ignore the issue of student anxiety, or are based on the belief that gaining experience with computers (throughout a course) will necessarily reduce computer anxiety. The controversy regarding the effects of computer experience on student anxiety and achievement, as cited above, caused the present author to
question the wisdom of ignoring the impact of computer contact on student anxiety, or presuming that such contact, per se, will alleviate anxiety.

The ability to use computers is becoming a crucial component in the educational process (and indeed, in some institutions, a compulsory part of the curriculum). In order to develop programs to alleviate the situation of students avoiding, fearing and failing with computers, institutions which seek to prepare students in the field of computer applications must become concerned with identifying those students who are computer anxious and evaluating the impact of compulsory computer oriented courses on student anxiety and achievement. Such an issue is of considerable relevance to the training of prospective teachers who will need to use computers both throughout their training and future teaching.

Significantly high levels of computer anxiety have been found in students of "artistic" and "social" vocational personality types using Holland's model (Holland, 1985; Winer & Bellando, 1989), as well as in those enrolled in education (especially elementary teacher training) and humanities courses (Heinssen, Glass & Knight, 1987; Winer & Bellando, 1989). Heller and Martin (1987), for example, reported that of 495 teachers using computers in their first year, all exhibited the "non-user" profile. Although these teachers were actually using the computers, their personal concerns about the new technology outweighed their concerns about implementing the innovation in their classrooms. These personal concerns existed universally irrespective of years of teaching experience, amount of computer training or level of use of microcomputers in classroom instruction.

Sinclair and McKinnon (1987) found similar concerns among Australian teachers who were in the early stages of introducing computers into their teaching. Self concerns involving uncertainty and self adequacy in coping with the demands of the innovation were among the highest rated areas of concern. With regard to those in business such as clerical workers, managers and executives, Rosen and Weil (1996) also reported from a large (543) sample, that at least half were hesitant users of computers who might also be computer anxious, while another thirty to forty per cent were outright resisters of computer use and were likely to be quite anxious about its use, if not even phobic.

Australian Government documents such as the Carrick Report (1989, p. 61)) recommend that all school students should have access to, and familiarity with computers, among other technologies. It is evident, however, that many teachers at both primary and high school levels who are responsible for facilitating the development of such familiarity are themselves anxious with computers, and do not provide sufficient student access nor model computer "comfort". A similar argument can be made for those in business and health professions where trainees are to be
mentored into the use of computerised technology by those who are inexperienced or avoiding it themselves. The implications for students across a range of disciplines who enrol in universities where it is mandatory to graduate computer literate, are that their low initial levels of expertise with computers engender feelings of anxiety which may seriously interfere with learning. In other words, potentially computer competent individuals may be limited by anxiety in their gaining of expertise and confidence in courses provided by universities, or where self-tutoring computer packages are provided for students without human instructional support.

General Overview of Anxiety

In order to understand the construct of computer anxiety, it is necessary to examine it in relation to the broader context of anxiety theory in general. When doing so, it becomes clear that anxiety is a very complex phenomenon which may be a generalised personality trait for some individuals, i.e., a proneness to be anxious, while for others it is quite clearly context bound (Philips, Martin and Meyers, 1972), that is, a stressful state in a particular situation. In educational settings, for example, anxiety may be related to a range of factors including self-concept (Beck & Emery, 1985; McReynolds, 1989), cognitive style (Chu and Spires, 1991), motivation (Covington and Omelich, 1991), attribution (Dweck, 1975), classroom climate (Ames, 1992), and the cognitive appraisal process (Tanzer, 1992).

The Nature of Anxiety

Although a vast amount of anxiety research has been reported in the literature, a theoretically and methodologically agreed upon definition of the construct has not yet been reached, with consequent lack of consensus regarding its causes, measurement and treatment. Is anxiety a disposition (trait), for example, or situation-specific (state) as Spielberger (1972a, 1972b) suggests? How is this distinction helpful in an educational context in relation to gaining basic skills in information technology? To what extent are test anxiety and computer anxiety related? These are the questions that are explored in the present chapter.

Biological Paradigm

Most authorities on anxiety theory consider it a psychological construct of the twentieth century with origins both in Darwin's (1872) insights into human emotional states as having a biological evolutionary role (Barlow, 1988), and Freud's identification of "angst" as a clinical entity (Cambre and Cook, 1984).
The biological paradigm of anxiety which has developed from Darwin's original work regards anxiety as an important emotional capacity for human survival, and has given rise to considerable research in the identification of brain mechanisms involved in mediating stress and anxiety responses and those that block them. The "fight or flight" reaction, for example, in which adrenaline secretion was identified by Cannon in 1927, was the forerunner of such investigations which have been particularly active since World War II (Barlow, 1988). This paradigm is mentioned briefly here out of historical interest as it was important in giving rise to the "drive theory" of anxiety which linked physiological arousal (a function of various need states or drives), anxiety (aversive arousal) and performance (Hull, 1943). This connection was first made by Yerkes and Dodson (1908) who proposed that the learning of simple responses was enhanced by arousal but that learning of complex tasks was adversely affected.

As the biological perspective has little of practical application to the educationalist, especially in relation to computer anxiety, and is largely the province of medical practitioners, it is not dealt with in any further detail. It is important to point out, however, that the biological paradigm has influenced the development of anxiety measures which include assessments of bodily symptoms of anxiety such as, racing heart, increased perspiration and nervous stomach, for example. Furthermore, biofeedback in which patients monitor their physiological responses to anxiety (such as, changes in heart rate, muscle tension, body temperature etc.) and are trained to use this feedback in reducing their anxiety has emerged from this paradigm and has been extensively used in clinical practice for decades (Edelmann, 1992).

**Psychoanalytic Paradigm**

The psychoanalytic paradigm was particularly influential between the two World Wars and was based on Freud's "signal theory" of anxiety in which anxiety was regarded as a signal of the breakdown of an individual's unconscious defense mechanisms. Freud shows the influence of Darwin's writings in this signal theory in that the "signal" has an adaptive function in an evolutionary sense (Roth, Noyes, & Burrows, 1988). Although this approach is not one from which educationalists can draw many practical implications, and is described only briefly in this context, therefore, both the biological and the psycholanalytic paradigms serve to highlight the functions of anxiety as a survival mechanism and as a defensive strategy in response to threat. Somatic symptoms are one way of "dealing" with unresolved anxiety in a vicarious way (Roth, Noyes, & Burrows, 1988).
**Behavioural Paradigm**

The behavioural paradigm which originated from the early works of Pavlov, Watson and Thorndike produced its greatest impact on theorising about how behaviour is acquired with the research of Skinner in North America after World War II. In its original form, the behavioural paradigm maintained that all behaviour was learned in an effort either to gain positive reinforcement or to avoid negative reinforcement and punishment. The focus, therefore, was on observable forms of behaviour and how they could be modified. This included not only bodily movements as seen by an observer, but also the internal physical processes related to overt bodily movements (McInerney & McInerney, 1994). Behaviourists emphasised the learned nature of anxiety, and the role of situational and environmental stressors.

Behavioural theory has given rise to a range of treatment approaches which attempt to modify anxious behaviour using conditioning principles. However, the persistence of anxiety and autonomic arousal for some individuals who have received such treatment has demonstrated that this paradigm does not provide a complete account of the nature of anxiety for all individuals. Not only does anxiety manifest itself in behaviours, but may also remain undetected in the negative or distorted cognitions which are created by the anxious state of the individual. It is a recognition of this reality which gave rise to the cognitive paradigm, addressed next.

**Cognitive Paradigm**

Within the cognitive paradigm, anxiety is seen as an irrational emotion which is a function of inappropriate attributions or appraisals (Beck & Emery, 1985). Typically, theorists within the cognitive paradigm characterise anxiety as a diffuse cognitive-affective structure which is characterised by high negative affect, perceptions of lack of control over events, and shifts of attention to self-evaluative concerns (Barlow, 1988). In the case of test anxiety, some argue that it is not so much the difficulty that the individual has in focussing attention on the task because of self-doubting thoughts generated in the evaluative situation (Wine, 1971) that is the main factor in anxiety, but rather the ineffective information processing skills of the individual (Naveh-Benjamin, 1991). Specifically, Naveh-Benjamin argues that this information processing model accounts for test anxiety in the following ways: Either ineffective processing at the outset of learning through poor study skills is the main factor, or interference from negative cognitions at the retrieval stage of information processing for individuals who have good study skills. Cognitive theory, therefore, provides a useful model of test anxiety which can direct treatment approaches in an educational context.
Social-Cognitive Paradigm

It is the social-cognitive paradigm which has provided one of the most pragmatic analyses of the causes of anxiety and its treatment. Social-cognitive theorising incorporates aspects of behavioural theory in so far as describing behaviours such as anxiety as learned, but also adds the important perspective of the "mental" or cognitive workings of the individual as he or she operates in a social context.

The social-cognitive view differs from the behavioural in that it emphasises, in addition to learning through conditioning, symbolic representation (thoughts) and self-regulatory procedures (McInerney & McInerney, 1994). This paradigm is most closely associated with the work of Bandura (1962, 1977a, 1986, 1988, 1993, 1997). In relation to the development and reduction of anxiety, Bandura's model of perceived self-efficacy as a determinant of fear and avoidance is significant. Self-efficacy could be defined as an individual's perceptions of their capabilities to organise and execute actions required to attain designated performance of skill for specific tasks (Bandura, 1986; Olivier & Shapiro, 1993). Bandura (1988), argues that it is an individual's perception of their ability to exercise personal control over potential threats that is central to anxiety arousal, where threat is described as a "relational property reflecting the match between perceived coping capabilities and potentially hurtful aspects of the environment. People who believe they can exercise control over potential threats do not engage in apprehensive thinking and are not perturbed by them. But those who believe they cannot manage threatening events that might occur experience high levels of anxiety arousal." (p.77).

Essentially, Bandura (1977a) maintains that increasing one's self-efficacy or competence in mastering a feared situation successfully reduces anxiety. This may be accomplished in a number of ways: The most powerful of these is direct behavioural experience and accomplishment; however, also of great value are verbal instructions to the effect that the individual will be successful (which may be delivered by a trusted outsider or taught as part of a coping skills program in increasing positive self-talk), as well as watching other people perform the task successfully. In other words, it is not only the development of behavioural coping efficacy which reduces anxiety but also the development of perceived self-efficacy in controlling negative thoughts, or "dysfunctional apprehensive cognitions", as Bandura (1988, p.77) puts it. Schwarzer (1996) adds support to this assertion by proposing the construct of self-doubt to explain how anxiety (or worry) about specific coping capabilities in a self-regulatory process has a detrimental effect on motivation that reduces the information processing efficiency of the anxious individual.
It is from the social-cognitive paradigm that the present author has derived insights into modifying anxiety in those educational settings related to computer training using approaches such as self-regulated learning, modelling and coaching by the instructor, and metacognitive strategy training.

Three Response Systems Underlying Anxiety

The construct of anxiety, as it is understood at the present time, may be viewed in relation to a combination of the paradigms outlined in the above discussion. Fundamentally, it involves three relatively independent response systems: Behavioural, cognitive-affective and somatic (Barlow, 1988). The behavioural response system refers to those avoidance behaviours exhibited by the anxious individual such as fleeing; the cognitive-affective response system refers to the subjective experiences of the individual such as fear and negative self-talk; and the somatic response system refers to the bodily symptoms of heightened physiological arousal experienced by the anxious individual such as accelerated heart beat and muscle tension. It is interesting that this latter system is considered to be an ambiguous one (Barlow, 1988) in that physiological responses may remain high for some individuals even when avoidance behaviour and subjective experiences of anxiety are reduced: "... this may be a very normal and relatively unemotional response to an upcoming event reflecting a preparatory set." (Barlow, 1988, p. 295). This has implications for the diagnosis of anxiety. Many anxiety scales include a measure of bodily symptoms; those used to assess anxiety in evaluative situations (test anxiety) are premised on the assumption that such bodily symptoms are negative consequences of anxiety and are associated with debilitated performance (Spielberger, 1972a).

Theoretical Perspectives on Anxiety and its Alleviation in Educational Settings

Self-Efficacy, Self-Concept and Anxiety

With regard to anxiety, the constructs of self-efficacy and self-concept have a great deal of relevance. As defined previously in relation to the social-cognitive view of anxiety, self-efficacy refers to perceptions about capabilities to perform designated types of actions. Self-concept, on the other hand, is a construct which has a multidimensional, hierarchical structure comprising a collection of beliefs about oneself. Self-concept, thus, comprises an overall "general" component in addition to components relating to specific skills such as mathematics or verbal ability (Marsh,
1994), or to personal attributes such as physical fitness or body image (Marsh, 1993; Marsh, Richards, Johnson, Roche & Tremayne, 1994). Self-concept will be influenced by one’s perceptions of self-efficacy in relation to specific tasks and situations. Computing skill is clearly one area where a specific self-concept would be formed (e.g., “I am good/no good with computers, therefore, I am/am not a computing type”).

Gorrell (1990) maintains that insights from both self-efficacy and self-concept theories can be combined to explore ways of changing self-beliefs where these are negative and predispose the individual to anxiety, as both theories support what he refers to as the "enhancement model" of self-belief change which argues that changes in behaviour are an outcome of changes in self-concept. Given the correlation between self-efficacy, sense of control, self-concept and anxiety (Gorrell, 1990), the present author believed that the design of an effective anxiety reduction intervention for computer training courses would entail strategies that would maximise these variables. As for the causal relationship between them, Hodapp's (1989) path analytical models of the anxiety-achievement relationship have shown that what he calls "confidence" determines anxiety. Confidence is composed of appraisal of self-efficacy and a belief in one's competence to master a situation, factors which were incorporated into the Sense of Control scale of the Computer Anxiety and Learning Measure developed by the present author as part of this Dissertation (outlined in Chapter Four). In Hodapp's path model, it is an individual's self-evaluation and self-concept which precede confidence. A feedback loop exists in that self-evaluation will be determined in some measure by actual achievement as well as by attributions of ability. Thus, in computer training settings, it is as important to ensure that students experience success which, in turn, will boost a sense of control and self-concept in these settings and reduce fear of failure (manifested as anxiety). Such strategies should include both behavioural and cognitive components which have been demonstrated to have powerful effects in anxiety reduction, as described elsewhere in this Dissertation in relation to instructional methods and their effects on anxiety (Chapters Seven and Eight). Specifically, it will be shown how elements derived from these paradigms were incorporated into an experimental intervention designed by the author to investigate the aptitude-treatment-interaction effects of two instructional approaches on student anxiety levels in computer training settings.

A Motivational Perspective: Anxiety as Fear of Failure

The conception of anxiety as a multifaceted cognitive reaction to the threat of failure has been proposed in much of the research literature in this field (Hagtvet,
1983; Lazarus, 1966; Pekrun, 1984, 1988; Spielberger, 1972). The self-worth theory of achievement motivation developed by Martin Covington (1984, 1992) has as one of its tenets, this interpretation of anxiety as a function of fear of failure and a reaction to self-perceived low ability. Covington's theory has important implications for anxiety theory and research, in general, and especially in relation to the gaining of computing skills in a tertiary educational setting. Covington proposes that humans are predominantly motivated by the search for self-acceptance, and that within Western society, this is equated with accomplishment. As he puts it, "In our society, ... individuals are thought to be only as worthy as their achievements. Because of this, it is understandable that students often confuse ability with worth." (Covington, 1992, p. 74). In educational settings, this typically becomes the case when "success" is measured by how well one achieves competitively. Of course, in this environment, not enough rewards exist for all to succeed, so there remain many whose motivation becomes to avoid failure.

**Test Anxiety**

Test anxiety research has been conducted over the past thirty years and it is now generally accepted that test anxiety can be defined as a situation-specific anxiety, with worry and emotionality as its two main components. Liebert and Morris (1967), in particular, proposed this conception of anxiety which described worry as a "cognitive concern about the consequences of failure" (Liebert & Morris, 1967, p.975) typified by negative beliefs, disturbing thoughts and ineffective judgment; and emotionality as the subjective perception of autonomic reactions (internal physiological responses) that were brought on by the stress of evaluation.

Earlier, Alpert and Haber (1960) had also proposed that test anxiety was bidimensional, but in their theory, anxiety could be either debilitating or facilitating (cf., Yerkes & Dodson, 1908) In the former case, the poorer performance of highly test anxious students was attributed to (debilitating) self-focussed responses which interfered with performance; in the latter, anxiety could serve as a motivator or (facilitating) drive to increase the probability of successful task completion. This was an important distinction as it accounted for the existence of highly anxious students whose performance did not necessarily suffer in test situations. The ambivalent impact of anxiety on performance has also been noted by Pekrun (1992) who points out the mediating effect of motivation. Pekrun's analysis of the varying effects of strong negative emotions such as anxiety on learning and achievement are discussed in greater depth later in this chapter (See Effects of Anxiety in Educational Settings). The work of I. G. Sarason (1960, 1972) also identified the high test anxious individual as one who made derogatory, self-critical responses which
interfered with performance in evaluative situations. Such research into the causes and correlates of anxiety focussed on the nature of the individual's cognitions in varying situations.

Another important factor in the understanding of test anxiety was that of attention, as demonstrated by Wine (1971) and presented as an "attention hypothesis" of the negative effects of anxiety on performance (1980). Specifically, she proposed and experimentally confirmed that individuals with high test anxiety divided their attention between "task-relevant" responses and self-related or "task-irrelevant" responses, whereas those with low test anxiety concentrated attention on the task.

Spielberger (1972a, 1972b, 1975a, 1975b), on the other hand, takes the perspective that anxiety is a response to real (physical) or perceived (psychological) threat (such as failure which may lead to loss of self-esteem). Furthermore, he distinguishes between anxiety as a transitory emotional state which is characterised by activation of the autonomic nervous system and subjective feelings of apprehension and tension, and anxiety as a trait or "relatively stable individual differences in anxiety proneness, that is, to differences in the disposition to perceive a wide range of stimulus situations as dangerous or threatening, and in the tendency to respond to such threats with state anxiety reactions." (Spielberger, 1972a p. 39). In his definition of anxiety, Spielberger extends the earlier drive theory by focussing on the extent to which the environment is perceived as threatening by the individual: Thus, even individuals who have high trait anxiety may not experience anxiety if the particular situation is non-threatening to them, or if they are reassured that this is the case.

This latter point refers to research evidence that there is an opportunity for educators to intervene in reducing perceived threat in a number of ways: By providing training in strategies for coping and gaining of a sense of control; by removing time constraints for evaluative tasks; and by providing frequent feedback as to progress for individuals high in trait anxiety, thereby, reducing the feelings of excessive tension which are believed to be responsible for poor performance (Covington, 1992). It is important to note, however, that the high trait-anxious individual is more likely to be vulnerable to stress and to perceive situations as threatening (that is, they experience state-anxiety reactions more frequently) than those low in trait-anxiety (Eysenck, 1992). This may explain why some individuals maintain their computer anxiety even after objectively sufficient experience in their use.

In relation to computer anxiety, although test anxiety has conceptual similarities to computer anxiety "when computer interaction is viewed as a 'test' that must be passed" (Weil, Rosen and Wugalter, 1990, p364), computer anxiety and test
anxiety are not the same according to a meta-analysis conducted by Rosen and Maguire (1990), even though there is a slight overlap between the two constructs. For the purposes of this Dissertation, therefore, computer anxiety is treated as a separate construct.

**Anxiety as Skill Deficit Versus Cognitive Interference**

A current theory of anxiety in educational settings proposes that test anxiety is actually a side-effect of perceived incompetence (Birenbaum & Nasser, 1994; Smith, Arnkoff & Wright, 1990; Smith, Snyder & Handelsman, 1982; Topman & Jansen, 1984), that is, the poor performance of highly anxious individuals is an emotional reaction to an awareness of poor preparation, but not a cause of it. Although this may explain the decrement in performance of highly anxious individuals in evaluative situations to some extent, Heckhausen (1991) argues that such anxiety is really more of an interaction with cognitive interference (task-irrelevant thoughts) caused by the subjective difficulty of the task experienced by the individual (if it is expected to be easy or difficult), compared with how difficult it is in reality for that individual. In other words, because of ineffective learning strategies, an individual may feel that a task is more difficult than it really is and, thus, may experience an increase in the fear of failure which, in turn, begins to dominate the cognitions of the individual (as worry) and interferes with performance. Using an information-processing approach, Tobias (1985) proposes that "the cognitive representation of test anxiety must absorb some of the student's processing capacity, leaving a reduced portion for task solution" (p. 138).

Currently, the skill deficit hypothesis has been the focus of research which highlights the complex interactions which occur that prevent simple generalisations. Training in study skills actually improves performance and decreases anxiety for some highly test anxious individuals (with poor study habits which prevent initial processing of information), while not for others (those who suffer from interference at the retrieval stage of information processing which results from fear of failure (Naveh-Benjamin, 1991). To further complicate matters, Naveh-Benjamin, McKeachie & Lin (1987) showed that some students who had good study skills and typically achieved well were still anxious, although objectively, there was no cause for fear. According to Covington, these individuals are "overstrivers" for whom "the capacity to do well intensifies their anxiety rather than reducing it because they have tied their worth to the nearly impossible dream of academic perfection" (Covington, 1992, p. 120).

The research of Deffenbacher (Deffenbacher, 1978, 1986; Deffenbacher & Hazaleus, 1985) has demonstrated the relative impact on performance of the types of
anxiety factors that have emerged from various anxiety theories discussed above. In particular, worry has the greatest detrimental effect on performance, followed, in order, by task interference and emotionality, with physiological arousal having only a minor effect.

Effects of Anxiety in Educational Settings: Insights from Cognitive Theories

Motivation, Learning, Metacognition and Achievement

Pekrun's (1992) analysis of the ambivalent effects of anxiety on learning and achievement is pertinent here. As he points out, there are four possible outcomes of negative task emotions such as anxiety. The first might be an increase in cognitive effort or "tightening of information-processing" (p.372) in which detail-oriented, analytical processing of information occurs which inhibits creativity. The second outcome might be the temporary blocking of any processing of task information as a function of a high level of task-irrelevant thinking and self-concerns. The third outcome is a possible reduction in positive intrinsic motivation (performing a task for its own sake) and an increase in negative intrinsic motivation (avoiding performing a task because it is inherently experienced as negative). Conversely, anxiety related to failure and negative outcomes may produce a fourth outcome, that of strong motivation to avoid such failure or outcomes with a consequent increase in task effort.

In relation to the present research, Pekrun’s comments on the effects of anxiety on self-regulatory learning and metacognitive processes have considerable bearing. He maintains that conscious, intentional, metacognitive and motivational decisions involved in cognitive strategy use such as problem solving, are influenced subconsciously by emotions. In the case of negative emotions such as anxiety, the divergent thinking involved in metacognitive problem solving is less likely to occur in the anxious individual because information-processing becomes detail-focussed and analytical rather than holistic and creative. As Pekrun (1992) argues, "Positive emotions may be no less important for learning and achievement than anxiety, and they may be essential for both the cognitive and motivational components of self-regulated learning." (p. 374) In order for learning and conscious cognitive strategy use to be effective in educational settings, positive emotions rather than anxiety should be engendered. Implications for the educator are, therefore, that instructional approaches should be designed to foster positive emotions. In this context, the
positive affective outcomes of cooperative learning along with the positive sense of control emanating from metacognitive strategy training are important.

As for the interaction of anxiety and metacognition on performance of complex cognitive tasks, it has been demonstrated that poor metacognition is associated with anxious worrying, that is, anxious individuals are not aware of their own cognitive resources, nor do they consciously use them (Everson, Smolak & Tobias 1994). Their academic performance is consequently poorer than those who are not anxious or who use their existing metacognitive knowledge. On the basis of their findings, Everson et al. (1994) argue for metacognitive training as a compensatory strategy for anxious students to foster the development of "durable, transferable learning" (p. 94).

Avoidance and Motivation

One obvious consequence of reduced motivation (attributed to low perceived self-efficacy and low sense of control which causes anxiety) is avoidance. In the context of computer training courses, this can be measured in two ways: the first is by students dropping out of the computing course, and the second is by noting subsequent enrolment in a further (more advanced) computing course at the completion of the first compulsory course. As will be described later in relation to both the pilot and the intervention studies, avoidance and retention are powerful indicators of student coping skills in computing courses.

Attention

According to cognitive-attentional theories (Wine, 1980; Sarason, 1984), students who suffer from anxiety will demonstrate a lack of attention in a variety of forms such as distractability, lack of concentration, and wandering thoughts. These are the products of negative cognitions (self-talk) and perceptions of emotionality (physiological symptoms of anxiety) which arise out of worry about potential failure. As Benson and Tippets (1990) point out, worry has been found to be consistently correlated with decreased performance, more so than symptoms of physiological arousal such as racing heart or "butterflies" in the stomach.

In terms of the relationship between attention and learning, evidence exists from information-processing theorists that if attention is lacking in the learning of new material, initial processing will be ineffective. In learning situations, sustained attention can be facilitated by the instructor through the use of questions. In the intervention study described later in this Dissertation, such a strategy is incorporated into the instructional method used for one group.
Time on Task

As previously discussed, anxiety is not necessarily always debilitating on performance. In this context, however, time on task is an important mediating variable in anxiety manifestations. If there are minimal time constraints (as in long-term preparation for exams or assignments), anxiety effects on achievement may be positive, in that "cognitive processing impairment can be compensated for by extra hours of work" (Pekrun, 1992, p. 372). On the other hand, extra effort cannot help the anxious individual when time is limited for task completion. There is no way of knowing how much extra time a student has put into an assignment because of fear of failure, whereas in an examination, time for completion is limited and anxiety cannot be compensated for. For students in computer training courses, time for learning is largely restricted to the class period, although independent practice is sometimes possible after this time. The reality of group instruction, however, mitigates against the highly anxious learner having sufficient time or access to individual help from the instructor during class time to gain enough proficiency to reduce anxiety. Furthermore, during computer competency examinations, such learners may also be limited by time constraints.

By virtue of the multiplicity of anxiety effects on learning, motivation and performance, as discussed above, the present author believes that the research reported in this Dissertation has significant implications for educational practice, and for computer skills training programs, in particular.

Definition of Computer Anxiety

Among the early literature on the psychological state of individuals who have negative affective reactions to computers, one finds a variety of terms employed which include "computer aversion", "computer resistance", "computerphobia", and "computer anxiety". Although "computer anxiety" is the most commonly used, "computerphobia" is often referred to synonymously in many studies. These terms are typically undefined, presumably with the assumption that computer "anxiety" is self-explanatory, i.e., the same as other situation-specific anxieties such as test anxiety and maths anxiety (Gressard & Loyd, 1986; Raub, 1982).

Until the extensive original research into computerphobia (and more recently into technophobia) by both Larry Rosen and Michelle Weil (Rosen, Sears & Weil, 1987a & b; Rosen, Sears & Weil, 1993; Rosen & Weil, 1995a & b; Weil, Rosen & Sears, 1987; 1988; Weil & Rosen, 1995; Weil & Rosen, 1997), this relatively recent area of research suffered from a lack of common, or in some cases, any definition of its terms. Similarly, there was also no common psychological or sociological theory which underlay the literature in the area. Drawing implications from the findings of
such early research that can be of practical value to those dealing with computer anxiety is, therefore, problematic. Although there exist a number of theories as to the etiology and appropriate remediation of computer anxiety, some of which are highlighted later in this chapter, none can yet claim to be more than tentative.

For the purpose of this Dissertation, computer anxiety is defined as an affective response of apprehension or fear of computer technology accompanied by feelings of nervousness, intimidation and hostility. Negative cognitions and attitudes towards computers may also accompany such feelings of anxiety and include worries about embarrassment, looking foolish or even damaging computer equipment.

It is suggested that in some circumstances, test anxiety and computer anxiety will bear similar characteristics. Such circumstances would be where the task was seen as complex and demanding, and where an evaluational element overlay it (Sarason, 1991). In the present research, it was conjectured that for the undergraduate students who comprised the population under study, introductory computer skills courses would be perceived as demanding by novice and intermediate users of computers, and as stressful because of the evaluative components involved. As such, anxiety akin to test anxiety would be engendered, even for some experienced users of computers.

**Computer Anxiety and Experience**

Early researchers in the area of computer anxiety such as Loyd and Gressard (1984b) suggested that a major factor in computer anxiety is lack of familiarity with computers, and that with increased experience anxiety should decrease. The subsequent research of Howard and Smith, (1986) gave some support to this hypothesis. Weil, Rosen and Sears (1987, p. 180) argued, in contrast, that "during repeated exposure to the computer, the computerphobic is being reconditioned at increased levels of anxiety which, in turn, increases discomfort and anxiety". In a major research project, Rosen, Sears and Weil (1987) found that experience with computer interaction did not reduce computer anxiety nor improve attitudes. On the contrary, it was found that for the computer anxious student, increased experience (40 hours of computing over 10 weeks for 150 students) appeared to exacerbate rather than "cure" the problem. Although these students felt more knowledgeable about computers after the course, they displayed more self-reported discomfort (anxiety) at the computer terminal.

Corroboration for such assertions comes from Mahmood and Medewitz (1989) who found that even after an extensive computer literacy course which trained undergraduates in word processing, programming, and the use of spreadsheets and database applications, initial negative attitudes and values towards computer
technology persisted, albeit somewhat diminished. Similarly, Leso and Peck (1992) reported that in both a tool use computing course and a programming course, significant numbers of students reported anxiety at the end of fourteen weeks, one third in the former case, and over two-thirds in the latter. This was despite the fact that almost seventy-five percent of the students in both courses had prior computer experience. As they put it simply, but pointedly, "These courses alone do not guarantee reduction in anxiety for many individuals" (Leso & Peck, 1992, p. 476). Even among employees at a major U.S. aircraft corporation, almost one third of employees sampled were found to be more computer anxious after an intensive workshop on computer use (Rosen, Sears & Weil, 1993).

It is clear from these examples, that computer anxiety can persist in individuals irrespective of exposure to computers (Marcoulides, Mayes & Wiseman, 1995).

The Etiology of Computer Anxiety

Such divergent perspectives on the role of experience in computer anxiety as described above appear to stem from differing theoretical stances regarding the etiology of computer anxiety. Meier (1983), for example, believes that computer anxiety can be understood within a social learning model and is a result of low expectations of efficacy, outcome or reinforcement. Such anxiety is ameliorable by enhancing self-efficacy through skill building and success experiences.

On the other hand, Rosen, Sears and Weil (1987a & b) conceptualize computer anxiety as a clinical entity wherein anxiety may vary anywhere from mild discomfort to severe "phobia" (in the classic psychological sense). More specifically, Weil, Rosen and Wugalter (1990) describe three types of computerphobic. The first is the "Anxious" individual who exhibits physiological signs of an anxiety reaction including sweaty palms and heart palpitations. A "Cognitive" computerphobic is the second type who experiences internal self-critical statements about his or her incompetence with computers. Thirdly, an "Uncomfortable User" is a person whose anxiety may be a milder version of one or both of the other two types, or who may only need additional information about computer technology. What characterizes computerphobics is their avoidance of computer interaction whenever possible. The cause of such phobia is previous "uncomfortable" computer interactions which make "all future computer experiences and even mechanical experiences appear to be negative regardless of their outcome" (Rosen & Maguire, 1990, p.185). Remediation, according to this perspective, needs to be clinical and may include the
use of densensitization, relaxation and counselling interventions (Heinssen & Glass, 1987; Weil, Rosen & Shaw, 1988).

**Recent Developments in Research into Technophobia**

As mentioned earlier, Rosen and Weil have been prolific researchers in the area of computer anxiety for almost a decade, and would be considered the foremost spokespersons in both this field and that of the broader area of technophobia, where their current research is centred (Rosen & Weil, 1995c, d & e; 1996). In their opinion, it is critical for those involved in training the novice computer user to be aware of the range of attitudes towards technology that the learners bring to the training situation (Rosen & Weil, 1996). Specifically, they categorize three attitudinal types of computer users in terms of their reactions to new technology and indicate the average proportion of these users in any Western population: Those who eagerly adopt computers and enjoy using them (10-15%); those who are reluctant to use computers until convinced of their value, and who may be anxious (50-60%); and those who avoid using computers and may be highly anxious or even phobic (30-40%). These different user attitudes have significant implications for the approach taken in computer training, according to Rosen and Weil (1996).

In terms of anxiety, the first user type will have a high computing self-efficacy and sense of control, and will anticipate that any problems that emerge can be solved. The second user type, on the other hand, who is uncomfortable with and may resist technology, will have a poor sense of control with computers and feel that he or she is responsible for any problems that occur. Finally, the third user type who actively avoids computers, convinced that he or she is unable to learn how to use them, blames him- or herself when problems arise. For these highly anxious individuals, "Problems with technology are taken as severe blows to [their] self-esteem and self-confidence. [they] have difficulty asking for help as they feel foolish, stupid and embarrassed" (Rosen & Weil, 1996, p.5). In terms of sense of control and computing self-concept, this type would rate very low.

**The Development of a Model of Computer Anxiety for Beginning Adult Learners**

Each of the theories outlined in the earlier discussion of general and test anxiety, as well as the etiology of computer anxiety and the range of user types that
will comprise any population of learners undertaking a computer skills course, have important implications for the present research. In relation to the anxiety experienced by novice adult computer users undergoing initial computer training, the focus of this Dissertation, the approach taken by the present author is an eclectic one which integrates a number of perspectives outlined earlier. The paradigms of anxiety drawn from clinical psychology that have been referred to earlier, have provided the foundation for understanding the causes of anxiety in computing situations and for designing an appropriate instrument to measure it. In addition, theories derived from educational psychology have been integrated into the model of computer anxiety and its treatment presented in this Dissertation. In particular, those relating to motivation (attributions, self-worth and cooperative goal structures); constructivist approaches to learning; social cognition in relation to modelling (of thought processes), self-regulated learning strategies and metacognitive skills training (reciprocal questioning and reflective learning), have been drawn upon. Fundamentally, strategies which focus on developing and enhancing a sense of control and a positive computing self-concept in the anxious individual form the bases of the anxiety reduction approaches adopted in the quasi-experimental (aptitude-treatment-interaction) studies reported in Chapters Seven and Eight of this Dissertation. The rationale for this approach is derived from self-efficacy theory (Bandura, 1986; 1993; Olivier & Shapiro, 1993).


In trying to come to terms with the measurement of computer anxiety as a starting point for designing appropriate instructional methods, one is faced with the apparent lack of distinction between "anxiety" and "negative attitude" in the considerable range of instruments available in the literature. The relationship between attitude and anxiety, and particularly, the direction of their relative influences is a problematic area. Both Mahmood and Medewitz (1989) and Igbaria & Parasuraman (1989) have demonstrated, for example, that computer anxiety leads to negative attitudes and that learners may still have both high anxiety and negative attitudes even at the end of a training course. Heinssen, Glass and Knight (1987) point out that negative attitudes towards computers reflect "feelings about the impact of computers on society and the quality of life, and [individuals'] understanding of computers. In contrast, computer anxiety involves a more affective response, such that resistance to and avoidance of computer technology are a function of fear and apprehension, intimidation, hostility, and worries that one will be embarrassed, look stupid, or even damage the equipment" (p. 50). While the significance of all this
may appear only semantic on the surface, in reality, it makes for considerable confusion in determining the dimensions which underly anxiety for computer users, and which can provide insights into potential remediation of its debilitating effects on learning, performance and motivation.

In the opinion of Bandalos and Benson (1990), one of the reasons for the contradictory results in the literature on computer anxiety is the lack of common agreement about what it is that actually underlies the construct. Although several instruments designed to measure computer anxiety have identified (using exploratory factor analysis) one similar general anxiety factor, there is also a range of other dimensions on which there is little agreement and which confuse the issue for the researcher.

For the majority of computer anxiety measures in present use, there does not appear to be any underlying theoretical structure derived from anxiety theory such as outlined earlier in this literature review. Certainly, few provide separate measures of the constructs hypothesised by the present author to underly computer anxiety which are derived from cognitive and social-cognitive paradigms as they apply to educational settings. Only The Computer Anxiety Rating Scale (CARS), and The Computer Thoughts Survey (CTS), designed by Rosen, Sears & Weil (1987) for use in their Computerphobia Reduction Program at California State University, reflect some of the components that are typically present in the anxiety literature. The CARS focusses on anxiety specifically related to aspects of computers as machines, while the CTS concentrates on the thoughts and feelings of individuals about their computer abilities. As a starting point for the investigation of computer anxiety among undergraduates, the first of these instruments was used in the pilot study with education students that preceded the design of the Computer Anxiety and Learning Measure (CALM) by the present author.

Like the CARS, the Computer Anxiety Scale (CAS) designed by Loyd & Gressard (1984a) has also been used frequently in research over the last ten years. It consists of three factors: Computer liking, computer confidence, and computer achievement (concerns related to academic aspects of learning to use computers such as taking courses).

The conceptual and measurement limitations of the existing computer anxiety instruments are discussed in further detail in Chapter Four. Because of these limitations, a significant component of this research program was to design a valid and reliable computer anxiety scale to be used in the experimental and correlational studies forming the major part of this Dissertation.
Matching User Aptitudes and Training Methods Can Lead to Greater Success in Anxiety Reduction

Within any group learning computing skills there will be a range of abilities, interests, affective reactions, perceptions of usefulness and perceptions of likelihood of success. These may be called student "aptitudes" (see Snow, 1992). Such aptitudes are likely to interact with situation specific events differentially for each individual. These interactions may be referred to as aptitude-treatment-interactions (Cronbach & Snow, 1977; Tobias, 1989a, Snow, 1992). It is clear that measures of central tendency may overlook these individual differences and hence mask the effect of particular events (such as training programs) on individuals with specific attributes.

What are the implications of the different attitudinal and behavioural reactions (which we may term aptitudes) to new technology, especially in terms of the computer skills training of adult users in university settings? Rosen and Weil (1996) strongly argue that, for a number of reasons, the different psychological makeup of the potential user must be taken into account when designing computer training. For example, there are differences in the coping styles used for dealing with problems between the three user types discussed earlier: A problem-solving coping style is preferred by low anxious computer users who are probably computer proficient to a large extent; a support seeking coping style for those initially reluctant to learn the technology who may have some computer experience; and an avoidance style for those who are strongly resistant to computer use and probably have little if any prior experience. In terms of appropriate instructional design for computer training courses which contain a mix of such coping styles and experience levels, it would seem that for each type of computer user, a cooperative task structure within training would be beneficial in that it would provide both an emotionally and a socially supportive peer environment for learning. Undoubtedly, there is also a greater likelihood of humour with its anxiety alleviating benefits erupting spontaneously in cooperative settings than in traditional delivery modes of instruction, a bonus well supported in the research literature (Rosen & Weil, 1996). The further gaining of metacognitive, problem-solving, and anxiety reducing strategies through training in self-monitoring of learning (asking oneself and one's peers higher order questions, and collaboratively answering and explaining them) is possible within a cooperative, self-regulated training approach such as was designed and experimentally evaluated in the aptitude-treatment-interaction studies reported in Chapters Seven and Eight of this Dissertation.
The research of Rosen and Weil (1996) identifies three student aptitudes which may impact on successful teaching of technological skills to inexperienced computer users who are computer anxious. These are outlined below:

- Those who are hesitant users of computers need motivation and a clear purpose for using the technology before they will want to learn to do so. This can be achieved by personalising the content of the course in some way - by making it relevant to their perceived needs. Given the reality of university computer training courses, however, such personalisation is not likely. The motivation typically comes from the outside in recognition of the need to graduate computer literate.

- Those who avoid learning to use computers need to be reassured that potential problems have been anticipated so that any "crashes" will not be taken personally by these highly anxious (and forewarned) users. Once again, this is rarely possible in tertiary educational settings.

- Those who eagerly adopt computers and may already have some proficiency may intimidate the others by their style, and need to be "educated" to be sensitive to the fears and hesitations of the others. As such they can make a good addition to a training team or a good 'buddy' for another co-worker" (Rosen & Weil, 1996, p.21). Cooperative learning groups which are heterogeneous in terms of computer experience and associated levels of anxiety can provide opportunities for peer tutoring with mutual benefits for both tutors and tutees when elaborated explanations of concepts and skills are given (Dansereau, 1985; Webb & Farivar, 1994).

In the aptitude-treatment-interaction study referred to earlier, the mix of user types defined by Rosen and Weil was assumed to exist within each group of undergraduate students. However, the luxury of adapting training styles to accommodate the three different user types within an existing, graded, university computer skills course was not afforded the present researcher, where it might have been in a business setting, for example. Nonetheless, the intervention designed to alleviate anxiety would incorporate some aspects of Rosen and Weil's suggestions: For the hesitant users, the relevance of the computing skills to be learned was provided by the tools software applications to some extent, especially the wordprocessing package which had to be used to complete two assessment tasks. Those who resisted using computers because they were anxious would have computing problems dealt with in the context of problem-solving and mutual helping provided by the structured cooperative learning environment, as well as by the
metacognitive strategy training in the use of generic question stems to monitor their learning. In addition, the metacognitive training in self-questioning would enhance a sense of control leading to self-efficacy in computing. Finally, those experienced, eager computer users would be trained to be interdependent through reciprocal peer-questioning and to provide help within their allocated cooperative group.

**The Instructor is a Critical Variable in Anxiety Alleviation**

Although seemingly obvious, it bears saying that "The trainer is the key ingredient in the training process" (Rosen & Weil, 1996, p. 24). In the case of the aptitude-treatment-interaction studies conducted by the present researcher (see Chapters Seven and Eight) to determine the efficacy of alternative instructional methods for computer skills' training, an important factor was the instructor herself, a calm person (certainly not a "Gee whizz, look at what this machine can do!" type) who was patient and with each of the user types in her groups, experienced or not, anxious or not. Despite her considerable expertise, this instructor communicated in relatively jargon-free language (as much as is possible with some of the software that had to be taught, namely, DBase, Lotus 123; WordPerfect, not to mention the IBM operating system, DOS).

**Interventions to Reduce Computer Anxiety**

According to Covington (1992), the wide range of interventions designed to reduce anxiety in achievement settings (comparable to computer training) have been marked by only limited success. For many studies "the magnitude of improved scholastic performance is marginal in practical terms, small enough, in fact, that sometimes the results of a number of studies must be aggregated to establish a reliable, overall trend (Hembree, 1988)" (p. 123). Emotionally-based therapies such as relaxation training and systematic desensitisation (Wolpe, 1973), for example, to reduce excessive emotional arousal (relieving feelings of stress) have little effect on test performance, except for overstrivers, in which case it may actually reduce achievement by removing the fear that motivates them.

Cognitively-based approaches, on the other hand, attempt to reduce worry cognitions which interfere with performance. One form is rational-emotive therapy (Ellis, 1979) in which the therapist helps the individual to identify and refute irrational or inappropriate beliefs that interfere with performance ("Everyone else but me knows how to do this"; "I'm going to break the computer if I press the wrong key!"). Rosen, Sears and Weil (1987), for example, adapted this individualised approach to the treatment of computer phobia. Using a thought-stopping/covert assertion approach (Rimm & Masters, 1979), highly computer anxious students were
successfully trained by a therapist in the process of identifying internalised negative self-statements and substituting them with positive, motivating self-statements. Another cognitive approach which has shown positive effects on achievement is the direct training of anxious individuals in how to prepare for tests (study) as well as in test-taking skills (Kalechstein, Hocevar, & Kalechstein, 1988).

In the perspective of the present author, it is the social-cognitive approach (Bandura 1986, 1988, 1993), however, that offers the most hope for effecting changes in the learning of behaviours, cognitions and emotions in an educational setting where groups of learners are involved in a potentially stressful computer training procedure. The reasons for this assertion are outlined below.

**Coping Skills, Metacognitive Strategy Training and Self-Regulation from a Social-Cognitive Perspective**

In relation to anxiety management, research has shown that enhancement of coping skills is an effective social-cognitive strategy (Michelson & Ascher, 1987). In an educational context, self-regulated learners have been shown to have a high sense of efficacy in their capabilities which influences the goals they set for themselves and their confidence in fulfilling these challenges.

Research has shown that self-regulation involves skills which can be learned, and that students can develop the will or motivation to be self-regulated by realizing that they are responsible and capable of their self-development and self-determination (McCombs & Marzano, 1990). This awareness of the personal agency for learning is gained through the processes of metacognition (awareness of one's own thinking processes) and produces in the individual a sense of self-efficacy which enhances the experience of competency. As Borkowski and Muthukrishna (1992) argue, the individual’s beliefs about their self-efficacy develop as their proficiency with metacognitive strategy use becomes more refined, and attributions for successful or unsuccessful learning are increasingly made to personal effort.

Previous research in the areas of self-regulated and cooperative learning has demonstrated the power of these approaches in reducing anxiety about mastery (Boekaerts, 1995; Mealey & Host, 1992), raising self-esteem (Johnson & Johnson, 1994), and enhancing achievement (Pajares, 1995; Qin, Johnson & Johnson, 1995; Slavin, 1994; Stevens & Slavin, 1995). Cooperative learning structures, in particular, help create a non-threatening learning environment which reduces anxiety and promotes risk-taking (Waters, 1992). Both of these educational philosophies, namely self-regulated and cooperative learning, therefore, were incorporated into the social-cognitive intervention that formed the experimental segment of the present research and which is discussed below.
It is from Bandura's theory of self-efficacy and its relationship to anxiety that the present author has derived insights into what might be effective interventions in computer training settings where individuals may be fearful about computer use. In essence, Bandura (1997, p. 236) maintains that "in activities posing threats, anxiety and impaired performances are effects of a low sense of coping efficacy, rather than anxiety causing impaired performances." In this context, a study of teaching approaches and their effects on computer anxiety and student achievement in a semester-long computer course was designed (see Chapters Seven and Eight). This included strategies to develop students' self-efficacy and sense of control through training in self-regulatory metacognitive behaviours such as planning, monitoring, and modifying their own learning. Training in the use of generic question stems and reciprocal peer-questioning (King, 1991, 1992, 1993, 1994; Rosenshine, Meister & Chapman, 1996) included in the study are strategies which can enhance self-efficacy perceptions by developing a sense of control over one's learning. Another is the use of cooperative learning task structures which provide social support from peers during learning, and the opportunity to learn from, or act as, models of efficacious behaviour. Both of these strategies were incorporated into the teaching/learning approach received by the experimental group in the aforementioned study. Such an intervention was designed to build a strong sense of coping efficacy through the development of self-guidance in learning and generalisable self-regulatory skills for managing the acquisition of new computing skills while recognising the benefits of social assistance in such (Bandura, 1997).

**Metacognitive Strategy Training in Anxiety Management**

The rationale for incorporating metacognitive training in the use of generic question stems was derived from research into clinical anxiety as much as educational research. As Michelson and Ascher (1987) point out in their extensive review of research into the cognitive-behavioural assessment and treatment of anxiety and stress disorders, merely attempting to change cognitive products of anxiety such as negative thoughts, self-doubts, or self-statements is not likely to be as efficacious as working on knowledge structures and cognitive processes. This is because the former places little metacognitive demand on the individual and involves more "surface" than "deep-structural" shifts (Michelson & Ascher, 1987, pp. 19-20) in cognitions, whereas altering cognitive processes requires a higher level of metacognitive demand which has been shown to have powerful effects on complex behaviours.
Self-Regulated Learning

In his overview on self-regulated learning and achievement, Zimmerman (1990, p.4-6) defines self-regulated learners as "metacognitively, motivationally, and behaviourally active participants in their own learning ..... In terms of motivational processes, these learners report high self-efficacy, self-attributions, and intrinsic task interest." One of the objectives of the present research was to develop an instructional approach for use in computer training settings which would help to foster in students a sense of personal agency for learning which would be reinforced by feedback of the effectiveness of their learning (Zimmerman, 1995). In this context, the important influence of affective variables on self-regulated learning has been pointed out by Boekaerts (1995). From this perspective, self-regulation must involve the control of negative emotions that emerge during the learning process such as anxiety, which may be expressed as negative self-referenced cognitions and self-talk, as much as the regulation of cognitive and metacognitive processes. In the opinion of the present author, this control can emerge from the "emotional scaffolding" (Boekaerts, 1995, p.199) provided by peers in a cooperative learning group. Metacognitive strategy training guides the learning process and fosters the development of a sense of competence; working collaboratively to help and explain processes to others can help individuals learn how to interpret increased arousal and how to control stress and emotions, according to Boekaert (1995). This theoretical stance was important in the design of the aptitude-treatment-interaction studies conducted by the present author.

A more elaborated discussion of the rationale for the use of metacognitive strategy training within a cooperative learning setting as a means of developing self-regulatory behaviour and sense of self-efficacy about learning computer skills is found in Chapter Seven.

Rationale for Use of the Aptitude-Treatment-Interaction (ATI) Paradigm in Anxiety Research

I have described, earlier in this chapter, the potential importance of relevant student aptitudes when considering the efficacy of alternative computer training programs for individuals. As Tobias (1989a, p.213) comments: "The adaptation of instruction to student characteristics is a much sought after goal among educators". Typically, aptitude-treatment-interaction (ATI) research methodology is adopted in order to determine whether the effects of different instructional methods are influenced by the individual characteristics of the learner (Borg & Gall, 1989; Snow,
1989). In the present Dissertation, the aim is to examine aptitude-treatment-interaction effects to investigate the relationships between levels of student computing anxiety and alternative instructional methods. The primary foci of the intervention were to determine the educational significance of any interactions found between level of anxiety and instructional method, and to identify which treatment was optimal for a given level of student anxiety. An ATI design was considered most appropriate as it allows for a more complex analysis of the effects of instructional methods than would be possible by just comparing treatment groups (Borg & Gall, 1989). In relation to anxiety, it has been shown that students differ in the extent to which they benefit from clearly structured instruction, depending on their level of anxiety or defensiveness (Cronbach & Snow, 1977): For those with little anxiety, "treatments that look to the learner himself to apply a good deal of the structure and the specification of the task" (p.469) are optimal, whereas it is the converse for those who are anxious (Wigfield & Eccles, 1989). Generalisations about what is the "best" method of teaching computing skills, therefore, are ill-advised. In the ATI research conducted by the present researcher, the focus was on the interaction between the different instructional approaches and the different levels of learner’s anxiety. In this context the following research question might be asked: would a student with initially high anxiety and who expressed negative self-referenced cognitions do better at learning computing, and experience lowered anxiety and higher positive cognitions, from the direct instruction or the cooperative, self-regulated instructional approach? Similarly, what would the impact of the different instructional approaches be on a student with initially low anxiety and positive cognitions?

At this point, it is important to acknowledge and discuss, briefly, some of the problems found in ATI research. In particular, Tobias (1989a) points out that while "interesting and theoretically meaningful interactions" (p. 218) may be found, it is often difficult to replicate findings and to extend ATI research. One of the reasons that he cites for this deficiency is the mistaken assumption in ATI research that different instructional methods automatically elicit student use of different "macroprocesses" (cognitive processes under student volitional control, i.e., learning strategies). On the basis of his own extensive ATI research, he strongly advises that "researchers should not assume student use of cognitive processes, no matter how clearly these appear to be required or stimulated by the instructional method. Instead, some students should be trained or at least prompted to use the cognitive processes expected to be invoked by instructional methods, whereas such training should be omitted for others" (Tobias, 1989a, p. 220).
Another approach to the study of “aptitudes” is that of the aptitude process approach which describes student individual differences in terms of the different cognitive processes that comprise them (Peterson, 1988). Using this approach, the present researcher hypothesized that training in the use of metacognitive strategies would enhance the performance of all students, and would raise the perceptions of control and self-efficacy of those with initially low levels. Anxiety would be perceived as heightened arousal by such individuals and become self-monitored as “emotion control” in the developing process of self-regulated learning (Boekaerts, 1995).

Research Questions

To this point I have discussed theoretical perspectives on anxiety, approaches to measurement of computer anxiety and their limitations, the relationship of student aptitudes including anxiety to achievement in training settings. I have also examined the potential strengths of social-cognitive theory as a framework for alleviating anxiety while maximizing achievement in educational settings. From this literature review, I have derived the following research questions:

- Does computer anxiety exist in an undergraduate student population?
- If so, what are the correlates of computer anxiety for this group?
- Can computer anxiety be measured validly and reliably?
- Is computer anxiety affected by the instructional approach used in computer training?
- How does a training program based on social-cognitive theory interact with student aptitudes?

To this end a series of studies was designed to address these questions. An outline of the methodology of these studies is provided in Chapter Two.
CHAPTER TWO

Methodology

This Doctoral Dissertation consists of a series of seven integrated quasi-experimental, correlational and qualitative studies. In this Methodology chapter, an overview is provided of the following for each of the studies: summary of the project, aims and research plan, participants, measures, procedures, and statistical analyses. Subsequent chapters in the Dissertation will elaborate further on each study. Table 2.1 provides a conceptual outline of the sequence of studies.

Table 2.1
Outline of Sequence of Studies

| Study 1: Student teachers, computer anxiety and computer experience: A pilot study | (Chapter Three) |
| Study 2: Instrument design and validation | (Chapter Four) |
| Study 3: Computer anxiety among university students: Differences related to faculty, sex, ownership of personal computers, and computing experience | (Chapter Five) |
| Study 4: Computer anxiety among university students: Faculty differences in training courses | (Chapter Six) |
| Study 5: Effects of metacognitive strategy training within a cooperative group learning context on computer achievement, anxiety and cognitions: An aptitude-treatment-interaction study | (Chapter Seven A) |
| Study 6: A qualitative examination of the comparative effects of two methods of computer instruction on computer achievement, anxiety and cognitions | (Chapter Seven B) |
| Study 7: Effects of metacognitive strategy training within a cooperative group learning context on computer achievement, anxiety and cognitions revisited: An aptitude-treatment-interaction study | (Chapter Eight) |
Summary, Aims and Research Plan of Each Study

The following section presents an outline of the studies that were designed to attempt to answer the research questions posed at the end of Chapter One. The first of these was a pilot study conducted to investigate the existence of computer anxiety among a small sample of undergraduate students (Faculty of Education), as well as the range of possible computer anxiety measurement instruments available in the literature for use in the study. Furthermore, the vexed question of the role of increased computer experience on anxiety was explored.

On the basis of the evidence found in relation to potential correlates of computer anxiety, and the many questions that were raised about the methodological rigour of existing instruments, insights were gained into future research directions. The first of these was the need for an instrument that was founded on a sound theoretical base and that was statistically valid and reliable. This was the focus of the second study - design of the Computer Anxiety and Learning Measure (CALM). The second concern that emerged from the pilot study was the generalisability of computer anxiety across a number of faculties. This concern motivated both the third study, an investigation of the anxiety levels of students from four different faculties and the demographics variables related to these, and the fourth study which examined the ways in which computer training courses operated in these faculties.

The notion that the type of instructional approach used in computer training might have a bearing on student anxiety emerged from studies one, three and four: a number of students remained anxious after a semester-long computer training course in the pilot study; and studies three and four clearly showed that computer anxiety was present in each of the four faculties (Education, Business and Technology, Arts and Social Sciences and Health) to differing degrees. Study five, therefore, was designed to examine, more closely, the effects of a specific (unstructured) approach to training on computer anxiety within one faculty (Education). It also provided an opportunity to use the CALM instrument as a measurement tool. This investigation once again demonstrated that computer experience alone was not necessarily going to alleviate anxiety for the inexperienced, highly anxious student, nor to enhance their perceptions of control and self-efficacy in computing situations.

The questions of appropriate instructional approaches for different levels of anxiety and positive cognitions, and the interaction of these aptitudes and achievement remained to be answered through aptitude-treatment-interactions, the basis of the sixth study. An intervention in the form of an instructional approach aimed at both enhancing perceptions of control in learning environments and reducing anxiety was planned and contrasted in its effectiveness with a traditional
computer training approach. In the design of this study, while it was anticipated that the quantitative findings from the analyses of aptitude-treatment-interaction would provide important evidence of the effects of the treatment on anxiety, cognitions and achievement, it was also expected that qualitative data would add depth to these findings. To this end, study seven was designed to use qualitative data analysis methodology to explore, in greater depth and over a period of time, a range of student aptitudes and responses to two instructional approaches to computer training. Based on the combined results of both Studies 5 and 6, the author planned a final study which aimed to replicate the design of Study 5 to a large extent so that there was comparability of findings, but which carefully redesigned and strengthened the intervention.

**Study 1: Student Teachers, Computer Anxiety and Computer Experience: A Pilot Study (Chapter Three)**

**Summary of Project**

Recent research has demonstrated the debilitating effect of computer anxiety on achievement in computer related learning. As controversy exists over the merits of increasing experience with computers in order to reduce computer anxiety, the effects of increased computing experience on computer anxiety were assessed for students enrolled in a university teacher education course. In addition, other hypothesised correlates of computer anxiety were studied, viz., age, sex, school background, and computer competence.

**Aims and Research Plan**

The aims of the research were:

1. To obtain demographic data on the following: sex, age, ownership of PC, ethnic background, intentions to purchase PC, use of computers and computerised technology, attendance at single sex or coed high school, and self ranking of computer competence.
2. To measure and compare levels of anxiety among students completing and not completing computer training at the beginning and end of a semester.
3. To relate levels of computer anxiety to sex, age, ownership of PC, attendance at single sex or coed high school, and self ranking of computer competence.
4. To examine the effects of the computer training on levels of computer anxiety for the students completing the computing course.
A control group, not undergoing computer training, was used for comparison purposes. All students were administered a computer anxiety rating scale (Computer Anxiety Rating Scale CARS) in the second week of their educational psychology course during the lecture time. The instrument was readministered during the second last week of their fourteen week course. Pretest and posttest forms were matched for each subject.

**Study 2: Instrument Design and Validation**
*(Chapter Four)*

**Summary of Project**

Preliminary work in this area (Study 1) revealed considerable levels of computer anxiety among first year teacher training students. However, the instrumentation used in the earlier work was considered inadequate for exploring the full range and depth of anxiety that might characterise up to 15% of tertiary students confronted with mastering the new technologies. This project was designed, therefore, to further develop and validate through exploratory and confirmatory factor analyses, an instrument for measuring levels of computer anxiety among beginning learners. The project was also designed with the purpose of identifying students of computing in need of support.

**Aims and Research Plan**

The aims of the research were:

1. The development of a theoretical model of anxiety as it relates to learning computing skills.
2. The development and validation of the Computer Anxiety and Learning Measure (CALM) based on the theoretical model to measure and monitor levels of anxiety among students of computing.

**Instrument construction.** Based on the theoretical framework developed, a series of constructs were derived around which items were generated. Face validity was established.
**Instrument validation.** In order to examine the psychometric properties of the instrument, a cross-sectional sample of first year University students was surveyed (n= 794). Among the analyses carried out on data derived from this sample were the following:

1. Frequencies, crosstabulations, and descriptive statistics to "clean up" the data and to view preliminary trends.
2. Exploratory and confirmatory factor analyses to verify and/or derive scales; to identify inappropriate or weak items, and to identify the most effective items.
3. Reliability tests on derived scales.
4. Factorial analysis of invariance of the CALM scales across four faculties.

Data were analysed using the SPSSx package on the mainframe university computer.

**Study 3: Computer Anxiety among University Students: Differences Related to Faculty, Sex, Ownership of Personal Computers, and Computing Experience (Chapter Five)**

**Summary of Project**

In order to obtain baseline data on computer anxiety among university students, and to examine whether there were differences related to faculty, sex, ownership of computer, and computing experience, seven hundred and ninety four first year university students were administered the Computer Anxiety and Learning Measure (CALM) at the commencement of their first semester. Demographic details and anxiety levels on the four scales of CALM were collected and descriptive statistics computed. Crosstabulations between computer ownership, computer experience, and student sex and faculty were performed. In addition, univariate analyses (ANOVAS) were performed for each of the scales in order to determine differences between groups on the range of demographic variables considered.

**Aims and Research Plan**

The aims of the research were:

1. To assess initial levels of computer anxiety among a sample (n= 794) of first year university students drawn from the faculties of Education, Arts and Social
Sciences, Business and Technology, and Health at the beginning of their respective computing courses.

2. To investigate similarities and differences among levels of anxiety by faculty, sex, ownership of personal computers, and computing experience.

3. To investigate a range of correlates of computer anxiety for these students.

4. To consider implications for computer training and follow-up research.

During the second week of semester all students were surveyed using the CALM which was administered by the author and two assistants. The administration of the survey was standardised, and an explanation of the purpose of the research given. All students completed informed consent forms. Data were analysed using the SPSSx package on the mainframe university computer.

Study 4: Computer Anxiety Among University Students: Faculty Differences in Training (Chapter Six)

Summary of Project

Increasingly, universities are introducing compulsory computing components into courses that have traditionally not required students to develop skills in the use of computers. It could be argued that with the implementation of such policies, universities are obliged to monitor the initial levels of computer anxiety of all students, evaluate teaching techniques and their potential for alleviating or exacerbating computer anxiety, and to develop and implement teaching and treatment programs designed to minimize stress and to enhance the achievement of students who can no longer avoid the technology.

This study examined the alternative modes of delivery of computing skills training across all faculties at the University of Western Sydney, Macarthur, in the context of the University's non-credit competency requirements.

Aims and Research Plan

The aims of the research were:

1. To interview "key players" in the implementation of the university's computer literacy policy.

2. To describe and evaluate a representative sample of approaches across the four faculties.
Each individual that was interviewed was responsible for designing and teaching their Faculty’s computing competency course. These interviews were semi-structured and elicited information related to: Guiding principles and philosophy (e.g., mainstream or purpose specific courses); mode of teaching and variety of techniques used (e.g., direct instruction, discovery learning; collaborative learning; independent study, mastery learning); materials used; perceptions of student difficulties and anxieties while learning computing and ways of dealing with this; and attitudes and difficulties of teaching staff. Interviews were conducted in each academic’s office and were tape recorded. The interview transcripts were content analysed and used to develop frameworks within which to evaluate current practices in operation.

Study 5: Effects of Metacognitive Strategy Training within a Cooperative Group Learning Context on Computer Achievement, Anxiety and Cognitions: An Aptitude-Treatment-Interaction Study (Chapter Seven Part A)

Summary of Project

This project was designed to examine the comparative effects of metacognitive strategy training within a cooperative, self-regulated learning context and direct instruction on student acquisition of computing competencies. It also examined the comparative efficacy of these modes of teaching on the reduction of computer anxiety and enhancement of positive cognitions among students.

Aims and Research Plan

The aims of the research were:
1. To conduct quasi-experimental research using two equivalent classes in the subject Introduction to Computers. One class was taught using direct instruction. The other class was taught using a combination of direct instruction plus cooperative, self-regulated learning in which students were trained in the use of higher-order self-questioning.
2. To measure the direction and size of any changes in initial cognitions, anxiety scores and levels of student achievement at the conclusion of the computer training course.
3. To relate changes in initial cognitions, anxiety and achievement scores to instructional method by examining aptitude (levels of anxiety and cognitions) - treatment (instructional approach) - interaction effects.

**Hypotheses:**

The following hypotheses guided the research:

1. That positive cognitions would increase for students with initially low positive cognitions.
2. That computer anxiety would decline for students who were initially highly anxious.
3. That support for hypotheses 1 & 2 would vary with the nature of the instructional program: positive cognitions would increase and computer anxiety would decrease in the cooperative group.
4. That there would be a significant difference in achievement scores between students taught using direct instruction and those whose skills were developed through metacognitive strategy training within a cooperative learning context: achievement would be greater in the cooperative group.

Two equivalent groups of students completing compulsory computer coursework taught by the same instructor were given alternative modes of delivery of a course entitled Introduction to Computer: traditional teacher-led direct instruction and a combination of direct instruction plus cooperative, self-regulated learning in which students were trained in self-questioning. The computing content covered in each class was equivalent as were the assessment modes. Pretest/posttest questionnaire instruments were administered to elicit information regarding base levels of computing competence (using the Computer Competency Checklist), and positive cognitions and positive cognitions and anxiety levels (using the CALM). High and low anxious students, and those with high and low levels of positive cognitions were identified.
Study 6: A Qualitative Examination of the Comparative Effects of Two Methods of Computer Instruction on Computer Achievement, Anxiety and Cognitions (Chapter Seven Part B)

Summary of Project

In order to triangulate results and give verisimilitude to the quantitative study described in Study 5, an in-depth qualitative study was conducted with a selection of students in each group and with their instructor. Particular areas of interest were instructor and student perceptions of advantages and disadvantages of each instructional method, and the processes involved in gaining metacognitive and self-regulatory skills. The researcher also obtained information regarding these students' perceptions of the computer competency training they received, particularly in the context of anxiety alleviation/exacerbation and gaining of self-efficacy (positive cognitions) and self-regulated learning skills.

Aims and Research Plan

The aims of the research were:
1. To describe and evaluate the instructional approaches in operation using interviews with the instructor as well analysis of instructor diaries.
2. To select four high anxious students (two from each group) and four low anxious students (two from each group) for close study through case-work methodology using weekly interviews and analyses of student logbooks.

Interviews with the instructor were conducted by the author. All case-study interviews were conducted by a trained research assistant directly following their weekly tutorials for eleven weeks. The interviews were tape recorded and transcribed. These data were then analysed using the NUD.IST (Richards & Richards, 1994) statistical program (Non-Numerical Unstructured Data Indexing Searching and Theorizing) which provided a means of indexing and searching transcripts for meaningful patterns, and of confirming or rejecting a priori hypotheses.
Study 7: Effects of Metacognitive Strategy Training within a Cooperative Group Learning Context on Computer Achievement, Anxiety and Cognitions Revisited: An Aptitude-Treatment-Interaction Study (Chapter Eight)

Summary of Project

A number of methodological limitations were identified in Study 5. Study 7 was designed to rectify these limitations, thereby strengthening the intervention. In addition, the self-regulatory component was enhanced by requiring the intervention group to record their reflections on four questions related to difficulties experienced in the computing class each week. These were to be shared with members of their cooperative group in the following week.

Aims and Research plan

The aims of the research were:

1. To design a study to address methodological concerns in Study 5, namely, instructor effects; occurrence of spontaneous collaboration and helping behaviours in both groups; need for earlier and more extensive training in higher order self-questioning.

2. To conduct the redesigned quasi-experimental research using two equivalent classes in the subject Introduction to Computers taught by the same instructor as in Study 5 and using the same instructional approaches as previously.

3. To measure the direction and size of any changes in positive cognitions, anxiety scores and levels of student achievement at the conclusion of the computer training course.

4. To relate changes in positive cognitions, anxiety and achievement scores to instructional method by examining aptitude (levels of anxiety and positive cognitions) - treatment (instructional approach) - interaction effects.

Hypotheses

The same hypotheses as guided the research in Study 5 pertained to Study 7.

Two equivalent groups of students completing compulsory computer coursework, comparable to those in Study 5 and taught by the same instructor, were given alternative modes of delivery of a course entitled Introduction to Computers:
traditional teacher-led direct instruction and a combination of direct instruction plus cooperative, self-regulated learning in which students were trained in self-questioning. The computing content covered in each class was equivalent as were the assessment modes. Pretest/posttest questionnaire instruments were administered to elicit information regarding base levels of computing competence (using the Computer Competency Checklist), and positive cognitions and anxiety levels (using the CALM). High and low anxious students, and those with high and low levels of positive cognitions were identified.

Participants

The participants in all studies of this Doctoral dissertation were drawn from four faculties of the University of Western Sydney Macarthur. The University of Western Sydney Macarthur, which was established as a university in 1989, consists of two campuses (Bankstown and Campbelltown) which are set in the heart of the rapidly developing western region of Sydney. The population of this region, known as “Greater Western Sydney”, is drawn from a largely working to middle class socioeconomic background with many of the first year students the first in their family to undertake a university degree. At the time during which the research was conducted, both campuses shared the delivery of courses in Education, Health, and Arts and Social Sciences, while one campus also offered Business and Technology. All students involved in the research were at the beginning (second week) of their first year of full-time university studies.

In the following section, I give a brief outline of the samples chosen and a brief description of the participants in each study.

Study 1: Pilot Study

Participants in this study were 101 (m= 21, f= 80) first year education students training to be primary school teachers. The average age of these students was 19 years. Fifty-nine of the participants were school leavers, while forty-two had been one or more years out of school before commencing university. Thirty-five students had attended single sex high schools, twenty-five were classified as of ethnic background, and forty-three owned a personal computer. Sixty-five of the students rated themselves as beginners in using computers, while thirty-six considered themselves advanced users.
Study 2 and Study 3: Instrument Design and Validation, and Computer Anxiety among University Students

The participants consisted of seven hundred and ninety-four first year students from four faculties: Education, Health, Arts and Social Sciences, and Business and Technology. The distribution of the sample across the faculties was as follows: Faculty of Education, n= 165 (males= 28; females= 137); Faculty of Arts and Social Sciences, n= 268 (males= 69; females= 199); Faculty of Business and Technology, n= 282 (males= 175; females= 107); and the Faculty of Health, n= 79 (males= 16; females= 63). In all, therefore, there were 288 male students and 506 female students.

The average student age was twenty years with ninety per cent of the students aged twenty-five years old or less; the youngest students were seventeen years (n= 103), and the oldest 57 years (n= 1). Approximately seventy per cent of the sample came from an English speaking language background. The remaining thirty-one per cent of the students came from a wide range of language backgrounds (42 languages), with the most common being Chinese (n= 28), Greek (n= 27), Italian (n= 25), Spanish (n= 20), Arabic (n= 18), Vietnamese (n= 16), Croatian (n= 12) and Lebanese (n= 10).

170 males and 285 females went to co-educational schools, while 183 males and 98 females went to single-sex schools. A number of students moved between the two types of schools, and some respondents failed to indicate the type of school attended. Four hundred and forty-two respondents attended government schools, and 268 attended non-government schools. A small number moved between the two sectors of education.

Four hundred and six respondents entered the university on the basis of their Tertiary Entrance Rank (TER) score, 255 entered on the basis of a special entry test, while 102 entered on other criteria (such as overseas qualifications and mature-age entry). There were missing data for approximately 31 students.

Participation in the study was voluntary and all respondents completed informed consent forms.

Study 4: Computer Anxiety among University Students: Faculty Differences in Training

The four faculties from which the students in the previous study were taken (namely, Education, Health, Arts and Business and Technology) had different approaches to computer training programs for undergraduate students which reflected
the philosophies of those who designed them and the guiding principles of the particular faculty. Thus, at one extreme, the Faculty of Health had no policy, whatsoever, regarding computing skills, with students having to find means of gaining such skills in order to satisfy university competency requirements. While the Faculty of Education, on the other hand, did address the computing skills need, it adopted the philosophy of the computing subject convenor which was one of unstructured, collaborative student learning. In contrast to both of these faculties were the faculties of Arts and Social Sciences and Business and Technology, whose instructional approach was direct teaching of specific computing skills in a structured, expository manner.

In summary, the four faculties differed markedly in terms of whether the computer training program was one-semester long or year-long, whether it was elective or compulsory, or whether it existed at all. Moreover, the approach taken to learning and teaching varied between faculties.

**Study 5: Effects of Metacognitive Strategy Training within a Cooperative Group Learning Context on Computer Achievement, Anxiety and Cognitions: An Aptitude-Treatment-Interaction Study**

Two equivalent groups of students completing compulsory computer coursework in the subject Introduction to Computers were selected from the Faculty of Arts and Social Sciences (Group 1, n= 16, m= 10, f= 6) (Group 2, n= 15, m= 7, f= 8). The average age of the students was 20 years. Participation in the study was voluntary and all students completed an informed consent form.

**Study 6: A Qualitative Examination of the Comparative Effects of Two Methods of Computer Instruction on Computer Achievement, Anxiety and Cognitions**

The participants in this qualitative study were drawn from the two groups involved in the aptitude-treatment-interaction study. The selection of participants was as follows: Students who had the highest scores (above 3 out of 4 or 5, i.e., moderate to high anxiety) on most of the scales of the CALM were considered for selection as high anxious participants. Conversely, those who scored 2 or below were considered as low anxious participants. The four students in each of these groups with the highest and lowest scores (two of each) were invited to participate in the research following a brief explanation of their commitment. These students were recompensed for their time spent in interviews by the reimbursement of the cost of
the textbook required in their computing course, as well as a certificate which recognised their contribution to the research project, suitable for inclusion in their curriculum vitae.

**Study 7: Effects of Metacognitive Strategy Training within a Cooperative Group Learning Context on Computer Achievement, Anxiety and Cognitions Revisited: An Aptitude-Treatment-Interaction Study**

Two equivalent groups of students completing compulsory computer coursework in the subject Introduction to Computers were selected from the Faculty of Arts and Social Sciences (Group 1 n= 15, m= 6, f= 9) (Group 2 n= 15, m= 8, f= 7). The average age of the students was 22 years. Participation in the study was voluntary and all students completed an informed consent form.

**Measures**

To carry out the studies described in this Dissertation, a number of measures were used which are described in detail in the appropriate chapters. A brief description of each of the measures is given below:

- **The Computer Anxiety Rating Scale (CARS)**, designed by Rosen and Weil (1987a & b), was used in the pilot study to assess initial levels of student computer anxiety. This instrument measures cognitive aspects of general computer anxiety, as well as specific anxiety relating to use of computers in society, computer equipment, computers in the media and computer games.

- **The Computer Anxiety and Learning Measure (CALM)** was designed by the present author on the basis of an extensive literature review in collaboration with research and academic colleagues (McInerney, McInerney & Roche, 1994) in order to investigate four aspects of computer anxiety experienced by beginning learners: General anxiety about gaining initial computing skills; sense of control; computing self-concept; and state anxiety in computing situations.

- **The Computer Competency Checklist (CCC)** was designed by the computer instructor in the ATI studies in collaboration with the researcher, and took the form of a checklist of specific competencies which students ranked on a five-point scale from “not at all” to “very competent”, relative to their proficiency at the start of their course. The competencies related to the content of the training program which encompassed DOS, wordprocessing, database and spreadsheet applications.
The checklist was used at the conclusion of the course by students in both groups of the two studies as a self-assessment measure to predict their computing performance in the practical computing skills test.

◦ Computing Achievement Measures: These varied according to the study and consisted of assessment items that were indicators of computing performance as defined within the particular training program under study. Specific details are given within each study.

◦ Demographic Measures: Prior to the administration of the CARS and the CALM, demographic details of the participants were collected in relation to age, sex, ethnicity, type of school attended, PC ownership, and computer experience.

◦ Interview Schedules for the Qualitative Research: Structured interview questions were designed for use in the weekly case-study interviews in the ATI studies. The format of these remained consistent from week to week, however, additional questions were included to monitor student reactions to specific aspects of the computer training that they were experiencing at particular times during their course (e.g., groupwork or use of questioning as a learning tool).

◦ Instructor’s Diary: The instructor involved in the ATI studies kept a diary in which she recorded details of the weekly tutorials for each of the two groups (direct instruction and self-regulated, cooperative learning). In this, the learning content for the tutorial was defined and the ways in which the two groups approached the learning was described, along with details of problems that individuals experienced, or any positive outcomes that occurred.

◦ Student Logbooks: Students involved in the first ATI study kept logbooks in which they recorded reflections on their weekly computing tutorials. These were framed by a set of guiding questions regarding the learning content, any achievements or difficulties experienced, and the “action” to be taken in relation to mastering the latter.

Administration of the Study

As the studies described in this Dissertation were concerned with sensitive material related to students’ levels of anxiety in computing, and involved correlating anxiety levels with performance and achievement, ethical clearances were obtained through the Universities Human Research Ethics Committee. As part of this procedure, all participants were informed as to the nature of the study in which they were involved, and were asked to complete informed consent forms prior to the commencement of the study.
In all cases where survey data and interview data were collected, standardised procedures were adopted. Specifically, the administration of the survey included the reading out of a description of the purpose of the research and an explanation of how to complete the survey. This was conducted by the researcher, or by her assistant who was trained in the procedure. On all occasions, the classroom instructor was absent from the room during the administration of the surveys in order to minimise student inhibitions about disclosing concerns about learning computing skills.

Regular interviews were conducted with case-study individuals in each of the two groups in the first ATI study. These followed a semi-structured format and were led by a graduate research assistant with considerable experience in interview techniques. The interviewer was trained by the researcher in the use of the specific question schedule designed to be used in a standardised fashion for each interviewee each week. This interviewer was kept “blind” to the nature of the research (that is, that there was a quasi-experimental treatment being investigated in relation to computer anxiety), to the group from which the students came, and to their initial levels of anxiety.

In relation to the two aptitude-treatment-interaction studies, the present researcher met with the instructor (the same in both studies) on two occasions (two hours each) before the study began. During the first meeting, discussion centered on the nature of the lesson-based questions that the instructor would write in order to model the use of higher-order questioning, while in the second meeting, examples of actual questions were considered. In addition, a script for presenting the rationale for self-questioning to students was designed.

The two ATI studies were conducted in the following manner: A pretest/posttest questionnaire instrument, the Computer Competency Checklist (Lawson & McInerney, 1994), was administered to elicit information regarding base levels of computing competence in the areas to be taught, namely, DOS, wordprocessing (WordPerfect 5.1), database (DBase 4) and spreadsheet (Lotus 123) applications. This was used to determine the levels of perceived student self-efficacy with regard to these specific computing skills.

Levels of computer anxiety and positive cognitions were determined using the Computer Anxiety and Learning Measure - CALM (McInerney, McInerney, & Lawson, 1996; McInerney, McInerney, & Roche, 1994). Both the Computer Competency Checklist and the CALM were administered by the present researcher following an explanation of the purpose of the research (namely, to gather information on the attitudes of students undertaking computer training). This was done in the absence of the instructor with the assurance to students that the
information would not be available to her, nor would it impact on their assessment in any way.

Achievement data were also obtained at the end of the course. These consisted of two folios of student work in which specific activities related to the tutorial content were completed, a practical test on computing skills (DOS, wordprocessing, database and spreadsheet), and a research report.

Statistical Analyses

The data base from this research is very large. Data from all precoded quantitative survey forms were entered by a commercial data entry company (Adaptadata) and were uploaded onto the University's mainframe computer. Taped data from the qualitative interviews were professionally transcribed.

Statistical analyses used to examine the research questions for each study are described in detail in the relevant chapters. However, the following analytical plan (Table 2.2) outlines the particular procedures used and their purposes.
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<td>Study</td>
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<td>Descriptives</td>
<td>To establish equivalence of groups at pretest</td>
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<td>ANOVA</td>
<td>To examine potential achievement differences between groups at the end of the treatment</td>
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Notes
CARS: Computer Anxiety Rating Scale; CALM: Computer Anxiety and Learning Measure; CCC: Computer Competency Checklist; EFA: Exploratory Factor Analysis; CFA: Confirmatory Factor Analysis; NUD.IST: Non-numerical Unstructured Data Indexing Searching and Theorizing
CHAPTER THREE

Student Teachers, Computer Anxiety and Computer Experience: A Pilot Study

As discussed in Chapter One of this Dissertation, the relatively recent area of research into the psychological state of individuals who have negative affective and cognitive reactions to computers suffers from a lack of definition of its terms and theoretical underpinnings. Consequently, for those involved in computer training (where computer anxiety is frequently encountered), the practical value of many research findings in this area is questionable. One area of considerable controversy in the literature is that of the role of computer experience in alleviating anxiety. This variable was to be the focus of the present study, therefore. In addition, the research was to serve as a pilot study for the Dissertation in allowing me to explore the issue of measuring computer anxiety in an undergraduate student population, as well as to investigate a range of possible correlates of computer anxiety for such a population.

It is commonly argued that a major factor in computer anxiety is lack of familiarity with computers, and that with increased experience, anxiety should decrease (Heinssen, Glass & Knight, 1987; Howard & Smith, 1986; Loyd & Gressard, 1984). On the other hand, there are those who maintain that that for the computer anxious student, increased experience may exacerbate rather than alleviate computer anxiety, despite increased knowledge about computers (Mahmood & Medewitz, 1989; Weil, Rosen & Sears, 1987).

Increasingly, Australian government documents recommend that all school students should have access to and familiarity with computers among other technologies. It seems logical to argue that teachers themselves must be "comfortable" with this technology, both to facilitate their delivery of education and to assist students in gaining computer competence. The implications for teacher training programs, therefore, are that it is educationally unsound to allow potentially computer competent individuals to be limited by anxiety in their gaining of expertise and confidence.

While it is known that research into computing in Australian tertiary institutions has examined various student characteristics such as sex and computer experience, it appears that none has investigated student anxiety with regard to this technology. Furthermore, none has empirically tested the commonly held belief that increased computer experience will reduce anxiety. The present author, therefore, sought to examine the effects of "forced" computing experience such as compulsory computing courses required during teacher training, on the computer anxiety of first year teacher education students. This type of experience is distinct from voluntary computer interaction which would be predicted to cause little anxiety. The present research, thus, was to serve as a pilot study with four main objectives:
1. To assess initial levels of computer anxiety among a sample of beginning trainee teachers;
2. To investigate a range of correlates of computer anxiety for these trainees;
3. To measure the effects of compulsory computer interaction on the computer anxiety of these student teachers; and
4. To investigate the psychometric properties of the computer anxiety measure (CARS) for the Australian population under study with a view to designing a new instrument.

Method

Participants

Participants in the study were 101 (m= 21, f= 80) first year education students at a university in New South Wales. At the time of the study, this university required all undergraduate students to demonstrate computer competency at the completion of their respective courses. To fulfil this requirement, the Faculty of Education had introduced a compulsory subject in educational computing in its first year teacher education program. Although unrelated in content, the course was lodged within the Maths curriculum for lack of any other timetable location. Students were unaware of what subjects comprised the particular curriculum areas in each semester, thus the researcher was confident that they did not self-select to avoid either maths or computing. In the absence of any likely systematic factors in group formation, participants were considered to have been randomly allocated to groups. The treatment group consisted of those students (n= 46) who chose a timetable "package" that included the computing course, called Educational Computing, during the first semester. The comparison group consisted of the other students (n= 55) who selected a timetable which meant that the course would be done in the second semester. Fifty-nine of the participants were school leavers while forty-two had been one or more years out of school before commencing university. Thirty-five students had attended single-sex high schools, twenty-five were classified as of ethnic background, and forty-three owned a personal computer. Sixty-five of the students classified themselves as beginners in using computers (no computer experience or games only) while thirty-six classified themselves as advanced (experienced in word processing and other applications).

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Measures

The Computer Anxiety Rating Scale (CARS) (Rosen, Sears & Weil, 1987) was chosen as the instrument to evaluate levels of computer anxiety, as it was acknowledged in the literature at the time as a reliable measure. In this instrument, twenty statements reflect a variety of aspects and features of computer anxiety, including anxiety about the machines themselves, computer terminology, computer programming, computer applications, and consumer use of computers. Each statement was rated on a 5 point scale indicating how anxious the item expressed in the statement made the person feel "at this point in time" (1 = not at all, 2 = a little, 3 = a fair amount, 4 = much, and 5 = very much). Items comprising the scale are found in Table 3.1.

As well as the CARS, students were administered demographic questionnaires eliciting information on the following: sex, age, ethnic background, ownership of PC, intentions to purchase PC, use of computers and computerised technology, attendance at single-sex or coeducational high school, and self-ranking of computer competence. Zero-order correlations were computed between these demographic variables and the anxiety scales comprising the CARS.

Procedures

The compulsory computer course, Educational Computing, was of one hour duration per week for fourteen weeks. Coursework consisted of learning to use a keyboard ("Keycoach" touch typing tutor) and a word processing application ("PC Write") on IBM JX computers, and was presented as a series of workshops which included a short lecture or discussion and skill practice. Students worked individually at computer terminals. Skill development was assessed by a series of word processing exercises that were submitted for grading. In addition, students were required periodically to undertake self and peer assessments of competence. The overall grading in the course was either pass or fail. Extra support and assistance was available from the instructor for those who requested it. The purpose of the course was to develop a range of computing skills.

Both prior to, and at the completion of the Educational Computing course, students who elected to take the course in the first semester were surveyed using the CARS. A comparison group of students who were enrolled in the same educational psychology course, but not enrolled in the Educational Computing course were also surveyed. All students were administered the CARS during the second week of their educational psychology course during the lecture time. The instrument was readministered during the second last week of their fourteen week course. Pretest and posttest forms were matched for each participant. Students with either the pre or posttests missing were excluded from the sample (n= 40). There did not appear to be
any pattern in the missing data which would suggest that this procedure would affect the results of the study.

**Statistical Analyses**

Using findings from a range of cross-cultural studies employing the CARS instrument with university students, Rosen and Weil (1991, 1995) identified three clear factors: Interactive Computer Learning Anxiety, Consumer Technology Anxiety, and Observational Computer Learning Anxiety. As previous research using the CARS has been based on non-Australian samples, and cultural differences in responses to computers have been previously clearly identified (Rosen & Weil, 1995), preliminary exploratory factor analyses (principal axis with varimax rotation) were conducted in the present study to examine the structure and subscales of the instrument for the Australian sample.

**Results**

**Factor Analyses**

There was some similarity between the factor structure found in this study and that of a number of groups drawn from the United States, Germany, Japan and Hungary, with the Interactive Computer Learning Anxiety and Observational Computer Learning Anxiety having the greatest consistency. The United States structure is presented in Table 3.1 and is compared to the Australian structure identified among the teacher trainees studied by the author.

The exploratory factor analyses showed four clear factors accounting for 49.8% of the variance. After rotation, the factors were named according to the major items defining the factors. Learning about Computers Anxiety (LERN), Computer Equipment Anxiety (EQP), Computer Message Anxiety (MESS), and Observing Computers Anxiety (OB). Learning about Computers Anxiety represents a dimension that relates to learning how to use computers, for example, taking a class in computers, reading a computer manual, or erasing and deleting files. Computer Equipment Anxiety measures anxiety with regard to computerised equipment such as automated bank teller machines or programmable microwave ovens. Computer Message Anxiety refers to items which measure the anxiety experienced when it is necessary to demonstrate proficiency in computer skills. Observing Computers Anxiety deals with observing from a distance others using computers. Factor loadings for the scales are presented in Table 3.1. In a small number of cases, items loaded on two factors (> .3). Where this occurred, items were included in the scale
for which they had the highest factor loading and face validity. Items were included in only one scale. The first factor, Learning about Computers Anxiety, is very similar to Interactive Computer Learning Anxiety, capturing eight items of the eleven comprising the American scale. The remaining three items from this scale, together with two others, constitute the Computer Message Anxiety scale. The second two factors from the U.S. sample (Consumer Technology Anxiety and Observational Computer Learning Anxiety) broke into three with the Australian sample, computer message anxiety, Observing Computers Anxiety and Computer Equipment Anxiety. Mean scores were derived for each of the participants on the items comprising each scale. Coefficient alpha estimates of reliability were computed for the scales. The highest reliability estimate was for the LERN factor (r = .79) with the other factors in the following order: MESS (r = .65), OB (r = .63), and EQP (r = .75). These reliability estimates are adequate for the purposes of the pilot study described in this chapter.
### Table 3.1

**Rotated Factor Loadings for Items Defining the CARS Scales (n= 101)**

<table>
<thead>
<tr>
<th>Learning about Computers Anxiety (LERN)</th>
<th>Factor Loadings</th>
<th>Com USA Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 Reading a computer manual</td>
<td>74 13 12 22</td>
<td>63 a^1</td>
</tr>
<tr>
<td>11 Learning to write a computer program</td>
<td>60 02 34 19</td>
<td>52 a^1</td>
</tr>
<tr>
<td>1 Thinking about taking a course in a computer language</td>
<td>60 17 33 01</td>
<td>50 a^1</td>
</tr>
<tr>
<td>16 Learning computer terminology</td>
<td>59 09 12 51</td>
<td>63 a^1</td>
</tr>
<tr>
<td>20 Learning how a computer works</td>
<td>56 01 21 53</td>
<td>63 a^1</td>
</tr>
<tr>
<td>12 Thinking about buying a personal computer</td>
<td>54 02 32 13</td>
<td>41 b^1</td>
</tr>
<tr>
<td>13 Erasing or deleting material from a computer file</td>
<td>49 10 44 09</td>
<td>45 a^1</td>
</tr>
<tr>
<td>14 Taking a class about the use of computers</td>
<td>46 22 29 24</td>
<td>41 a^1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Computer Equipment Anxiety (EQP)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8 Using automated bank teller machines</td>
<td>00 80 03 15</td>
<td>66 b^3</td>
</tr>
<tr>
<td>19 Programming a microwave oven</td>
<td>09 72 03 11</td>
<td>54 a^2</td>
</tr>
<tr>
<td>15 Re-setting a digital clock after the electricity has been off</td>
<td>06 67 03 23</td>
<td>50 a^2</td>
</tr>
<tr>
<td>4 Sitting in front of a home computer</td>
<td>29 60 23 21</td>
<td>55 a^3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Computer Message Anxiety (MESS)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Getting &quot;error messages&quot; from the computer</td>
<td>36 14 78 10</td>
<td>76 a^1</td>
</tr>
<tr>
<td>3 Applying for a job that requires some computer training</td>
<td>35 04 60 10</td>
<td>49 b^1</td>
</tr>
<tr>
<td>10 Being unable to receive info because the computer down</td>
<td>07 01 53 10</td>
<td>29 b^1</td>
</tr>
<tr>
<td>2 Taking a test using a computer scoring sheet</td>
<td>21 02 45 10</td>
<td>26 b^2</td>
</tr>
<tr>
<td>6 Looking at computer printout</td>
<td>14 13 37 35</td>
<td>29 a^3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Observing Computers Anxiety (OB)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>18 Watching someone work on a personal computer</td>
<td>18 28 01 63</td>
<td>50 b^3</td>
</tr>
<tr>
<td>5 Watching a movie about an intelligent computer</td>
<td>09 33 13 61</td>
<td>51 a^1</td>
</tr>
<tr>
<td>9 Visiting a computer centre</td>
<td>25 32 14 48</td>
<td>41 a^3</td>
</tr>
</tbody>
</table>

**Note.**

Factor loadings are written without decimal points. Negative loadings are underlined. Com = Communalities. Where items load on two factors (loading > .3) they are included in the scale for which they have the highest loading and greatest face validity. Items loading on the U.S.A. factors are indicated: ¹Interactive Computer Learning Anxiety; ²Consumer Technology Anxiety; ³Observational Computer Learning Anxiety.

a. Indicates that the item had a loading of .5 or greater; b. Indicates that the item had a loading of .30 -.49.

---

**Levels of Computer Anxiety**

In order to estimate initial levels of anxiety at the item level, percentages of responses to each of the twenty items comprising the CARS, as well as their means and standard deviations, were calculated. For each item, students were required to indicate on a five point scale, how much a particular situation made them feel anxious. Table 3.2 indicates the number of students responding to each point on the five point scale across the twenty items at the pretest.
Table 3.2

Percentage of Responses on Computer Anxiety Rating Scale Items for Pretest Full Group (n= 101)

<table>
<thead>
<tr>
<th>Item</th>
<th>not at all (1)</th>
<th>little (2)</th>
<th>fair amount (3)</th>
<th>much (4)</th>
<th>very much (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning about Computers Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading a computer manual</td>
<td>31</td>
<td>32</td>
<td>23</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Learning to write a computer program</td>
<td>21</td>
<td>30</td>
<td>24</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>Thinking about course in computing lang.</td>
<td>22</td>
<td>54</td>
<td>14</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Learning about computer terminology</td>
<td>36</td>
<td>35</td>
<td>21</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Learning how a computer works</td>
<td>42</td>
<td>38</td>
<td>13</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Thinking about buying a PC</td>
<td>45</td>
<td>28</td>
<td>13</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Erasing or deleting material</td>
<td>28</td>
<td>33</td>
<td>19</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Taking a class about the use of computers</td>
<td>35</td>
<td>33</td>
<td>11</td>
<td>13</td>
<td>9</td>
</tr>
<tr>
<td>Computer Message Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Getting error messages from the computer</td>
<td>13</td>
<td>51</td>
<td>16</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Applying for a job that requires</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>computer training</td>
<td>26</td>
<td>40</td>
<td>18</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Being unable to receive information because the computer is down</td>
<td>21</td>
<td>36</td>
<td>29</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Taking a test using a computer scoring sheet</td>
<td>48</td>
<td>24</td>
<td>13</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Looking at a computer printout</td>
<td>55</td>
<td>35</td>
<td>3</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Observing Computers Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watching someone work on a PC</td>
<td>77</td>
<td>17</td>
<td>6</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Watching a movie about an intelligent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>computer</td>
<td>84</td>
<td>11</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Visiting a computer centre</td>
<td>62</td>
<td>25</td>
<td>13</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Computer Equipment Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using automated bank teller machines</td>
<td>79</td>
<td>17</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Programming a microwave oven</td>
<td>75</td>
<td>17</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Resetting a digital clock</td>
<td>85</td>
<td>7</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Sitting in front of a home computer</td>
<td>66</td>
<td>23</td>
<td>7</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Note:
The stem of the question was: "The items in this questionnaire refer to things and experiences that may cause anxiety or apprehension. For each item, place an X under the column that describes how anxious (nervous) each would make you feel at this point in your life."

An analysis of these frequency distributions indicates that a large percentage of students experience anxiety on items comprising the Learning about Computers Anxiety and the Computer Message Anxiety scales at pretest. Almost half the group (49%) reported from "a fair amount" to "very much" anxiety (i.e., a rating of 3-5)
regarding learning to write a computer program, erasing or deleting material from a
computer file, and being unable to receive information because the computer is down.
For the remaining items from the Computer Message Anxiety and Learning about
Computers Anxiety scales (except for "looking at a computer printout"), between 20-
40% of the students expressed anxiety beyond "a fair amount" (a rating of above 3).
In contrast, the majority of students (87%) expressed little or no anxiety (a rating of 1
or 2) on the Computer Equipment Anxiety and Observing Computers Anxiety scales.

Table 3.3 presents item means and standard deviations at pre and posttest. A
mean score of 2 or more and a standard deviation greater than 1 indicate items on
which there was considerable anxiety. Mean scale scores (see Table 3.4) on the four
pre and posttest scales indicate moderate levels of anxiety on the Computer Message
Anxiety and Learning about Computers Anxiety scales, and low levels of anxiety on
the Computer Equipment Anxiety and Observing Computers Anxiety scales.

Table 3.3

<table>
<thead>
<tr>
<th>Means And Standard Deviations For Each Pretest And Posttest Item</th>
<th>pretest</th>
<th></th>
<th>posttest</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Learning about Computers Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading a computer manual</td>
<td>2.27</td>
<td>1.15</td>
<td>2.31</td>
<td>1.22</td>
</tr>
<tr>
<td>Learning to write a computer program</td>
<td>2.62</td>
<td>1.24</td>
<td>2.59</td>
<td>1.27</td>
</tr>
<tr>
<td>Thinking about course in computing lang.</td>
<td>2.19</td>
<td>1.01</td>
<td>1.97</td>
<td>.91</td>
</tr>
<tr>
<td>Learning about computer terminology</td>
<td>2.08</td>
<td>1.08</td>
<td>2.06</td>
<td>1.10</td>
</tr>
<tr>
<td>Learning how a computer works</td>
<td>1.91</td>
<td>1.03</td>
<td>1.90</td>
<td>1.14</td>
</tr>
<tr>
<td>Thinking about buying a PC</td>
<td>2.06</td>
<td>1.26</td>
<td>1.78</td>
<td>1.02</td>
</tr>
<tr>
<td>Erasing or deleting material</td>
<td>2.44</td>
<td>1.29</td>
<td>2.18</td>
<td>1.13</td>
</tr>
<tr>
<td>Taking a class about the use of computers</td>
<td>2.29</td>
<td>1.31</td>
<td>2.08</td>
<td>1.19</td>
</tr>
<tr>
<td>Computer Message Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Getting error messages from the computer</td>
<td>2.55</td>
<td>1.17</td>
<td>2.59</td>
<td>1.16</td>
</tr>
<tr>
<td>Applying for a job that requires computer training</td>
<td>2.33</td>
<td>1.17</td>
<td>2.29</td>
<td>1.09</td>
</tr>
<tr>
<td>Being unable to receive information because the computer is down</td>
<td>2.47</td>
<td>1.15</td>
<td>2.38</td>
<td>1.16</td>
</tr>
<tr>
<td>Taking a test using a computer scoring sheet</td>
<td>2.03</td>
<td>1.27</td>
<td>1.76</td>
<td>1.04</td>
</tr>
<tr>
<td>Looking at a computer printout</td>
<td>1.64</td>
<td>.88</td>
<td>1.76</td>
<td>.92</td>
</tr>
<tr>
<td>Observing Computers Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watching someone work on a PC</td>
<td>1.32</td>
<td>.63</td>
<td>1.49</td>
<td>.82</td>
</tr>
<tr>
<td>Watching a movie about an intelligent computer</td>
<td>1.26</td>
<td>.67</td>
<td>1.39</td>
<td>.82</td>
</tr>
<tr>
<td>Visiting a computer centre</td>
<td>1.53</td>
<td>.76</td>
<td>1.51</td>
<td>.80</td>
</tr>
<tr>
<td>Computer Equipment Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using automated bank teller machines</td>
<td>1.34</td>
<td>.82</td>
<td>1.28</td>
<td>.59</td>
</tr>
<tr>
<td>Programming a microwave oven</td>
<td>1.40</td>
<td>.86</td>
<td>1.38</td>
<td>.85</td>
</tr>
<tr>
<td>Resetting a digital clock</td>
<td>1.36</td>
<td>.97</td>
<td>1.22</td>
<td>.66</td>
</tr>
<tr>
<td>Sitting in front of a home computer</td>
<td>1.52</td>
<td>.90</td>
<td>1.64</td>
<td>.94</td>
</tr>
</tbody>
</table>
Table 3.4
Scale Means and Standard Deviations on the Pretest and Posttest CARS Scales

<table>
<thead>
<tr>
<th>Scale</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Learning</td>
<td>2.23</td>
<td>.84</td>
</tr>
<tr>
<td>Message</td>
<td>2.20</td>
<td>.79</td>
</tr>
<tr>
<td>Observing</td>
<td>1.37</td>
<td>.55</td>
</tr>
<tr>
<td>Equipment</td>
<td>1.40</td>
<td>.71</td>
</tr>
</tbody>
</table>

Note.
Learning = Learning about Computers Anxiety; Message = Computer Message Anxiety; Observing = Observing Computers Anxiety; Equipment = Computer Equipment Anxiety.

From the pretest data, it appears that a considerable proportion of beginning teacher trainees express a great deal of anxiety about experiences that are basic to the world of computing as represented by the items comprising the Learning about Computers Anxiety and Computer Message Anxiety scales. Comparable studies of tertiary students suggest that in excess of twenty-five percent of individuals suffer from mild "computerphobia", while five percent are potentially severely computerphobic (Rosen & Maguire, 1990).

As shown in Table 3.4, at the completion of the Educational Computing course, there were still moderate levels of anxiety on both the Learning about Computers Anxiety and Computer Message Anxiety scales (M = 2.11, SD = .74; M = 2.16, SD = .69, respectively), and low levels of anxiety on the Observing Computers Anxiety and Computer Equipment Anxiety scales (M = 1.46, SD = .61; M = 1.38, SD = .58, respectively. The comparative levels of anxiety for the treatment and comparison groups were explored through analysis of variance.

One of the major objectives of the present research was to examine the relative impact of "forced" interaction with computers (Educational Computing course) on computer anxiety for those students who completed the compulsory course as part of their timetable "package" in the first semester compared to those who were not doing the course currently, but who were enrolled in the same educational psychology course.

Pretest ANOVAS indicated that there were no significant main effects due to the grouping variable Educational Computing course on any of the scales prior to the
commencement of the course. For all intents and purposes, both treatment and comparison groups appeared to be equivalent prior to the beginning of the course.

Univariate analyses (ANCOVA) were performed for each of the posttest scales, with its pretest scale as the respective covariate. This approach enabled treatment and comparison groups to be equated. Consequently, posttest differences between the means of the treatment and comparison groups were analysed after taking into account, and making appropriate statistical adjustments for, any initial differences in the pretest. The independent variables considered in the successive analyses were sex, ownership of personal computer, self-ranked computer competence, attendance at single-sex or coeducational high school, and membership of Educational Computing course or comparison group.

The analysis of covariance for the four CARS scales revealed only one significant main effect for self-ranked computer competence ($F= 2.95, df= 3/92, p= .037$) on the Computer Message Anxiety scale. There were no other significant main or interaction effects. In particular, it should be noted that there were no main effects on any of the four scales for the treatment (Educational Computing course) on levels of anxiety at posttest.

**Discussion**

From the results of this study, it could be strongly argued that computer anxiety as measured by the four scales of the CARS does exist, and that high levels of anxiety characterise a large proportion of the students in relation to learning about computers and receiving computer messages. The level of computer anxiety experienced by the participants in this study appears to be related to a number of variables: sex, prior computing experience and ownership of a personal computer.

Of greatest importance is the finding that the completion of a semester-long computing course by teacher trainees apparently made little difference to initial levels of computer anxiety as measured by the CARS. Why was this so?

Furthermore, the impact of both PC ownership and initial computer competence on levels of anxiety in this study implies that a broader, more encompassing definition of "experience" with regard to computing is needed than that which commonly occurs in the literature.

**Type of Computing Experience**

When evaluating the impact of computer experience on student's anxiety, one must take into account the level and nature of computer anxiety, the level and nature
of different computing experiences themselves, and how these interact with levels of interest, motivation and self-efficacy perceptions of various students.

The nature of computer course content has been shown to affect self-concept and motivation via a vis computers. Burns and Hagerman (1989), for example, showed that the use of a Logo program which allowed users to make errors as part of the learning process led to an increase in internal locus of control and lower levels of computer anxiety, while a comparable program in which errors were considered to be detrimental led to an external locus of control which was associated with higher levels of anxiety. Damarin (1989) maintains that females prefer an unstructured style of computer interaction. Therefore, computer training courses that require (or value) structured learning that is "top down" and "bug-free" may inhibit the development of self-efficacy and an internal locus of control for some female students.

Threat of evaluation on computing tasks perceived as "difficult" may increase the anxiety experienced by highly (test) anxious individuals, whereas freedom to make mistakes, without competition or evaluation, may lower anxiety (Pocius, 1991). Where evaluation is required, computer interaction has been found to precipitate the same sort of reactions as math and test anxiety (Dambrot et al., 1985; Weil, Rosen & Wugalter, 1990). Perceptions of self-efficacy and self-esteem, which are strongly correlated with anxiety and motivation (Heckhausen, 1982), have been shown to be influenced by classroom climate (Ames, 1992). Thus, in an evaluative climate such as the university classroom in which students are expected to demonstrate competency relative to others in terms of grades, rather than merely achieving personal mastery, it would be predicted that getting computer error messages, and having to interpret a computer printout, for example, as measured by the Computer Message Anxiety scale, would increase anxiety. Conversely, in a climate where the focus is on the intrinsic value of learning (computing skills), and where making "mistakes" is a normal and necessary part of the process rather than a threat to one's self-esteem, anxiety might be predicted to be lower.

Sex Differences And Computer Anxiety

Sex and gender are often used interchangeably but refer, respectively, to the biological (sex) and social-role identification and socialization (gender) of females and males. Descriptive findings from this study are based on the sex classification of the participants, however, in interpreting these differences, gender is used to consider socially assigned or adopted role functions (Gordon, 1991). Research on gender differences in computing suggest, in general, that males show greater interest in and confidence with computers (Chen, 1986; Collis, 1985, 1987). As the Western socialisation of males favours their involvement in technology, gender differences in
Computer Anxiety may be interpreted in terms of prior experience. In this context, Rosen and Maguire (1990) point out that the roots of such differences in computer experience are found as early as kindergarten. Numerous studies have demonstrated that males receive substantially more computer experience than females, both at home and at school (Fetler, 1985; Levin & Gordon, 1989). As a function of this differential exposure, school-age males and females stereotype the computer as male, with this gender stereotyping increasing with age (Hess & Miura, 1985).

**Computer Ownership**

It is reasonable to conjecture that computer confidence is related to computer ownership. In this context, Miura (1987), for example, reported that computer ownership by female college students contributed significantly to their perceived self-efficacy while Levin and Gordon (1989) found that owning a PC had a stronger positive effect on attitudes towards computers than sex.

**Conclusion**

A simplistic belief that increased computer experience alone will reduce computer anxiety does not account for the fact that a large proportion of students still remained anxious at the end of the Educational Computing course, and that there was no difference between students who completed the course and those who did not in terms of anxiety. Clearly, for some individuals, increased computer experience does not necessarily alleviate anxiety, especially when such experience forms part of formal tertiary coursework. Within any group of students interacting with computers there may be those who suffer from a debilitating form of anxiety that is clinical. Averaging group anxiety scores may mask those scores which indicate high individual levels. A qualitative analysis of individual differences in type and degree of computer anxiety will be a valuable direction for future research. It is the severely and moderately anxious students that need to be identified so that remediation appropriate to their specific area of anxiety can be designed, and their performance maximised. Better still, research into the types of computer training for students that best prevent initial anxiety from escalating, perhaps by focussing on building confidence and a sense of personal control in a non-threatening learning environment is needed. Emanating from this exploratory pilot study, such research perspectives gave rise to the design of a subsequent intervention study in which aptitude-treatment-interaction effects are examined along with in-depth qualitative data collected from students undertaking a computer training course.
In terms of the measurement of computer anxiety, the CARS instrument has made an important contribution. Similarly, its use in the present study enabled me to determine without doubt that significant levels of computer anxiety existed within an undergraduate student population. Items in the CARS, however, did not appear to emerge so much from a strong theoretical base in the anxiety and educational literature as from a practitioner’s perspective. The identification of factors through exploratory factor analyses in its design as well as reliabilities that were relatively modest also suggested that a sound substantive base may be lacking. In the context of the literature described in detail in Chapter One and the findings of this study, the value of further instrument development using confirmatory factor analysis became obvious. This theoretical literature prompted me to consider a broader definition of the computer anxiety construct which included cognitive elements relating to perceptions of control and self-efficacy in computing situations, as well as physiological and emotional aspects of state anxiety. Furthermore, the limitations of the pilot study research conducted with a relatively small sample taken from only one faculty gave me additional impetus to conduct further research with a much larger sample across four university faculties.

In summary, therefore, a number of significant questions emerged from the present study that gave rise to the design of subsequent studies in this Doctoral Dissertation. These were as follows:

- The measure used in this study identified four factors underlying computer anxiety. What new dimensions could be added to such a measure that would be appropriate for Australian university students undertaking compulsory computer training?
- Are there faculty and gender differences in computer anxiety?
- How, and to what extent, does the nature of a training course interact with individual levels of anxiety to alleviate or exacerbate anxiety?
- Do particular aspects of anxiety interact with specific instructional approaches adopted in computer training?
- Why didn’t the semester-long computing course alleviate student anxiety?
CHAPTER FOUR

Designing a Valid and Reliable Instrument to Measure Computer Anxiety: The Development of CALM (Computer Anxiety and Learning Measure)

Given the large proportion of the population in societies where information technology is prevalent that is affected by varying degrees of computer anxiety (as discussed in Chapter One), the identification of computer anxious individuals is an important focus of research as a basis for appropriate training and anxiety reduction (LaLomia and Sidowski, 1993). Despite the proliferation of instruments designed to measure computer anxiety which emerged in the mid- to late-1980's (a function of the recognition that all was not well with the public response to mass availability of computerised technology), there were none that were specifically designed for the beginning adult user in a university setting. Furthermore, none presented a detailed analysis of the range of relevant constructs, both situation-specific to the gaining of initial computing skills, and more general psychological constructs such as sense of control, self-concept and anxiety, which the author believes define computer anxiety. The present research, therefore, emerged from an effort to develop a theory of computer anxiety relevant to beginning adult learners in a range of university disciplines. To this end, the first step was to design and refine an instrument which was reliable and valid for this population, and which would test the substantive hypotheses proposed. Both exploratory and confirmatory factor analyses were used to analyse the data in this initial stage of the lengthy process of instrument development and validation.

As Bandalos and Benson (1990 p. 51) point out, there has existed in the area of computer anxiety research for some time a degree of "inconsistency in the hypothesized dimensionality of the construct, computer anxiety." They suggest that clear explication of the specific dimensions which are hypothesized to underlie computer anxiety "may allow for a more nearly precise measurement of this construct".

The aim of the present study, therefore, was to design an instrument which did clearly explicate these dimensions and which would measure, with considerable validity and reliability, the multiple dimensions of computer anxiety in a training situation. This was achieved by incorporating into a model of computer anxiety for beginning adult learners a number of factors which had emerged reliably from previous anxiety research together with additional dimensions which were derived from theories
of motivation and learning, as conceptualised by the present author and described in Chapter One. Items considered to have face validity for these factors were generated. Item face validity was evaluated by three other independent raters. The first of these had a broad background in computer training (from children through to adults at tertiary level); the second was a senior academic from the discipline of psychology with particular expertise in learning theory motivation; and the third was a senior graduate research associate with a background in psychology and extensive psychometric experience especially in relation to instrument design.

Specifically, the dimensions included in the theoretical model were as follows: Competence with Computers; Handling Computer Equipment; Receiving Feedback on Computing Skills; and Learning about Basic Computer Functions; Positive Sense of Control (cognitions about being able to master computers); Fear (fearful cognitions about damaging the computer and public embarrassment in computing situations); Positive and Negative Computing Self-Concept (perceptions of self-image in relation to computers); and, Worry, Happiness, Distractability, and Physiological Symptoms (of anxiety in computing situations).

The full Computer Anxiety and Learning Measure in its original design (111 items) is presented in Appendix A1.

The Emergence of CALM

Computer anxiety is a multidimensional construct, as mentioned earlier. In this chapter, I describe the development of the a priori model adopted in the present study and the validation of this theoretical model through exploratory and confirmatory factor analyses. In particular, I highlight the adoption or adaptation of relevant dimensions (or items) from pre-existing instruments, as well as the development of new scales.

Computer Anxiety Scales

The first stage in the design of the Computer Anxiety and Learning Measure (CALM) involved a pilot study (described in Chapter Three) which was conducted with first year teacher trainees (n = 101) using an abridged form of the original Computer Anxiety Rating Scale (CARS-R) designed by Rosen, Sears and Weil (1987a), and considered the most powerful measure of computer anxiety at the time of the research. The original CARS-R contains fifty-four items and measures five main factors, namely, General Computer Anxiety; Anxiety about Use of Computers in Society; Anxiety about Computer Equipment; Anxiety about Computers in the Media;
and, Anxiety about Computer Games, plus an additional seven factors which contain three or less items relating to Computers in the Future; Calculators and Personal Computers; Calculators and Typewriters; Computer Errors; Computer Error Messages; Computer Mail; and an unnamed factor. In addition to the CARS-R, the Computer Thoughts Survey (CTS), also designed by Rosen, Sears & Weil (1987b), was evaluated in relation to the development of the CALM. The factor structure of the original CTS, which includes twenty eight items, measures six factors: Positive Feelings and Cognitions; Positive Attitudes Towards Learning; Negative Cognitions Towards Abilities; Cognitions about Other Users' Views and Abilities; Negative Feelings about Computers; and, Cognitions of Personal Doubt.

To the present author, there are a number of methodological concerns with these instruments. First, the factors underlying computer anxiety identified by Rosen, Sears and Weil (1987a & b) do not appear to provide a parsimonious model of computer anxiety, nor do they appear to be entirely a priori, as is often the case with research using exploratory factor analytic techniques. Rosen, Sears and Weil themselves suggest this in their own description of the development of the CARS-R instrument: "Based on those items with the highest loadings [greater than .45], names have been given to each factor. Although these names are subjective assessments of the factors, they appear reasonable based on the similarities between most items on each factor." (1987b, p 14). Second, the reliability and validity of the instruments are based on a relatively small and atypical sample of university students (Rosen, 1989b; LaLoma & Sidowski, 1993). Third, it was felt that the CARS-R and CTS could be considerably shortened and refined in order to provide valid diagnostic information. Indeed, Rosen, Sears and Weil (1987a & b) subsequently proceeded to do this and derived a twenty item CARS-C form which was used by the present author in the pilot study referred to earlier (reported in Chapter Three).

While there appeared to be methodological limitations in the original and revised CARS, several of the factors that emerged from the development of these instruments fitted well with the hypotheses held by the present author regarding the constructs underlying the computer anxiety of beginning adult learners (see discussion in Chapter One), and were incorporated, therefore, into the design of the Computer Anxiety and Learning Measure.

In particular, the following factors were considered to be most in keeping with the my hypotheses regarding computer anxiety: Anxiety related to learning about computers; anxiety related to handling computer equipment; positive and negative cognitions /feelings about one's ability to learn, and to use, computers, and cognitions of personal doubt. The exploratory factor analyses conducted in the pilot study confirmed the existence of these factors with an Australian undergraduate sample.
Table 4.1 shows the items that were adapted or included in their original form from the original versions of CARS-R and CTS into the CALM instrument as it was first designed.

Table 4.1
Items from CARS-R\(^1\) and CTS\(^2\) Adapted for CALM

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety about Computer Equipment (CARS-R)</td>
<td>Taking a class in the use of computers.</td>
</tr>
<tr>
<td></td>
<td>Getting “error messages” from the computer.</td>
</tr>
<tr>
<td></td>
<td>Learning to write computer programs.</td>
</tr>
<tr>
<td></td>
<td>Learning computer terminology.</td>
</tr>
<tr>
<td></td>
<td>Deleting material from computer files.</td>
</tr>
<tr>
<td></td>
<td>Applying for job that requires computers.</td>
</tr>
<tr>
<td></td>
<td>Attending workshop on computer uses.</td>
</tr>
<tr>
<td>Anxiety about Computer Equipment (CARS-R)</td>
<td>Watching someone working at a computer terminal.</td>
</tr>
<tr>
<td></td>
<td>Taking test with computer scoresheet.</td>
</tr>
<tr>
<td>Positive Feelings and Cognitions (CTS)</td>
<td>I’m too embarrassed to ask for help (reversed).</td>
</tr>
<tr>
<td>Positive Attitudes towards Learning (CTS)</td>
<td>I am willing to give it a try.</td>
</tr>
<tr>
<td></td>
<td>Others have learned this and so can I.</td>
</tr>
<tr>
<td></td>
<td>I know I can do it.</td>
</tr>
<tr>
<td></td>
<td>I can get help if I get stuck.</td>
</tr>
<tr>
<td>Negative Cognitions toward Abilities (CTS)</td>
<td>I am totally confused.</td>
</tr>
<tr>
<td></td>
<td>I am going to make a mistake.</td>
</tr>
<tr>
<td></td>
<td>I am afraid I’ll wreck the machine.</td>
</tr>
<tr>
<td></td>
<td>I feel stupid.</td>
</tr>
</tbody>
</table>

From this pilot study, therefore, dimensions of computer anxiety for an Australian undergraduate population began to emerge. One issue that remained a concern in relation to many of the early computer anxiety instruments - that of the perception by many of their designers that computer anxiety can be measured as a unidimensional construct. In my belief, this construct is multidimensional, with each

\(^1\) Computer Anxiety Rating Scale
\(^2\) Computer Thoughts Survey
component providing separate information, as shown in the work of Rosen et al. (1987b).

In addition to the CARS-R and CTS of Rosen, Sears and Weil (1987a & b), additional pre-existing computer attitude/anxiety instruments were reviewed with a view to expanding and refining the model of computer anxiety that had begun to crystallise from the pilot study. These included those emanating from the research of Loyd & Gressard (1984), Maurer and Simonson (1984), Heinssen, Glass and Knight (1987), and Meier (1988). As both the Loyd and Gressard Computer Attitude Survey and the Computer Anxiety Index of Maurer and Simonson had been statistically validated and used extensively in other research, they were selected for close analyses.

The early work of Loyd and Gressard (1984) focussed on what they referred to as "computer attitudes" although, in fact, the personality constructs of anxiety and confidence were included as two of the three subscales of their Computer Attitude Scale (CAS), the third being computer liking. These subscales, and particularly the anxiety and confidence factors (highly correlated at .92 and likely, therefore, to be measuring the same construct), did not, however, appear to be theoretically differentiated in a number of subsequent studies with different groups (Kay, 1989; Bandalos and Benson, 1990). As Kay and others (e.g., Gardner, Discenza & Dukes, 1993) have pointed out, this measure, along with numerous others which emerged around this time and since, "have proven to be either statistically weak or theoretically vague" (Kay, 1989, p. 456). While the reliability and validity of the CAS were originally determined from a high school sample (grades 8 to 12) and have been subsequently examined with high school teachers and counsellors (LaLomia & Sidowski, 1993), the measure has not been validated with an undergraduate population.

As the items defining the Computer Confidence factor in the CAS were identified as having strong face validity for the Computing Self-Concept factor in the present model of computer anxiety, eight of the ten items were included into the original scale. Table 4.2 shows these items from the CAS which were adapted for inclusion into the CALM.
### Table 4.2
**Items from CAS\(^3\) Adapted for CALM**

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Confidence</td>
<td>I’m no good with computers.</td>
</tr>
<tr>
<td></td>
<td>I am sure I can do work with computers.</td>
</tr>
<tr>
<td></td>
<td>I am not the type to do well with computers.</td>
</tr>
<tr>
<td></td>
<td>I am sure I can learn a computer language.</td>
</tr>
<tr>
<td></td>
<td>I think using a computer would be very hard for me.</td>
</tr>
<tr>
<td></td>
<td>I could get good grades in computer courses.</td>
</tr>
<tr>
<td></td>
<td>I do not think I could handle a computer course.</td>
</tr>
<tr>
<td></td>
<td>I have a lot of self-confidence when it comes to working with computers.</td>
</tr>
</tbody>
</table>

In the development of their Computer Anxiety Index (CAIN), Maurer and Simonson (1984) attempted to capture the feelings of fear or apprehension felt when an individual used or thought about using computers. In particular, they focussed on four areas: Avoidance of computers; negative attitudes towards computers; caution when using computers; and disinterest in computers. As the first two of these dimensions had relevance to the model of computer anxiety proposed in the CALM instrument, notably, as they related to “sense of self” constructs in the Sense of Control and Computing Self-Concept scales, several items were generated that incorporated these dimensions. It is worth noting that the CAIN scale has undergone considerable methodological refinement over a period of years. The validity and reliability of the instrument have been developed from a large sample of undergraduate students, making it an attractive model from which to draw for the present research. Table 4.3 shows the items from the CAIN which were adapted for inclusion into the CALM.

### Table 4.3
**Items from CAIN\(^4\) Adapted for CALM**

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoidance of Computers</td>
<td>I avoid using computers whenever possible.</td>
</tr>
<tr>
<td>Negative Attitudes towards</td>
<td>I sometimes get nervous just thinking about computers.</td>
</tr>
<tr>
<td>Computers</td>
<td></td>
</tr>
</tbody>
</table>

\(^3\) Computer Attitude Scale  
\(^4\) Computer Anxiety Index
I feel very negative about computers in general.

I will probably never learn to use a computer. I am usually uncomfortable when I have to use computers. I sometimes feel intimidated when I have to use a computer.

I doubt if I would ever use computers very much. If I had a computer at my disposal, I would try to get rid of it.

**Anxiety Inventories**

In the second stage of the CALM instrument design, pre-existing instruments relating to test anxiety (Spielberger 1972; and Sarason, 1984) were reviewed with a view to further refining the model of computer anxiety that was hypothesized by the present author. Of these, the research into test anxiety of both Spielberger (1972) and Sarason (1984) appeared to have the greatest bearing on the model of anxiety that was being developed by the present author. Furthermore, instruments designed in each of these cases had undergone extensive validation and were reliable starting points, therefore. The degree to which these instruments influenced the design of the Computer Anxiety and Learning Measure (CALM) is outlined below.

In developing the State-Trait Anxiety Inventory (STAI), Spielberger adopted the earlier model of test anxiety proposed by Liebert and Morris (1967). His construct of state anxiety consisted of two components, Worry ("I am at present worrying over possible misfortunes") and Emotionality ("I feel upset"; "I feel pleasant"). The two-factor structure of the STAI has been validated in numerous studies (Benson & Tippetts, 1990; Benson, Moulin-Julian, Schwarzer, Seipp, & El-Zahhar, 1992). It is worth noting, however, that a limitation in the STAI is the high correlation which exists between these two dimensions (Benson & El-Zahhar, 1994).

As computer anxiety is a situation-specific anxiety, it was felt that similar factors would exist as for Spielberger's state anxiety construct in test situations. Thus, from the STAI Form X-1 (State form), the following items were adapted into the design of the Computer Anxiety and Learning Measure (as shown in Table 4.4).
Table 4.4

Items from STAI5 Form X-1 Adapted for CALM

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worry</td>
<td>I am at present worrying over possible misfortunes.</td>
</tr>
<tr>
<td></td>
<td>I feel self-confident.</td>
</tr>
<tr>
<td></td>
<td>I am worried.</td>
</tr>
<tr>
<td></td>
<td>I feel anxious.</td>
</tr>
<tr>
<td></td>
<td>I feel over-excited and &quot;rattled&quot;.</td>
</tr>
<tr>
<td>Emotionality</td>
<td>I feel calm.</td>
</tr>
<tr>
<td></td>
<td>I feel secure.</td>
</tr>
<tr>
<td></td>
<td>I feel tense.</td>
</tr>
<tr>
<td></td>
<td>I feel upset.</td>
</tr>
<tr>
<td></td>
<td>I feel comfortable.</td>
</tr>
<tr>
<td></td>
<td>I am relaxed.</td>
</tr>
<tr>
<td></td>
<td>I feel content.</td>
</tr>
<tr>
<td></td>
<td>I feel at ease.</td>
</tr>
</tbody>
</table>

Contrary to Spielberger, Sarason's (1984) conception of test anxiety is a multidimensional one comprising cognitive, emotional, behavioural, and physiological reaction aspects. Sarason proposed that Emotionality be considered as two components: "physiological arousal" and "tension". His Reactions to Tests (RTT) instrument, therefore, consists of four scales:

- **Tension** ("I feel distressed and uneasy before tests")
- **Physiological Reactions** ("My heart beats faster when the test begins")
- **Test-Irrelevant Thoughts** ("Irrelevant bits of information pop into my head during a test"), and
- **Worry** ("During tests, I wonder how the other people are doing").

Worry, Test-Irrelevant Thoughts and Physiological Symptoms have been confirmed in the literature as important aspects of anxiety in evaluative situations. Similarly, Tension has appeared elsewhere as "emotionality" (Spielberger, 1972; Liebert & Morris, 1967). As the traditional computer learning situation in tertiary settings, where groups of students are "trained" in the use of computers and are evaluated on their achievement, is akin to this notion of test anxiety, these four dimensions were incorporated into the first version of the CALM. Interestingly, the

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5 State-Trait Anxiety Inventory
four-factor structure using the original 40 items of the RTT was not supported in a recent confirmatory factor analysis (Benson and Bandalos, 1992), however, when a modified form of twenty of the items was used, the four-factor structure was retained. Items reflecting each of these four factors were written for inclusion in the CALM. Table 4.5 shows some of the items from the RTT which were adapted.

Table 4.5

Items from RTT\textsuperscript{6} Adapted for CALM

<table>
<thead>
<tr>
<th>FACTOR</th>
<th>ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worry</td>
<td>... I worry about failure.</td>
</tr>
<tr>
<td></td>
<td>... I feel troubled about what is going to happen.</td>
</tr>
<tr>
<td>Tension</td>
<td>I feel jittery.</td>
</tr>
<tr>
<td></td>
<td>I feel distressed and uneasy.</td>
</tr>
<tr>
<td></td>
<td>I find myself becoming anxious.</td>
</tr>
<tr>
<td>Test-Irrelevant Thinking</td>
<td>Irrelevant bits of information pop into my head.</td>
</tr>
<tr>
<td></td>
<td>I find myself thinking of things unrelated to the material.</td>
</tr>
<tr>
<td>Physiological Symptoms</td>
<td>My stomach gets upset during ...</td>
</tr>
<tr>
<td></td>
<td>My heart beats faster when ...</td>
</tr>
</tbody>
</table>

**Latent Variables**

The third stage in the development of the CALM involved the design of an a priori measurement model of latent variables representing computer anxiety as a multifaceted construct. In the present study, computer anxiety was hypothesized to be a situation-specific or state anxiety with some similarities to test anxiety. Dimensions of general anxiety which have emerged as universally agreed upon in the literature are: worry, emotionality/tension, physiological symptoms, negative cognitions relating to the self-preoccupations of the anxious individual which interact with attention or distractability (Sarason, 1984). These were incorporated into the CALM in several scales. In addition, situation-specific factors related to the learning of computing skills by adults, along with the motivation to do so, were also hypothesized to underly computer anxiety in the present model. These were anxieties derived from a sense of personal control over the mastery of computing skills, referred to as Sense of Control, and confidence with regard to using computers, referred to as Computing Self-Concept. In addition, dimensions of the computer learning situation itself were

\textsuperscript{6} Reactions to Tests
hypothesized to be important factors, namely, anxieties about the actual computer learning process (for example, reading a manual, writing a program, learning the operating system); computer competence; using computer equipment; and receiving feedback on computing skills from peers and teachers.

The original CALM instrument, therefore, consisted of 111 items divided over four scales (see below) and comprised twelve factors in total. The factors hypothesized and tested through Structural Equation Modelling were as follows:

**Factors Underlying the Computer Anxiety and Learning Measure**

**Gaining Initial Computing Skills**

The items defining this scale were derived from the notion that computer anxiety for beginning users is a context-specific anxiety, and that features of the learning situation, therefore, will affect that anxiety. This scale, therefore, was hypothesised to consist of four factors related to anxiety about: Learning about Basic Computer Functions; Competence with Computers; Handling Computer Equipment; and Receiving Feedback on Computing Skills.

**Sense of Control**

The theoretical literature in the area of general anxiety clearly posits that perceptions of control may be both positive and negative and, as such, exist as discretely different constructs (Bandura, 1991). Furthermore, research into other components of personality also suggests that positive and negative cognitions exist as separate constructs (Bagozzi, 1994). There is ambiguity in the research literature, however, about whether a negative factor as such can be measured by negatively worded items (Carmines & Zeller, 1979; Benson & Hocevar, 1985; Marsh, 1986). As a consequence, therefore, two alternative approaches were tested using SEM in relation to this scale.

In the first instance, two factors defining Sense of Control were hypothesized: Positive Cognitions (or self-talk) about being able to master computers, and Negative Cognitions expressing fear about learning to use the computer. These were derived from the original Computer Thoughts Survey (CTS) of Rosen, Sears & Weil (1987a & b), and supported by the argument of Bagozzi (1994) who maintains that all the cognitive and affective elements of one's attitudes consist of aggregations of positive, negative, and positive and negative atomistic mental representations of knowledge (or knowledge units held in memory). In the second approach, a model positing the existence of one substantive factor plus a "negative item method effect" was tested.
(Marsh, 1994b) on the premise that negatively worded items in a survey do not measure the opposite of the same construct as do positively worded items, and are, therefore, too "weak" to include in a total scale score.

Computing Self-Concept

Contrary to the evidence in regard to positive and negative sense of control perceptions, the research literature on general self-concept strongly argues that, rather than representing a substantive negative factor (negative self-concept), negatively worded items in an instrument merely contain a measurement-method "artefact" (Benson & Hocevar, 1985; Marsh, 1986; 1994b). Much of this literature, however, is derived from research with young children, while the present sample consisted of adults in a tertiary education setting and who were predicted, therefore, to be better able to cope with the cognitive demands of negatively worded items. The same approach to model testing was adopted in this scale as in the previous one. In other words, both a single factor and a two-factor model with regard to self-concept about one's proficiency with computers were tested.

In the case of both the Sense of Control and Computing Self-Concept scales, items were written to assess different responses in relation to cognitions. These were expressed semantically in Sense of Control as positive and negative self-talk ("I can master the computer" or "Everyone else but me knows what they are doing"), and in the Computing Self-Concept scale as a positive or negative perceptions of self-image in relation to computing situations ("I can help others solve computer problems" or "I am not the type to do well with computers").

State Anxiety in Computing Situations

This scale was hypothesised to consist of three components - cognitive, emotional and somatic. The cognitive component consisted of two factors - Worry and Distractability; the emotional component consisted of one factor - Happiness; and the somatic component consisted of the Physiological Symptoms factor.

Method

Participants

In the present study, the participants consisted of seven hundred and ninety-four undergraduate students from four faculties (Education, Health, Arts and Social Sciences, and Business and Technology) of a university in the western region of
metropolitan Sydney, Australia. Detailed descriptions of this sample are provided in Chapter Five.

**Statistical Analyses**

Both exploratory (EFA) and confirmatory (CFA) factor analyses were conducted on the data from the present study. Although the structure of the model of computer anxiety used in this investigation was defined a priori on the basis of the theoretical analyses described at the beginning of this chapter, it was considered worthwhile using EFA in advance of CFA to explore possible alternative models. In terms of the relationship between the types of analyses, exploratory factor analysis is concerned with the estimation of the number of factors that are necessary to explain the relations among a set of indicators and an estimation of the factor loadings. In the design of the CALM instrument, the questions of unidimensionality and multidimensionality (discussed earlier) were key issues that could be examined through EFA. Confirmatory factor analysis, on the other hand, is concerned with parameter estimation and testing of hypotheses regarding the number of factors underlying the relations among a set of factors (see Pedhazur & Schmelkin, 1991, pp. 67-69).

Confirmatory factor analyses using the mainframe versions of PRELIS and LISREL 7 (Joreskog & Sorbom, 1989) were conducted on the data in this study. First-order factor models were specified by fitting parameters in three design matrices: factor loadings (relations between measured variables and latent factors - the "validity" of the measured variables; factor variances and covariances (relations among the factors); and uniquenesses (a combination of specific and error variances) (Marsh, 1994b; 1995). Simple models in which items were posited to represent only one factor were examined. Factors were assumed to be correlated except in the one factor plus "negative item method effect" models for the Sense of Control and Computing Self-Concept scales, respectively, as described above.

The purpose of higher-order confirmatory factor analysis (HCFA) is to explain covariation among first-order factors with higher-order factors (and the correlation among first-order factors). In the present study, HCFA was accomplished by fixing factor covariances in the PSI matrix to be zero, and using the first-order factors to define an additional second-order factor. A single second-order factor was posited to represent the covariation among the four first-order factors in the Gaining Initial Computing Skills and State Anxiety in Computing Situations scales of the CALM instrument.

To the extent that the higher-order model fits the data nearly as well as the first-order model, the former is supported (Lance, Teachout & Donnelly, 1992).
Confirmatory Factor Analysis and Goodness-of-fit Indices

Contrary to "exploratory" factor analysis in which there is little control over resulting factors in a model, in "confirmatory" factor analysis, the researcher posits an a priori structure, indicating which items (or indicators) should load onto which factors (or latent variables). The ability of a solution based on this hypothesized model to fit the data is then tested by determining whether the observed relations (correlations or covariances) among the indicators can be reproduced or closely approximated by using the parameter estimates (Pedhazur & Schmelkin, 1991, p. 71). In so doing, the basis for evaluating the proposed model is far stronger. Goodness-of-fit indices are used to assess how closely a matrix reproduced from parameter estimates for the posited model correspond to the matrix based on the actual data. A more detailed introduction to the conduct of confirmatory factor analysis is available elsewhere (Byrne, 1989; Joreskog & Sorbom, 1989; Pedhazur & Schmelkin, 1991).

In the present study, a number of indices were taken into account in deciding what would constitute an adequate goodness-of-fit: the parameter estimates (factor loadings, factor correlations and error/uniquenesses) were examined in relation to the substantive model and to permissible values (such as non-negative variances); and chi-square values for alternative models were compared and subjective evaluations made in terms of whether statistically significant values were acceptable. A further subjective index of adequate fit is the chi-square/degrees of freedom ratio. In this context, a number of researchers suggest that the value of what may be accepted will increase in proportion to the sample size and does not reflect on the adequacy of the model (Wheaton, 1987; Marsh, Balla, and McDonald, 1988). Therefore, in the present study, the relative values of the chi-square/degrees of freedom ratios and for the root mean square residual (RMSR) for each model tested were compared, and the lowest ratio considered optimal. The adjusted goodness-of-fit index (AGFI), the relative non-centrality index (RNI) (McDonald & Marsh, 1990) and the Tucker-Lewis index (TLI) (Tucker & Lewis, 1973) were also computed. These latter two subjective indices are used in preference to the AGFI and chi-square/degrees of freedom ratio alone, as Marsh (1994b, p. 444) points out that "... no restrictive model with positive degrees of freedom is able to fit real data and will be rejected by a formal test of significance for sufficiently large N.....". For both the relative non-centrality index (RNI) and the Tucker-Lewis index (TLI), indices greater than .90 are interpreted as indicating an "acceptable fit" (Marsh, 1994b). In the results reported below, the RNI is invariably higher than the TLI so that only the AGFI and the TLI are discussed as indicators of "best" model fit.

Finally, the target coefficient goodness-of-fit index developed by Marsh and Hocevar (1985) for higher-order factor models was applied where appropriate. This is
the ratio of the chi-square of the first-order model to the chi-square of the more restrictive model. In this context, Marsh and Hocevar point out that the target coefficient increases as the number of parameters estimated in the higher-order model increases.

In relation to the higher-order models, the chi-square value for the first-order model will always be larger than that for the corresponding second-order model in which there are fewer parameters estimated (Marsh, 1987).

As the self-rating responses on the CALM instrument used in the present study are categorical, the recommendations of Joreskog and Sorbom (1989, p. 193) with regard to LISREL 7 were taken, namely, that the estimates of relations among the categorical variables be computed as polychoric correlations and that the matrices be analysed by the fully weighted least squares procedure based on estimates of the asymptotic variances and covariances.

**Item Deletion**

One of the main objectives of the model testing was to develop an instrument that was both robust psychometrically and was parsimonious for ease of administration and interpretation. For the latter reason, particularly, factors comprising no more than 6 or 7 items were aimed for in the instrument refinement process. Items whose factor loadings were between .3 and .4 were critically evaluated in terms of their contribution to the substantive model under consideration. Similarly, items whose contribution to the corrected item-total correlation was low (and whose deletion would, therefore, improve the standardised item alpha coefficient) were scrutinised for possible deletion, pending a confirmatory factor analysis.

LISREL 7 was used to perform confirmatory factor analyses on the data using the same theoretical factor structure derived from the initial substantive model from which items had been generated. This was compared with the EFAs to determine which items could clearly be deleted in the final instrument. Items were retained whose standardised uniquenesses were below .5 (indicating that 50% or more of the variance was error or uniqueness that could not be explained by the factor it was intended to measure, and implying factor loadings \(\geq .71\)); whose modification indices were low and/ or indicated that an item was not loading strongly on more than one factor; and that had greatest face validity.

**Use of Self-Report Measures**

The Computer Anxiety and Learning Measure was designed as a self-report instrument using a Likert format. All but the State Anxiety in Computing Situations factor used a five-point rating scale. This factor used a four point scale of response as
it made more sense to rate frequency of anxiety in four degrees, leaving no ambiguity about occasional anxiety.

While it is acknowledged that self-ratings of internal states have the potential for bias, Assor & Connell (1992) have shown that they are valid and reliable indicators of mental processes in children over age nine. In the context of the present research, it was considered unlikely that a self-report measure of anxiety would be unreliable as there was nothing to be gained by distortion through the need for social desirability. Participants in the data collection were informed that their responses would be used to determine the impact of various computer training courses across the university. It was pointed out, therefore, that it was in their interests to be honest.

**Negatively Worded Items**

In order to guard against response bias such as acquiescence, it is commonly argued by measurement specialists that rating scales used in instruments designed to measure personality, attitude, and other aspects of psychology should include both positively and negatively worded items to measure the same construct (Paulhus, 1991; Pedhazur & Schmelkin, 1991; Spector, 1992). Marsh, on the other hand, argues that this approach is premised on the assumption that such positively and negatively worded items do, in fact, measure the same construct (Marsh, 1996). As he points out, "When factor analytic techniques reveal separate factors associated with the positively and negatively worded items, the validity of this assumption is called into question" (Marsh, 1996 p. 810). Typically, in psychological rating scales, separate factors reflecting negatively and positively worded items do emerge (Bachman & O'Malley, 1986; Bagozzi, 1993; Carmines & Zeller, 1986; Marsh, 1986, 1992). The key issue, as Marsh puts it, is whether the distinction between these apparently separate factors is "substantively meaningful or an artefact of response styles associated with positively and negatively worded items " which produce "substantively unimportant method effects" (1996, p. 810).

Attempting to resolve this difficulty was seen as an important aspect of the CALM instrument design process. For both the Sense of Control and Computing Self-Concept scales, three models were tested through confirmatory factor analysis: The first which proposed a single factor; the second which allowed for two separate factors (positive and negative); and the third which proposed a single substantively important dimension of either Sense of Control or Computing Self-Concept "contaminated by a method artefact, response set" (Carmines & Zeller, 1979, p. 69). The rationale for testing the latter two interpretations in this Dissertation was derived from Marsh (1996) when he argues that, "Whereas these two diametrically opposing explanations have quite different implications that are particularly relevant in personality and social
psychological research, distinguishing between these two explanations may be difficult" (1996, p. 810).

As mentioned earlier, the Sense of Control and Computing Self-Concept latent constructs in the CALM instrument contained items which expressed negative concepts. Some of these, as in the Sense of Control scale, were expressed as opposite in meaning to positive cognitions (for example, "People will notice if I make a mistake" and "I might break the machine"). Others, as in the Computing Self-Concept scale, were actually worded negatively (for example, "I don't think I could handle a computer course" and "I am no good with computers"). While the items which represent negative cognitions or sense of control were not negatively worded, they nonetheless had a negative semantic value. The present researcher wanted, therefore, to test statistically both the possibility that these items constituted a negative method "artefactor", and that they be considered a valid separate construct, i.e., a sense of lack of control in computing situations as expressed by an individual's negative self-talk.

Sufficient evidence, especially from self-concept research, strongly supports the existence of one general self-concept construct plus a negative item method factor which accounts for the effects of negatively worded items, rather than a substantively distinct second factor (Benson & Hocevar, 1985; Shavelson & Marsh, 1986; Marsh, 1986; Marsh, 1994b). As both constructs of Sense of Control and Computing Self-Concept reflect different aspects of an individual's self perceptions about computing efficacy, and are conceptually related, therefore, the same interpretation of the statistical analyses is applied to each.

An important complication in making appropriate interpretations exists, however, based on evidence from self-concept research in that measurement method effects associated with negatively worded items generally decrease for more verbally able respondents (Marsh, 1986). Consequently, the issue of whether the age and/or verbal ability of the respondent is related to response bias was also taken into account in the interpretation of the statistical findings relating to the alternative models tested. In this regard, Kaufman et al. (1991), argues that the differentiation between the two factors (positive and negative) should become more pronounced with increasing age and verbal ability. As the participants in the present study were adults enrolled in university courses, it may be argued that their verbal reading ability would be above average and that they might be expected, therefore, to discern the subtle differences in meaning between negative and positive items. Two separate factors in this context would support an argument for substantive differences between factors with such a sample. With the present data, however, clear resolution of this contention is not possible as there is no measure of reading ability from which to draw samples of those high and low on this dimension and to compare their scores on the scales in question.
If, on the other hand, a strong correlation between the factors exists, this would support the existence of a method effect rather than a substantive difference between factors.

Results

The present research investigated a priori predictions about those latent constructs underlying the anxiety felt by undergraduate students when learning to use computers. Confirmatory factor analysis indicated that a ten factor model of computer anxiety for beginning adult users plus one negative item "artefactor" which "treats the effects of item wording as a method effect" (Marsh, 1996) provided an adequate fit to the data from the present investigation. In addition, two single higher-order factors were able to explain much of the variance in the first-order factors, for the Gaining Initial Computing Skills and State Anxiety in Computing Situations scales, respectively. In all, a parsimonious model of computer anxiety was produced. Further tests of the model’s stability and generalisability were conducted using factorial invariance models in which all, or any number of parameter estimates can be constrained to be constant across groups. In this study, generalisability of the predicted latent constructs across different faculties was tested. These results are reported at the conclusion of this chapter.

The following are the separate results for each of the four scales within the CALM instrument. The final version of the instrument (65 items) is given in Appendix A2.

Gaining Initial Computing Skills

This scale was defined by four factors related to general anxiety about gaining initial computing skills: Learning about Basic Computer Functions; Competence with Computers; Handling Computer Equipment; and Receiving Feedback on Computing Skills.

The criteria for determining how many factors to rotate were that factors approximate simple structure as much as possible while providing a close fit to the data and be supported by a strong substantive/ theoretical base.

The original 41 items comprising this scale (shown below in Table 4.6) were reduced in number in an attempt to arrive at a more parsimonious scale. Nine items with ambiguous face validity and which did not load clearly on separate factors in the initial exploratory factor analysis were deleted, leaving a total of 32 items (items excluded from further analyses were: 2, 13, 17, 18, 19, 23, 32, 34, 36).
### Table 4.6

**Original Gaining Initial Computing Skills Items**

1. Taking a course in a computer language
2. Learning to use the computer in private
3. Taking a test on my computer competence
4. Working in a job that requires some computer experience
5. Working on an unfamiliar computer
6. Getting ‘error’ messages from the computer
7. Being unable to receive information because the computer is down
8. Learning to write a computer program
9. Erasing or deleting material from a computer file
10. Taking a class about the use of computers
11. Learning computer terminology
12. Reading a computer manual
13. Watching someone else work on a computer
14. Using computerised equipment
15. Learning how a computer works
16. Using a computerised library catalogue
17. Making a back-up copy of a file
18. Working in a group at the computer
19. Working individually at the computer
20. Having the lecturer/teacher watching while I use the computer
21. Teaching someone else about computers
22. Remembering the sequence of commands to carry out a procedure
23. Having someone watch me while I work on a computer
24. Learning the operating system of a computer
25. Learning a new computer application
26. Dealing with computer malfunctions
27. Dealing with “viruses” or “bugs” in the program
28. Printing off documents
29. Being evaluated on my computer competence
30. Using a “mouse”
31. Using a text interface rather than a graphics interface
32. Coming back to use a computer after an absence
33. Learning about computers without structured guidance
34. Being taught step by step correct computer procedures
35. Presenting work completed on a computer
36. Talking with people about computers
37. Being taught how to use a computer by a peer
38. Getting feedback from my teacher on my computer skills
39. Getting feedback from my peers on my computer skills
40. Collaborating with a friend while learning to use a computer
41. Getting feedback on my computer skills

---

A principal components factor analysis with oblimin rotation produced a four factor solution that explained 52.1% of the systematic covariance among the 32 items.
The first four unrotated factors accounted for 40%, 6.5%, 3.3%, and 2.5%, respectively.

The first rotated factor, Competence Anxiety, consisted of 14 items (items 3, 4, 5, 6, 7, 9, 20, 21, 22, 26, 27, 29, 31, 33). The items defining this factor relate to anxiety associated with one's real and perceived competence with computers.

The second rotated factor, Equipment Anxiety, consisted of 5 items (items 14, 16, 28, 30, 35). The items defining this factor relate to anxiety about using specified computerised equipment.

The third rotated factor, Receiving Feedback on Computing Skills, consisted of 5 items (items 37, 38, 39, 40, 41). The items defining this scale relate to feelings of anxiety generated by receiving feedback on one's computer skills.

The fourth rotated factor, Learning about Basic Computer Functions, consisted of 8 items (items 1, 8, 10, 11, 12, 15, 24, 25). The items defining this factor relate to anxiety associated with learning about computers in a class situation.

Using the 32 items, alpha coefficients for each of the computed scales were as follows:

- Factor 1: .92
- Factor 2: .80
- Factor 3: .88
- Factor 4: .89

Four models were tested for the Gaining Initial Computing Skills scale:

- **Model 1** was the four factor model submitted to EFA using exactly the original 32 items.

- **Model 2**, based on the results of Model 1, extracted those items which conformed to the criteria outlined above. This left 22 items as follows:

  - Factor 1: 3, 4, 6, 21, 26, 29, 33
  - Factor 2: 14, 28, 30, 35
  - Factor 3: 37, 38, 39, 40, 41
  - Factor 4: 1, 11, 12, 15, 24, 25

Using these 22 items, alpha coefficients for each factor were:

- Factor 1: .88
- Factor 2: .78
- Factor 3: .88
- Factor 4: .88

As the results from Model 1 indicated a high correlation (mean \( r = .6 \)) between each of the four factors and as it was hypothesized that all items in the Gaining
Initial Computing Skills scale logically related to aspects of gaining initial computing skills in formal class settings, two additional models were tested.

- **Model 3**, therefore, was a unidimensional one in which all items from the previous (second) model were included as one factor.

- **Model 4** predicted that there was one higher-order factor, general anxiety about Gaining Initial Computing Skills, in addition to four first-order factors (Learning about the Basic Functions of Computers; Competence with Computers; Handling Computer Equipment; and Receiving Feedback on Computing Competence). This model was believed to be the most appropriate fit as it was in keeping with the substantive grounds for the items in the Gaining Initial Computing Skills scale, and would also account for the correlation between factors, referred to earlier.

### Table 4.7

**Four Models of General Anxiety about Gaining Initial Computing Skills**

<table>
<thead>
<tr>
<th>Model</th>
<th>(X^2)</th>
<th>df</th>
<th>AGFI</th>
<th>RMSR</th>
<th>(X^2/df) ratio</th>
<th>RNI</th>
<th>TLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>1543.75</td>
<td>438</td>
<td>.935</td>
<td>.057</td>
<td>3.61</td>
<td>.929</td>
<td>.918</td>
</tr>
<tr>
<td>Model 2</td>
<td>569.44</td>
<td>203</td>
<td>.968</td>
<td>.046</td>
<td>2.81</td>
<td>.976</td>
<td>.968</td>
</tr>
<tr>
<td>Model 3</td>
<td>2294.85</td>
<td>209</td>
<td>.873</td>
<td>.108</td>
<td>10.99</td>
<td>.841</td>
<td>.824</td>
</tr>
<tr>
<td>Model 4</td>
<td>587.60</td>
<td>205</td>
<td>.967</td>
<td>.047</td>
<td>2.87</td>
<td>.971</td>
<td>.967</td>
</tr>
</tbody>
</table>

**Note 1.**

Model 1: Four factors (32 items)

Model 2: Four factors (the "best" 22 items)

Model 3: One factor (22 items)

Model 4: Higher-order factor plus four first-order factors

**Note 2.**

AGFI = adjusted goodness-of-fit index  
RMSR = root mean square residual  
TLI = Tucker-Lewis index  
RNI = relative noncentrality index

If one were to use the chi-square/degrees of freedom ratio as the strongest indicator, the "best" fit to the data is Model 2 (ratio of 2.8) with the AGFI and TLI very strong at .968 (see Table 4.7. **Note:** the large sample size inflates the chi-square along with the large number of parameters estimated). However, on substantive grounds, namely, the correlation between factors, Model 4 is preferred. The chi-square/degrees of freedom ratio in this case is only marginally higher (ratio of 2.87) with the AGFI and TLI still very high at .967. Support for this model is also provided by the high
correlation between the first-order factors (ranging from .65 to .94) as well as the target coefficient of .97 (the ratio of chi-square of the first-order factor model to the chi-square of the higher-order factor model), which indicates that the more restrictive higher-order model provides an excellent fit to the data.

Figure 4.1 depicts the final hierarchical model of the Gaining Initial Computing Skills scale and shows the factor loadings and error variances.

The correlations among the four a priori factors are positive and range between .63 and .84 (mean \( r = .75 \)). While moderate, such correlations provide support for arguing the separation of the four factors in the Gaining Initial Computing Skills scale in that an average of 44% of the variance in the factors is unexplained. A higher-order model attempts to explain the correlations among the first-order factors. In this scale, the correlation between the higher-order factor and the first-order factors ranges between .78 and .94 (mean \( r = .87 \)). Such a strong correlation supports the existence of an underlying factor which may justify the use of a total score in this scale. However, examination of the residuals indicates that from 12% to 39% of the variance is unexplained by the higher-order model. It is clear that one cannot adequately summarise the four factors with a higher-order one. Thus, caution needs to be exercised when using a total score to recognise that, while providing a useful overview and demonstrating a logical substantive relationship between the first-order factors, such a score would be an oversimplification of an individual's anxiety in Gaining Initial Computing Skills. Far more information would be obtained by recognising the multidimensionality of this factor. Throughout this Dissertation, therefore, where the CALM has been used, mean scales derived from those items loading on each of the first-order factors (see Pedhazur & Schmelkin, 1991, pp. 625-626) were used as the basis for determining individual and group levels of anxiety across the instrument.

While statistically significant, the substantive difference between the first-order and the higher-order model needs to be considered carefully (for detailed discussion of the evaluation of higher-order models see Marsh, 1987; Marsh & Hocevar, 1985). Clearly, there is virtually no difference in the goodness-of-fit indices (TLIs of .967 and .968). The residuals range between .06 and .22.
Figure 1  Model of Gaining Initial Computing Skills Scale Showing Factor Loadings and Error Variances
**Sense of Control**

The two factors hypothesized to define this construct were Positive and Negative Cognitions (or self-talk) about being able to master computers. As mentioned earlier, an alternative model was tested as well, that comprising one general factor plus a negative item artefactor.

Exploratory factor analyses were conducted on the 20 items defining this scale (shown below in Table 4.8).

**Table 4.8**

<table>
<thead>
<tr>
<th>Original Sense of Control Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<tr>
<td>2</td>
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<tr>
<td>3</td>
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<td>17</td>
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<tr>
<td>18</td>
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<tr>
<td>19</td>
</tr>
<tr>
<td>20</td>
</tr>
</tbody>
</table>

Using an oblimin rotation, two clear factors were identified which accounted for 49.5% of the variance. The first factor, Fear, consisted of those 11 items which represented negative or fearful cognitions (items 2, 3, 4, 5, 6, 9, 11, 12, 13, 15, 17).

The second factor, Positive Sense of Control, was hypothesized to consist of those items which represented positive cognitions (items 1, 7, 8, 10, 14, 16, 18, 19, 20). However, only the following items appeared to load on this second factor, namely items 1, 7, 16, 18, 19, 20. All items in both factors had factor loading between .57 (the lowest) and .81 (the highest).

Interestingly, a third factor emerged which isolated three items that did not appear to have strong face validity although they were related to the Control construct.
The factor loadings were .56, .57 and .57 for these three items (8, 10, and 14). It was decided, therefore, to delete them from the scale altogether.

In an attempt to arrive at a parsimonious model, factor one was reduced by 5 items, using the same criteria as described earlier, as it was felt that those items remaining (items 3, 5, 9, 12, 13, 17) were sufficiently strong, both psychometrically and substantively, to define the factor. Items that were retained were:

Factor 1: 3, 5, 9, 12, 13, 17.
Factor 2: 1, 7, 16, 18, 19, 20.

Cronbach alphas for each of the factors were as follows:
Factor 1: .91 (before deletion of items - total of 11)
Factor 2: .84 (after deletion of 5 items)
Factor 2: .88 (before deletion of items - total of 9)
Factor 2: .89 (after deletion of 3 items)

It is worth noting that the factor correlation matrix for the Sense of Control scale showed a .44 correlation between the two factors. Although moderate, it was decided to test a unidimensional model as well as a possible "negative item method effect".

As with the Gaining Initial Computing skills scale, LISREL 7 was used to perform confirmatory factor analyses on the data in the Sense of Control scale. Three models were fit to the data.

• **Model 1** used the factor structure derived from the initial substantive model from which items had been generated, and which had been supported by exploratory factor analyses, albeit somewhat "pruned". In this model, two substantive factors (positive and negative) were posited.

• **Model 2** examined the possibility that there was only one factor underlying both the negative and positive items, that is, it was unidimensional.

• **Model 3** predicted two factors, one "substantive" one on which all 12 items were allowed to load, and a "negative item" method factor for the 6 negative items only. Here the factor loadings for the two factors and the error/uniquenesses associated with each item were freely estimated. This allowed for all the negative items to load on one separate method factor.
Table 4.9
Three Models of Sense of Control

<table>
<thead>
<tr>
<th>Model</th>
<th>$X^2$</th>
<th>$df$</th>
<th>AGFI</th>
<th>RMSR</th>
<th>$X^2/df$ ratio</th>
<th>RNI</th>
<th>TLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>204.73</td>
<td>53</td>
<td>.976</td>
<td>.490</td>
<td>3.86</td>
<td>.980</td>
<td>.975</td>
</tr>
<tr>
<td>Model 2</td>
<td>1445.40</td>
<td>54</td>
<td>.833</td>
<td>.144</td>
<td>26.77</td>
<td>.819</td>
<td>.778</td>
</tr>
<tr>
<td>Model 3</td>
<td>161.86</td>
<td>48</td>
<td>.979</td>
<td>.420</td>
<td>3.37</td>
<td>.985</td>
<td>.980</td>
</tr>
</tbody>
</table>

Note 1.
Model 1: Two factors (12 items)
Model 2: One factor only (12 items)
Model 3: Two factors: one substantive factor and one method "artefactor"

Note 2.
AGFI = adjusted goodness-of-fit index
RMSR = root mean square residual
TLI = Tucker-Lewis index
RNI = relative noncentrality index

As seen in Table 4.9, Model 2 is clearly a very poor one with a chi-square/degrees of freedom ratio of 26.77, an AGFI of .833 RMSR of .144 and TLI of .778. Using the criteria of parsimony and the chi-square/degrees of freedom ratio as the strongest indicators, the "best" fit to the data is Model 3 (chi-sq/degrees of freedom ratio of 3.37) with the AGFI high at .979 and TLI at .980. It is worth noting that Model 1, however, is only marginally weaker in a statistical sense, with an AGFI of .976 and a TLI of .975 (Note: the large sample size, along with the large number of parameters estimated, inflates the chi-square so that the AGFI and TLI are taken to be more appropriate indicators of fit).

The relatively modest correlation (PHI = .52) between the latent factors, with only 27% of their variation shared, however, also supports Model 1 substantively. Figure 4.2 depicts the two-factor model of the Sense of Control scale (Model 1) and shows the factor loadings and error variances. This model was chosen on substantive grounds, with the intention of further testing the utility of the two-factor model.
Figure 2  Model of Sense of Control Scale Showing Factor Loadings and Error Variances
Computing Self-Concept

Exploratory factor analyses were performed on the 20 items in this scale (shown below in Table 4.10).

Table 4.10

Original Computing Self-Concept Items

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I am no good with computers</td>
</tr>
<tr>
<td>2</td>
<td>It wouldn’t worry me to try a new problem on a computer</td>
</tr>
<tr>
<td>3</td>
<td>I am sure I can do work with computers</td>
</tr>
<tr>
<td>4</td>
<td>I am not the type to do well with computers</td>
</tr>
<tr>
<td>5</td>
<td>I think using a computer would be very hard for me</td>
</tr>
<tr>
<td>6</td>
<td>I am very confident when it comes to working with computers</td>
</tr>
<tr>
<td>7</td>
<td>I can get good grades in computer courses</td>
</tr>
<tr>
<td>8</td>
<td>I am sure that I could learn a computer language</td>
</tr>
<tr>
<td>9</td>
<td>I don’t think I could handle a computer course</td>
</tr>
<tr>
<td>10</td>
<td>I feel threatened when other people talk about computers</td>
</tr>
<tr>
<td>11</td>
<td>I avoid using computers as much as possible</td>
</tr>
<tr>
<td>12</td>
<td>I need an experienced computer user nearby when I use a computer</td>
</tr>
<tr>
<td>13</td>
<td>I can make the computer do what I want</td>
</tr>
<tr>
<td>14</td>
<td>I need help when I use the computer</td>
</tr>
<tr>
<td>15</td>
<td>I am confident storing important information on a computer</td>
</tr>
<tr>
<td>16</td>
<td>I am sure I could solve any problems I had while I was using a computer</td>
</tr>
<tr>
<td>17</td>
<td>I can help others solve computer problems</td>
</tr>
<tr>
<td>18</td>
<td>If something went wrong with the computer I don’t feel that I could do anything about it.</td>
</tr>
<tr>
<td>19</td>
<td>I am sure that I can help others learn to use the computer</td>
</tr>
<tr>
<td>20</td>
<td>I am not worried about having to solve computer problems without help.</td>
</tr>
</tbody>
</table>

As with the previous scale, Sense of Control, it was originally hypothesized that there would be two factors in this scale; one which measured a Positive Computing Self-Concept ("I am good at computing"), and the other which measured a Negative Computing Self-Concept ("I am no good at computing").

Using an oblimin rotation, two clear factors emerged which accounted for 53% of the variance. The first was that of a Positive Computing Self-Concept which consisted of 12 items. The items defining this factor related to perceptions of confidence and self-efficacy with regard to computing. The second factor which had been hypothesized, was that of Negative Computing Self-Concept. The 8 items in this factor related to lack of confidence and belief in one's ability with computers. It is worth noting that the factor correlation matrix showed a strong correlation between the two factors (r=.75).
As the scale was considered too long (20 items) to be included in a battery of tests, it was decided to delete those items in both factors which did not have strongest face validity. Those that were retained (11 items) had factor loadings of between .45 and .94 (the majority were greater than .6). Items that were retained were:

Factor 1: 6, 7, 15, 16, 17, 19
Factor 2: 1, 4, 5, 9, 11

Alpha coefficients for the reliabilities of the two hypothesized factors in their reduced form were as follows:

Factor 1: .91
Factor 2: .86

LISREL 7 confirmatory factor analyses were performed on the Computing Self-Concept scale. Three models were fit to the data:

- **Model 1** predicted that there were two factors (positive and negative) as in the exploratory factor analyses in which the factors were allowed to be correlated.

- **Model 2** was a unidimensional factor estimation.

  **Model 3** estimated two factors: One a "real" or substantive factor; the other a "method" factor which accounts for the negatively worded items. Here factor loadings for each factor and the error/uniqueness associated with each item were freely estimated. This allowed for all the negative items to load on one separate method factor.

### Table 4.11

**Three Models of Computing Self-Concept**

<table>
<thead>
<tr>
<th>Model</th>
<th>$X^2$</th>
<th>$df$</th>
<th>AGFI</th>
<th>RMSR</th>
<th>$X^2/df$ ratio</th>
<th>RNI</th>
<th>TLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>165.53</td>
<td>43</td>
<td>.978</td>
<td>.041</td>
<td>3.85</td>
<td>.983</td>
<td>.979</td>
</tr>
<tr>
<td>Model 2</td>
<td>387.71</td>
<td>44</td>
<td>.950</td>
<td>.068</td>
<td>8.80</td>
<td>.953</td>
<td>.941</td>
</tr>
<tr>
<td>Model 3</td>
<td>114.91</td>
<td>39</td>
<td>.983</td>
<td>.034</td>
<td>2.94</td>
<td>.990</td>
<td>.985</td>
</tr>
</tbody>
</table>

**Note 1**
- Model 1: Two factors (11 items)
- Model 2: One factor only (11 items)
- Model 3: Two factors: one substantive factor and one method "artefactor"

**Note 2:**

AGFI = adjusted goodness-of-fit index

RMSR = root mean square residual

TLI = Tucker-Lewis index

RNI = relative noncentrality index
Table 4.11 shows that Model 3 provides an excellent fit to the data with an AGFI of .983 and a TLI of .985. It is also the most parsimonious model. Furthermore, the chi-sq/degrees of freedom ratio is the lowest of the three models.

Statistically, the evidence supports a model for the Computing Self-Concept scale of one self-concept factor and an additional "method effect" constituted by negatively worded items. This is supported by the relatively strong correlation between the two hypothesized factors (PHI = .84), indicating that approximately 71% of the variation between the latent factors is shared. However, as with the Sense of Control scale, it is clear that there is little statistical difference between Model 3 and the two-factor (positive and negative), Model 1, whose AGFI was .978 and whose TLI was .979. On substantive grounds again, the one-factor model is chosen in this case (see discussion earlier in this chapter). Figure 4.3 depicts this model of the Computing Self-Concept scale (Model 3) and shows the factor loadings and error variances.
Figure 3  Model of Computing Self-Concept Scale Showing Factor Loadings and Error Variances
State Anxiety in Computing Situations

The research literature in the area of anxiety of a clinical nature typically reports three component of anxiety: cognitive, emotional and somatic (see Chapter One). These components, therefore, were hypothesised to comprise the state anxiety that individuals would experience in computing situations. Specifically, in the CALM instrument, the cognitive component was hypothesised to consist of two factors - Worry and Distractability; the emotional component was hypothesised to consist of one factor - Happiness; and the somatic component was hypothesised to consist of the Physiological Symptoms factor.

Exploratory factor analyses using an oblimin rotation were performed on the 30 items in this scale (shown below in Table 4.12).

Table 4.12
Original State Anxiety in Computing Situations Items

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nervous stomach, “butterflies”</td>
</tr>
<tr>
<td>2</td>
<td>Hot and sweaty</td>
</tr>
<tr>
<td>3</td>
<td>Heart palpitations</td>
</tr>
<tr>
<td>4</td>
<td>Feeling of unease</td>
</tr>
<tr>
<td>5</td>
<td>Lack of concentration</td>
</tr>
<tr>
<td>6</td>
<td>Distractable</td>
</tr>
<tr>
<td>7</td>
<td>Tense</td>
</tr>
<tr>
<td>8</td>
<td>Calm</td>
</tr>
<tr>
<td>9</td>
<td>Self-confident</td>
</tr>
<tr>
<td>10</td>
<td>Worried about possible problems</td>
</tr>
<tr>
<td>11</td>
<td>Irritable</td>
</tr>
<tr>
<td>12</td>
<td>Dry mouth</td>
</tr>
<tr>
<td>13</td>
<td>Sweaty palms</td>
</tr>
<tr>
<td>14</td>
<td>Happy</td>
</tr>
<tr>
<td>15</td>
<td>Comfortable</td>
</tr>
<tr>
<td>16</td>
<td>Enthusiastic</td>
</tr>
<tr>
<td>17</td>
<td>In charge</td>
</tr>
<tr>
<td>18</td>
<td>Threatened</td>
</tr>
<tr>
<td>19</td>
<td>Secure</td>
</tr>
<tr>
<td>20</td>
<td>Insecure</td>
</tr>
<tr>
<td>21</td>
<td>Helpless</td>
</tr>
<tr>
<td>22</td>
<td>Regretful</td>
</tr>
<tr>
<td>23</td>
<td>Upset</td>
</tr>
<tr>
<td>24</td>
<td>Restful</td>
</tr>
<tr>
<td>25</td>
<td>Anxious</td>
</tr>
<tr>
<td>26</td>
<td>Relaxed</td>
</tr>
<tr>
<td>27</td>
<td>Worried</td>
</tr>
<tr>
<td>28</td>
<td>Rattled</td>
</tr>
<tr>
<td>29</td>
<td>At ease</td>
</tr>
<tr>
<td>30</td>
<td>Content</td>
</tr>
</tbody>
</table>
As hypothesized, four interpretable factors were identified which explained 57.7% of the systematic covariance among the items. These were named according to the items defining the factors.

Factor one, Worry, consisted of ten items (items 4, 7, 10, 18, 20, 21, 22, 25, 27, 28) which represent thoughts that are synonymous with the "worry" which occurs specifically in computing situations. Factor loadings for all of the items ranged from .42 to .73. Three items (7, 22, 25) were considered for deletion, namely those which had a factor loading of below .59 (each of these also cross-loaded on at least one other factor) and whose face validity were doubtful.

The reliability of the factor was .88 with all ten items included. After deletion of the weaker items, the reliability increased to .90.

Factor two, Happiness, consisted of eleven items (items 8, 9, 14, 15, 16, 17, 19, 24, 26, 29, 30) which related to a positive emotional state while using computers. As it was considered desirable to reduce the number of items in this factor to be more consistent with the others in this scale, five items (items 8, 9, 16, 17, 24) with the lowest factor loadings were deleted. The remaining items had factor loadings between .73 and .85. Standardised item alpha was .93 for the reduced set of items.

Factor three, Distractability, consisted of three items (items 5, 6, 11) which related to inability to concentrate while in a computing situation. One item, "Irritable" (item 11), was found to cross load on two other factors, which reduced the alpha reliability coefficient. Standardized item alpha rose from .74 for the three items to .81 after the deletion of the weak item. Although this reliability is relatively high, it is recognised that two item scales are not really acceptable. It is worth noting that in recognition of this design problem, this factor was revised to include three new items relating to distractability which are anticipated to further extend this important dimension of state anxiety.

Factor four, Physiological Symptoms, consisted of six items (items 1, 2, 3, 12, 13, 23) which related to the range of physiological symptoms typically associated with anxiety. The reliability of this factor was .86. Factor loadings for the items ranged between .42 and .81. One item, "Upset" (item 23), cross loaded on another factor (Worry) and was deleted, therefore. The final scale had a reliability of .85.

Items that were retained were:
Factor 1: 4, 10, 18, 20, 21, 27, 28
Factor 2: 14, 15, 19, 26, 29, 30
Factor 3: 5, 6
Factor 4: 1, 2, 3, 12, 13
Using LISREL 7, confirmatory factor analyses were conducted on the revised set of items from the exploratory factor analyses in the State Anxiety in Computing Situations scale. Two models were fit to the data:

- **Model 1** predicted that there were four first-order factors in the State Anxiety in Computing Situations scale, comparable to the exploratory factor analyses.
- **Model 2** predicted that, in addition to the four first-order factors in model one, there was one second- or higher-order factor.

### Table 4.13
**Two Models of State Anxiety in Computing Situations**

<table>
<thead>
<tr>
<th>Model</th>
<th>( \chi^2 )</th>
<th>( df )</th>
<th>AGFI</th>
<th>RMSR</th>
<th>( \chi^2/df ) ratio</th>
<th>RNI</th>
<th>TLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>345.30</td>
<td>164</td>
<td>.986</td>
<td>.045</td>
<td>2.10</td>
<td>.988</td>
<td>.988</td>
</tr>
<tr>
<td>Model 2</td>
<td>372.55</td>
<td>166</td>
<td>.985</td>
<td>.048</td>
<td>2.24</td>
<td>.987</td>
<td>.987</td>
</tr>
</tbody>
</table>

**Note 1**
- Model 1: Four factors (20 items)
- Model 2: Higher-order factor plus four first-order factors

**Note 2**
- AGFI = adjusted goodness-of-fit index;
- RMSR = root mean square residual;
- TLI = Tucker-Lewis index;
- RNI = relative noncentrality index;

The four factor model clearly provides a very good fit to the data, as shown in Table 4.13. However, using the ratio of chi-square of the first-order factor model to the chi-square of the higher-order factor model as a criterion (Marsh and Hocevar, 1985), the value of the target coefficient (.93) indicates that the more restrictive factor model also provides a very good fit to the data. There was moderate to high correlation between the first-order factors (ranging from .43 to .8) which was considered sufficient to support the existence of a higher-order factor as well, although the Distratractability factor had the lowest correlation with each of the other factors (ranging between .43 and .51). As with the Gaining Initial Computing Skills scale, there is virtually no statistical difference between the two models. The results clearly support the multidimensionality of this scale at the same time as providing evidence of the underlying substantive relationship among the four factors. The comparative weakness
of the Distractability factor was recognised and efforts to remedy this were implemented, as mentioned above.

As demonstrated in Figure 4.4, factor 1 (Worry) accounts for all of the variance in that factor (i.e., a higher-order factor loading of 1.00), while factor 3 (Distractability) accounts for only 30% of the variance (i.e., a higher-order factor loading of .53^2. Factors 2 (Happiness) and 3 (Physiological symptoms) account for over half of the variance in those factors. Some of this inconsistency may be explained by the number of items in each factor, with factor 1 having 7 items, and factor 3 having only 2 items.
Figure 4  Model of State Anxiety in Computing Situations Scale Showing Factor Loadings and Error Variances
It would appear that the Distractability construct only partly fits within a Worry state context, although the literature would support its very strong substantive connection. As Wine (1971) and Heckhausen (1991) have demonstrated, the negative effects of worry on performance are seen in terms of task irrelevant responses such as interfering self-related thoughts. From a substantive point of view, therefore, it would be valuable to be able to determine an individual's overall state of anxiety in a computing context, and examine scores on each of the cognitive, emotional and somatic components of state anxiety. Figure 4.4 represents this hierarchical model of the State Anxiety in Computing Situations scale and shows the factor loadings and error variances.

Tests of Factorial Invariance

Subsequent to the tests of goodness-of-fit for the a priori models reported earlier, tests of factorial invariance were conducted to determine the stability and generalisability of the results across independent groups. The results of these tests are presented below in Tables 4.14 and 4.15, following the discussion of the rationale behind the analyses.

As parallel data exist for each of the faculty groups in the sample, confirmatory factor analysis provides a particularly powerful test of the equivalence of solutions across these groups (for further discussion see Bollen, 1989; Marsh & Hocevar, 1985; Marsh, 1993, 1994b). Using such analyses, it is possible to fit the data subject to the constraint that any one, any set, or all parameters are equal in the multiple groups. "The minimal condition for 'factorial invariance' is the equivalence of all factor loadings in the multiple groups (Marsh, 1994b, p. 11). Following Marsh's (1994b) hierarchical ordering of invariance testing, three tests were conducted:

- **Model 1**: Total non-invariance with no between-groups invariance constraints.
- **Model 2**: Factor loadings invariant across groups.
- **Model 3**: Total invariance with all parameters (factor loadings, factor correlations, factor variances, and uniquenesses) constrained to be the same for all groups.

When the focus of the confirmatory factor analysis is to test invariance across multiple groups, it is advised that analyses be conducted using covariance matrices, not correlation matrices that are standardised in relation to responses by each group separately (for further discussion see Joreskog & Sorbom, 1989). In the present investigation, therefore, the invariance of factor solutions based on responses by students from three faculty groups were tested using covariance matrices. The three groups consisted of students from the faculties of Business and Technology, Arts and Social Sciences, and Education combined with a smaller sample of students in the
Faculty of Health. The logic behind combining these samples was as twofold: as the Faculty of Health had only 79 students compared with 165 in the Faculty of Education, and had a similar relative proportion of males to females as the Education group, (Education males = 17%; Health males = 20%), it was considered appropriate to combine the two so that factorial invariance tests could be conducted on sufficiently large samples to satisfy the requirements for optimal sample size needed for invariance testing using the LISREL program (that is, over 200 students in each group). Secondly, both samples represented "helping" professions so that students enrolled in them were likely to be more similar than from other faculties. Because these three faculty group initial intakes are self-selected to be quite different, these tests of factorial invariance provide a good test of the generalisability of the factor solution of the Computer Anxiety and Learning Measure. As the group sizes were modest (Business and Technology = 282, Arts and Social Sciences = 268, and Education combined with Health = 244) and were not optimal for using polychoric and/or asymptotic matrices (as used for testing the a priori models for the full group), it was necessary to run subsequent analyses using covariance matrices. The Tucker-Lewis Index (TLI) and Relative Noncentrality Index (RNI) were used to assess goodness-of-fit.

In summary, therefore, analyses of the a priori models (reported earlier in this chapter) and the tests of invariance (reported below) were conducted using different matrices. This was due both to differences in sample size between the full group (n = 794) and separate faculty groups (n = between 235 and 273), where asymptotic covariance matrices are appropriate for large samples but not for small), and to the fact that covariance matrices are required for invariance testing. Thus, Table 4.14 presents the results for total group analyses for the a priori model based on asymptotic covariance matrices, and Table 4.15 presents results of invariance tests of the models using covariance matrices. Separate faculty group analyses were conducted to test the model fit in each faculty. Irrespective of differences in academic focus between the faculty groups, it was shown that the goodness-of-fit for the models of anxiety in each scale were very comparable and relatively high, reaching the Tucker-Lewis index of acceptable fit (.90) for Faculties 1 and 3 for the Sense of Control scale, and exceeding it considerably in most other cases. In sum, both the RNI and TLI indices were at least .9 for each of the three groups analysed separately.
Table 4.14
Summary of Goodness-of-fit Indices for "Best" Models of Scales in the Computer Anxiety And Learning Measure: Total Group Analyses

<table>
<thead>
<tr>
<th>Model</th>
<th>(X^2)</th>
<th>df</th>
<th>(X^2/df)</th>
<th>RNI</th>
<th>TLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaining Initial Computing Skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>null</td>
<td>13332.17</td>
<td>231</td>
<td>57.715</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>1storder</td>
<td>569.44</td>
<td>203</td>
<td>2.805</td>
<td>.976</td>
<td>.968</td>
</tr>
<tr>
<td>hiorder</td>
<td>587.60</td>
<td>205</td>
<td>2.866</td>
<td>.971</td>
<td>.967</td>
</tr>
<tr>
<td>Sense of Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>null</td>
<td>7743.47</td>
<td>66</td>
<td>117.325</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>methodeff</td>
<td>459.16</td>
<td>48</td>
<td>9.566</td>
<td>.985</td>
<td>.980</td>
</tr>
<tr>
<td>2factor</td>
<td>204.73</td>
<td>53</td>
<td>3.862</td>
<td>.980</td>
<td>.975</td>
</tr>
<tr>
<td>Computing Self-Concept</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>null</td>
<td>7346.55</td>
<td>55</td>
<td>133.574</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>methodeff</td>
<td>114.91</td>
<td>39</td>
<td>2.946</td>
<td>.990</td>
<td>.985</td>
</tr>
<tr>
<td>2factor</td>
<td>165.53</td>
<td>43</td>
<td>3.849</td>
<td>.983</td>
<td>.979</td>
</tr>
<tr>
<td>State Anxiety in Computing Situations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>null</td>
<td>16374.98</td>
<td>190</td>
<td>86.184</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>1storder</td>
<td>345.30</td>
<td>164</td>
<td>2.10</td>
<td>.988</td>
<td>.988</td>
</tr>
<tr>
<td>hiorder</td>
<td>372.55</td>
<td>166</td>
<td>2.244</td>
<td>.987</td>
<td>.987</td>
</tr>
</tbody>
</table>

Note.
null = null models for the total group; 1storder = first-order models for the total group; hiorder = higher-order models for the total group; methodeff = method effect models for the total group; 2factor = two-factor models for the total group; TLI = Tucker-Lewis Index; RNI = relative noncentrality index.

Clearly, with Tucker-Lewis indices for each scale of the Computer Anxiety and Learning Measure ranging between .968 and .988, the support for the a priori models is very strong indeed.
<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$\chi^2$/df</th>
<th>RNI</th>
<th>TLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaining Initial Computing Skills (Higher order model)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3gp (no inv)</td>
<td>1570.34</td>
<td>615</td>
<td>2.553</td>
<td>.934</td>
<td>.975</td>
</tr>
<tr>
<td>3gp (fl inv)</td>
<td>1593.93</td>
<td>651</td>
<td>2.448</td>
<td>.935</td>
<td>.977</td>
</tr>
<tr>
<td>3gp (tot inv)</td>
<td>1681.29</td>
<td>711</td>
<td>2.365</td>
<td>.933</td>
<td>.978</td>
</tr>
<tr>
<td>Sense of Control (Two factor model)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3gp (no inv)</td>
<td>372.01</td>
<td>144</td>
<td>2.583</td>
<td>.971</td>
<td>.987</td>
</tr>
<tr>
<td>3gp (fl inv)</td>
<td>402.05</td>
<td>180</td>
<td>2.234</td>
<td>.971</td>
<td>.990</td>
</tr>
<tr>
<td>3gp (tot inv)</td>
<td>423.40</td>
<td>204</td>
<td>2.075</td>
<td>.972</td>
<td>.991</td>
</tr>
<tr>
<td>Computing Self-Concept (Method effect model)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3gp (no inv)</td>
<td>283.62</td>
<td>117</td>
<td>2.424</td>
<td>.979</td>
<td>.990</td>
</tr>
<tr>
<td>3gp (fl inv)</td>
<td>324.02</td>
<td>149</td>
<td>2.175</td>
<td>.977</td>
<td>.992</td>
</tr>
<tr>
<td>3gp (tot inv)</td>
<td>353.18</td>
<td>171</td>
<td>2.065</td>
<td>.977</td>
<td>.992</td>
</tr>
<tr>
<td>State Anxiety in Computing Situations (Higher order model)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3gp (no inv)</td>
<td>956.09</td>
<td>498</td>
<td>1.920</td>
<td>.973</td>
<td>.990</td>
</tr>
<tr>
<td>3gp (fl inv)</td>
<td>993.03</td>
<td>530</td>
<td>1.874</td>
<td>.974</td>
<td>.990</td>
</tr>
<tr>
<td>3gp (tot inv)</td>
<td>1091.44</td>
<td>586</td>
<td>1.863</td>
<td>.971</td>
<td>.990</td>
</tr>
</tbody>
</table>

Note.  
3gp (no inv) = no invariance constraints across the three groups; 3gp (fl inv) = refers to factor loadings invariant across the three groups; 3gp (tot inv) = refers to all parameters constrained to be invariant across the three groups; TLI = Tucker-Lewis Index; RNI = relative noncentrality index.

As can be seen in Table 4.15, conclusions based on the Tucker-Lewis index of goodness-of-fit indicate that the best fit for each scale is for models imposing complete invariance - the most parsimonious and, therefore, those favoured by the Tucker-Lewis index (which penalises model complexity). There was considerable consistency between results for the three invariance models. Such strong support for invariance provides excellent support for all of the a priori models.

In conclusion, therefore, it appears that the model of computer anxiety presented in the Computer Anxiety and Learning Measure can be applied with considerable confidence across different faculty groups on the basis of the very good fit of the invariance model.
Discussion

CALM - A Valid Measure of the Multifaceted Nature of Computer Anxiety

The strongest goodness-of-fit indices from the confirmatory factor analyses reported in the present study support a multifaceted model of computer anxiety for beginning adult users which consists of ten factors plus one negative item factor. Such a model provides excellent explanatory power in that the use of individual facets of a construct can sometimes predict dependent variables more accurately than the more general construct (Carver, 1989). A more parsimonious model still, consisting of only five factors plus a measurement-method effect, was identified using CFA analyses of the data. In particular, the results supported the existence of one second (higher) order factor for each of the Gaining Initial Computing Skills and State Anxiety in Computing Situations scales. This was not surprising, as all items defining the first-order factors in these scales related logically to the general construct for each section, as discussed previously.

Although the results for the Gaining Initial Computing Skills and the State Anxiety in Computing Situations scales, based on their respective four factor models, support the multidimensional nature of these computer anxiety constructs, it is implied by the more parsimonious higher-order models in each case that it may be valid to subsume the different dimensions under a broader construct of General Anxiety in Gaining Initial Computing Skills. Thus, for administration of the CALM instrument in settings where the greater explanatory power of the four factor models of these scales is not deemed significant, the use of a single score for these single higher-order constructs may be justified (cf. Shek, 1993), while acknowledging the considerable oversimplification that this represents, as discussed earlier (because it is comparable to adopting a one factor model whose fit was considerably poorer). On the other hand, given that the overall fits for both first- and second-order models in these scales are almost identical (as shown in Table 4.15), the decision to adopt one or the other is dependent on one's research purpose.

Resolution of the Two-Factor Versus One-Factor Plus Method Effect Dilemma

As for the Sense of Control and Computing Self-Concept constructs, there was equivalently strong statistical support for both a model in which there is one substantive factor, with negatively worded items forming a separate "method" factor, and for a two-factor (positive and negative cognitions) model. There was only .005 and .006 improvement in the Tucker-Lewis indices for the former model in each of the Sense of Control and Computing Self-Concept scales, respectively.
As the confirmatory factor analyses in the present investigation did not discriminate sufficiently between the alternative models, it seems plausible, therefore, that both can be argued for with equal validity. On the basis of the confirmatory factor analyses, there is almost equal support for an interpretation of two substantively distinct factors and for the one general factor plus method "artefactor" for both Sense of Control and Computing Self-Concept. In the Sense of Control construct, the items were originally written to illustrate two factors, with a semantic distinction being made between the positive and negative constructs: the first factor relates to perceptions of mastery or control in computing situations which are characterised by positively expressed cognitions (for example, "I know I can do it"); "I feel in control of what I do"). The second factor relates to perceptions of helplessness or lack of control in computing situations which are characterised by negative self-talk (for example, "Everyone else but me knows what they are doing"); "What if I hit the wrong key?"). There is considerable research evidence to support the existence of two separate "Control" factors here.

It could be argued that in this study the adult respondents clearly distinguished between these two factors. On the other hand, the correlation of .52 between the two latent factors suggests caution in making this interpretation boldly. As for the latter scale (Computing Self-Concept), the correlation between the positive and negative latent factors for the two-factor model was .85. The positively worded factor contained items such as "I can get good grades in computer courses" and "I am very confident when it comes to working with computers", while the negatively worded factor included "I don't think I could handle a computer course" and "I am no good with computers". In the case of this scale, the items were expressed as opposites of each other, rather than as separate constructs. Marsh (1986) showed that the size of the negative item effect is related to verbal ability (that is, there is a small correlation between the positive and negative scales for young children, and a greater one for adults). Such a high correlation (.85) in the case of Computing Self-Concept gives even stronger support to the interpretation of a method effect for negatively worded items. Furthermore, the results are based on the substantial body of prior research in the area of general self-concept which clearly supports such a view, albeit somewhat moderated by verbal ability and age.

It is suggested that if the respondents are capable of discriminating between positive and negative items as they are in the present study (being adults of presumed high verbal ability in a university setting), and still the negative item effect is clearly demonstrated through confirmatory factor analysis, one can strongly argue for the need to recognise the potential bias introduced by negative items in rating scales.
What Conclusion Should the Present Researcher Make in this Regard?

One option is simply to avoid using any negative items in a rating scale, which successfully ignores the problem (Marsh, 1996). Another is to include the negative items, if there appears to be a substantive basis for doing so, making sure that the proportion of positive and negative items is much the same and measuring the effects, as was done in the present research (Marsh, 1996).

In the case of the present research, the issues are as follows: Can positive and negative factors be clearly distinguished? For the Sense of Control scale, the evidence supports such a case, namely, a moderate correlation of .52 between the factors and strong substantive grounds for arguing that perceptions of control are expressed as positive and negative cognitions or self-talk (Bandura, 1977; Boggiano & Ruble, 1986: Schwarz, 1986; 1996).

In the case of Computing Self-Concept, the evidence more strongly favours the interpretation of a single substantively important factor. Here the high correlation of .85 and the weight of research in self-concept (cited earlier) which demonstrates that any "effects" found for negative items can clearly be accounted for by correlated uniquenesses and are not substantively important, provides the greatest support for this argument.

Support for the models that I have chosen in this chapter is drawn from the theoretical literature, as described earlier. The issue can be evaluated further by seeing if the two factors are differentially correlated in predictable ways to external criteria, that is, using a construct validity approach. The results of both the analysis of variance tests of the baseline data (reported in Chapter Five), and of the experimental interventions (reported in Chapters Seven and Eight), are presented using the two versions of these constructs, however, in an effort to further clarify the validity of my interpretations.

A Final Version of CALM

The final Computer Anxiety and Learning Measure (CALM) that was derived from both EFAs and CFAs in the present study comprised 65 items. Eleven first-order factors provided a good fit to the data. Two second-order factors explained the correlations between the four oblique factors in the Gaining Initial Computing Skills and State Anxiety in Computing Situations scales, respectively. In summary, the latent constructs in the model of computer anxiety that have evolved from the present research can be represented in the following way, as shown in Table 4.16.
Table 4.16
Factors Defining Computer Anxiety for Adult Learners Using the Computer Anxiety and Learning Measure: A Model of CALM

<table>
<thead>
<tr>
<th>Gaining Initial Computing Skills:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Four first-order factors</strong> -</td>
</tr>
<tr>
<td>* Learning about Basic Computer Functions</td>
</tr>
<tr>
<td>* Competence with Computers;</td>
</tr>
<tr>
<td>* Handling computer Equipment;</td>
</tr>
<tr>
<td>* Receiving Feedback on Computing Skills</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>One second-order factor -</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Gaining Initial Computing Skills</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sense of Control:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>One factor</strong> -</td>
</tr>
<tr>
<td>* Sense of Control plus negative-item artefactor, or</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Two factors -</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Positive Sense of Control and Fear (alternative model)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Computing Self-Concept:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>One factor</strong> -</td>
</tr>
<tr>
<td>* Computing Self-Concept plus negative-item artefactor, or</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Two factors -</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Positive and Negative Computing Self-Concept (alternative model)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>State Anxiety in Computing Situations:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Four first-order factors</strong> -</td>
</tr>
<tr>
<td>* Worry</td>
</tr>
<tr>
<td>* Happiness</td>
</tr>
<tr>
<td>* Distractability</td>
</tr>
<tr>
<td>* Physiological Symptoms</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>One Second-order factor -</th>
</tr>
</thead>
<tbody>
<tr>
<td>* State Anxiety in Computing Situations</td>
</tr>
</tbody>
</table>
The final version of CALM that has emerged from the exploratory and confirmatory factor analyses described in this chapter is shown in Figure 4.5. The factor loadings and reliabilities derived from the LISREL 7 analyses for the sixty-five items retained in the final instrument are shown in Table 4.17.

In conclusion, although the Computer Anxiety and Learning Measure appears statistically and substantively “robust”, the generalisability of the model of computer anxiety presented in this study has yet to be demonstrated. While the original sample was representative of the composition of the population of interest, namely, adults undertaking initial computer literacy skills training courses, the model needs to be replicated with a more diverse sample and with a non-student population. It is important to note, however, that the tests of factorial invariance across different faculties reported earlier give considerable support for the stability and generalisability of the findings. Future research would need to examine whether the CALM model is invariant across different groups in similar learning /training environments (cf. Marcoulides, Mayes & Wiseman, 1995).
Figure 5  Final Model of the Computer Anxiety and Learning Measure (CALM) Derived from Exploratory and Confirmatory Factor Analyses
Table 4.17

Standardised Estimates for the 65 item Computer Learning and Anxiety Measure

<table>
<thead>
<tr>
<th>Item</th>
<th>factor loading</th>
<th>SMC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GAINING INITIAL COMPUTING SKILLS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SCALE 1: COMPETENCE ANXIETY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Taking a test on my computer competence</td>
<td>.79</td>
<td>.62</td>
</tr>
<tr>
<td>4. Working in a job that requires some computer experience</td>
<td>.73</td>
<td>.53</td>
</tr>
<tr>
<td>6. Getting &quot;error&quot; messages from the computer</td>
<td>.66</td>
<td>.40</td>
</tr>
<tr>
<td>21. Teaching someone else about computers</td>
<td>.74</td>
<td>.55</td>
</tr>
<tr>
<td>26. Dealing with computer malfunctions</td>
<td>.81</td>
<td>.66</td>
</tr>
<tr>
<td>29. Being evaluated on my computer competence</td>
<td>.84</td>
<td>.71</td>
</tr>
<tr>
<td>33. Learning about computers without structured guidance</td>
<td>.72</td>
<td>.52</td>
</tr>
<tr>
<td><strong>SCALE 2: EQUIPMENT ANXIETY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Using computerised equipment</td>
<td>.80</td>
<td>.65</td>
</tr>
<tr>
<td>28. Printing off documents</td>
<td>.79</td>
<td>.63</td>
</tr>
<tr>
<td>30. Using a &quot;mouse&quot;</td>
<td>.62</td>
<td>.40</td>
</tr>
<tr>
<td>35. Presenting work completed on a computer</td>
<td>.75</td>
<td>.56</td>
</tr>
<tr>
<td><strong>SCALE 3: FEEDBACK ON COMPUTING SKILLS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37. Being taught how to use a computer by a peer</td>
<td>.75</td>
<td>.56</td>
</tr>
<tr>
<td>38. Getting feedback from my teacher on my computer skills</td>
<td>.93</td>
<td>.89</td>
</tr>
<tr>
<td>39. Getting feedback from my peers on my computer skills</td>
<td>.88</td>
<td>.77</td>
</tr>
<tr>
<td>40. Collaborating with a friend while learning to use a computer</td>
<td>.79</td>
<td>.63</td>
</tr>
<tr>
<td>41. Getting feedback on my computer skills</td>
<td>.93</td>
<td>.87</td>
</tr>
<tr>
<td><strong>SCALE 4: LEARNING ABOUT BASIC COMPUTER FUNCTIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Taking a course in a computer language</td>
<td>.72</td>
<td>.52</td>
</tr>
<tr>
<td>11. Learning computer terminology</td>
<td>.81</td>
<td>.66</td>
</tr>
<tr>
<td>12. Reading a computer manual.</td>
<td>.68</td>
<td>.46</td>
</tr>
<tr>
<td>15. Learning how a computer works</td>
<td>.83</td>
<td>.69</td>
</tr>
<tr>
<td>24. Learning the operating system of a computer</td>
<td>.89</td>
<td>.79</td>
</tr>
<tr>
<td>25. Learning a new computer application</td>
<td>.90</td>
<td>.82</td>
</tr>
<tr>
<td><strong>STATE ANXIETY IN COMPUTING SITUATIONS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SCALE 1: WORRY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Feelings of unease</td>
<td>.86</td>
<td>.75</td>
</tr>
<tr>
<td>10. Worried about possible problems</td>
<td>.70</td>
<td>.49</td>
</tr>
<tr>
<td>18. Threatened</td>
<td>.85</td>
<td>.72</td>
</tr>
<tr>
<td>20. Insecure</td>
<td>.89</td>
<td>.78</td>
</tr>
<tr>
<td>21. Helpless</td>
<td>.81</td>
<td>.66</td>
</tr>
<tr>
<td>27. Worried</td>
<td>.85</td>
<td>.73</td>
</tr>
<tr>
<td>28. Rattled</td>
<td>.75</td>
<td>.57</td>
</tr>
<tr>
<td>Item</td>
<td>factor loading</td>
<td>SMC</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------------</td>
<td>-----</td>
</tr>
<tr>
<td><strong>SCALE 2: HAPPINESS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Happy</td>
<td>.81</td>
<td>.65</td>
</tr>
<tr>
<td>15. Comfortable</td>
<td>.90</td>
<td>.81</td>
</tr>
<tr>
<td>19. Secure</td>
<td>.89</td>
<td>.80</td>
</tr>
<tr>
<td>26. Relaxed</td>
<td>.92</td>
<td>.84</td>
</tr>
<tr>
<td>29. At ease</td>
<td>.91</td>
<td>.83</td>
</tr>
<tr>
<td>30. Content</td>
<td>.87</td>
<td>.76</td>
</tr>
<tr>
<td><strong>SCALE 3: PHYSIOLOGICAL SYMPTOMS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Nervous stomach, &quot;butterflies&quot;</td>
<td>.91</td>
<td>.83</td>
</tr>
<tr>
<td>2. Hot and sweaty</td>
<td>.89</td>
<td>.80</td>
</tr>
<tr>
<td>3. Heart palpitations</td>
<td>.91</td>
<td>.83</td>
</tr>
<tr>
<td>12. Dry mouth</td>
<td>.80</td>
<td>.63</td>
</tr>
<tr>
<td>13. Sweaty palms</td>
<td>.80</td>
<td>.64</td>
</tr>
<tr>
<td><strong>SCALE 4: DISTRACTABILITY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Lack of concentration</td>
<td>.99</td>
<td>.97</td>
</tr>
<tr>
<td>6. Distractable</td>
<td>.80</td>
<td>.64</td>
</tr>
</tbody>
</table>

**SENSE OF CONTROL (Two-factor model)**

<table>
<thead>
<tr>
<th>Scale 1: Positive Sense of Control</th>
<th>factor loading</th>
<th>SMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can master the computer</td>
<td>.66</td>
<td>.43</td>
</tr>
<tr>
<td>7. I know I can do it</td>
<td>.73</td>
<td>.53</td>
</tr>
<tr>
<td>16. I will be able to get the computer to do what I want</td>
<td>.75</td>
<td>.56</td>
</tr>
<tr>
<td>18. I will understand what to do</td>
<td>.81</td>
<td>.66</td>
</tr>
<tr>
<td>19. I feel in control of what I do</td>
<td>.93</td>
<td>.86</td>
</tr>
<tr>
<td>20. I feel confident about my ability with computers</td>
<td>.88</td>
<td>.76</td>
</tr>
<tr>
<td>3. Everyone else but me knows what they are doing</td>
<td>.77</td>
<td>.60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scale 2: Fear</th>
<th>factor loading</th>
<th>SMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. People will notice if I make a mistake</td>
<td>.80</td>
<td>.63</td>
</tr>
<tr>
<td>9. I'm afraid I'll wreck the program</td>
<td>.72</td>
<td>.53</td>
</tr>
<tr>
<td>12. What if I hit the wrong key?</td>
<td>.74</td>
<td>.55</td>
</tr>
<tr>
<td>13. I'm too embarrassed to ask for help</td>
<td>.68</td>
<td>.46</td>
</tr>
<tr>
<td>17. I might break the machine</td>
<td>.75</td>
<td>.56</td>
</tr>
</tbody>
</table>

**SENSE OF CONTROL (One factor plus negative item method effect)**

<table>
<thead>
<tr>
<th>Item</th>
<th>factor loading</th>
<th>SMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can master the computer</td>
<td>.66</td>
<td>.43</td>
</tr>
<tr>
<td>7. I know I can do it</td>
<td>.73</td>
<td>.53</td>
</tr>
<tr>
<td>16. I will be able to get the computer to do what I want</td>
<td>.75</td>
<td>.56</td>
</tr>
<tr>
<td>18. I will understand what to do</td>
<td>.81</td>
<td>.66</td>
</tr>
<tr>
<td>19. I feel in control of what I do</td>
<td>.93</td>
<td>.86</td>
</tr>
<tr>
<td>20. I feel confident about my ability with computers</td>
<td>.88</td>
<td>.76</td>
</tr>
<tr>
<td>Item</td>
<td>factor loading</td>
<td>**</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>----------------</td>
<td>------</td>
</tr>
<tr>
<td>3. Everyone else but me knows what they are doing</td>
<td>.48</td>
<td>.56</td>
</tr>
<tr>
<td>5. People will notice if I make a mistake</td>
<td>.41</td>
<td>.69</td>
</tr>
<tr>
<td>9. I'm afraid I'll wreck the program</td>
<td>.34</td>
<td>.67</td>
</tr>
<tr>
<td>12. What if I hit the wrong key?</td>
<td>.37</td>
<td>.65</td>
</tr>
<tr>
<td>13. I'm too embarrassed to ask for help</td>
<td>.31</td>
<td>.63</td>
</tr>
<tr>
<td>17. I might break the machine</td>
<td>.37</td>
<td>.66</td>
</tr>
</tbody>
</table>

**COMPUTING SELF-CONCEPT (Two-factor model)**

**SCALE 1: POSITIVE COMPUTING SELF-CONCEPT**

<table>
<thead>
<tr>
<th>Item</th>
<th>factor loading</th>
<th>**</th>
<th>SMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. I am very confident when it comes to working with computers</td>
<td>.89</td>
<td>.79</td>
<td></td>
</tr>
<tr>
<td>7. I can get good grades in computer courses</td>
<td>.78</td>
<td>.62</td>
<td></td>
</tr>
<tr>
<td>15. I am confident storing important information on a computer</td>
<td>.78</td>
<td>.60</td>
<td></td>
</tr>
<tr>
<td>16. I am sure I could solve any problems I had while using a computer</td>
<td>.79</td>
<td>.63</td>
<td></td>
</tr>
<tr>
<td>17. I can help others solve computer problems</td>
<td>.86</td>
<td>.74</td>
<td></td>
</tr>
<tr>
<td>19. I am sure that I can help others learn to use the computer</td>
<td>.87</td>
<td>.75</td>
<td></td>
</tr>
</tbody>
</table>

**SCALE 2: NEGATIVE COMPUTING SELF-CONCEPT**

<table>
<thead>
<tr>
<th>Item</th>
<th>factor loading</th>
<th>**</th>
<th>SMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I am no good with computers</td>
<td>.87</td>
<td>.76</td>
<td></td>
</tr>
<tr>
<td>4. I am not the type to do well with computers</td>
<td>.85</td>
<td>.72</td>
<td></td>
</tr>
<tr>
<td>5. I think using a computer would be very hard for me</td>
<td>.81</td>
<td>.66</td>
<td></td>
</tr>
<tr>
<td>9. I don't think I could handle a computer course</td>
<td>.69</td>
<td>.48</td>
<td></td>
</tr>
<tr>
<td>11. I avoid using computers as much as possible</td>
<td>.79</td>
<td>.62</td>
<td></td>
</tr>
</tbody>
</table>

**COMPUTING SELF-CONCEPT (One factor plus negative item method effect)**

<table>
<thead>
<tr>
<th>Item</th>
<th>factor loading</th>
<th>**</th>
<th>SMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. I am very confident when it comes to working with computers</td>
<td>.89</td>
<td>.79</td>
<td></td>
</tr>
<tr>
<td>7. I can get good grades in computer courses</td>
<td>.78</td>
<td>.61</td>
<td></td>
</tr>
<tr>
<td>15. I am confident storing important information on a computer</td>
<td>.78</td>
<td>.60</td>
<td></td>
</tr>
<tr>
<td>16. I am sure I could solve any problems I had while using a computer</td>
<td>.79</td>
<td>.63</td>
<td></td>
</tr>
<tr>
<td>17. I can help others solve computer problems</td>
<td>.86</td>
<td>.74</td>
<td></td>
</tr>
<tr>
<td>19. I am sure that I can help others learn to use the computer</td>
<td>.87</td>
<td>.75</td>
<td></td>
</tr>
<tr>
<td>1. I am no good with computers</td>
<td>.78</td>
<td>.29</td>
<td>.69</td>
</tr>
<tr>
<td>4. I am not the type to do well with computers</td>
<td>.70</td>
<td>.51</td>
<td>.76</td>
</tr>
<tr>
<td>5. I think using a computer would be very hard for me</td>
<td>.66</td>
<td>.55</td>
<td>.73</td>
</tr>
<tr>
<td>9. I don't think I could handle a computer course</td>
<td>.57</td>
<td>.44</td>
<td>.51</td>
</tr>
<tr>
<td>11. I avoid using computers as much as possible</td>
<td>.69</td>
<td>.35</td>
<td>.60</td>
</tr>
</tbody>
</table>

**Note 1.** factor loadings = factor loadings derived from confirmatory factor analysis (LISREL 7)

**Note 2.** SMC = squared multiple correlations (a measure of item reliability).

**Note 3.** The items in the Sense of Control and Computing Self-Concept scales were presented originally in random order. They are separated here into positively and negatively worded items.

**Note 3.** **= For the negatively worded items in the Sense of Control and Computing Self-Concept scales the factor loadings on a separate negative-item method factor are shown in bold next to the item loadings on the factor as a whole.
CHAPTER FIVE

An Investigation of Computer Anxiety within Four University Faculties: An Application of CALM

Previous research has shown that computer anxiety levels are strong predictors of successful learning of computing skills (Marcoulides, 1988; Speier, Morris & Briggs, 1996) and that students in introductory computer courses can experience high anxiety. Howard, Murphy and Thomas (1987), for example, found that approximately one third of students in two introductory computer courses were so afflicted. Honeyman and White (1987) also showed that students (and educators) perform computer tasks more poorly and develop negative attitudes as a result of computer anxiety. Marcoulides (1988) further demonstrated that a strong negative relationship exists between computer anxiety and computer literacy, aptitude, and interest. On the other hand, positive attitudes towards computers have motivational implications: As Campbell and Perry (1988) put it, "negative emotions serve as inhibitors of the productive behaviors necessary for increased achievement levels, while positive emotions motivate students to engage in those productive behaviours" (p.9).

In the following chapter, I shall describe the collection of baseline data on the computer anxiety of the 794 undergraduate students that were surveyed at the start of their first semester using the four scales of the Computer Anxiety and Learning Measure (CALM). It was felt to be of some importance to ascertain the degree of anxiety felt by these first year students as they prepared to undertake a range of computer training programs within their faculties. As Speier, Morris and Briggs (1996) point out, there is a significant correlation between high initial level of anxiety and decreased skill performance throughout training. An important question was raised in this context: Are young people graduating from schools sufficiently experienced with computers to experience little psychological discomfort when they have to use computers in their university courses? The evidence strongly points to the answer being no (Price & Winiecki, 1995). Young people are assumed to be comfortable and experienced with computers because of their availability in high schools and the entertainment media, and because of the frequency with which they play computer video games. However, playing computer games which are self-selected, motivating and fun, does little to prepare an individual for the type of learning involved in the computer skills courses typically required at university. In fact, students (particularly males who are more likely to be computer games players) frequently report that such courses, which are often of a drill-and-practice nature, are
difficult for them and cause them some anxiety because the skills require so much rote learning/practice and are so tedious that their motivation wanes (personal communication from Year 12 students at St. Dominic's Senior Boys' College, Harrow on the Hill, London, July, 1994).

In summary, therefore, the purpose of this study was to measure the initial levels of computer anxiety of the students beginning their courses. If it is evident that computer performance is negatively affected by anxiety, as indicated above, and the present investigation reveals significant levels of anxiety among undergraduates, then it would seem prudent that where compulsory training programs are introduced, indicators of student anxiety should be assessed with a view to informing course developers and instructors so that appropriate steps may be taken in terms of instructional design.

Research Questions

In the pilot study to this Dissertation, a number of limitations were recognised in relation to the research undertaken. Specifically, the small sample size (46 students comprised the treatment group undertaking the semester-long computer training course) and the restricted nature of the population from which it was drawn (teacher trainees from the Faculty of Education) were concerns. Furthermore, a number of significant research questions were prompted by the findings of this pilot study. The present study, therefore, was designed to address the limitations referred to above as well as the following questions:

- How much and what type of computer experience do undergraduate students actually have prior to coming to university: formal coursework at high school, recreational use, ownership of their own personal computer (PC)?
- Does this experience vary according to the faculty in which students are enrolled, gender, or prior learning of computing?
- Does computer anxiety exist among undergraduate students who would be presumed to be familiar and experienced with computers?
- What is the nature of this anxiety (if it exists) as measured by the scales on the Computer Anxiety and Learning Measure (CALM)?
- Are computer anxiety and prior experience related to gender?
- Does computer anxiety vary according to faculty: are students undertaking studies involving mathematics and science (such as Business and Technology) likely to be less anxious than those studying the humanities (such as Arts and Social Sciences) or the helping professions (such as Education or Health)?
Specifically, the present study had three main objectives:

1) To assess initial levels of computer anxiety among a sample of first year university students drawn from the Faculties of Education, Arts and Social Sciences, Business and Technology, and Health;
2) To investigate a range of correlates of computer anxiety for these students such as prior computer experience and gender.
3) To investigate similarities and differences among levels of anxiety by faculty, gender, ownership of personal computers, and computing experience;

In relation to these objectives, a series of investigations was conducted, the results of which are presented in this chapter. The data are presented in the following forms:

1) Crosstabulations of initial classifying variables (gender and faculty) and key computer experience variables (ownership of personal computer, level of initial computer experience, and number of hours spent learning to use a computer). Significant relationships are tested using the chi-square test;
2) Frequency distributions of responses to items on the CALM scales; and,
3) Univariate analyses of variance for each of the CALM scales to examine differences in initial levels of anxiety by faculty, gender, ownership of personal computer, and level of initial computer experience.

Method

Participants

Participants in this study were 794 first year university students drawn from four faculties of a university in New South Wales. The distribution of the sample across the faculties was as follows: Faculty of Education n = 165 (males = 28; females = 137), Faculty of Arts and Social Sciences, n = 268 (males = 69; females = 199), Faculty of Business and Technology, n = 282 (males = 175; females = 107), and the Faculty of Health, n = 79 (males = 16; females = 63). In all, therefore, there were 288 male students and 506 female students. The average student age was 20 years, with 90% of the students aged 25 years old or less; the youngest students were 17 years (n = 103), and the oldest 57 years (n = 1). Approximately 70% of the sample came from an English speaking language background. The remaining 30% of the students came from a wide range of language backgrounds (42 languages), with the most common being
Chinese (n = 28), Greek (n = 27), Italian (n = 25), Spanish (n = 20), Arabic (n = 18), Vietnamese (n = 16), Croatian (n = 12) and Lebanese (n = 10). 170 males and 285 females had attended co-educational schools, while 183 males and 98 females came from single-sex schools. A number of students moved between the two types of schools, and some respondents failed to indicate the type of school attended. Four hundred and forty-two respondents had attended government schools, and 268 had attended non-government schools. A small number moved between the two sectors of education. Four hundred and six respondents entered the university on the basis of their score on the Tertiary Entrance Rank (TER), 255 entered on the basis of a special entry test for those who did follow the usual high school matriculation path, while 102 entered on other criteria (such as overseas qualifications or mature age). There were missing data for approximately 31 students.

**Procedure**

The CALM was administered by either myself or one of two trained research assistants to all participants during lecture or tutorial periods in the first week of their respective courses. Instructions were standardized from group to group. Students were informed that the survey was to collect data across the university on their attitudes towards computers, and were asked to complete an informed consent form to acknowledge their willingness to participate in the research. The anonymity of students' identities in any written reports was assured. All data were entered commercially and analysed using the SPSSx statistical program on the mainframe computer.

As well as the CALM, students were administered a demographic questionnaire eliciting information on the following: Gender, age, ethnic background, ownership of a PC, intentions to purchase a PC, use of computers and computerised technology, attendance at single-sex or co-educational high school, and self-rating of computer competence which was measured on a three point scale 1 = beginner (no experience or games only), 2 = intermediate (familiar with one application only such as a word processor or spreadsheet), 3 = advanced (familiar with a number of applications).

**Results**

In the following section, I present results obtained from the refined version of the Computer Anxiety and Learning Measure (CALM) (discussed in Chapter Four) which consists of four scales: Gaining Initial Computing Skills; Sense of Control; Computing Self-Concept; and State Anxiety in Computing Situations. On
each of the scales, scores were reversed where necessary (namely, in the Sense of Control, Computing Self-Concept and Happiness scales) so that a high score would consistently reflect high anxiety or negative cognitions.

**Computer Experience**

A range of demographic information was obtained from the respondents related to their use of technology before commencing University. Approximately half the sample owned a PC (n = 395) with the majority owning an IBM PC (65%). While many of the respondents used their personal computers for a variety of applications (36%), main uses included wordprocessing and spreadsheets. Students were asked to rate their computing experience using the following scale:

How would you rate your computer experience?
1. Beginner (no experience or games only)
2. Intermediate (familiar with one application only such as a word processor or spreadsheet)
3. Advanced (familiar with a number of applications)

Thirty-five percent (n = 274) rated themselves as a beginner, 48% (n = 374) as intermediate, and 17% (n = 129) as advanced. The following table (Table 5.1) provides an insight into the respondents' general use of technology. Students were asked to indicate on a three-point scale how many times they have used computerised technology in a range of ways.

**Table 5.1**
**Frequency of Responses to Uses of Computer Technology Survey (n = 794)**

<table>
<thead>
<tr>
<th>Computer Use</th>
<th>1&lt;sup&gt;a&lt;/sup&gt;</th>
<th>2&lt;sup&gt;b&lt;/sup&gt;</th>
<th>3&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used computers at high school</td>
<td>30</td>
<td>52</td>
<td>18</td>
</tr>
<tr>
<td>Played computer games</td>
<td>9</td>
<td>61</td>
<td>30</td>
</tr>
<tr>
<td>Used CD-ROM searches</td>
<td>64</td>
<td>30</td>
<td>6</td>
</tr>
<tr>
<td>Used computerised library catalogue</td>
<td>14</td>
<td>48</td>
<td>38</td>
</tr>
<tr>
<td>Programmed a microwave oven</td>
<td>20</td>
<td>26</td>
<td>54</td>
</tr>
<tr>
<td>Programmed VCR</td>
<td>13</td>
<td>30</td>
<td>57</td>
</tr>
<tr>
<td>Used computers in a job</td>
<td>55</td>
<td>23</td>
<td>22</td>
</tr>
<tr>
<td>Used a word processor</td>
<td>16</td>
<td>49</td>
<td>35</td>
</tr>
<tr>
<td>Loaded a run software</td>
<td>27</td>
<td>42</td>
<td>31</td>
</tr>
<tr>
<td>Used a computer printer</td>
<td>19</td>
<td>48</td>
<td>33</td>
</tr>
</tbody>
</table>

*Note.*
<sup>a</sup> 1 = Never; <sup>b</sup> 2 = Sometimes; <sup>c</sup> 3 = Frequently
As can be seen from the frequencies of various uses of computerised technology shown in Table 5.1, 90% of the students had games experience of varying degrees. On the other hand, as many as 80% of students had either never used a computer at high school or had only sometimes done so. In relation to the content of initial computer training courses at university, between 16% and 20% of students had no experience whatsoever in wordprocessing, loading and running software, or using a printer. This finding runs counter to the often heard suggestion that most young people today are familiar with computers and their applications, and that computer anxiety is symptomatic of mature-aged learners who have had no prior experience with computers.

Students were also asked to indicate the number of hours they had spent learning computing skills. Table 5.2 presents the results.

<table>
<thead>
<tr>
<th></th>
<th>&lt; 10 hrs</th>
<th>10 - 20 hrs</th>
<th>20 - 50 hrs</th>
<th>&gt; 50 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>38%</td>
<td>21%</td>
<td>15%</td>
<td>26%</td>
</tr>
</tbody>
</table>

The findings shown in Table 5.2 further confirm the fact that almost 40% of the sample had had a minimum (less than ten hours) of learning time with computers. This corresponds with the self-rating by 35% of the sample as overall beginners. It is also important to acknowledge that just over 40% of students reported between twenty and fifty hours learning time. Although it is unclear whether this is from formal training sessions or from informal experiences at home with one’s own computer, such findings have obvious implications for the establishment of computer skills courses. Even though the student population sampled here is a young one (90% between 17 and 25 years), it is clear that the range of experience in learning to use computers is great across a broad range of faculties. It would be anticipated that levels of discomfort about using computers would vary widely, therefore, and that this should be taken into account in the design of training programs for undergraduate students.

Prior to a close examination and discussion of the anxiety levels of the participants in the present study, crosstabulations between a number of variables related to computer experience (self-rated level of experience and number of hours spent learning to use a computer) and computer ownership are presented. These were conducted to ascertain whether there were significant relationships between these
variables, student gender and faculty. Specifically, crosstabulations were performed on the following variables: Ownership of PC by faculty, by gender, and by level of experience; level of experience by faculty and by gender; level of experience by gender controlling for faculty; level of experience by gender controlling for PC ownership; level of experience by gender by faculty controlling for PC ownership; number of hours spent learning to use a computer by gender; number of hours spent learning to use a computer by faculty; number of hours spent learning to use a computer by faculty controlling for gender. Where it appears that a diagrammatic representation of particular results is helpful, a figure is presented to supplement the tabulations.

In the following analyses, it is hypothesised that the categories of interest are independent (that is, there is no relationship between them). A chi-square test of significance was used to test this assumption.

**Ownership of PC**

There is a significant relationship between ownership of PC and faculty (chi-sq = 22.0; df = 3; p<.01). Of the four faculties, students with the greatest ownership of personal computers were in the Faculty of Business and Technology where 58% owned a computer, followed by Arts and Social Sciences with 52%, Education with 42%, and Health with 31% ownership. It appears that Health and Education students are significantly less likely to own a personal computer than students in the other faculties.

Males more likely to own personal computers than females (m = 57%; f = 43%) (chi-sq = 6.3; df = 1; p<.05).

As for ownership of PC and level of experience, of those who rated themselves as advanced users of computers, 70% owned personal computers; of intermediate users, 57% owned their own computer; and of the beginners, only 31% (chi-sq = 68.4; df = 2; p<.01). It appears that advanced users of computers are more likely to own computers (see Figure 5.1).
Figure 5.1. Ownership of Personal Computer by Levels of Computer Experience

**Faculty**

Analysis revealed a significant relationship between faculty and level of computer experience (chi-sq = 20.1; df = 6; p<.01). Of the Education students, 40% classified themselves as beginners, the same proportion as in the Faculty of Business and Technology. Considerably fewer Health and Arts students classified themselves as beginners (33% and 28% respectively). Only 10% of Education students rated themselves as advanced, compared to 21% of Business and Technology students. A greater proportion of Arts students relative to Health students rated their experience as advanced (17% and 13% respectively). Clearly, there is a tendency for more Business and Technology and Arts students to rate themselves as advanced users of computers (see Figure 5.2).
Figure 5.2. Levels of Computer Experience by Four Faculties

Gender

There is a significant relationship between level of experience and gender (chi-sq = 15.6; df = 2; p<.01). More females classify themselves as beginners than males (m = 33%; f = 37%), and more males classify themselves as advanced than females (m = 25%; f = 11%). Intermediate users were more likely to be female than male (m = 51%; f = 42%). Thus, it appears that males are likely to be the advanced users of computers.

It is interesting to note that there is a significant relationship between level of experience and gender for Arts and Business and Technology students (chi-sq = 9.7; df = 2; p<.01 and chi-sq = 5.8; df = 2; p<.05, respectively) but not for the Faculty of Arts and Social Sciences those who classified themselves as beginners were more likely to be female than male (m = 16%; f = 32%). Of those who rated themselves as advanced among Arts and Social Sciences students, 27% were male and 13% were female. At the intermediate level, there were about the same number of males and females (m = 58%; f = 54% respectively). As for the Faculty of Business and Technology, again there were about the same number of males and females classifying themselves as beginners (m = 38%; f = 41%), but twice as many males as females who classified themselves as advanced users (m = 26%; f = 13%). It appears, therefore, that within these latter two faculties, males are twice as likely to classify themselves as advanced than females.

Although there are no significant relationships between level of experience and gender for Education and Health students, it is interesting to note that higher percentages of males than females in both faculties said that they were beginners.
(Faculty of Education males = 46.4%; females = 39.4%; and Faculty of Health males = 53.3%; females = 27.8%). More females rated themselves as advanced users in the Faculty of Education, however, than males (m = 7.1%; f = 11.8%). There was no difference between the advanced groups in the Faculty of Health with both having 13% of students classifying themselves as advanced.

Level of experience and gender were also significantly related when controlling for PC ownership (chi-sq = 12.66; df = 2; p<.01). Twenty-two percent of both females and males who own a personal computer describe themselves as beginners. Sixty-one percent of those females who own a personal computer rate themselves as intermediate compared with 46% of males, while there are far more males who rated themselves as advanced who own a personal computer compared with females (m = 32%; f = 17%).

Although there are no significant relationships between level of computer experience, gender, faculty and ownership of PC within each faculty, interesting comparisons of distributions across faculties can be made. For faculties other than Education, males who rated themselves as advanced users were twice as likely to own computers than females of this level. In the Education faculty, this ratio was reversed with twice as many females who classified themselves as advanced owning a computer (m = 8.3%; f = 16.1%). Furthermore, relative to the other faculties, those males who rated themselves as advanced in the Education faculty had the lowest computer ownership (Education = 8.3%; Arts = 32.4%; Business and Technology = 34%; Health = 40%). Of those who owned a PC across all faculties, male Health students had the highest ownership at both beginner level (40%) and advanced (40%). Within the Faculty of Arts and Social Sciences only 11% of the male beginners owned a personal computer, compared to 33% of their advanced male peers.

As for females who owned a personal computer, the Faculty of Business and Technology had the greatest proportion of beginners compared with other faculties. For all faculties more females than males owned a personal computer at the intermediate level of experience than at either beginner or advanced (see Figure 5.3).
Figure 5.3. Crosstabulations of Levels of Computer Experience, PC Ownership, Faculty, and Gender
Number of Hours Spent Learning to Use a Computer

There is a significant relationship between number of hours spent learning to use a computer and faculty (chi-sq = 19.0; df = 9; p<.05). Students in the Faculty of Education had the highest percentage of students who had spent less than ten hours learning to use a computer (n = 50%). The proportions in the other three faculties were considerably lower (Business and Technology = 38%; Health = 34%, and Arts = 31%). In the over fifty hours learning category, Education students had the lowest percentage once again (20%), followed by Health students (23%). On the other hand, 30% of students in the Faculty of Business and Technology and 28% of students in the Faculty of Arts and Social Sciences had had over fifty hours learning to use a computer. It appears that Education students have spent the least time learning to use a computer, and Business students the most (see Figure 5.4).

Furthermore, the number of hours spent learning to use a computer was significantly related to gender (chi-sq = 11.6; df = 3; p<.01). Forty-two percent of females had spent less than 10 hours learning to use a computer compared with 30% of males, whereas 20% of females had spent over 50 hours learning computing compared to 35% of males. There was little difference between the sexes in the other two categories, namely, 10 to 20 hours (m = 19%; f = 23%) and 20 to 50 hours (m = 16%; f = 15%). It appears that females are likely to spend less time than males learning to use a computer.

![Hours Spent Learning to use a Computer by Faculty](image)

**Figure 5.4. Hours Spent Learning to Use a Computer by Faculty**
For males within the four faculties, a significant relationship with number of hours spent learning to use a computer (chi-sq = 17.5; df = 9; p<.05) (see Figure 5.5a below). Of all male students, 50% of those in Education had had less than ten hours learning to use a computer, compared with only 16% of those in Arts, 27% in Health and 38% in Business and Technology. There is clearly a tendency for male Education students to have the lowest level of prior computer learning of the four faculties. Similarly, for the highest level of prior learning (over 50 hours) Education students have the lowest proportion (21%) relative to Arts (37%), Business and Technology (33%), and Health (40%) (see Figure 5.5a)

![Chart: Hours Spent Learning to use a Computer by Faculty - Male](image)

**Figure 5.5a. Hours Spent Learning to Use a Computer by Faculty - Male**

It is also interesting to note the differences in hours spent learning to use the computer for females across the faculties (see Figure 5.5b), however, the relationship between number of hours spent learning to use a computer and faculty is not significant in this case and may be due to chance differences.
Figure 5.5b. Hours Spent Learning to Use a Computer by Faculty - Female

Discussion

Examination of the results presented above suggest the following conclusions: It would appear that on entrance to university, computer "illiterate" (inexperienced) students will be found in each faculty. Initially computer literate students, on the other hand, tend to most heavily concentrated in the faculties of Business and Technology, and Arts and Social Sciences (where they can major in computing subjects). Computer ownership seems to be related to computer literacy, with advanced users (who tend to be males) more likely to own their own computers. Computer literacy seems to be related to both gender and faculty, with females being most prominent amongst those who rate their entry-level skills as beginners. However, within those faculties (Education and Health) which train the "helping professions" (namely, future teachers and nurses), it is the males rather than the females who classify themselves as beginners.

Summary

A summary of the conclusions derived from the above comparisons is provided below:
- Health and Education students are significantly less likely to own a personal computer than students in the other two faculties.
- Advanced users of computers are more likely to own computers.
- Males are likely to be the advanced users of computers.
• The majority of females in the faculties of Arts and Business are likely to be beginners.
• Advanced males and intermediate females have a tendency to own a personal computer.
• Females are likely to have spent less time than males learning to use a computer prior to commencing university studies.
• Education students have spent the least time learning to use a computer, and Business students the most.
• More Business and Technology and Arts students to rate themselves as advanced users of computers.
• Male Education students have the lowest level of prior computer learning of the four faculties and relatively fewer male Education students the highest level of prior learning, over fifty hours.

Similarities and Differences Among Levels of Anxiety by Faculty, Gender, Ownership of PC, and Level of Computer Experience

The pilot study discussed in Chapter Three indicated that computer anxiety is a reality for a substantial number of first year students studying education. However, the number of participants in the pilot study was small (n=101), and the range of computer “anxieties” measured was limited to those derived from the CARS. As discussed in Chapter Four, in the light of the theoretical literature, I considered that the CARS and other computer anxiety instruments failed to include additional dimensions of anxiety that were important and that were consequently incorporated into the Computer Anxiety and Learning Measure (CALM), the instrument used to derive the findings presented below.

In the next section of this chapter, I shall describe initial levels of computer anxiety among a large sample of first-year students drawn from the Faculties of Education, Arts and Social Sciences, Business and Technology, and Health. I shall also consider the correlates of computer anxiety for these students and investigate similarities and differences among levels of anxiety by faculty, gender, ownership of PC, and computing experience. Descriptive statistics and frequencies are presented for each of the scales in the CALM, and factorial analysis of variance is used to examine the similarities and differences among levels of anxiety.
Results and Discussion

In the following section, I will present percentage data to indicate something of the extent of anxiety in different areas of each of the scales within the Computer Anxiety and Learning Measure (CALM) across the whole sample. Mean scores for each of the factors within the CALM are subsequently used in the analyses of variance used to examine group differences.

Gaining Initial Computing Skills

The first scale of the CALM, Gaining Initial Computing Skills consists of twenty two statements (listed in Table 5.3) which reflect a variety of aspects of computer anxiety in a learning situation. Confirmatory factor analysis supported the existence of four first-order factors within this scale. Table 5.3 indicates the number of students responding to each rating across the twenty-two items for these four factors. Means and standard deviations for each item and for each factor are also shown.

Table 5.3
Percentage Frequencies of Responses to Questions Relating to Gaining Initial Computing Skills

<table>
<thead>
<tr>
<th>Question*</th>
<th>% responses</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Taking a test on computer competence</td>
<td>16</td>
<td>28</td>
<td>22</td>
</tr>
<tr>
<td>Working in a job that requires some computer experience</td>
<td>24</td>
<td>30</td>
<td>24</td>
</tr>
<tr>
<td>Getting error messages from computer</td>
<td>17</td>
<td>31</td>
<td>25</td>
</tr>
<tr>
<td>Teaching someone else about computers</td>
<td>20</td>
<td>28</td>
<td>21</td>
</tr>
<tr>
<td>Dealing with computer malfunctions</td>
<td>12</td>
<td>24</td>
<td>28</td>
</tr>
<tr>
<td>Being evaluated on computer competence</td>
<td>14</td>
<td>23</td>
<td>28</td>
</tr>
<tr>
<td>Learning about computers without structured guidance</td>
<td>20</td>
<td>29</td>
<td>26</td>
</tr>
</tbody>
</table>

Scale: Competence with Computers (alpha = .88; M = 2.81, SD = .97)

Scale: Handling Computer Equipment (alpha = .78; M = 1.80, SD = .80)

<table>
<thead>
<tr>
<th>Question</th>
<th>% responses</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using computerised equipment</td>
<td>43</td>
<td>36</td>
<td>15</td>
</tr>
<tr>
<td>Printing off documents</td>
<td>54</td>
<td>27</td>
<td>12</td>
</tr>
<tr>
<td>Using a mouse</td>
<td>63</td>
<td>22</td>
<td>8</td>
</tr>
<tr>
<td>Presenting work completed on computer</td>
<td>47</td>
<td>29</td>
<td>13</td>
</tr>
</tbody>
</table>
Scale: Receiving Feedback on Computing Skills (alpha = .88; M = 1.81, SD = .81)

<table>
<thead>
<tr>
<th>Question</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Being taught how to use a computer by a peer</td>
<td></td>
<td>59</td>
<td>28</td>
<td>9</td>
<td>2</td>
<td>2</td>
<td>1.60</td>
</tr>
<tr>
<td>Getting feedback from my teacher on my computer skills</td>
<td></td>
<td>37</td>
<td>29</td>
<td>20</td>
<td>8</td>
<td>6</td>
<td>2.15</td>
</tr>
<tr>
<td>Getting feedback from my peers on my computer skills</td>
<td></td>
<td>46</td>
<td>33</td>
<td>14</td>
<td>5</td>
<td>2</td>
<td>1.84</td>
</tr>
<tr>
<td>Collaborating with a friend while learning to use a computer</td>
<td></td>
<td>66</td>
<td>24</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>1.50</td>
</tr>
<tr>
<td>Getting feedback on my computer skills</td>
<td></td>
<td>42</td>
<td>31</td>
<td>17</td>
<td>5</td>
<td>5</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Scale: Learning about Basic Computer Functions (alpha = .88; M = 2.04, SD = .86)

<table>
<thead>
<tr>
<th>Question</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taking a course in a computer language</td>
<td></td>
<td>33</td>
<td>38</td>
<td>18</td>
<td>6</td>
<td>5</td>
<td>2.12</td>
</tr>
<tr>
<td>Learning computer terminology</td>
<td></td>
<td>47</td>
<td>30</td>
<td>14</td>
<td>5</td>
<td>4</td>
<td>1.88</td>
</tr>
<tr>
<td>Reading a computer manual</td>
<td></td>
<td>41</td>
<td>29</td>
<td>17</td>
<td>8</td>
<td>5</td>
<td>2.10</td>
</tr>
<tr>
<td>Learning how a computer works</td>
<td></td>
<td>53</td>
<td>28</td>
<td>12</td>
<td>4</td>
<td>3</td>
<td>1.80</td>
</tr>
<tr>
<td>Learning the operating system of a computer</td>
<td></td>
<td>33</td>
<td>34</td>
<td>22</td>
<td>7</td>
<td>4</td>
<td>2.20</td>
</tr>
<tr>
<td>Learning a new computer application</td>
<td></td>
<td>29</td>
<td>35</td>
<td>23</td>
<td>9</td>
<td>4</td>
<td>2.24</td>
</tr>
</tbody>
</table>

Note.

a. The general introductory focusing statement for this scale is: “Please indicate the extent to which each of the following situations described below would make you anxious at this point in your life.”

b. The rating scale is: 1. Not at all; 2. A little; 3. A fair amount; 4. Much; 5. Very much

Overall, it is clear from Table 5.3 that students at the start of their university careers express a considerable degree of anxiety with regard to gaining initial computing skills computers. The greatest anxiety was shown in the area of demonstrating competence with computers (scale M = 2.81, SD = .97). For example, in response to the items relating to being evaluated or taking a test on computer competence, between 56% and 63% of the sample (445 to 502 students) reported in the range of "a fair amount" to "very much" anxiety (M = 2.91, SD = 1.32; M = 3.10, SD = 1.25 respectively). These findings suggest that for students faced with learning to use computers to fulfill university competency requirements, considerable anxiety will be experienced by well over half of the students.

As for anxiety related to handling computer equipment, rather less anxiety was exhibited (scale M = 1.80, SD = .80). Moderate to extreme anxiety was reported by 21% of students in response to the item about using computerized equipment, and by 24% of students when asked about presenting work completed on a computer. Although not a huge proportion, in terms of actual student numbers, these
percentages translate into between 167 and 191 students out of a first year intake of 794.

In relation to collaborative learning, the Receiving Feedback on Computer Skills scale has implications for the incorporation of this instructional strategy into computer training programs. As this approach to learning is presumably non-threatening, it is not surprising that 87% of students indicated minimal anxiety (score of 1 or 2) when asked how anxious they would be "Being taught how to use a computer by a peer" (M =1.60, SD = .85). Similarly, 90% of students expressed minimal anxiety when asked about "Collaborating with a friend while learning to use a computer" (M = 1.50, SD = .79). Although such findings give strong support to the incorporation of collaborative learning into computing skills courses, there still remain the 10% to 13% of students (79 to 103) who had considerable anxiety in this regard. These students may prefer an independent learning style and not like others watching them make mistakes.

As for "Getting feedback from a teacher on one's computing skills", much greater anxiety was reported, in fact, for 34% (270 students) (M = 2.15, SD = 1.17). Interestingly, even getting feedback on computing skills from one's peers causes considerable anxiety for 21% of students (M = 1.81, SD = 1.00). It is possible that "feedback" may be interpreted as evaluation and, therefore, ego-threatening, especially in a highly public setting such as a computer laboratory where teachers wander around checking screens, and students sit at terminals very close together or even share computers which make noises (pings, beeps, boings etc) for everyone to hear when mistakes are made (at least they don't send out peals of computerised laughter!). Clearly, these findings have implications for those charged with teaching courses in computing skills to such students and have bearing on the appropriate use of collaborative learning strategies in initial computer skills classes.

Within the "Learning about Basic Computer Functions" scale, two items appeared to be related to the greatest anxiety: "Learning the operating system of a computer" for 33% of students (M = 2.20, SD = 1.10), and "Learning a new computer application" for 36% of students (M = 2.24, SD = 1.10). As these items represent fundamental components of initial computer training courses at the university, such high levels of anxiety should be taken into account by educators involved in teaching these courses. Overall, this scale revealed that in all aspects of learning about computers (computer language, terminology, manuals, operation, software and hardware), about 30% of students (238) were very anxious indeed (scale M=2.04, SD= .86). One could suggest from this evidence that learning about computers at university is clearly anticipated with a great deal of apprehension.
Table 5.4
Scale Means and Standard Deviations for Gaining Initial Computing Skills
(n = 794)

<table>
<thead>
<tr>
<th>Scale</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer competence</td>
<td>2.81</td>
<td>.97</td>
</tr>
<tr>
<td>Equipment</td>
<td>1.80</td>
<td>.80</td>
</tr>
<tr>
<td>Feedback</td>
<td>1.81</td>
<td>.81</td>
</tr>
<tr>
<td>Learning</td>
<td>2.04</td>
<td>.86</td>
</tr>
</tbody>
</table>

From Table 5.4 it can be seen that there are moderate to very high levels of anxiety expressed for items relating to demonstrating or being evaluated on one's computer competence (M = 2.81, SD = .97). Less anxiety, but still up to “a fair amount” is reported for items relating to learning about basic computer functions (M = 2.04, SD = .86), receiving feedback from teacher and peers on one’s computing skills (M = 1.81, SD = .81), and handling computer equipment (M = 1.80, SD = .80), in slightly decreasing order. It is worth noting that within these three scales, considerable anxiety was expressed on a number of items, as described earlier.

Comparisons of Initial Levels of Anxiety for Gaining Initial Computing Skills

Analysis of variance results for the factors within the Gaining Initial Computing Skills are presented below. These analyses were conducted to examine differences in initial levels of anxiety by faculty, gender, ownership of personal computer, and level of computer experience.

**Competence with Computers.** The analysis of variance on competence with computers revealed main effects for gender (F = 18.75, df = 1/715, p<.01) and self-rating of experience (F = 104.70, df = 2/715, p<.01). There were no significant interaction effects. Males were significantly less anxious on this scale than females (M = 2.54 and 2.97 respectively). Follow-up one way tests with contrasts performed for self-rating of experience indicated that each of the three levels of experience were significantly different from one another, with the advanced being the least anxious (M = 1.91) compared with intermediate (M = 2.75) and beginner (M = 3.32).

**Handling Computer Equipment.** The analysis of variance on handling computer equipment revealed main effects for ownership of a PC (F = 7.34, df = 1/715, p<.01) and self-rating of experience (F = 54.55, df = 2/715, p<.01). On this scale, students who owned a personal computer were significantly less anxious than those who did not (M = 1.62 and M = 1.94 respectively). Follow-up one way analyses with contrasts indicated that each of the three levels of self-rating of experience were significantly different from one another with the advanced being the least anxious (M = 1.25) compared with intermediate (M = 1.70) and beginner (M =
There was also a significant faculty by gender interaction ($F = 2.84$, $df = 3/715$, $p<.05$). Follow-up one-way analyses on the faculty by gender interaction indicated that female students in the Faculty of Health were significantly more anxious than both male and female students in the Faculty of Education, and male students in the Faculty of Arts and Social Sciences, the Faculty of Business and Technology, and the Faculty of Health. They were not significantly more anxious than female students in the Faculty of Arts and Social Sciences or the Faculty of Business and Technology.

**Receiving Feedback On Computing Skills.** The analysis of variance on receiving feedback on computing skills indicated main effects for faculty ($F = 3.08$, $df = 3/713$, $p<.05$) and self-rating of experience ($F = 19.37$, $df = 2/713$, $p<.01$). Follow-up one-way analyses with contrasts indicated that students from the Faculty of Education were significantly less anxious than students from the Faculty of Arts and Social Sciences on this particular scale. There were no other differences between groups. Follow-up one-way analyses with contrasts indicated that all three levels of self-rating of experience were significantly different from each other, with the advanced being the least anxious ($M = 1.48$) followed by intermediate ($M = 1.76$) and beginners ($M = 2.01$).

There was also a significant faculty by gender interaction ($F = 2.93$, $df = 3/713$, $p<.05$). Follow-up one-way analyses on the faculty by gender interaction indicated that males within the Faculty of Health were significantly less anxious on this scale than all of the other groups. However, it should be noted that this group was small relative to the other groups ($n = 15$) and this should be taken into account when interpreting results. There were no other significant differences.

**Learning About Basic Computer Functions.** The analysis of variance indicated main effects for gender ($F = 6.83$, $df = 1/715$, $p<.01$) and self-rating of experience ($F = 34.52$, $df = 2/715$, $p<.01$). There were no significant interaction effects. Males in the sample were significantly less anxious on this scale than females ($M = 1.89$ and $M = 2.12$ respectively). Follow-up one-way analyses with contrasts indicated that all three levels of self-rating of experience were significantly different from each other, with the advanced the least anxious ($M = 1.56$) followed by intermediate ($M = 1.99$) and beginners ($M = 2.32$).

**Sense of Control**

As discussed in Chapter Four of this Dissertation, in the design of the second scale of the CALM, Sense of Control, two factors relating to positive and negative perceptions of control when using a computer were identified using confirmatory factor analysis. These factors reflect an individual's sense or lack of personal control.
as indicated in their cognitions or "self-talk". The following results are presented on the basis of a two-factor model which was selected as the best substantive model in which all positive items comprised one factor (Positive Sense of Control), and all negative items comprised a second factor (Fear) (see extended discussion in Chapter Four). Tables 5.5 and 5.6 indicate the number of students responding to each level of anxiety within each faculty across the 12 items. Table 5.7 indicates the scale means and standard deviations on the Sense of Control scales.

| Question | % responses | 1 | 2 | 3 | 4 | 5 | M | SD |
|----------|-------------|---|---|---|---|---|---|----|----|
| I can master the computer | 6 | 12 | 3 | 32 | 30 | 3.70 | 1.20 |
| I know I can do it | 15 | 19 | 23 | 32 | 11 | 3.06 | 1.24 |
| I will be able to get the computer to do what I want | 10 | 16 | 26 | 32 | 16 | 3.28 | 1.20 |
| I feel in control of what I do | 9 | 17 | 27 | 34 | 13 | 3.26 | 1.15 |
| I feel confident about my ability with computers | 8 | 13 | 24 | 34 | 12 | 3.46 | 1.20 |

Note:
a. The general introductory focusing statement for this scale is: "Please indicate how often you have the following thoughts when you use a computer or think about using a computer." b. The rating scale is: 1. Very much; 2. Much; 3. A fair amount; 4. A little; 5. Not at all. These ratings were reverse coded for positively worded items so that a low score refers to high positive cognitions and a high score refers to low positive cognitions (high negative self-talk or fear).

Table 5.5 indicates that on this scale, a substantial proportion of the students surveyed did not feel a strong sense of personal control over mastering computing skills (M = 3.35, SD = .95). In fact, on the two items that best represent this construct, "I can master the computer" and "I feel confident about my ability with computers", the percentages of students across all faculties who expressed the two most negative levels of cognitions were 62% (M = 3.70, SD = 1.20) and 46% (M = 3.46, SD = 1.20), respectively. In addition, 40% thought that they would not "understand what to do", and 40% admitted that they did not "feel in control of what I do" with regard to using a computer.
Table 5.6
Percentage Frequencies of Responses to Questions Relating to Negative Control (Fear) Anxiety (n = 794)

<table>
<thead>
<tr>
<th>Question</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Everyone else but me knows what they are doing</td>
<td>25</td>
<td>33</td>
<td>22</td>
<td>10</td>
<td>10</td>
<td>2.50</td>
<td>1.24</td>
</tr>
<tr>
<td>People will notice if I make a mistake</td>
<td>37</td>
<td>34</td>
<td>16</td>
<td>9</td>
<td>4</td>
<td>2.10</td>
<td>1.13</td>
</tr>
<tr>
<td>I’m afraid I’ll wreck the program</td>
<td>34</td>
<td>33</td>
<td>17</td>
<td>9</td>
<td>7</td>
<td>2.23</td>
<td>1.21</td>
</tr>
<tr>
<td>What if I hit the wrong key</td>
<td>39</td>
<td>35</td>
<td>15</td>
<td>7</td>
<td>4</td>
<td>2.01</td>
<td>1.10</td>
</tr>
<tr>
<td>I’m too embarrassed to ask for help</td>
<td>56</td>
<td>26</td>
<td>8</td>
<td>5</td>
<td>5</td>
<td>1.80</td>
<td>1.11</td>
</tr>
<tr>
<td>I might break the machine</td>
<td>65</td>
<td>20</td>
<td>7</td>
<td>4</td>
<td>4</td>
<td>1.60</td>
<td>1.03</td>
</tr>
</tbody>
</table>

Note. a. The general introductory focusing statement for this scale is: “Please indicate how often you have the following thoughts when you use a computer or think about using a computer.” b. The rating scale is: 1. Very much; 2. Much; 3. A fair amount; 4. A little; 5. Not at all.

Table 5.6 shows the degree of lack of perceived personal control over computing, expressed as negative self-talk or even fear, with 42% of students admitting that they have the thought that "Everyone else but me knows what they are doing (with computing)” a fair amount of the time to very often (score between 3 and 5) (M = 2.50, SD = 1.24). In relation to items which typify phobic reactions to computers such as "I'm afraid I'll wreck the program", "What if I hit the wrong key?", and "People will notice if I make a mistake", between a quarter and a third of students again rated low on positive cognitions.

Table 5.7
Scale Means and Standard Deviations for Sense of Control (n = 794)

<table>
<thead>
<tr>
<th>Scale</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Control</td>
<td>3.35</td>
<td>.95</td>
</tr>
<tr>
<td>Negative Control (Fear)</td>
<td>2.03</td>
<td>.85</td>
</tr>
</tbody>
</table>

Note. A high score refers to low positive cognitions, high negative self-talk or fear
Overall, Table 5.7 shows that both a moderately high to severe lack of perceived personal control (M = 3.35, SD = .95) and a preponderance of negative (fearful) cognitions with regard to using computers (M = 2.03, SD = .85) were reported.

**Comparisons of Initial Levels of Anxiety for Sense of Control**

**Positive Sense of Control.** The analysis of variance for this scale indicated main effects for faculty (F = 5.60, df = 3/714, p<.01), gender (F = 14.40, df = 1/714, p<.01) and self-rating of experience (F = 77.08, df = 2/714, p<.01). There were no significant interactions. Follow-up oneway analyses with contrasts indicated that students from the Faculty of Health had a greater positive sense of control (or more positive cognitions about computing) than students from the Faculty of Arts and Social Sciences on this scale. The contrast between the Faculty of Arts and Social Sciences and the Faculty of Business and Technology approached significance (p = .06) with students from the latter faculty showing a greater positive sense of control than those from the former. Males appeared to have more positive cognitions than females, (M = 3.1 and M = 3.4 respectively), while all three levels of self-rating of experience were significantly different from each other, with the advanced being the most positive (M = 2.51), followed by the intermediate (M = 3.25) and beginning (M = 3.72) user.

**Fear.** The analysis of variance for fear revealed main effects for faculty (F = 4.90, df = 3/714, p<.01), gender (F = 19.87, df = 1/714, p<.01) and self-rating of experience (F = 72.95, df = 2/714, p<.01). There were no significant interaction effects. Follow-up oneway analyses with contrasts on the faculty main effect failed to indicate any significant differences, however, the contrast between the Faculty of Education and the Faculty of Health approached significance (p = .076) with the students from the Faculty of Health having more negative cognitions about computing than students from the Faculty of Education (M = 2.16 and M = 1.94, respectively). Male students were significantly less negative than female students (M = 1.85 and M = 2.13 respectively), while all levels of self-rating of experience were significantly different from each other, with the advanced being the least negative (M = 1.47), followed by the intermediate (M = 1.89) and the beginners (M = 2.48).

**Computing Self-Concept**

As discussed in Chapter Four, in the research literature on general self concept, it is strongly argued that, rather than representing a substantive factor, negatively (or oppositely) worded items merely contain an artefact. For this reason, a model of computing self-concept comprising one-factor (positively worded items
with regard to self-concept about one's proficiency with computers) plus a negative-item method factor was selected as the best substantive model.

The Computing Self-Concept scale of the CALM consists of eleven items comprising one factor entitled Computing Self-Concept plus negatively worded items relating to negative perceptions of a computing self-concept. Table 5.8 indicates the number of students responding to those positive items defining the Computing Self-Concept scale.

Table 5.8
Percentage Frequencies of Responses to Questions Relating to Computing Self-Concept Scale (n = 794)

<table>
<thead>
<tr>
<th>Scale: Computing Self-Concept (alpha = .91; M = 3.11, SD = .83)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questiona</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am very confident when it comes to working with computers</td>
<td>7</td>
<td>26</td>
<td>27</td>
<td>28</td>
<td>12</td>
<td>3.11</td>
<td>1.13</td>
</tr>
<tr>
<td>I can get good grades in computer courses</td>
<td>7</td>
<td>8</td>
<td>45</td>
<td>13</td>
<td>7</td>
<td>2.83</td>
<td>1.00</td>
</tr>
<tr>
<td>I am confident storing important information on a computer</td>
<td>14</td>
<td>33</td>
<td>34</td>
<td>20</td>
<td>9</td>
<td>2.80</td>
<td>1.20</td>
</tr>
<tr>
<td>I am sure I could solve any problems when I am using a computer</td>
<td>4</td>
<td>19</td>
<td>36</td>
<td>30</td>
<td>12</td>
<td>3.30</td>
<td>1.03</td>
</tr>
<tr>
<td>I can help others solve computer problems</td>
<td>4</td>
<td>19</td>
<td>31</td>
<td>24</td>
<td>22</td>
<td>3.42</td>
<td>1.13</td>
</tr>
<tr>
<td>I am sure I can help others learn to use the computer</td>
<td>6</td>
<td>25</td>
<td>30</td>
<td>26</td>
<td>13</td>
<td>3.20</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Note.
a. The general introductory focusing statement for this scale is: "Using the following scale please indicate how much you agree or disagree with the following propositions." b. The rating scale is:

As can be seen from Table 5.8, the percentage of students who feel that they have a high computing self-efficacy (those who rate themselves 1 or 2), that is, those who believe that they can manage information, solve problems and help others with computing, is small compared to those who lack this perception. Excluding those who were "unsure", between 20% and 46% either disagreed or strongly disagreed with items expressing such a positive computing self-concept.

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Table 5.9
Scale Mean and Standard Deviation for Computing Self-Concept Scale (n = 794)

<table>
<thead>
<tr>
<th>Scale</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computing Self-Concept</td>
<td>3.11</td>
<td>.83</td>
</tr>
</tbody>
</table>

As Table 5.9 illustrates, there is very clear evidence of poor computing self-concept (self-efficacy or confidence for computing) for a significant proportion of this sample (M = 3.11, SD = .83).

Comparisons of Initial Levels of Anxiety for Computing Self-Concept

**Computing Self-Concept.** The analysis of variance for computing self-concept showed that there were significant main effects for faculty (F = 3.92, df = 3/712, p < .01), gender (F = 37.22, df = 1/712, p < .01), ownership of PC (F = 12.64, df = 1/712, p < .01) and self-rating of experience (F = 187.71, df = 2/712, p < .01). There were no significant interactions. Follow-up oneway analyses with contrasts indicated significant differences between students from the Faculty of Business and Technology and students from both the Faculty of Arts and Social Sciences and the Faculty of Health, with Business students having more positive computing self-concepts than students from the Faculty of Arts and Social Sciences and the Faculty of Health (M = 2.65, M = 2.8 and M = 2.87, respectively). There were no significant differences between the Faculty of Education and the other faculties. Male students had more positive computing self-concepts than female students (M = 2.52 and M = 2.86 respectively), while there were significant differences between all levels of self-rating of experience, with the advanced being most positive (M = 2.12) followed by intermediate (M = 2.98) and beginner (M = 3.70). The significant main effect for ownership of PC indicated that those who owned a personal computer had significantly more positive computing self-concepts than those who did not (M = 2.50 and M = 2.96 respectively).

**State Anxiety in Computing Situations**
State Anxiety in Computing Situations of the CALM consists of 19 items reflecting an individual's level of state anxiety while using, or thinking about using, a computer. Table 5.10 indicates the number of students responding to each level of anxiety across the 19 items.
Table 5.10
Percentage Frequencies of Responses to Questions Relating to State Anxiety Scale
(n = 794)

<p>| Scale 1: Worry (alpha = .90; M = 1.75, SD = .63) |</p>
<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threatened</td>
<td>63</td>
<td>28</td>
<td>6</td>
<td>3</td>
<td>1.50</td>
<td>.73</td>
</tr>
<tr>
<td>Insecure</td>
<td>49</td>
<td>37</td>
<td>9</td>
<td>5</td>
<td>1.71</td>
<td>.84</td>
</tr>
<tr>
<td>Helpless</td>
<td>44</td>
<td>39</td>
<td>12</td>
<td>5</td>
<td>1.80</td>
<td>.83</td>
</tr>
<tr>
<td>Anxious</td>
<td>41</td>
<td>40</td>
<td>13</td>
<td>6</td>
<td>2.20</td>
<td>.86</td>
</tr>
<tr>
<td>Worried</td>
<td>40</td>
<td>44</td>
<td>11</td>
<td>5</td>
<td>1.80</td>
<td>.81</td>
</tr>
<tr>
<td>Rattled</td>
<td>59</td>
<td>31</td>
<td>8</td>
<td>2</td>
<td>1.53</td>
<td>.73</td>
</tr>
</tbody>
</table>

<p>| Scale 2: Happiness (alpha = .93; M = 2.41, SD = .83) |</p>
<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Happy</td>
<td>17</td>
<td>41</td>
<td>27</td>
<td>15</td>
<td>2.40</td>
<td>.94</td>
</tr>
<tr>
<td>Comfortable</td>
<td>14</td>
<td>38</td>
<td>29</td>
<td>19</td>
<td>2.53</td>
<td>.96</td>
</tr>
<tr>
<td>Secure</td>
<td>21</td>
<td>40</td>
<td>24</td>
<td>15</td>
<td>2.33</td>
<td>.97</td>
</tr>
<tr>
<td>Relaxed</td>
<td>18</td>
<td>38</td>
<td>28</td>
<td>16</td>
<td>2.43</td>
<td>.97</td>
</tr>
<tr>
<td>At ease</td>
<td>18</td>
<td>38</td>
<td>27</td>
<td>17</td>
<td>2.41</td>
<td>1.00</td>
</tr>
<tr>
<td>Content</td>
<td>19</td>
<td>42</td>
<td>25</td>
<td>14</td>
<td>2.35</td>
<td>1.00</td>
</tr>
</tbody>
</table>

<p>| Scale 3: Physiological Symptoms (alpha = .85; M = 1.24, SD = .43) |</p>
<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nervous stomach, “butterflies”</td>
<td>67</td>
<td>27</td>
<td>4</td>
<td>2</td>
<td>1.40</td>
<td>.66</td>
</tr>
<tr>
<td>Hot and sweaty</td>
<td>82</td>
<td>15</td>
<td>2</td>
<td>1</td>
<td>1.22</td>
<td>.51</td>
</tr>
<tr>
<td>Heart palpitations</td>
<td>86</td>
<td>11</td>
<td>2</td>
<td>1</td>
<td>1.20</td>
<td>.50</td>
</tr>
<tr>
<td>Dry mouth</td>
<td>88</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>1.80</td>
<td>.82</td>
</tr>
<tr>
<td>Sweaty palms</td>
<td>80</td>
<td>16</td>
<td>3</td>
<td>1</td>
<td>1.30</td>
<td>.60</td>
</tr>
</tbody>
</table>

<p>| Scale 4: Distractability (alpha = .81; M = 1.70, SD = .71) |</p>
<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of concentration</td>
<td>47</td>
<td>42</td>
<td>8</td>
<td>3</td>
<td>1.70</td>
<td>.75</td>
</tr>
<tr>
<td>Distractable</td>
<td>45</td>
<td>40</td>
<td>11</td>
<td>4</td>
<td>1.73</td>
<td>.80</td>
</tr>
</tbody>
</table>

Note:
a. The general introductory focusing statement for this scale is: “Using the following scale indicate how often you have the following feelings or symptoms when you use a computer or think about using a computer.” b. The rating scale is: 1. Almost never; 2. Sometimes; 3. Often; 4. Almost always. c. The Happiness scale has been reverse scored so that a high score relates to high anxiety.

As Table 5.10 shows, 58% of students indicated a moderately high to high level of unhappiness when they were in computing situations. In the literature, it is the Worry factor, however, that is most often associated with performance decrements followed, in order, by task interference and emotionality, with
physiological arousal having only a minor effect (Deffenbacher & Hazaleus, 1985). In this context, therefore, it is important to note that 19% of students reported themselves as often, or almost always "anxious" (M = 2.20, SD = .86), and 17% as feeling "helpless" in computing situations (M =1.80, SD = .83). As for the Physiological Symptoms factor, as many as 33% of students experienced "nervous stomach and "butterflies"" at least sometimes. Finally, for 15% of the sample (one hundred and nineteen students), distractability is a major concern (M = 1.73, SD = .80).

Table 5.11
Scale Means and Standard Deviations for State Anxiety in Computing Situations (n = 794)

<table>
<thead>
<tr>
<th>Scale</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worry</td>
<td>1.75</td>
<td>.63</td>
</tr>
<tr>
<td>Happiness(^a)</td>
<td>2.41</td>
<td>.83</td>
</tr>
<tr>
<td>Physiological Symptoms</td>
<td>1.24</td>
<td>.43</td>
</tr>
<tr>
<td>Distractability</td>
<td>1.70</td>
<td>.71</td>
</tr>
</tbody>
</table>

Note.
\(^a\) The rating scale is: 1. Almost never; 2. Sometimes; 3. Often; 4. Almost always. \(^b\) The Happiness scale has been reversed so that a high score relates to high anxiety.

It can be seen from Table 5.11 that of the four factors which define state anxiety in computing situations, the Happiness (emotionality) factor has the most anxiety associated with it for this sample (M = 2.41, SD = .83). Only modest levels of anxiety are reported for the other scales.

Comparisons of Initial Levels of Anxiety for State Anxiety in Computing Situations

**Worry.** Significant main effects for faculty (F = 2.66, df = 3/715, p<.05), gender (F = 13.92, df = 1/715, p<.01) and self-rating of experience (F = 74.44, df = 2/715, p<.01) were found through the analyses of variance. Follow-up oneway tests with contrasts failed to reveal where the significant differences lie with regard to faculty differences. Male students were significantly less anxious than female students on this scale (M = 1.63 and M = 1.80 respectively) while there were significant main effects for all levels of self-rating of experience, with the advanced
being the least anxious ($M = 1.29$), followed by the intermediate ($M = 1.65$) and beginning ($M = 2.08$) users.

**Happiness.** Main effects for faculty, gender and self-rating of experience were found through analysis of variance for the Happiness scale, but these were qualified by interactions between each of the variables. A comparison of simple main effects on the significant faculty by self-rating of experience interaction ($F = 2.18$, $df = 6/714$, $p<.05$) indicated a complex range of interactions reflecting the fact that at each level of experience and faculty there were significant differences with the other levels of experience. In other words, advanced students within the Faculty of Education were significantly less anxious on this scale than intermediate and beginning students within the Faculty of Education and intermediate and beginning students within the other faculties. Advanced students across the Faculties were not significantly different from each other. Similar patterns existed for each of the other levels of experience.

A comparison of simple main effects on the significant gender by self-rating of experience interaction ($F = 4.57$, $df = 2/714$, $p<.05$) indicated that male and female students who have rated their experience as "beginner" were significantly more anxious on this scale than any of the other groups, however, they were not significantly different from each other. Female students with intermediate computer experience were significantly more anxious than both male intermediate students, and male and female advanced students. Male intermediate students were significantly more anxious than male and female advanced students. There were no significant differences between advanced male and female students.

**Physiological Symptoms.** The analysis of variance indicated significant main effects for self-rating of experience ($F = 16.51$, $df = 2/715$, $p<.01$) with each level significantly different from each other. Students who rated themselves as advanced were significantly less anxious on this scale ($M = 1.08$), followed by the intermediate ($M = 1.21$) and beginners ($M = 1.35$).

**Distractability.** There was a significant main effect for self-rating of experience on this scale but this was qualified by an interaction effect between this variable and gender. A comparison of simple main effects on the significant self-rating of experience by gender interaction ($F = 8.65$, $df = 2/714$, $p<.01$) indicated that male students, who indicated that they were "beginners", were significantly more distractable than all other groups, while, in contrast, female beginners were significantly more distractable than female intermediate and male advanced users. Females who rated their experience as intermediate were more distractable than males who rated themselves as advanced. There were no significant differences between advanced males and females on this scale.
"Learning to use the computer is important"

In this analysis, a single item question was used with a five point scale from "strongly agree" (1) to "strongly disagree" (5). The analysis of variance indicated significant main effects for faculty (F = 3.54, df = 3/633, p<.05) and self-rating of experience (F = 8.28, df = 2/633, p<.01). Follow-up one way analyses with contrasts indicated that there was a significant difference between the students from the Faculty of Business and Technology and students from the Faculty of Arts and Social Sciences, with the former more strongly agreeing with the proposition that learning to use the computer is important. There were no other differences between the groups. Follow-up one way analyses with contrasts indicated that there were significant differences in student beliefs about the importance of learning to use the computer between those who ranked themselves as advanced and those who were beginners, and again between intermediate users and beginners, with the former holding more positive beliefs than the other two groups. There was no difference, however, between students who rated themselves as advanced or intermediate in computer experience.

Discussion

An examination of the analyses presented above shows that a consistent pattern of results has emerged. Four factors are strongly related to computer anxiety for these undergraduate students.

First, undoubtedly the most powerful factor related to level of anxiety is the individual's perceptions of their entry-level computer experience. For every scale in the CALM, there was a clear, strong main effect for this variable, with advanced users having significantly less anxiety than either intermediate or beginner. Even where other variables such as gender or faculty interacted, it was the self-rated level of experience which was the most significant one. Thus, for example, although males were shown to be typically less anxious than females as a main effect, when gender interacted with experience, it was the advanced level of experience that determined the anxiety (even if it were for females), rather than gender per se. For instance, on two factors in the State Anxiety in Computing Situations scale, male beginners had higher "Distractability" scores and lower "Happiness" scores than other levels of experience, female or male.

Second, gender is also significantly related to level of anxiety. Excluding its interaction with self-ranked experience, as described above, males were less anxious
than females on seven of the eleven CALM scales: Competence with Computers; Learning about Basic Computer Functions; Positive Sense of Control; Fear; Computing Self-Concept; Worry; and Happiness.

Third, faculty major is another variable which is clearly related to levels of anxiety, and which interacted with the previous two variables. Faculty of Arts and Social Sciences students demonstrated more anxiety than other faculties on a number of scales, namely, Receiving Feedback on Computing Skills (they were more anxious than the Faculty of Education); Positive Sense of Control; and Computing Self-Concept (they had significantly fewer positive cognitions about computing and a less positive self-concept in computing situations than the Faculty of Health and Business and Technology). Females in the Faculty of Health were more anxious about Handling Computer Equipment than both male and female Education students, but no more so than female students in the other two faculties. In addition, Faculty of Business and Technology students had the most strongly positive attitude of all faculties to the statement that "Learning to use computers is important".

Finally, owning a personal computer is related significantly to lower anxiety on aspects of Handling Computer Equipment as well as to Computing Self-Concept - more positive cognitions in relation to self-perceptions as a "computing type", that is the ability to solve computer problems and to help others do the same.

While many tertiary institutions (such as the one represented in the present research) require students to gain computer competencies but do not necessarily provide formal classes, the evidence from this study that 51% of students are highly anxious in relation to the question of learning about computers without structured guidance, while another 29% are anxious to some extent, should give rise for concern about adopting such teaching strategies as the "self-help" computerised tutorial-based programs available in computing labs from which students are expected to gain proficiency independently.

In terms of the extent of negative cognitions regarding control in computing situations and lack of a sense of computing self-efficacy, the evidence from the present investigation strongly points to the need for strategies to be devised by computer course designers to foster student confidence and motivation. As Reznich (1996, p. 246) points out, "The computer-anxious learner not only lacks necessary procedural knowledge, but faces a motivational barrier brought about by his/her fears. Thus training, in whatever form, may not be enough. It will be necessary to address the motivational problem besetting computer-anxious individuals."

Such motivation will be derived from perceptions of self-efficacy or confidence in one's ability to learn about computers and to demonstrate competence in computer-related tasks. On the basis of the findings from the Gaining Initial
Computing Skills scale of the CALM described earlier, I would suggest that providing learners with opportunities to gain experience and confidence in skills involved in handling computerised equipment routinely themselves, for example, loading software, changing disks, connecting to printers, dealing with error messages and computer malfunctions, as well as in teaching others about computers in a collaborative, non-evaluative way would be important components of developing such confidence (computing self-concept) and perceptions of control. The considerable degree of negative cognitions expressed in relation to perceptions of control and computing self-efficacy in the relevant CALM scales supports my contention that these areas of student cognition warrant serious attention on the part of those charged with developing and teaching introductory computing courses.

The evidence from the State Anxiety in Computing Situations scale of the CALM regarding student feelings of helplessness, anxiety, worry, distractability and negative emotional states has clear implications for influencing student achievement in learning initial computing skills for such a undergraduate student population.

At the time that the present investigation of computer anxiety across the four faculties of this regional university was conducted, the range of approaches to computer skills training varied widely across the university. Within the Faculty of Health and the Faculty of Arts and Social Sciences, for example, students could elect to take the competency-based, self-directed computerised tutorial mentioned earlier, or to enrol in a formal class for a semester taught by the computing staff in the Faculty of Arts and Social Sciences (FASS). Students enrolled in the Faculty of Business and Technology, on the other hand, had formal classes in computing (using IBM PCs) with the same content as in those taught by Arts and Social Sciences, namely, Disk Operating System (DOS), WordPerfect, dBase and Lotus. In addition, students enrolled in Accountancy within the Business and Technology faculty had additional computer lab tutorials where they practised using software specifically designed for their accounting training. A different approach, yet again, was adopted for those within the Faculty of Education, who learned only the basics of word processing (using Macintosh computers) "incidentally" through weekly tutorial sessions in the following way: They would use electronic mail to write as "aliens "to children in schools using a software package called "Space Station Alpha"; collaborate with their peers to develop a literary project on the theme of an alien culture; and then present this project as a word-processed report for assessment. Peer tutors were offered for students experiencing extreme difficulty in mastering the computing skills required. (A detailed qualitative account of the different approaches to computer training adopted by the four faculties is presented in Chapter Six).
Such a range of computer training approaches as described above raises questions about what is the best strategy to be adopted if student computer anxiety is to be minimised and the learning of computing skills to be enhanced. The focus of the aptitude-treatment-interaction studies reported in Chapters Seven and Eight of this Dissertation relates to this question of optimal strategy, and compares the traditional approach used in computer skills courses (such as in the Faculty of Arts and Social Sciences), namely, direct instruction, to a collaborative approach where students work in cooperative groups, such as in the Faculty of Education. In the research undertaken to examine this question of instructional design, the latter approach incorporated training in a metacognitive strategy of self-questioning and in self-regulated learning within a cooperative learning paradigm.

Conclusion

Self-Rating of Computer Experience and Anxiety

It is clear from the data presented that students' self-perceptions of their level of computer experience are significantly correlated with anxiety. The evidence from the present findings are unequivocal: Those who rate themselves as "advanced" have far lower anxiety scores on the CALM. Whether this reflects an objective description of their expertise using the categories provided in the demographic section of the CALM (as described earlier in the Method section), or a subjective one which either masks true competence or inflates it, is hard to determine. This issue of subjectivity in self-rating is pertinent here. Heller and Martin (1987), for example, point out that even those with considerable computer experience may rate themselves as novices because of concerns about adequacy. On the other hand, there is sufficient evidence which shows that males, in general, express more confidence about their ability with computers than females, despite equivalent demonstrable competence (Chen, 1986).

In relation to the present findings, Hunt and Bolin (1993) assessed the attitudes of over 500 teacher education students (using the Computer Attitude Scale of Loyd and Gressard, 1984) on their enrolment into educational computing courses and correlated these with previous computer experience (word processing, programming, spreadsheet and database applications, and recreational uses). Not surprisingly, they found that extensive experience (especially with word processing) was strongly related to low anxiety. Interestingly, as for confidence in one's ability to use computers, the strongest effect was found when computers were used for recreational purposes (games).
In the present study, it is the individual with no experience of computers, or experience of games only, (namely, the "beginner") who expresses the most anxiety or negative cognitions on each scale in the CALM. The difference between these two sets of findings may well relate to the nature of the samples used. Teacher education students in the Hunt and Bolin (1993) study came from four different campuses of California State University which represent quite different populations in terms of ethnicity and socio-economic background, variables which have been linked to computer anxiety by Rosen, Sears and Weil (1987). Furthermore, differences in teaching major (elementary or secondary) have not been accounted for and have been shown to influence computer anxiety, with elementary teacher trainees showing far higher computer anxiety than secondary majors (Reed, Anderson, Ervin & Oughton, 1995).

It would seem that recreational use of computers may well demonstrate a positive attitude and lack of anxiety towards computer use. However, this does not necessarily lead to less anxiety with regard to learning to use computers for educational purposes, especially where such skills are gained in formal classes and assessed (as in the present study where students are "required" to demonstrate university-set computer competencies for graduation). The present study has shown that anxiety diminishes the more applications one has had experience with. Hunt and Bolin (1993) found in this context that extensive prior experience with word processing, for example, was strongly correlated with a reduction in computer anxiety. Furthermore, as described earlier, students in the present study with prior computer experience in a number of applications held more positive beliefs about the importance of learning to use computers than those with less experience. The impact of such beliefs on student motivation to acquire computing skills must be taken into account when designing computer training courses.

With the proportion of beginners in the present study being over a third, and the level of anxiety ranging from moderate (such as on the Receiving Feedback on Computing Skills and Worry scales) to high (on the Competence with Computers and Positive Sense of Control scales), such findings have significant educational implications. It was recognition of this importance that prompted further research by the present researcher into a way in which such anxiety could be reduced within the context of a computer training course. This investigation was the basis of the aptitude-treatment-interaction studies reported in Chapters Seven and Eight of this Dissertation. A key consideration was whether anxiety remained at the same levels after completion of the course as at the start.

In this context, a number of researchers have reported that anxiety actually increased after introductory computer courses, as mentioned earlier in this chapter.
(Rosen & Maguire, 1990; Speier, Morris & Briggs, 1996). Carlson and Wright (1993), for example, had found that at pretest, computer anxiety was related to level of prior experience, as in the present study (more experience, lower anxiety and more positive attitudes). After a semester-long basic computer course, however, students who had reported prior computer experience actually showed significantly increased anxiety levels and decreased computer confidence and liking. Liu, Reed and Phillips (1990) had even found that despite increases in computer experience for teacher education cohorts over a four year period, computer anxiety remained high.

**Gender and Computer Anxiety**

As for the correlation between student gender and computer anxiety, it is evident that the finding of lower anxiety about using computer technology for male students than for females is consistent with previous research (Colley, Gale & Harris, 1994). In the present research, males expressed less anxiety than their female student peers in learning about computers and in demonstrating their competence. Furthermore, they have a greater sense of personal control over computing (expressed as positive cognitions), a stronger sense of confidence about their ability to master computers, more feelings of comfort and relaxation with the technology, and far less of worry or helplessness in computing situations.

Hattie (1990) maintains that control is learned and is highly correlated with gender. He suggests that males more than females have a greater sense of control with computers and are more able to cope with aversive situations because of gender socialisation. Females are taught to avoid risk-taking, to be compliant and to negotiate. The consequences of this socialisation is that for females, perceived sense of control is minimised.

Much research into computer anxiety has yielded ambiguous findings as to the relative degrees of anxiety and confidence for males and females. Shashaani’s (1993) study with 1750 senior high school students clearly showed that girls have a fear of using computers and feel helpless around computers. Gender-role socialisation of girls with regard to the need for females to learn about computers and to receive encouragement from parents, teachers and school counsellors to do so, was found to be the main factor influencing girls' self-confidence. For undergraduates, on the other hand, Koohang (1989) found no significant differences in computer anxiety, but did find again that males had more positive attitudes, scoring significantly higher on belief in computer "usefulness" than females. The stereotypical gender pattern with regard to anxiety was found by Rosen (1991) with a large sample of both primary and secondary female teachers who showed more computer anxiety than males, but who also expressed more positive attitudes towards computers, contrary to
the pattern for students described above. Without doubt, the picture of gender differences in computer anxiety is not consistent in the literature.

Nonetheless, the findings from the present study resemble those of Colley, Gale and Harris (1994) who reported that male undergraduates at the start of their university studies had less anxiety, greater confidence and liking of computers than females. In their research, such gender differences were a function of prior computer experience. Increased confidence for males was related to number of years of computer experience and home use. For females, greater home experience with computers was associated with lower anxiety and higher computer liking.

**Faculty Differences in Anxiety**

The issue of whether there were faculty differences in anxiety was also one of relevance to the present research. As faculty differences in anxiety were found to be significant in a number of cases, it could be expected that these would interact with the different computer training approaches adopted by each of the four faculties surveyed. Further exploration of this issue is undertaken in the following chapter in which qualitative data collected from those responsible for designing and teaching computer training courses in each of the four faculties is presented.

**Implications for Educational Practice**

As there is evidence of such a wide range of individual differences in previous computer experience between students on entry into university, and these differences correlate with anxiety and lack of confidence in computing situations, it behoves the computer educator to ensure that student learning needs are met through a variety of teaching and learning strategies which take these different entry-level skills, self-perceptions and negative affect into account.

As for the implications for practice in terms of differences in faculty major, the evidence from the present study that students who enrol in Education and Health have very little prior computer experience relative to students in Business and Technology or Arts and Social Sciences, presents a challenge for both teacher and nurse educators, as these students need to be prepared for workplaces which increasingly require computer literacy. For teacher trainees, especially, the expectation is that future teachers will be able to use computers for professional and pedagogical purposes, and to model their use in their classrooms. Faculties of Education which assume that students have grown up with computers at home and at school and are, therefore, relatively literate and comfortable with them, must also
take heed of findings such as presented in this chapter and design training programs accordingly.

In this context, the issue of what instructional approach is most appropriate for students with differing levels of anxiety and computer experience is clearly one which needs to be explored further as an outcome of the findings presented in this chapter.

**The Importance of Learning to Use the Computer**

Student differences in the belief about the importance of learning to use the computer varied significantly according to level of experience and faculty, with more positive beliefs being expressed by both those with greater computer experience and those majoring in Business and Technology subjects. While causal relationships can only be conjectured, it would seem plausible that if individuals do not see the value of a task nor experience success in it, they will not be motivated to undertake it. Similarly, if they have had a range of computer learning experiences already, positive attitudes and lack of anxiety may reflect their interest and perceptions of computer usefulness. An enormous body of literature proposes that expectancy for success and subjective task value are related to motivation to perform a task (see Heckhausen, 1991; Weiner, 1992). It would seem that providing opportunities for students to develop both expectations for success and perceptions of the value of learning computing skills is vital if computer training courses are to be successful in teaching computer skills and minimise student anxiety. Such strategies as those explored in Chapters Seven and Eight, namely, training in both the use of metacognitive questions and self-regulation, as well as peer-collaboration and tutoring, can be readily incorporated into any computer skills courses. These strategies provide students with a sense of confidence and personal control over their own learning which are particularly important perceptions for the "beginner" (35% of the present sample) and "intermediate" (48% of the present sample) user in terms of motivation to learn. Developing such a sense of control and confidence in their ability to master computing skills, and receiving encouragement from their teacher and peers in a collaborative, socially supportive learning environment are fundamental to raising expectations for success and are key motivators of achievement. As for the perceived task value of computing skills or any other activity, Eccles (1987) suggests that this may originate from a number of sources - its utility value (how much the task enables one to realise goals); its attainment value (how well the task relates to one's self-image (e.g., gender-role) and fulfils one's perceived needs); its incentive value (how much value is attached to the task because of intrinsic or extrinsic rewards or punishment received for engaging in it); and, the cost of performing the task
(perceived consequences of engaging in the task such as energy and time expended, or failure). Computer skills courses must ensure that students clearly perceive their engagement in learning as having value in relation to these elements. Reducing anxiety about involvement with computers through appropriate teaching strategies, some of which have been mentioned above, will reduce the perceived effort of mastering the task. Other strategies include student self-pacing and "catch-up" sessions for students who are having difficulty or lack the same level of experience as the others (Hunt & Bolin, 1993). Encouraging students to apply their learning of computer skills to practical purposes (such as word processing assignments, or exploring software that relates directly to their academic major without assessing their competence) will undoubtedly enhance the utility value of gaining computing skills (even though the incentive value may well be the final assessment in the course). Liu, Reed and Phillips (1990) found with a sample of over 900 teacher education students over four years that both word-processing experience and "running content-area software", as they described it (p.4) considerably reduced student apprehension about using computers.

As ownership of a computer was related significantly to lower anxiety on handling computer equipment and to a greater self-confidence with regard to using computers, encouragement for students to buy a personal computer would be recommended.

One important point needs to be made with regard to the assumption that increasing student computer experience will necessarily prevent anxiety in computing situations. Although the data from the present research support the strong correlation between higher levels of self-rated previous computer experience and lower anxiety scores, evidence from other research suggests caution in that several studies have shown no reduction in computer anxiety.

In relation to the implications of the research reported in this chapter for further study, as it was found that Faculty of Arts and Social Sciences students were more anxious than the other faculties on a number of scales including: Receiving Feedback on Computing Skills, Positive Sense of Control, and Computing Self-Concept, it was felt that this would be the most appropriate sample on which to conduct an aptitude-treatment-interaction study into the relative efficacy of alternative approaches to computer training and their impact on anxiety and performance for different levels of initial anxiety and cognitions.
CHAPTER SIX

Computer Anxiety among University Students: Faculty Differences in Training Courses

A further perspective on the degree and nature of computer anxiety and computer-related cognitions to that which was derived from the extensive quantitative analyses described in the previous chapter is provided by the qualitative study discussed in the present chapter. To gain a detailed understanding of the nature of the training programs used by each of the faculties, and to ascertain the degree to which individual courses were planned to take account of student differences in aptitudes such as prior experience, anxiety, motivation, and purpose for doing the course, the author conducted in-depth interviews with those responsible for coordinating the computing courses for their respective faculties.

These interviews, conducted at the time of data collection for the validation of the Computer Anxiety and Learning Measure (CALM), were semi-structured in so far as they explored the same range of issues for each faculty, however, they allowed for individual variation depending on the need to clarify and expand on points raised. Interviews were held in either my office (for those staff on the campus) or that of the individual concerned (for those on a different campus) and lasted for approximately one hour each. Furthermore, all interviews were tape recorded and fully transcribed before content analysis was undertaken (refer to Appendix B1 for transcriptions of interviews).

A great deal of disparity existed among the approaches to computer training of undergraduate students taken in the faculties of Education, Arts and Social Sciences, Health, and Business and Technology. In particular, it became clear that within each faculty, some aspects of the computer training course appeared to contribute to student anxiety and negative cognitions, while other aspects appeared to alleviate these. There was no way of ascertaining, however, the nature of any relationships that existed between initial levels of such student aptitudes and instructional approach. One of the main objectives of the present phase of the research, therefore, was to collect relevant qualitative data with a view to designing a quasi-experimental study which would investigate alternative methods of computer training, the specifics of which would be informed by both theoretical literature and the reports of the effects on student learning, anxiety and cognitions of the various faculty approaches gathered from the interviews.
The remainder of this chapter presents key components of the interview data for each faculty in the following sequence: First, background information about the rationale for the particular computer training program; second, details of the nature of the course; third, problems experienced in the implementation of the computer training over the semester; fourth, how students worked in computing tutorials, and finally, assessment strategies used within each faculty.¹

**Faculty of Education: An Innovative Approach to Computing**

**Background**

An earlier pilot study (reported in Chapter Three of this Dissertation) conducted with a cohort of first-year teacher trainees demonstrated that significant anxiety remained at the end of a semester-long compulsory computer training course of weekly classes in keyboard skills and wordprocessing. Efforts within the Faculty of Education to develop a more effective way of having a comparable group of first-year teacher education students acquire computing skills, without formal structured classes in computing, led to an innovative program in which computing skills were integrated into a compulsory literacy and numeracy subject. Its aim was to be non-intimidatory and to present computing in an applied educational sense rather than as a skills-based graded course: *We hoped that the students would see that it wasn't just computing in isolation, but it was classroom computing that was relevant to the particular course that they were studying (namely, how to teach about language and maths to primary school children).* It was anticipated that the unstructured nature of the instructional approach, and the fact that the computing component would be perceived by students as valuable to their future teaching career, would reduce student anxiety and increase motivation to learn.

The following is a summary of the approach taken to computing in this subject extracted from interviews with the coordinator of the computer component.

**Nature of the Course**

As mentioned above, the one hour per week computing component that students experienced in the semester-long subject Foundations of Literacy and Mathematics dealt with ways in which computers could be integrated into literacy and mathematics teaching at primary school level. Students were led through their computing experiences by those teaching the subject content: two maths lecturers,

¹ Where direct quotations are reported, these are presented in italics.
three literacy lecturers, and two part-time tutors with either maths or literacy expertise.

Rather than the computing content being presented in a traditional manner in which skills are directly taught, students had to form collaborative groups to design and write an "Aliens Project" in which they created a mythical Alien culture as an outcome of reading children’s science fiction and factual science texts. In the process of doing so, they were expected to learn to use a wordprocessor to write to children (as "Aliens") via electronic mail and to use the Microsoft Works program to present their project to their university class. The basic resource for this project was a collection of computer files known as “Space Station Alpha” which were written and designed using Microsoft Works as a package for classroom teachers. *We took that set of files with its eight activities, and chose those that fitted into the overall plan of the Foundations of Literacy and Mathematics. The major focus in the literacy strand of the subject was on wordprocessing, however, where there was also a discussion of the use of spreadsheets in the mathematics component, we used those from the package.*

In sum, therefore, the intention of the computer coordinator was to fulfil a number of aims with this approach to gaining computer skills. These were:

- To satisfy the compulsory computer competency requirement across the University.
- To communicate to students that the use of technology such as computers is "normal" within everyday school life and to model this from the beginning of their teacher training.
- To encourage students to use a wordprocessor in their own writing during their time at University.

**Problems Experienced**

Difficulties experienced were of three types: Technical, instructor expertise, and anxiety (both student and instructor).

Early in the course technical problems developed in relation to the telecommunications link between the university and schools. In effect, the anticipated interchange of letters between children and students did not proceed as planned and was ultimately disbanded due to student frustration. This was because of excessive time delays between sending and receiving the electronic mail, in addition to the inconsistency of school responses.

The expertise of the tutors of each of the eight student groups varied enormously. Apart from the computer coordinator, the other tutors were either maths or literacy specialists, only one of whom was computer literate. After the first week's
tutorials, the majority of the tutors expressed that they were not confident to teach the students and were not coping, despite the fact that they used wordprocessors for their own purposes. Furthermore, their attitudes towards computer use varied from the one who eagerly adopted the technology through to the others who were hesitant in their use or outright resisters (cf. Rosen & Weil, 1996, as discussed in Chapter One). In response to the anxiety shown by the tutors, the computer coordinator took over the teaching of the tutorials for seven of the eight groups for half of the semester, after which he returned the groups to their tutors, providing structured guidance in the form of a script and other support material. He describes this in the following way:

The script and the prepared files that went with it were put onto the network so that they were accessible by the students. The pages of that script were then photocopied and blown up to A3 size and these were posted on the wall of the computer room so that any of the students or the tutor could simply look up on the computer room wall and see what to do next. The script was in a very specific, procedural form. Where it was needed, certain parts of it such as snapshots of the screen, such as the attributes of the different characteristics of characters, paragraphs and documents were put into a chart. Where those sorts of condensed pieces of information were needed, overheads were made of that so that the tutor could speak to those overheads. The notes were also published in electronic form so that students could have additional support.

Tutors reported that student anxiety and negative self-talk were manifested early and increased throughout the course. This was largely in response to the communications of the various tutors about integrating computing into their maths or literacy subject, and especially about having to teach it themselves in computing laboratories. In most cases, students' perceptions of their tutors' lack of both confidence and sense of control created anxiety amongst them. One example that was cited concerned one tutor who started teaching the course, but who put almost no value on the computing part of it and withdrew, leaving half way through the course. Her feelings about computing were obvious to the students. There was one exception, however, where the lecturer was open with his students about what he didn't know and then made attempts to find out what the answer was; this built a more cooperative working environment. Particularly in an area like computing, instructors can be forgiven because they are not expected to know everything.

Another factor which contributed to student anxiety was the pressure of time in which they had to master the computing skills: There was only a one hour computing tutorial per week which caused students stress as they would be just
getting into it and they would have to go. In addition, the nature of the assignment as a group product caused anxiety for many.

**How Students Worked**

Collaborative group work was the philosophy underpinning the computing component and its assessment. There were difficulties with this, however: *Most of these students had never worked in that way before. Those that had come from a high school situation had come from an education system that was highly competitive in which all students fight against all other students for the highest mark. Those students who were mature age students had come from an education system in which cooperation was always seen as short term way of motivating students (such as in projects) and cooperative learning as a regular way of working, therefore, was strange to most of them. The upshot was that some groups found working in a cooperative team to be a new and stimulating challenge for them and got a lot out of it; those were the sorts of groups where the people got on socially and personally. Others were willing to try but did not have all the necessary skills to work cooperatively. And then there were a small minority of groups where there was significant conflict within the group which impinged upon their ability to effectively complete the group assessment task (to develop and describe an alien culture).*

Peer tutoring was initiated in the tutorials as a way of providing support for the anxious students in each of the eight groups. The procedure which developed for this was as follows:

*The lecturer advertised for students who were literate in this particular program and arranged funding through the student services bureau (which allowed him to pay tutors $11.77 per hour for 5 hours). Tutors were each placed with a group of five students who had requested this assistance. It was the tutor's responsibility to contact these and to organise the lessons: The evaluations of that process were very positive for both parties. The tutors all offered to do it again, and at that level of money it's not because it was very remunerative. It was because it gave them a different role to play within the University within their course. Those who were tutees went back into their original classes being much more confident, and became role models and tutors to the people around them, people who hadn't taken up that opportunity. The second outcome was that they were most successful in that course because they were then able to get on with the course content, the course focus, and not be so hindered by the technicalities of running the gear. Another outcome was that the cooperative way of learning, the sharing of problems and experiencing solutions was then more able to become a feature of those particular*
classrooms. It was interesting that on the whole it was social grouping that occurred; people who wanted to go and do this together.

Assessment Strategies

Assessment of computing skills for students within this faculty was as follows: To design an “Alien culture” within a group and make a presentation of this completed project to the tutorial class using technological means. To submit a written report describing both what had been learned through the project and the individual contribution made to the cooperative interaction.

In summary, the focus of the assessment was on mastery within groups and not so much on individual performance. In essence, the assessment was aimed at minimising anxiety. In the words of the coordinator: I would describe the course as integrative, cooperative, problem-based, project-oriented; those sorts of words that describe learning environments in which the purpose of the learning and the direction of the learning, and the outcomes of the learning are as openly displayed as possible.

Faculty of Arts and Social Sciences:
A Traditional Structured Approach to Computing

Background

While the introductory computing course within the Faculty of Arts and Social Sciences was classified as a year-long elective subject, in reality, it was taken by the majority of first-year students enrolled in the faculty in order to meet the university computer competency requirements. The only alternative would have been to take the computer-based tutorial program available in the computer centre independently, and to have the competency recorded. As the latter way would not enable students to record credits towards their degree, nor to have regular tuition from a computer instructor, it was not an option chosen by many.

Nature of the Course

The computing subject that most students took was called Introduction to Computing and comprised a one hour mass lecture on theory related to tutorial content plus a two hour practical tutorial in the computer lab. Students were required to buy a textbook and were given a handout of basic commands and procedures in their first tutorial.
The content of the subject in the first semester involved learning to manage the computer operating system (DOS for the IBM machines) and a wordprocessing application, and in the second, use of a database application.

Teaching staff comprised four existing computing instructors within the faculty plus an additional four part-time tutors to take the other classes. Expertise was "guaranteed" as they were a really dedicated team of people who rostered themselves to help students in out-of-class times in the computer labs because of the vast range of abilities.

The level of student experience comprised mostly those who were lacking in proficiency, with only a few of those who were experienced.

Problems Experienced

Student anxiety appeared to the coordinator to be a function of lack of experience: There were certainly plenty of anxious ones and I suppose the anxious ones were the mature-aged ones that had absolutely no experience; a lot of school leavers do have some experience, but that is very patchy; some are very anxious because of poor keyboard skills; it is because of these things that we go to the lowest common denominator (assume little experience).

According to the computing coordinator, student anxiety and negative cognitions rose and fell "predictably": It began to rise around the second week when uncertainties about their ability to cope developed and continued to increase until about the fifth or sixth week, after which it began to dissipate when students submitted their Folios of completed wordprocessing exercises for assessment.

How Students Worked

Students worked as individuals in computer labs, one to a computer, where the instructor used a traditional direct-instruction teaching approach. During each tutorial, material was presented by the instructor which the students then practised. Following this, students were to complete practical exercises on each new skill taught and compile these, progressively, into a Folio (as described above). Ideally, these exercises, which had been outlined to students in a handout at the start of the course, were to serve as a form of skill self-evaluation which would allay anxiety. Students could work on these in class if they had time, in the computer labs outside of class time, or at home if they had a computer. Obviously, there was no way that independence of student work could be guaranteed under these circumstances, and, in fact, it was not unknown for some of the more computer literate (usually males) to do some of the exercises for the less competent (usually anxious females); although collaboration was anticipated, it was not actually fostered by the instructors. Rather,
the traditional nature of the instruction that the students received in class encouraged
dependent and competitive classroom behaviours: After all, the Folios were to
be graded!

Where collaboration in tutorials occurred it was informal and spontaneous as
the need for help with a specific problem arose. In most cases, such help merely took
the form of a more computer literate student solving the problem for another, rather
than actually explaining the solution. The emphasis, however, was on reliance on the
instructor for help: Students do work with each other in small groups sometimes; but
they are encouraged to ask the tutors as well. We are available at all times (outside
of class) - all they have to do is come and ask and they will be told. The reality,
however, was that many students (being in their first year at university) were very
reluctant to approach instructors who appeared to be experts and who were
considerably older than they; they found it too intimidating.

Faculty of Health: Laissez-Faire Approach to Computing

Background

At the time of data collection, the Faculty of Health had no specific computer
training program in place for its students. Those who wished to learn computing
skills were able to enrol, as miscellaneous students, in the Faculty of Arts and Social
Studies' elective described earlier. Alternately, they could take the computer-based
tutorial course independently in the computer lab. This program was known as the
Safety Net because it was a means of satisfying the university competency
requirement without having to attend classes or be graded (and some would say,
without really learning much about computing).

Thus, the onus was on the nurses themselves (who may have needed to learn
to use computerised technology in their workplace) to avail themselves of training
outside the faculty. As the computer coordinator from the Faculty of Arts and Social
Sciences pointed out, these students were invariably the most anxious. It is
important to note that, at the stage that the present interviews were conducted, there
were very few computers within the Faculty of Health (and those used by the
secretarial staff), and the majority of lecturing staff would have been classed as
resisters of technology, with a few hesitant users (cf. Rosen & Weil, 1996; see
Chapter One for a definition of these terms). Certainly, it was not generally
considered by (very pragmatic) nurse educators that learning wordprocessing,
database and spreadsheet applications had a great deal of relevance to their
workplace setting.
Assessment Strategies

Assessment items for students taking this three hour per week computing subject included two folios of completed exercises that related to each of the computer applications that had been covered in the course; a research report for which students were to use CD-ROM database searches to find references, as well as the wordprocessor to complete the written part of the assignment; a practical computing skills test; and a written exam on the theoretical content of lectures.

In summary, the assessment was individualistic, competitive and performance oriented. There was, however, the opportunity for student collaboration on the folios and research report, as well as for consultation with the instructor in out of tutorial times.

Case Study of a Professional Nurse: Insights into the Effects of Structured, Individualised Computer Training

The very few nurses who tried to gain computer literacy through formal coursework did not have an easy time. One such student, Jane, was interviewed by the author after she had completed the Computer Anxiety and Learning Measure (CALM). A thirty-six year old female who had considerable professional responsibility in a large women's hospital, and who used computerised technology in her work, Jane became highly anxious whenever she had to attend computing classes, to the point of confessing that she was beset by severe stomach upsets each time she left home for a practical computing session. She admitted that each week became harder for her as her sense of competence was increasingly threatened by public exposure of what she felt was her "obvious" ineptness relative to the majority of students who were straight out of high school. Jane wished for a learning environment where students were willing to help each other in solving problems. This approach to teaching computing, she said, would have helped both to reduce her anxiety and to develop her sense of competence in computing. At the stage that Jane was referred to the author by her instructor, she was already failing assignments and had no sense of control over computing. Given that it was not possible to change the instructional approach used within the Faculty of Arts and Social Sciences, it was suggested that a peer tutor might be organised to help her understand where to begin to solve problems, as she put it, and to work with her on a regular basis outside of class time.
Unfortunately, for this nurse who had been long out of formal education, her greatest fears were "taking a test on my computer competence", "remembering the sequence of commands to carry out a procedure", "watching someone else work on a computer", and "dealing with computer malfunctions", as indicated by items on the CALM. As described earlier, the course she was taking was heavily assessed. In terms of her negative cognitions and sense of control as measured on the CALM instrument, she was convinced that she was forever "going to make a mistake" and felt very strongly that she was "too embarrassed to ask for help". In all, she admitted to experiencing lack of concentration, distractability, heart palpitations and worry when using a computer, and felt insecure, tense, helpless and hopeless almost always in computing situations.

For this student, the individualised format of the computing course, its focus on performance as evaluated publicly, as well as the limited access to help she had both in class and out, were barriers that, ultimately, she could not overcome. The peer tutoring came too late: She failed the course.

Faculty of Business and Technology:
A Structured Approach for Confident Beginners

Background
For all students enrolled within the Faculty of Business and Technology, it was compulsory to take the introductory semester-long computing course. This course was taken by students enrolled in three different degrees - Science, Commerce and Business, and Accountancy, each of which may have had additional computing components. This was the case for the latter degree, specific details of which are given later in this section. While staff were technically proficient computer instructors in this introductory course, none were trained as educators. The majority of the students were high-school leavers.

Nature of the Course
Students attended a two hour lecture, a one hour tutorial and another hour-long practical computing session each week. The content of the lectures was theoretical information about the hardware and software of computing, which was further developed in tutorials, while the computer laboratory sessions comprised two weeks on DOS, five weeks on wordprocessing and six weeks on a spreadsheet application.
The course was designed as an introductory one so that students were taught as if they were novices: *You might find that 10-20% of students find the subject totally boring (those that had done computing in high school towards their Higher School Certificate) and their motivation levels drop markedly because they have 'been there and done that'. However, we really try to start at the bottom and to take it in as easy steps as possible so that don't have students being totally turned off because they don't understand it. We try to be as approachable as possible.*

**Problems Experienced**

Problems experienced within this computing course related to student attendance, unrealistically high computing self-concept among many students, staff attitude, and test anxiety. As lectures were delivered to groups of up to three hundred students at a time, it was suggested by the computer coordinator at the interview that serious overcrowding of the lecture theatre discouraged students from attending: *Attendance at lectures dropped markedly towards the end of the semester when we had probably no more than 20-25% of the students attending the lectures.* It was also noted that many students commented that they had more *interesting things to do* - a reflection on the unstimulating content of the lectures, perhaps?

While initial student expertise varied somewhat, *The problem that we have particularly noted is that students seem to feel they can pick up things quicker than they do ... their sense of confidence is unusually high, but it is not realistic; it oversteps the bounds of what they actually know.* One outcome of this inflated sense of confidence was the poor quality of students' practical work submitted for assessment.

Due to large student numbers in practical sessions in the computer labs (average of twenty-five), tutors were assisted by "demonstrators". These demonstrators were either second or third year students majoring in computing who were employed to help deal with the many questions that were posed during practical sessions: *One person is not enough; there might be a lot of questions at one time; you get run off your feet and you might not get to everybody.* Unfortunately, on some occasions demonstrators became *a little bit uppity and cocky*, which was discouraging for male students and intimidating for female students. In fact, it was reported by one instructor that females from non-English speaking backgrounds who were in the Faculty of Business and Technology avoided asking any questions of the male tutors and demonstrators, altogether, out of shyness and fear of looking foolish.

Student anxiety manifested itself during practical computing sessions in the laboratory. One limitation that led to frustration and anxiety (because of inability to keep up) was the lack of keyboard confidence or proficiency. Another, more
significant cause of anxiety appeared to be considerable student concern over being observed by their instructor while at the computer during an assessment exercise: A very common feeling that I've seen with a lot of students during quizzes, especially in practicum quizzes; I learned to leave them alone. I've occasionally walked around to make sure no mischief is going on, but generally speaking, it is better for me to sit up the front of the laboratory so they didn't have the perception that I was looking over their shoulder, watching what they were doing. It was a fear of making mistakes in public which led to feelings of awkwardness and embarrassment: They didn't like it at all - it really put them off! I don't know if it was a reflection on their confidence or whether they perceived it as being evaluated. ...

How Students Worked

Students sat one to a terminal throughout practical tutorials. As sessions were only one hour long, interactions between students were brief and related to answering specific questions; some students preferred to work alone; others chose to "pair-off". Collaboration was encouraged by the coordinator in his classes, however, as he admitted, he was not necessarily representative of the many other instructors in the course: I suggest to students that they can discuss things, toss around ideas; obviously, what is ultimately submitted in assignments must be the students' own work, but we try to emphasise the working together as a means of sharing a common pool of mind.

Faculty of Business and Technology:
A Subsample of Accountancy Students

Background

Accountancy students formed one of the groups within the Faculty of Business and Technology that had to take a compulsory computer skills course, as described earlier. In addition, however, this group had additional computing requirements in relation to their accountancy training.

Nature of the Course

Students enrolled in first year Accountancy attended a computing lab session for one hour per week in which they learned how to use both a specific software package designed to teach them how to handle the financial aspects of accountancy, and a computer-based tutorial package which taught accountancy theory through a question and answer mode on screen.
Problems Experienced

A number of problems beset this course: Lack of staff proficiency in computing; student inexperience related to age and opportunity to access computers, and student anxiety regarding the computerised review tests that they had to complete in the labs as part of the subject assessment.

The first issue was one of staff expertise. Those teaching in the School of Accountancy were trained accountants themselves, but were not necessarily computer literate nor proficient in the particular accountancy package that the students were to learn: *We have a couple that don't understand computers on the staff. There is a problem there and what we do is try to counteract that with some of the other tutors going in and also giving assistance. If we find that one of the tutors doesn't really understand computing then we may swap and they might do tutorials while the other tutor that is more conversant with computers will take on the practical aspects.* Not surprisingly, when this occurred, it caused the students unease.

The computing coordinator also pointed out that there was a wide discrepancy in students’ facility with the computers in relation to their age: *The young ones who do the course full-time during the day are usually O.K. They can use the labs and get additional help and practice. The older full-time and part-time students have difficulty with it initially, although usually they are quicker learners and pick it up quickly.* The difficulty caused by such imbalance in computer competence was that instructors needed to spend far more time with these students instructing them in the basic use of computers, before they could even begin to teach the accountancy packages. This was very time consuming and unsatisfactory as one tutor was not able to help everyone in an hour tutorial: *Sometimes it's difficult in labs because your time is so limited; if a lot of students don't understand something you find you are running around the room trying to help. When there are twenty in the room it is very difficult to get to every one at the same time, and when you have got through one group, your time has run out to go and show the others, some students have to sit and wait which is frustrating for them.*

Finally, as with the computing skills tests described earlier in the Business and Technology compulsory computing subject, many of these accountancy students experienced considerable anxiety during their tests: *They did three review tests throughout the course which consisted of twenty multiple choice questions, each presented on computer. Once they finished answering the questions they would have feedback straight away from the computer program as to what the results were and where they got the answer incorrect.* While the tests were not specifically on
computing skills per se but rather on the Accountancy content, students were anxious, nevertheless, because of the fear of the computer.

In order to reduce the computing exam anxiety, attempts were made to allow students who experienced extreme anxiety to do some other menial task during the exam period, and then to re-attempt the test on the following day, alone with the tutor.

**How Students Worked**

The approach taken to student collaboration in the School of Accountancy was that it was to be actively encouraged. This was explained as emanating from pragmatic reasons such as the difficulty of the tutor being available to help all those in need at once. It was also pointed out that within most groups there were one or two students who were taking a computing major and that these were used as resources by the other students. The attitude of the coordinator was that *We encourage them to work together but make sure, at the same time, that they do their own work. If someone else understands it and can teach them, that’s fine, so long as it is the right thing they are teaching them. We don’t make the labs silent although we try to keep the noise down because they get a bit excited. I think if you make it more relaxing it is not as pressured or intense.*

**Assessment Strategies**

Business and Technology students had to complete an examination on theoretical aspects of computing plus a number of practical quizzes in tutorials on wordprocessing and spreadsheets:

*They performed a series of tasks on a particular document or spreadsheet that they retrieved; then they submitted a disk that they had done the work on at the end of the hour. We imported the disks and marked them.*

It is interesting to note that the coordinator reported that students tended to tell each other what the questions on the practical quiz were likely to be, thereby helping each other to do well. This was a “mystery” to the coordinator who stressed the competitive nature of the exam procedure: *It didn’t seem to bother the students to help each other. We tried to reinforce the idea that they are doing themselves a disservice by telling their mates what’s in the exam.*

The Accountancy subgroup of the Faculty of Business and Technology, students similarly competed for grades in an examination. In summary, while there was informal collaboration in tutorial sessions, the approach to assessment in the Faculty of Business and Technology was individualised, competitive and performance based.
Factors Relating to Student Anxiety and Negative Self-Talk

Exacerbating Student Anxiety

A close examination of the interview data described above revealed a number of factors that might account for student anxiety and negative self-talk in computer training courses across the different faculties. Within the Faculty of Education the first of these factors related to the lack of expertise and confidence as well as the anxiety and negative attitudes towards computer use of course instructors. Neither of these would be expected to dissipate student anxiety or to model a sense of control or computing self-efficacy. In the Faculty of Business and Technology, on the other hand, where instructors were computer experts (although not trained educators), it was reported that students who were inexperienced and needed help often felt too foolish or shy to ask. Once again, self-efficacy and sense of control were not likely to be fostered by such an instructional approach where “ignorance” was perceived as humiliating and asking for help fostered dependence.

The aim of the cooperative learning approach that was adopted, in part, by the Faculty of Education was to encourage both mutual interdependence within a small learning group as well as individual accountability for learning. This aim could not be fulfilled as students were inexperienced in cooperative learning skills. Neither was there sufficient time within the one hour tutorials to teach and practise these as well as to master new computing skills. Student anxiety and negative self-talk were functions of the need for initial structure in learning and training in self-reliance.

Assessment strategies within this faculty were also considered to contribute to student anxiety. While the aim was to minimise anxiety by reducing competition in assessment, students were uncertain as to how to plan and present their major computing assignment collaboratively. Such uncertainty greatly increased anxiety. Within the other faculties, assessment took the form of traditional individually graded assignments and tests, both of which were reported to cause anxiety, especially where students were in a computer laboratory and their computer competence was evaluated publicly.

Alleviating Student Anxiety

As for those factors that appeared to alleviate anxiety, peer tutoring was found to be beneficial in two faculties, although to varying degrees. In the Faculty of Education, two positive outcomes of peer tutoring were described: the first was enhanced confidence on the part of the tutees who acted as role models and tutors to others after acquiring computing skills within the small cooperative groups led by peer tutors; the second was enhanced achievement because of a greater sense of self-
efficacy - computing problems could be solved and others could be helped to learn by these former tutees. Within the Faculty of Business and Technology, the outcome was not as positive but still helped reduce anxiety to some extent. In this faculty, peer tutors were employed as “demonstrators” within large tutorial groups where the instructor could not possibly provide individual help for all those who required it. The instructional approach adopted by such tutors was a didactic one rather than cooperative or collaborative. For those receiving help, the tutoring was beneficial as it provided specific instruction. The attitude of superiority to those requesting assistance that was communicated, however, reduced the benefits of tutoring: many students felt too embarrassed or intimidated to ask.

In each of the faculties, structured guidance was provided for novices in a variety of forms: scripted teaching and student material within the Faculty of Education to compensate for the lack of instructor expertise and student inexperience, and handouts of notes as well as textbooks in the other faculties. Together with step-by-step instruction and individual student practice, such traditional teacher-led approaches were considered helpful for novices in terms of anxiety reduction.

**Comparison of Structured and Unstructured Approaches to Computer Training**

As described earlier in this chapter, each faculty computer coordinator acknowledged that informal, spontaneous collaboration occurred among students for several practical reasons: the inability of tutors to attend simultaneously to the requests for help from a large group of students, and the recognition that discussion and mutual helping reduced tension while learning new skills. While the Faculty of Education attempted to incorporate cooperative structures into the computer training in terms of assessment requirements, there was little formal student preparation in the skills of cooperative interaction for learning in this particular faculty, and none in the others.

What appeared to be the strengths and weaknesses of the structured and more unstructured approaches to computer training as illustrated by the faculty interviews? A summary is presented in the table that follows (Table 6.1).
### Table 6.1
**Summary of Strengths and Weaknesses of Structured and Unstructured Approaches to Computer Training**

<table>
<thead>
<tr>
<th>STRENGTHS</th>
<th>WEAKNESSES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STRUCTURED APPROACH</strong></td>
<td></td>
</tr>
<tr>
<td>• Guided content presentation in small steps</td>
<td>• Dependence on a more knowledgeable &quot;other&quot;</td>
</tr>
<tr>
<td>• Scripted material as a guide for learning helpful for novices</td>
<td>• Drill and practice without a sense of control</td>
</tr>
<tr>
<td>• Monitoring of student learning by &quot;expert&quot;</td>
<td>• Learning as public performance of competence - mistakes humiliating</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>UNSTRUCTURED APPROACH</strong></td>
<td></td>
</tr>
<tr>
<td>• Social support of peers in informal collaborative learning reduces anxiety</td>
<td>• Focus on &quot;creative&quot; computing without building sufficient student expertise in basic skills</td>
</tr>
<tr>
<td>• Learning as mastery - mistakes to be expected</td>
<td>• Too little structure for novices especially in early stages of learning</td>
</tr>
<tr>
<td>• Student self-monitoring and self-regulation as a function of individual accountability within a group</td>
<td>• Self-reliance is sometimes threatening until a sufficient skill base is developed and self-efficacy perceptions emerge</td>
</tr>
</tbody>
</table>

The qualitative data gathered from the interviews described have provided a rich source of information regarding the approaches used to computing within the four faculties. These data have enabled the author to set the demographic quantitative data from the students enrolled in these faculties in a rich context from which to derive the design for the quasi-experimental study briefly described below, and described in greater detail in Chapters Seven and Eight.
Designing an Aptitude-Treatment-Interaction Study on the Basis of Faculty Interview, Pilot and Demographic Studies

Earlier exploratory research reported in the pilot study (Chapter Three) had demonstrated that when a direct instruction approach to teaching computing was used, computer anxiety and negative cognitions remained for some students but not for others, even after considerable experience over a semester-long course with only one computer application (wordprocessing).

Examination of the demographic data collected from students within the four faculties (Chapter Five) showed, amongst other things, that there is a considerable range of individual difference in prior computer experience (both formal and informal), ownership of personal computers (with implications for anxiety alleviation and developing perceptions of control and computing self-concept), and anxiety and negative cognitions with regard to learning computing.

The evidence from these two earlier studies, in addition to the analyses of each of the four approaches to computer training that have been described in the present chapter, gave rise to the research design adopted in the aptitude-treatment-interaction studies in the following chapters in this Dissertation. In sum, a structured didactic approach to computer training seemed to "suit" some students but to be detrimental for others, with the same applying to an unstructured exploratory approach. The aim of the author, therefore, was to design an intervention which would take heed of the factors that appeared to reduce student self-efficacy perceptions and contribute to anxiety and poor achievement as well as those factors which may have enhanced them. The theoretical framework within the aptitude-treatment-interaction study was situated has been described in the first chapter and is developed in greater depth in the following chapters. Briefly, it relates to strategies for reducing anxiety such as building perceptions of control and self-efficacy in learning computing skills within a cooperative learning structure.

The intervention, thus designed, was to be contrasted with what appeared from the interviews to be the one most commonly used in computer training classes, namely, direct instruction. It will be remembered that even the experiences of the Faculty of Education, which espoused an unstructured cooperative learning approach, however, highlighted the need for structured guidance where basic computing skills of students and tutors were lacking. Thus, while the qualitative evidence regarding the sole use of a didactic, teacher-directed approach for computer training was somewhat ambiguous, structure was considered an important instructional factor to incorporate into the design of the aptitude-treatment-interaction study in combination
with other elements. Theoretical literature supporting its instructional value for some students was also taken into account (Rosenshine, 1986; Rosenshine & Meister, 1995; Wigfield & Eccles, 1989). Similarly, the potential cognitive and affective benefits of cooperative learning (Hythker, Dansereau, & Rocklin, 1989) were also to be tested in the intervention in relation to reducing anxiety and fostering perceptions of control. However, rather than being unstructured and functioning as a means of social support, the theoretical literature suggested to the author that the cooperative groupwork should be explicitly structured (Cohen, 1986; 1994) and incorporate training in self-regulation and self-monitoring through higher-order questioning (King, 1992, 1993, 1994).

Given that the aptitude-treatment-interaction study was to be conducted in a naturalistic setting, some factors which had been identified as contributing to student anxiety, such as university assessment procedures, could not be avoided. In fact, to eliminate them would have made the research less valid to the population for which it was designed. Nonetheless, in order to minimise the degree to which anxiety emanating from computer-related assessment might occur, the intervention was designed to incorporate the metacognitive strategy training component in self-questioning referred to earlier which had been shown in previous studies to be effective in enhancing student self-efficacy through self-regulation of their learning. Such self-regulation was predicted to reduce student anxiety as a function of positive cognitions and perceptions of control in computing situations.

Another factor that had been identified in the faculty interviews as compounding student anxiety was the level of instructor confidence. As was reported in the faculty interviews, some instructors had virtually no computer expertise nor confidence, themselves, other had ample expertise but were not trained educators. In the aptitude-treatment-interaction study, therefore, an experienced instructor whose computing self-concept and sense of control in computing situations was positive was selected to teach two separate first-year groups beginning a computer training course using the two instructional methods outlined above.
CHAPTER SEVEN

PART A

Effects of Metacognitive Strategy Training Within a Cooperative Group Learning Context on Computer Achievement, Anxiety and Cognitions: An Aptitude-Treatment-Interaction Study

As had been shown in the pilot study (Chapter Three) as well as in other studies, even after students receive considerable computer training, many remain computer anxious to a degree which clearly affects their performance on computer-related achievement measures (Carlson & Wright, 1993; McInerney, McInerney, & Sinclair, 1994; Marcoulides, 1988; Nelson, Wiese & Cooper, 1990; Siann, McLeod, Glisso & Durndell, 1990). The aim of the present research, therefore, was to determine whether an instructional approach might be devised which could maximise positive cognitions and achievement in a compulsory computer training situation while minimising student anxiety. This chapter, which is in two sections (A & B), reports on both the initial quantitative study (A) conducted to investigate the effects of instructional approach on these variables and the qualitative study (B) conducted simultaneously to probe more deeply into the effects of the instructional approaches used in the research. The chapter which follows (Chapter Eight) presents the replication of the former research, considerably modified in response to the findings of these two studies.

Two instructional methods were adopted. The first was based upon the principles of direct instruction, the strategy most frequently used in computer training courses (Harrington, McElroy and Morrow, 1990). The second built upon direct instruction by adding cooperative self-regulated group work in which guided questioning was used to encourage student learning. This latter approach was considered to have potential for catering to a wider variety of student differences in anxiety and learning style within a group.

Structured Direct Instruction Model

Direct instruction, in the sense of teacher-led instruction (Rosenshine, 1986; Rosenshine & Meister, 1995), has traditionally been adopted for skills training such
as in computing. Proponents of this “transmission” approach maintain that proceeding in systematic short steps and giving guided individual practice by the instructor avoids overloading students' working memory. In terms of student anxiety in a computer training setting, it was anticipated that structured presentation of material would reduce the information processing demand of computer learning tasks, thereby reducing anxiety in relation to interfering cognitions such as negative self-perceptions and fear of failure (Tobias, 1986). The basis of one of the instructional approaches received by students in the present study, therefore, was this structured, teacher-directed instruction.

Cooperative Learning

Student interaction in cooperative learning settings has been shown to have both cognitive and affective benefits for participants in academic and computer training environments, especially in terms of achievement, positive self-esteem and self-concept, and interpersonal relations (Fantuzzo, King, & Heller, 1992; Johnson & Johnson, 1991; Johnson, Johnson & Smith, 1991; Keeler & Anson, 1995; Slavin, 1995). The second instructional approach, therefore, extended the direct instruction treatment in so far as students were placed by the instructor into heterogeneous groups (gender and computer experience) of three or four at the start of the course, and remained in these working groups during each computer laboratory tutorial for the whole semester. All students received metacognitive strategy training in self-questioning using a set of generic question stems as a guide for generating their own specific questions related to the material that they were learning in class (King, 1991, 1992, 1993, 1994; see also Rosenshine, Meister, & Chapman, 1996). These questions were then posed to others in the group and answered and elaborated upon in a group discussion format.

The differential effects of classroom goal climates (Ames & Archer, 1988) on learning and anxiety was also an important factor considered in the design of the present research. The group receiving direct instruction was anticipated to be more "ego-involved" (Nicholls, 1984) than that receiving metacognitive strategy training within a cooperative classroom context, who would be more "task-involved". The implications of this were as follows: For the former group, making mistakes and feeling foolish (easily done in relation to learning computing skills) were expected to cause greater stress than for the latter group, where the focus was on mutual peer support in efforts to improve performance and acquire learning strategies.
The procedure adopted in the intervention can be summarised as follows:

- Explanation by the instructor of the relevance and potential effectiveness of self-regulated learning and reciprocal peer questioning in computer skills training. This is an important motivational feature of strategy training as one means of encouraging students to use the strategies (Paris & Oka, 1986; Scheid, 1993).
- Guidance - modelling and coaching by instructor in how to generate metacognitive questions.
- Practice - individually and with partners in small groups.
- Feedback from peers and instructor.

The above procedure attempted to address some of the major cognitive, motivational and contextual issues involved in learning (Paris, 1988) as they applied to computer training.

It was hypothesised that the group receiving the metacognitive strategy training in self-questioning and the opportunity to work in structured cooperative groups would gain confidence, be better able to monitor and regulate their own learning, and achieve better. It is worth noting that the group receiving direct instruction was not disadvantaged in any way in that this approach has been shown to be the teaching method typically used with some success in basic skills and computer training (Harrington, McElroy, & Morrow (1990).

**The Roles of Self-Regulation and Metacognition in Anxiety and Learning**

There has been considerable educational interest over the last decade in the phenomenon of student self-regulated learning as a desirable product of education processes (Zimmerman, 1990, 1994, 1995; Zimmerman, Bonner, & Kovach, 1996). To facilitate learning, it is believed that students must develop the will or motivation to be self-regulated by realising that they are responsible and capable of their own self-development and self-determination (McCombs & Marzano, 1990; Schunk, 1995).

This sense of personal agency for learning is gained through enhanced metacognitive processes and produces in the learner a sense of self-efficacy which enhances the experience of competency (Bandura, 1986; Schunk, 1990; Zimmerman, Bandura & Martinez-Pons, 1992). Perceived self-efficacy, while enhancing
performance, may also reduce the debilitating effects of anxiety for those who are initially highly anxious learners (Bandura, 1988).

In this context, I wished to examine whether an approach incorporating self-regulatory training and structured cooperation would be beneficial for students per se, as well as for those who were initially highly anxious and had negative cognitions in a specific domain such as learning computing. Research predictions, thus, related to both main effects of treatment and to interactions between initial levels of anxiety and cognitions and treatment.

Interventions for promoting self-regulated learning must address student beliefs about their competency and control as these impinge heavily on their motivation to undertake self-regulatory strategies (McCombs & Marzano, 1990). In part, therefore, the author undertook to foster such beliefs and motivation with one group of students (intervention treatment) through cooperative learning structures in which students, allocated to specific groups were to:

a) engage in mutual helping behaviours such as providing explanations to problems encountered in understanding computing procedures; and,

b) take turns in self-questioning and sharing elaborated answers within their group.

As King (1992, p. 122-123) argues in relation to the development of student control through self-questioning, “The individual student has a great deal of control over the questions that are asked and the answers that are generated. Using the guided questioning strategy may increase feelings of autonomy because students are free to choose which question stems to use .... Making these kinds of choices puts students in control of deciding what they already understand, what they don't understand, and what they need to study. Putting students in control of their own learning in such ways has often been found to increase their intrinsic motivation and subsequent achievement. Presumably, use of the guided questioning strategy, which provides so much autonomy for the learner, would tend to promote self-regulated behaviour.” Self-regulation as operationalised in the present research, therefore, refers to the autonomous use of questioning as a learning strategy by students in the cooperative group, and involves metacognitive understanding of when and why to use the generic question stems which were provided by the instructor by modeling and explanation (see Pressley & Wolshyn, 1995).

The metacognitive training in using higher order questions was anticipated to act as a form of study skills training which has been shown to be effective in reducing the information processing demands of learning tasks (Tobias, 1986), and in
decreasing anxiety for highly anxious individuals (Naveh-Benjamin, 1991). The rationale for incorporating generic question stems which would facilitate tutorial content review was based on evidence that for anxious students, requiring students to review material using specific questions, and providing them with explicit instructions about the importance of review as a learning strategy, would enhance learning (Tobias, 1988, 1989b). Furthermore, for the cooperative group, an increase in perceived control over difficulties in the computer course was an expected outcome of the intervention. This was anticipated to have benefits in terms of anxiety reduction for the initially high anxious students (Bandura, 1993). Student motivation was also expected to reflect the increased sense of control over their learning (Eccles, Midgley, & Adler, 1984).

From another perspective, researchers investigating the effects of anxiety on learning from instruction have shown that the presentation of material in a well organised or structured form also enhances the performance of anxious students relative to those low in anxiety (Tobias, 1986). According to Wigfield and Eccles (1989, p.170), "Loosely structured, student-centered instructional strategies have been found to work less well with anxious students, presumably because the greater uncertainty in those kinds of situations poses a stronger evaluative threat to the anxious students."

Hence, the two research questions were: Is one instructional approach preferable to the other in terms of student learning, positive cognitions, and anxiety? Are the two treatments differentially effective for high and low anxious students? The appropriate way to test such questions is through aptitude-treatment-interaction analyses which are described below.

Aptitude-Treatment-Interaction Research

Richard Snow (1992, p. 6) described the concept of aptitude in research in the following way: "The concept is especially close to readiness (as in reading readiness), but also to susceptibility (for a purpose or position), and proneness (as in accident proneness).... Aptitudes are initial states of persons that influence later developments, given specified conditions." Snow goes on to say that such a conception of aptitude allows research attention to be paid to a range of intrapersonal variables such as personality, motivation, interests and attitudes, in addition to ability. The study of aptitude variations and ways of accommodating these through adaptations of instruction became the focus of early aptitude-treatment-interaction research (Cronbach & Snow, 1977; Snow, 1989). As Borg & Gall (1989, p. 700)
explain, "The purpose of aptitude-treatment-interaction (ATI) research is to determine whether the effects of different instructional methods are influenced by the cognitive or personality characteristics of the learner."

In the present study, the aim was to use aptitude-treatment-interactions (ATI) to examine the relationships between initial levels of student computing anxiety and two alternative instructional methods (direct instruction and cooperative, self-regulated learning). The primary foci of the experiment were to determine the educational significance of any interactions found between student anxiety and instructional method; to determine the relationship of these interactions to achievement; and, to identify treatments optimal for given levels of anxiety. This was possible through an ATI design which "allows for a more sophisticated analysis of the effects of instructional methods than would be possible by just comparing one treatment group with another." (Borg & Gall, 1989, p. 705; also see Pedhazur & Schmelkin, 1991). During this study I:

1. Conducted quasi-experimental research using two equivalent classes in the university subject Introduction to Computers. Equivalence of groups was ensured by using statistical controls elaborated in detail in the method section. One class was taught using direct instruction, the other was taught using a combination of direct instruction plus cooperative self-regulated learning. It is important to note that both the content covered in each class was equivalent and delivered by the same course instructor after consultation with the author/researcher, and the assessment measures were the same for each group.
2. Measured student computer competency, positive cognitions and anxiety at pretest and posttest, and related these to instructional approaches.
3. Monitored the treatment through regular interviews with the course instructor and content analysis of the tutorial diary kept throughout the course.

**Study 1**

**Method**

**Participants**

Two groups of students completing compulsory computer coursework in the subject Introduction to Computers were randomly assigned to alternative instructional approaches taught by the same instructor. The classes were selected from the Faculty of Arts and Social Sciences at a regional university in NSW, Australia.
One group (10 males and 6 females) received computer skills training through direct instruction, and the other group (7 males, 8 females) through a combination of direct instruction and strategies to foster the development of collaborative self-regulated learning. The average age of the students was 20 years.

**Measures**

A pretest/posttest questionnaire instrument, the Computer Competency Checklist (Lawson & McInerney, 1994), was administered to elicit information regarding base levels of computing competence in the areas to be taught, namely, DOS, wordprocessing (WordPerfect 5.1), database (DBase 4) and spreadsheet (Lotus 123) applications. This was used to determine the levels of perceived student self-efficacy with regard to these specific computing skills.

Levels of computer anxiety and positive cognitions were determined using the McInerney and McInerney Computer Anxiety and Learning Measure - CALM (McInerney, McInerney, & Lawson, 1996; McInerney, McInerney, & Roche, 1994) (see Chapter Four). The anxiety scales consisted of the following: Learning about Basic Computer Functions (Learning); Competence with Computers (Competence); Handling Computer Equipment (Equipment); Receiving Feedback on Computing Skills (Feedback), all of which relate to aspects of learning computing skills, and Gaining Initial Computing Skills (Skills), a scale combining all of these four subscales. The other anxiety scale was the Fear scale which measured both fearful cognitions about damaging the computer, and public embarrassment in computing situations. Preliminary analyses with the four anxiety scales in the State Anxiety in Computing Situations higher order factor (namely, Worry, Happiness, Physiological Symptoms and Distractability) showed that these scales did not sufficiently discriminate between the levels of anxiety for these participants. As such they did not provide an effective dimension for determining aptitude-treatment-interaction effects and were consequently dropped from the analyses.

Positive cognitions were measured by two scales, the first relating to Sense of Control about mastery of computer skills and the second to one’s Computing Self-Concept, or positive cognitions about proficiency with computers. Achievement data were also obtained at the end of the course. These consisted of two folios of student work in which specific activities related to the tutorial content were completed, a practical test on computing skills (DOS, wordprocessing, database and spreadsheet), and a research report.
Procedure

Students attended a one-semester course called Introduction to Computing which comprised a one hour mass lecture on the theory of the topic being taught, plus a two hour tutorial in the computer lab using IBM PS1 machines to amplify the lecture content and gain practical experience. Two groups that were taught by the same instructor on the same day were selected for study. The groups were randomly assigned to the direct instruction and cooperative learning conditions.

As for the integrity of computing content delivery, the present study was designed to ensure that both groups received equivalent structured input from the instructor for the first half of each two hour tutorial. During the second hour, the direct instruction group was allowed to practice individually, calling on the instructor for help as required. Students in the cooperative self-regulated group, on the other hand, received modeling from the instructor and practice in the use of higher order questions (in groups) in an effort to develop metacognitive strategies which would assist their learning and recall of new information, as well as to enhance a sense of personal control over their learning. Throughout the first hour of structured content delivery for this group, higher order questions were interspersed by the instructor at appropriate times (after sufficient material had been presented to warrant a logical pause for reflection, usually every twenty minutes or so) for students to consider independently, at first, and then in a cooperative discussion with their group. This took approximately five minutes. During the examination review period (the last two weeks of the course before their final computer-administered competency test), students in the intervention group were given a copy of fourteen generic question stems (see Table 7A.1) and encouraged to produce their own higher order questions on each of the topics being revised in order to clarify their understanding. After answering them for themselves, they then explained their answers to the other members of their group, giving elaborated help to each other in the form of explanations as well as answers to problems (Webb, 1989, 1991; Webb & Farivar, 1994). The direct instruction group used this period of review in the traditional, direct instructional (individual) way. Details of the intervention training procedures adopted at the different stages are given in Appendices C1, C2 and C3.
Table 7A.1  
**Generic Question Stems**

1. What is the main idea of .... ?  
2. What if .... ?  
3. What is the meaning of .... ?  
4. Why is .... important?  
5. Explain why ....  
6. Explain how ....  
7. How does .... relate to what I've learned before?  
8. What is the difference between .... and .... ?  
9. How are .... and .... similar?  
10. How would I use .... to .... ?  
11. What is the best .... and why?  
12. What are some possible solutions for the problem of .... ?  
13. What would happen if .... ?  
14. What do I still not understand about .... ?


**Lesson-based questions for modeling and practising guided questioning.**  
Specific examples of lesson-based questions used by the instructor as either review questions at the start of each tutorial, or interspersed throughout the lesson after sufficient material had been presented, are as follows (see Table 7A.2 below).

Table 7A.2  
**Instructor Designed Lesson-Based Questions as Models for Guiding Student Self-Questioning**

**Operating System (DOS)**

How are the operating system and applications similar?  
Why do I need to format diskettes?  
Why is it important to set up a directory structure to store my files?  
What do I still not understand about DOS?
Wordprocessing

Why do I press the <enter> key only at the end of paragraphs?
What is the main idea of giving my files meaningful filenames and extensions?
Why is it important to exit the document on screen before retrieving another document from disk?
What do I need to keep in mind when using the Thesaurus?

Database

What are some advantages and disadvantages of a database management system?
What are the steps involved in sorting and printing a database file?
What is the difference between DISPLAY, DISPLAY ALL, and LIST?

Spreadsheet

What is an example of a task that I would use a spreadsheet to undertake?
What is meant by the term ACTIVE CELL?
Is it an advantage or disadvantage to limit field names to 10 characters? Why?
What would happen if I change the justification of a value?

Training of instructor. The principal researcher met with the instructor on two occasions (two hours each) before the study began. During the first meeting, discussion centered on the nature of the lesson-based questions that the instructor would write using the generic stems that students in the intervention would receive later in the course. These questions would be used throughout each tutorial to help students think about and discuss ideas raised, and to model how students might ask themselves questions about tutorial content. In the second meeting, examples of actual questions which the instructor had written relating to specific computing skills that would be taught (such as those presented above in Table 7A.2) were considered. In addition, a script for explaining to students that asking and answering their own and others' questions would help them become more confident learners of computing skills was designed (see Table 7A.3 below for a summary and Appendix C1 for fuller details).
Table 7A.3  
Training of Students in the Reciprocal Peer-Questioning Approach.

1. This training will take place at the conclusion of each module of tutorial content (DOS; Wordperfect 5.1; DBase 4; and Lotus 123).

2. Students are to be told: “Asking yourself questions about what you have learned can help you find out what you do and don’t understand. I am going to show you some types of questions that you can ask about the topics we will cover in tutorials. You will be asked to make up your own questions and to answer these in a group.”

3. The instructor is to give an example of the types of questions that students can ask. Note: These will have been modelled by the instructor in each of the tutorials as content-related higher-order questions displayed on overhead transparencies.

4. Students are to be asked: "What questions would you still ask about this topic? Write these questions down and form a pair to try to answer them." The whole class comes together to share questions and answers following a period of time for student independent collaboration.

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**Note.**  
In the subject review period (Weeks 11 & 12) before the Practical Test (in Week 13), students will be asked to form larger groups (threes and fours) to create their own questions using the generic question stems and to discuss their understanding and test it out (summarise and check), test each other, and predict their performance on the test for each of the modules.

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**Fidelity to treatment.** A significant methodological issue with regard to instructor fidelity to treatment needs to be raised here. As Garner and Alexander (1989) point out, difficult though it may be to ensure that instructors will act as their own controls (as in this study, by presenting both a mastery- and performance-orientation to different groups), it is important to conduct such research, nevertheless.

In the context of the present study, the instructor was briefed on the research evidence regarding the beneficial aspects of direct instruction in skills training.
It was made clear to the instructor that both groups were expected to gain equally from the content instruction, albeit, that the experimental group was to receive additional metacognitive training in the use of generic question stems. It was anticipated that the weekly tutorial diary kept by the instructor (McInerney et al. 1996) would provide a powerful check on the fidelity to treatment.

**Analyses**

A multiple regression approach to analysis of covariance was used which is particularly appropriate to the study of aptitude-treatment-interaction effects (Aiken & West, 1991; Cohen & Cohen, 1983). Pedhazur and Schmelkin (1991, p. 558) suggest that in order to minimise Type II error in aptitude-treatment-interaction studies, a relatively large alpha (e.g., .10; even .25) be used for tests of interactions. For this reason and due to the small sample size, the Pedhazur and Schmelkin recommendation was followed, selecting .10 as the criterion probability for examining interaction effects.

In operationalising this multiple regression approach, all independent and dependent measures were standardized ($M = 0$, $SD = 1$) across the entire sample at the outset. Crossproduct scores (representing interaction effects) were computed in terms of these z-scores. Thus, for example, the product of the z-scores representing pretest self-concept and the grouping variable was used to test the Group x Pretest interaction on the posttest self-concept variable, that is, whether the group differences varied as a function of pretest self-concept levels. All these multiple regression results are presented in terms of unstandardized beta weights, however, because of the standardisation, standardized and unstandardized beta-weights are the same for all but the product terms (see Aiken & West, 1991; Marsh, 1993, for further discussion).

For analyses of the anxiety ratings and positive cognitions, the four independent variables were: group (1 = direct instruction comparison group, 2 = cooperative intervention), prior competency (a covariate consisting of the sum of self-ratings collected at the start of the study in particular computer skills: DOS, word processing, database, and spreadsheet applications), pretest (the pretest variable matching the outcome variable), and the Group x Pretest interaction (the aptitude-treatment interaction). For each outcome variable, the four independent variables were used to predict the outcome variable, and the p-values associated with each of the resulting four beta weights were used to test the statistical significance of the effect. For analyses of the achievement outcome scores, because there were no pretest achievement tests, self-rated prior competency was used as the pretest variable, and its interaction with the grouping variable was used to test for aptitude-treatment interaction effects. All statistically significant interactions were followed
up with post-hoc multiple regression tests of differences between regression lines at specific points (Aiken & West, 1991, pp. 132-133) to clarify the nature of the interaction. Because the pretest variables were continuous, it would be highly inappropriate to artificially divide participants into finite groups (e.g., high, medium, and low). Instead, tests of statistical significance at specific points along the pretest continuum were conducted (p < .05, two-tailed) using the multiple regression procedure. More specifically, because each of the pretest measures varied from a minimum of 1.0 to a maximum of 5.0 (i.e., scale scores were based on ratings along a 5-point response scale), group differences for the posttest outcomes were evaluated at pretest levels of 1, 2, 3, 4, and 5.

Results

Preliminary two-group t-tests were conducted to evaluate the equivalence of the two groups at pretest. There were no statistically significant group differences (all p > .05, two-tailed) on any of the prior competency self-rating scales, pretest anxiety scales, or pretest positive cognition scales.

There was one significant main effect for Feedback anxiety at posttest which was qualified by a group x anxiety level interaction and three additional significant interaction effects (see Table 7A.4). Follow-up analyses were conducted to explicate the nature of the significant ATIs. These are shown in Table 7A.5 which indicates at which points along the five-point pretest response scale the significant posttest differences occurred between the two groups. These ATI effects are summarised in terms of three major categories of outcome variables: anxiety, positive cognitions, and achievement test scores.

Anxiety Outcomes

There were significant ATI effects for Feedback and Fear anxiety. For both outcomes, students in the direct instruction group who were initially most anxious, experienced lower levels of anxiety at posttest than high anxious students in the cooperative group. In follow-up analyses (Table 7A.5) group differences were not statistically significant at the lowest levels of pretest anxiety (i.e., for participants with a mean score of “1” or “2” on the one-to-five responses scale for the pretest), but were significant for higher levels of pretest anxiety (i.e., for mean scores of “3”, “4”, and “5”). There were no significant group differences or ATIs for any of the other anxiety variables (i.e., Learning, Competence, Equipment and Skills).
Positive Cognitions

There were significant ATI effects for both positive cognition variables (see Table 7A.4). For Sense of Control, students with initially low levels of positive cognitions were advantaged by being in the cooperative group whereas students with initially high levels of positive cognitions were advantaged by being in the direct instruction group (see Table 7A.5). At the lowest level of positive cognition, there was a clear significant difference in favour of the cooperative group (pretest mean score of “1”). However, for Computing Self-Concept, no significant difference was found between groups at any point across the five-point response scale, although there was a marginal advantage (.05 < p < .10) for students with initially high levels of positive cognitions in the direct instruction group (see Table 7A.5).

Achievement Outcomes

There were no significant group or interaction differences for any of the achievement test scores.

Discussion

As shown in Table 7A.4, there were only two significant interactions within anxiety scales (namely, Feedback and Fear), and no difference between the groups in performance on assignments and tests. These findings were contrary to prediction as it was anticipated that the metacognitive strategy training and self-regulatory experience would actually enhance performance and reduce anxiety for those receiving the intervention relative to the comparison group, particularly for those higher in anxiety. Certainly, the evidence that neither group was disadvantaged by the treatment in terms of their achievement can be taken as a strong indication that both instructional approaches have value in terms of skills mastery, irrespective of student anxiety levels. In this context, it should be remembered that both groups received the same structured presentation of tutorial content for the first half of each class. The finding of no difference between groups on all the anxiety scales (except for Receiving Feedback on Computing Skills) relating to Gaining Initial Computing Skills, namely, Learning about Basic Computer Functions, Competence with Computers, and Handling Computer Equipment, might reflect the same experience of anxiety in computing skills mastery, irrespective of instructional approach, especially as the equivalent structured input by the instructor related specifically to such mastery.
The finding of an increase in the perceptions of control for those with initially low levels in the cooperative group was in line with the hypotheses. An enhanced sense of personal mastery and control over learning computing skills was predicted to be an outcome of the metacognitive strategy training in reciprocal peer and self-questioning for such students. It was not clear, however, why there was no improvement in computing self-concept for individuals initially low in these cognitions. The structured cooperative learning environment in the intervention was hypothesised to promote positive self-esteem and self-concept. Even more of a paradox was the finding of advantage for those with initially high positive cognitions of receiving a direct instruction transmission approach to computer training. Those with initially high positive cognitions presumably do not need an instructional approach designed to reduce anxiety and may be better off if allowed to work individually.

In all, the findings from this study raised a number of questions that needed further investigation:

- If you have initially high anxiety with regard to receiving feedback on your computing competence, or you fear making a mistake and being noticed, why is your anxiety not reduced as a result of the cooperative learning focussed intervention, although your positive cognitions increase?
- Is it the “private” nature of making mistakes and working independently in the direct instruction group and the knowledge that you can call on the instructor at any time for help that reduces your anxiety? Does the “public” nature of cooperative groupwork and the self-reliance expected by the instructor increase your fear and feedback anxiety, on the other hand?
- How is it that you can improve in your perceptions of control and ability in computing situations as a result of cooperative self-regulated groupwork, yet not increase your positive cognitions in relation to your computing self-concept?
- If you already have a sense of control over computing and a positive self image as a “computing type”, why are you better off in a direct instruction group? Or perhaps the question is actually the converse.
- What is it about the intervention that does not advantage you if you have initially high positive cognitions? Is it that you just don’t like having to work cooperatively if you are already confident about your ability to master the computer and show others how to solve problems? Does the opportunity to work independently suit you better?
- Why did the achievement of both groups on various measures of computing competency not differ at the end of the course? In other words, even though they
did no worse, why did those receiving the intervention not do better than those in
the comparison group, as hypothesized? Is it that anxiety reduction is not closely
linked to achievement, while increased positive cognitions are?

These questions and others prompted the author to closely investigate the range of
qualitative data that were gathered at the same time that the aptitude-treatment-interaction
study was conducted. It was hoped that through this process insights would be gleaned
that would help interpret the ATI findings and provide some answers to the puzzles. The
following section of this chapter presents these qualitative findings and discusses their
relationship to the quantitative findings in this chapter. Furthermore, it will be shown how
these data, in combination, allowed for a second ATI study to emerge (described in
Chapter Eight), one that was redesigned and considerably strengthened in terms of the
intervention. As the rationale for the intervention was to be the same for the second ATI
study as it was for the first, an extended discussion of the findings of both Studies 1 and 2,
as well as their implications for practice are presented in Chapter Eight.
### Table 7A.4

**Summary of Beta Weights from Multiple Regression Analyses in Study 1**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Total</th>
<th>Prior</th>
<th>Pretest</th>
<th>Group</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MR p</td>
<td>beta p</td>
<td>beta p</td>
<td>beta p</td>
<td>beta p</td>
</tr>
<tr>
<td><strong>Anxiety Ratings</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning</td>
<td>.77 .00</td>
<td>-.10</td>
<td>.50</td>
<td>.93 .00</td>
<td>.09 .53</td>
</tr>
<tr>
<td>Competence</td>
<td>.81 .00</td>
<td>-.10</td>
<td>.49</td>
<td>.71 .00</td>
<td>.21 .12</td>
</tr>
<tr>
<td>Equipment</td>
<td>.41 .39</td>
<td>-.26</td>
<td>.25</td>
<td>.15 .56</td>
<td>.20 .34</td>
</tr>
<tr>
<td>Feedback</td>
<td>.80 .00</td>
<td>-.24</td>
<td>.09</td>
<td>.56 .01</td>
<td>.41 .01</td>
</tr>
<tr>
<td>Skills</td>
<td>.73 .00</td>
<td>-.13</td>
<td>.44</td>
<td>.67 .00</td>
<td>.25 .11</td>
</tr>
<tr>
<td>Fear</td>
<td>.86 .00</td>
<td>.29</td>
<td>.03</td>
<td>.90 .00</td>
<td>.09 .43</td>
</tr>
<tr>
<td><strong>Positive Cognitions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pos Control</td>
<td>.72 .00</td>
<td>.10</td>
<td>.58</td>
<td>.62 .00</td>
<td>.10 .51</td>
</tr>
<tr>
<td>Self-Concept</td>
<td>.52 .14</td>
<td>-.31</td>
<td>.21</td>
<td>.52 .04</td>
<td>-.17 .38</td>
</tr>
<tr>
<td><strong>Achievement</strong></td>
<td>Total</td>
<td>Prior</td>
<td>Group</td>
<td>Interaction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MR p</td>
<td>beta p</td>
<td>beta p</td>
<td>beta p</td>
<td></td>
</tr>
<tr>
<td>Prac Test</td>
<td>.23 .77</td>
<td>-.01</td>
<td>.98</td>
<td>-.04 .87</td>
<td>.23 .30</td>
</tr>
<tr>
<td>Folio 1 Assig</td>
<td>.07 .99</td>
<td>-.04</td>
<td>.85</td>
<td>.05 .84</td>
<td>-.04 .86</td>
</tr>
<tr>
<td>Folio 2 Assig</td>
<td>.20 .83</td>
<td>.11</td>
<td>.56</td>
<td>.10 .59</td>
<td>.03 .88</td>
</tr>
<tr>
<td>Res Report</td>
<td>.29 .62</td>
<td>.11</td>
<td>.63</td>
<td>.17 .46</td>
<td>-.25 .28</td>
</tr>
</tbody>
</table>

**Note.**

Prior = self-rating of prior computer competency, a general covariate used in all analyses. Pretest = specific pretest corresponding to the outcome measure. Group (1 = direct instruction comparison group, 2 = cooperative intervention group). Interaction = aptitude-treatment-interaction (Group x Pretest); p = p-value (two-tailed). All betas are unstandardized. However, because all outcome and predictor variables were standardized (M = 0, SD = 1) prior to analysis, they are like standardized coefficients (see Aiken & West, 1991 for discussion of this strategy).
Table 7A.5
Summary of Group Differences (Coop Intervention and Direct Instruction Comparison) and Significance Levels (p-values) at Different Levels of Pretest Variables for those Outcomes with ATI Effects in Study 1 (see Table 7A.4)

<table>
<thead>
<tr>
<th>Levels of Pretest Variables (that vary from 1 to 5)</th>
<th>Pretest</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 p 2 p 3 p 4 p 5 p M SD</td>
<td></td>
</tr>
</tbody>
</table>

Study 1

Anxiety Ratings

| Feedback | 0.15 .59 0.86 .01 1.57 .01 2.28 .01 2.98 .02 1.69 0.84 |
| Fear     | -0.26 .31 0.21 .21 0.68 .04 1.15 .04 1.62 .04 1.83 0.73 |

Positive Cognitions

| Pos Control | 1.38 .04 0.72 .07 0.50 .85 -0.61 .19 -1.28 .09 2.81 0.89 |
| Self-Concept | 1.60 .17 0.68 .30 -0.24 .46 -1.15 .07 -2.07 .07 3.05 0.70 |

Note.
Group differences for posttest outcomes were evaluated at different levels along the pretest continuum that varied from a minimum of 1.0 to a maximum of 5.0 (i.e., scale scores were based on ratings from a 5-point response scale). Positive group differences mean that the cooperative intervention group scored higher (i.e., higher levels of anxiety for anxiety ratings and higher levels of positive cognitions for positive cognition ratings), whereas negative group differences mean that the direct instruction group scored higher. Multiple regression tests of statistical significance (Aiken & West, 1991, pp. 132-133) were conducted at each pretest level and are summarised by two-tailed p-values. * For all other variables, the ATIs involve pre- and posttests on the same variable, whereas the pretest for this analysis is a pretest self-rating of prior competency (on a one-to-five response scale). The posttest outcome variable has M = 10.75 and SD = 1.98.
Part B

A Qualitative Examination of the Comparative Effects of Two Methods of Computer Instruction on Computer Anxiety and Achievement

As discussed in the previous section of this chapter, the findings that emerged from the quantitative analyses of the aptitude-treatment-interaction study were somewhat unexpected in a number of areas. First, in terms of anxiety, it was predicted that high anxious students receiving the intervention (metacognitive strategy training in cooperative self-regulated groups) would report less anxiety on the CALM survey at the end of their computer training course than those in the comparison group (direct instruction). This did not turn out to be the case on most of the anxiety scales and, in fact, anxiety remained high for two of these: receiving feedback on competency, and fear of public embarrassment when using computers (Feedback and Fear scales). Second, in terms of positive cognitions, those intervention students with low levels of positive cognitions at the start of the course increased their level of positive cognitions in relation to Sense of Control and Computing Self-Concept at the end of the course, while those with high initial levels of positive cognitions were advantaged by being in the direct instruction group. There were no significant overall group differences, however. While these findings were in the predicted direction for those with low positive cognitions, the other results were not anticipated. Finally, the finding that students receiving both instructional approaches achieved equally well at the end of the course was unexpected as a main effect for the intervention was predicted.

On the surface, therefore, the outcomes of Study 1 appear difficult to interpret. In fact, it may have been all to easy to dismiss the study as only moderately successful rather than one which raised a number of important questions that might be answered through qualitative means, namely, those that related to the unexpected nature of the findings outlined above. The qualitative methods of investigation that were concurrently put in place provide an important opportunity to clarify the processes that were underlying the experiences of students and instructor in both treatments. Not only could the detailed thinking

of the participants in the present study be explored in relation to the ATI research issues, but also a better understanding of the results of the intervention gained. Even more important, methodologically sound ideas for research redesign and replication could be derived, as was the case in the present research with a more powerful follow-up study being conducted.

In this context, the present section presents an analysis of the qualitative data that was gathered to supplement the quantitative findings from the aptitude-treatment-interaction study.

**Objectives**

The overall objective of the present study was “to help validate, explain, illuminate, or reinterpret quantitative data gathered from the same setting ....” (Miles & Huberman, 1994, p. 10) by using a multimethod approach to data collection and analysis (Cohen & Manion, 1994). In this context, specific objectives were to:

1. Compare the achievement, motivation, positive and negative cognitions, and anxiety of a sample of students (eight case studies representing 25% of the total number of participants) undertaking a computing course taught through one of two methods: Direct instruction alone or a combination of direct instruction and cooperative, self-regulated learning which incorporated training in the metacognitive strategy of self-questioning (King, 1991, 1992, 1993, 1994; Rosenshine, Meister, & Chapman, 1996).

2. Describe and evaluate each instructional program in operation using qualitative research techniques, namely, regular in-depth interviews with a selection of students who had both high and low anxiety and positive cognitions with regard to computing, analyses of case study logbooks and instructor tutorial diary, and molecular analyses of survey data collected at pre- and posttest. Particular areas of interest were instructor and student perceptions of advantages and disadvantages of each teaching approach; the processes (cognitive and social) involved in gaining metacognitive and self-regulatory skills through self- and peer-questioning within a cooperative group setting; and those involved in learning computing skills through teacher-led instruction.

3. Correlate data from case studies regarding their perceptions of the computer skills training they received in the context of gaining self-efficacy and self-
regulated learning skills, as well as of their experiences of anxiety alleviation or exacerbation.

4. Triangulate the data obtained from the eight case studies with those from the first ATI study for those students. Specifically, the following questions were to be addressed:

a) Did the two treatments differ methodologically as intended?
b) Why was anxiety expressed by students receiving the intervention on some anxiety scales and not on others at the end of the computer course?
c) Why did initial level of positive cognitions interact with instructional approach?
d) Why did both groups achieve equally well at the end of the course?
e) To what extent did factors emerge in conducting the research that may have altered the predicted outcomes?

Method

“Qualitative data are attractive. They are a source of well grounded, rich descriptions and explanations of processes occurring in local contexts. With qualitative data one can preserve chronological flow, assess local causality, and derive fruitful explanations ....” (Miles & Huberman, 1994, p15).

The methodologies employed in this Dissertation have been driven by the specific issues involved in aspects of the research being conducted at particular stages and the questions that have emanated from them, rather than dictating the research process. As a consequence, I have adopted a range of research techniques for exploring the questions that have been posed. As Wiersma (1991, p.14) argues, “The methods of research should be directed to meeting the requirements of the specific research study, and the qualitative and quantitative procedures should be decided on that criterion.”

Qualitative Research Methods

Just as the detailed analysis of the differing approaches to computer training which was based on interview data (refer to Chapter Six) was conducted to add contextual depth to the quantitative analyses of the CALM survey data of students in the descriptive study reported in Chapter Five, so gathering of qualitative data was planned along with the quantitative. It was anticipated that
this approach would play a valuable role in complementing and interpreting the somewhat inconsistent finding of the quantitative study to help “... validate, explain, illuminate, or reinterpret the quantitative data gathered from the same setting” (Miles & Huberman, 1994, p. 10). Expressed most simply, the qualitative methods helped me to explore “What is going on here?” (Bouma, 1996, p.169) from the perspective of the case studies. The multimethod approach used in the present study, therefore, enabled “triangulation”, that is, the study of an aspect of human behaviour from a number of research standpoints in order to explain it more fully (see Cohen & Manion, 1994, pp. 233-251).

There were a number of strengths of qualitative data that were felt to be valuable to an understanding of the findings in the ATI study. These are outlined below.

- Richness of analysis is enabled through qualitative investigation because it allows the researcher to better understand the process that leads to the outcomes involved, not just the outcomes themselves (such as responses given on a survey, for example).

- Statistical analyses based on measures of central tendency reduce data such that it is no longer possible to examine individual trends in the data. Fine-grained qualitative analyses, especially compiled over a long term (such as the duration of the semester-long computer training course in the present research) provide an opportunity to detect patterns of responses and relate these to particular contexts.

- Self-report survey (questionnaire) data, especially that relating to sensitive or ego-threatening constructs such as anxiety, sense of personal control or self-concept may need to be interpreted with caution as potentially biased. Collecting additional interview data over a sustained period from a subsample of cases from both groups involved in the study provided a check on potential bias.

- In this context, heed was also taken of the caution that “A serious criticism of questionnaires is that they are often shallow; that is, they fail to dig deeply enough to produce a true picture of the respondents’ opinions and feelings.” (Borg, Gall & Gall, 1993, p. 113). It was clear that in-depth information on the “phenomenological reality of particular individuals” (Borg, Gall & Gall, 1993, p.194) involved in the aptitude-treatment-interaction study would add
considerably to my understanding of how well the instructional intervention was working relative to the comparison group, as gathered from the quantitative data. These further insights would come from analysing data on why the intervention worked or didn’t as perceived by the students and instructor, as well as comparing them with data from participants in the comparison group.

**Qualitative Procedures Utilised in the Present Study**

Five qualitative research tools used to collect and analyse the data collected from the eight students selected as case studies from the ATI study. These were:

1) **Weekly Case Study Interviews.** In order to capture the “chronological flow” (as referred to by Miles and Huberman earlier) of the students’ learning experiences, weekly half-hour interviews of eight case study students (two high and two low anxious from each of the two groups) were conducted throughout the semester by a trained interviewer (senior graduate research assistant) who was very experienced in interview techniques (refer to Appendix B4 for detailed summaries of eleven weekly interviews with students from both groups). Several case studies were included in order to determine if findings were idiosyncratic or were replicated across cases. Interviews were of a semi-structured nature (see Table 7B.1 and Appendix B3 for details of the interview questions used). The interviewer was unaware of the groups to which the case study subjects belonged so that bias was minimised. Information was tape-recorded and fully transcribed by the interviewer, following which a summary was made by the interviewer of key points discussed by the case study participant that specifically related to the focus of each of the interview questions. As a check on validity, all tape-recordings were also listened to by myself in the week that they were made in order to maintain a check on the appropriateness of questions (e.g., no leading questions) and the summaries. At these times, I made additional notes to the summaries in relation to the theoretical issues involved in the ATI intervention that was being conducted synchronously.
Table 7B.1

Semi-Structured Interview Questions

1) What do you THINK about the course so far?
2) How do you FEEL about the course so far?
3) What did you LEARN in this week's class?
4) Do you like getting COMMENTS from the other students/the lecturer while you are working?
5) Can you see any DIFFERENCE IN YOUR ATTITUDES from previous tutorials?
6) How would you RATE YOURSELF on the skill that you have learned this week?
   * “Happy to show others how to do it.” (Very capable)
   * “Can manage to do it on my own.” (Just comfortable)
   * “Couldn't do it on my own.” (Not mastered)
7) What did you have DIFFICULTY with this week?
8) Do you feel that you can HANDLE THIS DIFFICULTY on your own?.
9) What COULD YOU DO about this (difficulty)?
10) Where WILL YOU GO from here?

2) The NUD.IST (Richards & Richards, 1994) Statistical Program (Non-Numerical Unstructured Data Indexing Searching and Theorising) which was employed to conduct both exploratory and confirmatory analyses of the students' weekly interview data. The exploratory analyses consisted of indexing and searching the transcripts using the semi-structured interview schedule above (Table 7B.1) as a basis for coding. As there were specific a priori hypotheses derived from the theoretical literature as well, the data were also analysed to confirm or reject these hypotheses using a range of search options available within the NUD.IST program. Key terms used for indexing related to distinctive features of each instructional approach: “groupwork”, “helping”, “questioning”, “step-by-step instruction”, “anxiety”, “control”, “learning”, “boring”, “fun”, for example.
3) **Instructor’s Tutorial Diary.** A tutorial diary was kept by the instructor who taught the two groups (see Appendix B5 for full text of the diary). In this she reported on the academic content covered (relative to the prepared content sheets that were developed in advance of each tutorial to ensure equivalence of coverage), the classroom dynamics within each group, and her personal reflections on the impact of the instructional approaches used. The instructor was unaware of which students in the two groups were participating in the case study interviews, or who were keeping logbooks, so that comments regarding student performance and attitudes were unbiased. As with many university lecturers, this instructor was an expert in her discipline but not a trained teacher. Her commitment to keeping a tutorial diary in which she recorded details of her implementation of both the intervention and control conditions reflected her enthusiasm and commitment to enhancing student learning and her own teaching. Excerpts from the instructor’s tutorial diary are presented in Table 7B.6 later in the chapter.

4) **Student Tutorial Logbooks.** Each of the case study subjects recorded their perceptions regarding specific aspects of each week’s computing tutorial in a logbook. These logbooks were standardised to the extent that there was a recommended format for presentation of student responses which is shown in Table 7B.2. The potential for interpreting the data collected from the logbooks was restricted intentionally to those aspects of the learning situation that would be most pertinent to and would triangulate best with that gathered from interviews and instructor diary entries.

5) **Molecular Analyses** (Peck & Hughes, 1996) of the Computer Anxiety and Learning Measure (CALS) pretest and posttest survey forms from each case study. The outcomes of these analyses are shown in Tables 7B.4 and 7B.5 and are discussed in the Results section.
Table 7B.2
Student Logbook Format

Eight students (two high and two low anxious from each of the intervention and comparison groups) kept a LOGBOOK in which they recorded the following as soon as possible after each tutorial. This was the format given to students to follow for reporting in their logbooks:

PART A. Description of Each Computing Session

1. What your instructor taught.
2. What the student and others in your group did in the tutorial.
3. What happened with equipment (hardware and software).
4. Any other details that are a purely objective description (not your opinion) of what happened in the class time.

PART B. Impressions

1. What you feel you learned.
2. What you had difficulty with or did not understand.
3. What you felt before, during and after the tutorial (positive and negative).
4. What direction you think you might take on the basis of the experiences of the tutorial both in thoughts and actions. This can be referred to as an ACTION statement.

Methodological Issues Relating to Student Self-Reports

Collecting students' subjective evaluations of their learning in relation to investigating a new instructional approach can provide valuable insights into their cognitive activities, especially where the students are adults and capable of self-reflection (Volet, 1991). Furthermore, as the work of Volet and Styles (1992) has demonstrated, research conducted with learners in university settings should monitor adult students' subjective perceptions and evaluations of their learning in a course as these have been found to strongly influence student motivation to stay in that course. “When adult learners are targeted, success of the intervention is
not only affected by the quality of the teaching, but also by students' cognitive and affective appraisals of the learning situation” (Volet, 1991, p. 333).

There are several concerns about using self-report measures such as logbooks which include the following: Potentially unelaborated entries due to the time and effort needed to make adequate self-reports; and the tendency for participants to write in the language of the researcher rather than that which would occur casually (Cahoon, 1994). By involving students in ongoing (weekly) semi-structured interviews which replicated the structure of the logbook entry subheadings, both methodological concerns were controlled for in so far as more spontaneous and detailed responses to the issues could be collected cumulatively.

Detailed analyses were also conducted on each respondent's answers to the CALM items and these were cross-checked with the interview data and comments recorded in the instructor's diary. While the CALM survey provided a "snapshot in time" of student anxiety at both the start and conclusion of the computer training course and allowed for quantitative analyses of large aggregated data to be conducted, it was felt that there would be considerable individual variation in levels and determinants of anxiety and cognitions, as well as fluctuations in student responses to the two treatments over the time of the intervention (11 weeks).

In order to determine the validity of such quantitative findings, triangulation of the data sources is necessary to determine whether generally converging conclusions emerge or not, and why not.

**Participants**

As described in the first part of this chapter, the participants for the present study were drawn from the two groups of students completing compulsory computer coursework in the subject Introduction to Computers and who were randomly assigned to one of two instructional approaches (treatments) taught by the same instructor.

The selection of participants for the qualitative study was as follows: Students who had the highest scores (above a rating of 3 on a 4 or 5 point scale, i.e., moderate to high anxiety, or low to very low positive cognitions) on most of the scales of the CALM instrument were considered for selection as high anxious subjects. Conversely, those who scored 2 or below were considered as low anxious subjects. The two students in each of these groups with the highest and the lowest anxiety scores were invited to participate in the research following a brief explanation of their commitment: all students accepted (see Appendix B2
for memorandum to case study participants). Table 7B.3 presents a summary of
demographic details for the eight case studies receiving alternative modes of
computer instruction.

As can be seen from this summary, the case study participants reflected
the range of computer experience (formal, informal and self-rated), ownership of
personal computer, and anxiety levels as measured by the CALM that were
present in both treatment groups. Although objectively this is a small number of
individuals, these students nevertheless represented 25% of the sample in each
treatment group.

<table>
<thead>
<tr>
<th>Case/Name</th>
<th>Group</th>
<th>Anxiety</th>
<th>OwnPC</th>
<th>Type/Buy</th>
<th>Exper</th>
<th>Techexp</th>
<th>Learnhrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Andrew</td>
<td>Coop</td>
<td>Low</td>
<td>Yes</td>
<td>IBM</td>
<td>Adv</td>
<td>28</td>
<td>&gt;50</td>
</tr>
<tr>
<td>2. Michael</td>
<td>Coop</td>
<td>High</td>
<td>Yes</td>
<td>Amiga</td>
<td>Beg</td>
<td>26</td>
<td>&lt;10</td>
</tr>
<tr>
<td>3. Melissa</td>
<td>Coop</td>
<td>Low</td>
<td>No</td>
<td>Yes</td>
<td>Inter</td>
<td>22</td>
<td>10-20</td>
</tr>
<tr>
<td>4. Yonneka</td>
<td>Coop</td>
<td>High</td>
<td>No</td>
<td>Yes</td>
<td>Beg</td>
<td>17</td>
<td>&lt;10</td>
</tr>
<tr>
<td>5. Terry</td>
<td>D.I.</td>
<td>Low</td>
<td>Yes</td>
<td>Atari</td>
<td>Adv</td>
<td>26</td>
<td>10-20</td>
</tr>
<tr>
<td>6. Nathan</td>
<td>D.I.</td>
<td>High</td>
<td>No</td>
<td>Yes</td>
<td>Beg</td>
<td>28</td>
<td>&lt;10</td>
</tr>
<tr>
<td>7. Lisa</td>
<td>D.I.</td>
<td>Low</td>
<td>Yes</td>
<td>Amiga</td>
<td>Inter</td>
<td>29</td>
<td>&gt;50</td>
</tr>
<tr>
<td>8. Kylie</td>
<td>D.I.</td>
<td>High</td>
<td>No</td>
<td>Yes</td>
<td>Beg</td>
<td>23</td>
<td>&lt;10</td>
</tr>
</tbody>
</table>

Note.
Coop = Cooperative learning group. D.I.=Direct instruction group. Own PC = Ownership of a
personal computer. Type/Buy = Type of computer owned/ or answer to “Would you buy a PC if
money was not a consideration? Exper = Self-rated level of prior computer experience: adv =
advanced; inter = intermediate; beg = beginner. Techexp = Score (out of maximum of 33) for
frequency of different uses of computerised technology: high school use; in a job; games; word
processor; software; printer; library catalogue; ATMs; CD-ROMs; VCR; microwave. Learnhrs =
Pretest level of number of hours spent learning to use a computer.
Table 7B.4 Summary of CALM Pre- and Posttest Scores for Cooperative Group Case Studies

<table>
<thead>
<tr>
<th>CALM</th>
<th>Key items</th>
<th>Andrew Pre</th>
<th>Post</th>
<th>Michael Pre</th>
<th>Post</th>
<th>Melissa Pre</th>
<th>Post</th>
<th>Yonneka Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part A:</td>
<td>Getting feedback on my computer skills</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Low</td>
<td>Mod</td>
</tr>
<tr>
<td>Gaining</td>
<td>Being evaluated on my computer competence</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Mod</td>
<td>Mod</td>
<td>High</td>
</tr>
<tr>
<td>Initial</td>
<td>Using computerised equipment</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Mod</td>
<td>Mod</td>
</tr>
<tr>
<td>Computing</td>
<td>Learning a new computer application</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Skills</td>
<td>Learning about computers without structured guidance</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Low</td>
<td>High</td>
<td>Mod</td>
<td>High</td>
<td>Mod</td>
</tr>
<tr>
<td>Mean Scale Score =</td>
<td></td>
<td>1.0</td>
<td>1.5</td>
<td>2.5</td>
<td>1.5</td>
<td>2.5</td>
<td>3.5</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Part B:</td>
<td>I feel in control of what I have to do</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Mod</td>
<td>Mod</td>
</tr>
<tr>
<td>Sense of</td>
<td>People will notice if I make a mistake</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Control</td>
<td>I= not at all; 2= a little; 3= a fair amount; 4= much; 5= very much</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Scale Score =</td>
<td></td>
<td>1.5</td>
<td>1.5</td>
<td>3.0</td>
<td>2.0</td>
<td>3.0</td>
<td>4.5</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Part C:</td>
<td>I am very confident when it comes to</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Mod</td>
<td>Mod</td>
<td>High</td>
<td>Mod</td>
<td>Mod</td>
</tr>
<tr>
<td>Computing</td>
<td>working with computers</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Mod</td>
</tr>
<tr>
<td>Self</td>
<td>I think using a computer would be</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Mod</td>
</tr>
<tr>
<td>Concept</td>
<td>very hard for me</td>
<td>1.0</td>
<td>1.0</td>
<td>1.5</td>
<td>2.5</td>
<td>2.5</td>
<td>4.0</td>
<td>2.75</td>
<td></td>
</tr>
<tr>
<td>Mean Scale Score =</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part D:</td>
<td>Insecure</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>State Anx</td>
<td>Lack of concentration</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>in Comput</td>
<td>Nervous stomach</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Situation</td>
<td>Relaxed</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Mean Scale Score =</td>
<td></td>
<td>1.25</td>
<td>1.5</td>
<td>2.0</td>
<td>1.5</td>
<td>2.0</td>
<td>2.0</td>
<td>1.5</td>
<td></td>
</tr>
</tbody>
</table>

Note.
Parts B, C and D are reverse scored, as required - a low score represents low anxiety. a. Key items refers to items with highest factor loadings (per factor) in confirmatory factor analyses. b. Low = < 3; c. Moderate = 3; d. High = > 3; e. Mean scale score refers to the individual's average scores across the full scale of items at pre- and posttest.
Table 7B.5 Summary of CALM Pre- and Posttest Scores for Direct Instruction Group Case Studies

<table>
<thead>
<tr>
<th>CALM</th>
<th>Key items</th>
<th>Terry</th>
<th></th>
<th>Nathan</th>
<th></th>
<th>Lisa</th>
<th></th>
<th>Kylie</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>Part A:</td>
<td>Getting feedback on my computer skills</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Mod</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Gaining</td>
<td>Being evaluated on my computer competence</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Mod</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Initial</td>
<td>Using computerised equipment</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Low</td>
<td>Mod</td>
</tr>
<tr>
<td>Computing</td>
<td>Learning a new computer application</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Mod</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Mod</td>
</tr>
<tr>
<td>Skills</td>
<td>Learning about computers without</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>structured guidance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Mean Scale Score = 1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>3.0</td>
<td>2.75</td>
<td>1.25</td>
<td>1.5</td>
<td>3.0</td>
<td>2.75</td>
</tr>
<tr>
<td>Part B:</td>
<td>I feel in control of what I have to do</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Sense of</td>
<td>People will notice if I make a mistake</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean Scale Score = 1.5</td>
<td>1.5</td>
<td>1.75</td>
<td>3.0</td>
<td>3.5</td>
<td>3.0</td>
<td>4.0</td>
<td>3.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Part C:</td>
<td>I am very confident when it comes to</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
<td>High</td>
<td>Mod</td>
<td>Mod</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Computing</td>
<td>working with computers</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>Low</td>
<td>Low</td>
<td>High</td>
<td>Mod</td>
<td>Low</td>
<td>Mod</td>
<td>Low</td>
<td>Mod</td>
</tr>
<tr>
<td>Concept</td>
<td>very hard for me</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean Scale Score = 2.0</td>
<td>2.0</td>
<td>2.0</td>
<td>3.25</td>
<td>2.5</td>
<td>3.25</td>
<td>3.5</td>
<td>3.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Part D:</td>
<td>Insecure</td>
<td>Low</td>
<td>Low</td>
<td>Mod</td>
<td>Mod</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>State Anx</td>
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<td>Low</td>
<td>Mod</td>
<td>Mod</td>
<td>High</td>
<td>Low</td>
<td>Mod</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>in Comput</td>
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<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Situation</td>
<td>Relaxed</td>
<td>Low</td>
<td>Mod</td>
<td>High</td>
<td>Mod</td>
<td>Low</td>
<td>Mod</td>
<td>Mod</td>
<td>Mod</td>
</tr>
<tr>
<td></td>
<td>Mean Scale Score = 1.0</td>
<td>1.0</td>
<td>1.5</td>
<td>2.5</td>
<td>1.5</td>
<td>2.25</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Note.
Parts B, C and D are reverse scored, as required - a low score represents low anxiety.  a. Key items refers to items with highest factor loadings (per factor) in confirmatory factor analyses.  b. Low = < 3;  c. Moderate = 3;  d. High = > 3;  e. Mean scale score refers to the individual's average scores across the full scale of items at pre- and posttest.
Results

Molecular Analyses of the CALM Data for Eight Case Studies

In the next section of this chapter I present individualised analyses of the CALM pretest and posttest forms for the eight case studies. The intention is to provide a "molecular" analysis (Peck & Hughes, 1996) of the intraindividual anxiety at the start and end of the computer training course which triangulates with the aptitude-treatment-interactions and the weekly interviews. Tables 7B.4 and 7B.5 represent analyses of individual responses to selected items from the CALM categorised as representing low anxiety (responses < 3), moderate anxiety (responses = 3) and high anxiety (responses > 3) for each of the case studies. Using these tables it is possible to plot the movement (if any) of anxiety level for each individual on these selected questions and to compare across the cases (using an increase or decrease of greater than .5 of a score as a criterion for shift). As well, the individual's mean scale score at pre- and posttest is presented for comparison. This information is cross-referenced with that obtained from the interviews¹. Each case is discussed separately.

Summary of CALM Case Study Profiles: Cooperative Group (refer to Table 7B.4)

Case Study 1 (Andrew). This male student who has considerable prior computing experience, shows very low levels of anxiety across all thirteen items at pretest. There is no change in anxiety level on the thirteen items at posttest and virtually no change in level of anxiety or cognitions across the four scales at posttest. His low level of anxiety and negative cognitions is probably attributable to his abundant computing experience since childhood, typing out programs and playing computer games as I grew up; playing around with equipment, technical toys and games with my brother. He reports that he finds the computing course tedious as he has already learnt most of these things. It is clear from the CALM surveys that Andrew has both a strong Sense of Control in computing situations and Computing Self-Concept. Being in the cooperative self-regulated group, his anxiety and self-talk clearly did not increase as a consequence of the instructional approach used (although he does mention that when helping other people I get a bit bored).

It is important to note that factual recall and higher-order discussion questions were used by the instructor throughout the tutorial to check for student understanding (i.e., revision) in the intervention group. This modelled the use of questioning as a

¹ Where direct quotations are reported, these are presented in italics.
metacognitive strategy which was later practised as reciprocal peer-questioning during the review period prior to the students' practical exam. The degree to which these questions challenged students is of interest. In the case of Andrew, his attitude in the first interview was that they're good for the others if they are having difficulty. In the second interview, he acknowledges that although discussion questions are easy, they are sort of helpful .... everyone speaks and says what they think. By the third interview, he has decided that there is no disadvantage in them, but no real benefit; the questions are basic and easy to answer (for him). By the eighth interview, however, (after considerably more practice in use of questioning) Andrew concedes that, despite the fact that he feels that he already knows the answers to questions, checking answers to questions in a group is good because it confirms whether you're on the right track or not. It's good to ask someone next to you if you forget how to do something.

In terms of the metacognitive strategy training in using generic question stems that was given to the group, it would appear from interview data that Andrew progressively comes to use and value the training as the time draws closer to the practical skills test: It was helpful to make up questions for yourself as it helps you realise what you do know and still don't know. Using the sheet of questions as a basis (prompt) helps you with ideas about what you might still have trouble with and to use these as a review for the Practical Test. The group helps you check on your answers ..... Thinking up questions is helpful because it forces you to think about what you don't understand.

In relation to anxiety, it is important to note that while his responses on the CALM scales would indicate that Andrew has low anxiety and high positive cognitions, in fact, he does experience anxiety in relation to demonstrating his computing skills on the practical skills test, even though he reports no apparent difficulty with the computing course: I'm always worried about tests no matter how small - always stressed out even though I know the work - purely because it's a test.

**Case Study 2 (Michael).** Even though a self-rated “beginner”, this male student expresses little anxiety in his pretest survey on nine of the items, and moderate to high anxiety and negative cognitions (score >2) on four items (“Learning a new computer application”; “Learning about computers without structured guidance”; “I am very confident when it comes to working with computers”; and “I think using a computer would be very hard for me”). There was no change in anxiety level on these nine items at posttest, however, on the four remaining items there was a reduction in negative self-talk. There was a considerable increase in positive cognitions for this student on the Computing Self-Concept scale (from a mean scale
score of 3 to 1.5) and a marginal change on the other scales. This is consistent with comments made in weekly interviews in which Michael refers to being initially tense and lacking confidence: scared of touching the keyboard; wary of new things which are always potentially difficult.

At posttest, on the other hand, this student's computing self-concept has vastly improved with his ratings completely reversed. It is feasible that this increase in computing self-concept is attributable to the teaching strategy employed in this student's computing classes and reflected in his comments about the benefits of groupwork/collaboration in building confidence. Although he begins the course with a preference for working alone - individually it is good - where he can work at his own pace, find out how to deal with difficulties independently, experiment, explore options, fiddle around, see what happens, and learn more things by myself, he begins to shift to greater dependence and interdependence on the group once he experiences increasing difficulty in the course. This is evident from the significant number of times that "help" (both giving and receiving) is referred to (16 times) in the interviews.

Asking people for help is much better; it's a lot quicker ..... If you get something wrong there's nothing wrong with saying 'I got it wrong'; you should be able to ask for help ..... Being embarrassed to ask for help, that's what makes people more tense. Other students in the class are not anxious about or worried about learning about computers; it doesn't turn them off when they know they can actually ask for help ..... If they feel like they can't ask for help, like they're the only ones doing it wrong, then they'll be less likely to go along with the computer course ..... Asking people makes you more at ease ..... I don't feel like I'm the only one making mistakes; I'm not embarrassed to ask for help; I feel more comfortable; I'm more interested and more active in it (the computing work), rather than isolated because it's not just me having trouble.

As discussed earlier in this chapter (and throughout this Dissertation), the metacognitive strategy training in the use of generic question stems provided in the cooperative self-regulated group was hypothesised to reduce anxiety and increase positive cognitions in relation to learning computing skills. With regard to the learning benefits of using generic question stems and structured groupwork, Michael also notes that We answered questions in groups - it was good to correlate ideas; In groups we had to come up with a question for the class; Students each posed questions about issues or problems when they had completed a section of work; Everyone was asking everyone else how to do it; ..... the whole class knew the lot -
different people knew different parts ..... In a group-thinking process, we were applying knowledge in new ways; ..... we exchanged ideas - through trialling together we had to make changes, fine tuning things you may not see on your own; .... you get different perspectives. I appreciate the good cross of ideas in groupwork; ..... talking reinforces my learning. The evidence seems strong here for the benefits to this student of the metacognitive strategy training in self-questioning within a cooperative learning setting.

Case Study 3 (Melissa). This female student with an “intermediate” level of prior computing experience (having studied computers at high school and completed a TAFE course in computing, as well as practising at home on her father’s laptop) expresses little anxiety or negative cognitions in her pretest survey on nine of the items, and moderate to high anxiety (score >2) on four items (“Being evaluated on my computer competence”; “Learning about computers without structured guidance”; “I am very confident when it comes to working with computers”; and “Lack of concentration”). There was no change in anxiety levels on ten items at posttest. On two items her anxiety level decreased (“Learning about computers without structured guidance”; and “Lack of concentration”), while on one item it increased (“Getting feedback on my computer skills”). Her anxiety with regard to “Learning about computers without structured guidance” began at a high level and decreased to moderate at posttest. In two scales there was a strong drop in anxiety, namely Gaining Initial Computing Skills (from a mean scale score of 2.5 to 1.5) and Sense of Control (from a mean scale score of 3 to 2).

While the first impression that Melissa gives is one of confidence and positive attitudes towards computing, in her weekly interviews, she comments on both her reliance on the instructor for help and later her shift to the group: I used to ask R. a lot, but now I’m asking a few questions to other students .... I’d rather learn asking people next to me - it saves time and saves R. .... people beside me help me a lot; it's good asking for help from other students when something's hard, it makes things clearer; I can see why I'm doing things, the purpose; I'd rather work in groups because you get more opinions; myself thinking about it would have taken a lot longer time; it's not as boring. I could cope on my own, but I like to ask others for reassurance.

As for her Sense of Control, her level of negative self-talk shows a reduction from pre- to posttest (dropping from a mean scale score of 3 to 2). This suggests that the collaborative, self-regulatory nature of the teaching strategy experienced by this student may have been influential in raising her perceptions of personal control over computing. Her Computing Self-Concept remains at the same level of uncertainty,
however, which is again supported by comments in interviews during which she indicates the concerns she has about her ability to perform in a practical test of computing, and in particular, the competitive and public nature of the test: *I'm a bit worried - pretty stressed. I'm not looking forward to sitting next to someone who's really good (fear of comparison). Sitting there like little guinea pigs, no talking or looking at anyone's screen; not that that would help because everyone will be doing a different part of the test at the same time. Getting marks on the top of our screens as we go along - sort of competing with everyone else - it's nerve wracking and distracting* (getting marks progressively for each component of the test). *Everyone knew everyone else's marks so you felt like you were competing with the others, even though you weren't.* The State Anxiety in Computing Situations does not change from pre- to posttest, and remains relatively low.

**Case Study 4 (Yonneka).** This female, self-rated "beginner" who has had virtually no experience with computers, shows moderate to high levels of anxiety and highly negative cognitions for three of the four scales at pretest (she has a high level of anxiety on the "Insecure" item of the State Anxiety in Computing Situations scale, but a low level otherwise). There was no change in anxiety level on four items at posttest, ("Using computerised equipment"; "Lack of concentration"; "Nervous stomach"; and "Relaxed"), three of which she expressed low anxiety on at pretest. On seven items, the level of anxiety decreased ("Learning a new computer application"; Learning about computers without structured guidance"; "I think using a computer would be very hard for me"; and "Insecure") and that of positive cognitions increased ("I feel in control of what I have to do"; "People will notice if I make a mistake"; "I am very confident when it comes to working with computers"), while on two items it increased ("Getting feedback on my computer skills" and "Being evaluated on my computer competence").

On the basis of the CALM survey data alone, it would appear that moderate levels of anxiety and negative self-talk remained at the end of the course. What she disclosed week by week and in her logbook, however, did not really support such self-reports on the survey: Yonneka developed far more positive cognitions as a function of the instructional intervention and became one of the most skilled computer users in her class according to her instructor (see Table 7B.6), *Yonneka spoke up and wanted to answer a number of questions in this tutorial. This is the first time she has wanted to contribute. She seemed more confident today, and as evidenced by her grades. It is true, however, that like several of the other case studies from both groups (irrespective of initial levels of anxiety or proficiency), being evaluated on and publicly demonstrating computer competence elicited self-
reported anxiety on the CALM survey. This may well reflect test anxiety rather than computer anxiety as the CALM posttest preceded the final practical computing skills test that the students were to do in the course. Yonneka does confide in an interview conducted around the same time as the posttest survey: I know I'll get really uptight and tense about the exam; I won't be as good as other people in the class.

It is worth noting that Yonneka's high anxiety in relation to both Sense of Control (mean scale score 4.5) and Computing Self-Concept (mean scale score 4) at pretest did drop to moderate levels at posttest (mean scale scores 3 and 2.75 respectively). On the State Anxiety in Computing Situations scale, her high initial anxiety on the "Worry" factor subsequently dropped to a low level.

Clearly, this student's overall perception of her ability to control computers and of herself as a computing "type" has improved at the end of the course but still remains somewhat modest if taken solely on evidence indicated on the CALM survey. Her mean scale score on the Sense of Control scale showed a shift from a score of 4.5 (between very low to moderately low positive cognitions) to a score of 3 (moderate level of positive cognitions). Her mean Computing Self-Concept scale score shows a similar trend. A close look at her weekly interviews, however, indicates that her confidence level varies very much according to the specific difficulties that she is experiencing in a particular computing tutorial. As for her overall self-rating of competence at the end of the course, it was as follows: Wordprocessing and DOS - happy to show others; Dbase - able to do most of it on my own; Lotus - probably able to show others. In all, Yonneka gains a great deal in confidence by the end of the course as indicated in her final interview: "I'll continue on with another computer course next semester - there's no other subject I'd rather take. Follow-up anecdotal reports from her instructor reveal that she does go on to do a more advanced computer course in which she excels.

It would appear that social elements of the cooperative learning approach to instruction in her class have significant benefits for reducing this student's anxiety and increasing her positive self-talk: Laughing between students in my group is good; you can laugh at your mistakes - it helps relaxation and builds up confidence seeing someone else's mistake; I like having people next to me to talk to in case I make a mistake. I am not afraid of people finding out that I can't do things, nor embarrassed. It is worth noting that this student refers to "help/ing" twenty-nine times during interviews throughout her computing course - strong qualitative evidence of the influence of this factor in Yonneka's learning.

At the same time, in both her weekly interviews and the logbook entries, Yonneka also refers to the step-by-step nature of the computing instruction that she receives as reducing her anxiety. In fact, there are seven references to this phrase
throughout the interviews and another three in her logbook: *Before the tutorial I was worried about using a disk from scratch and having to program it. But it was fine during the tutorial because we went through it step-by-step. The step-by-step teaching helps me feel better; there's no need to panic. It would seem that for this initially highly anxious, inexperienced student, the combination of structured content delivery by the teacher (using traditional direct instruction), cooperative groupwork for social support, and training and practice in using metacognitive generic question stems is most effective in reducing her anxiety and enhancing her learning of computing skills: It builds up my confidence seeing someone else's mistake. When we put our opinions together to answer a (higher-order, lecturer-prompted) discussion question and get three different answers, we try all three and get the answer faster; it builds up my confidence faster.*

In relation to being asked questions as part of the direct instruction approach (checking for understanding using the review questions designed by the instructor), in the first interview, this student expressed anxiety as a function of the “audience effect”: *I don't like being asked to answer questions in class - it makes me more nervous; I'm too afraid to say anything that might be wrong. As the course progressed, however, her performance anxiety diminished. Doing questions with a partner was good - it helped me relax ... Because the whole class was given the same discussion questions, I wasn't worried that the lecturer might ask just me to answer .... Talking out loud helps me remember things better than studying alone. And in the final weeks of the course, Yonneka has this to say: *We were in groups making up questions for the class to try and answer; posing my own question helped me to solve a problem with the rest of the class.*

For this initially very highly anxious student, it is clear that a combination of structured content input and gradual training and practice in self-regulation and asking higher-order questions within a cooperative peer context facilitated learning and alleviated anxiety over the course of her computer training.

**Summary of Case Study Profiles: Direct Instruction Group (refer to Table 7B.5)**

**Case Study 5 (Terry).** This male student who had a moderate level of computer experience prior to this course rates himself as “advanced”. He considers himself *the techno wizz of the family; always involved with gadgets and equipment; trying to improve circuit boards and amplifiers; doing car repairs; using hand held games in primary school*, as he describes himself in an early interview. Terry would be classed as one of the “eager adopters” of technology who race ahead in class,
exploring and taking risks, and feeling bored with the slow pace of the beginners (Rosen & Weil, 1995c).

Terry has low levels of anxiety and negative cognitions across all of the items at pretest. At posttest, there was no difference in anxiety level or cognitions across eleven of the items, but an increase in anxiety low to moderate in two items ("Distractibility" and "Relaxed") at posttest. The impact of the direct instruction teaching method on this student’s anxiety appears to be minimal, as his style of learning is clearly influenced very little by the teacher.

I will admit however, that I tried to be too busy and inquisitive during tutorials and kept exploring the computer by experimenting with things which we haven’t been taught. My confidence and ability definitely improved during the tutorial, as it did the week before. After the tutorial I felt rather indifferent. I don’t know why, probably because it’s just a class and I expected to come out of it knowing more than when I went in. For some reason this class seems to remind me of the great secretarial typing pools of the '40s and '50s that you see in the movies, especially when we’re all bashing away. It’s just that atmosphere that I’m not used to.

Clearly, for this student, his computing classes were mechanical and boring places in which to learn. When asked whether there was ever any discussion or helping in tutorials, this student refers to the informal self-constructed group created between some of the male students: The 'clan' in the room has become global; everyone in class is helping and asking everyone else now; more of a common bond in class now; I keep looking at the screen next to me to check work; ..... groupwork stops me going off on tangents and making mistakes. On another occasion, he comments that he was a bit distressed when our group was split this week - people from other classes sitting in between .... but we kept leaning over and talking to each other. It appears that such spontaneously occurring groupwork provides social and cognitive support for even a confident student such as Terry.

It appears that Terry (if not others) had formed a “group” of their own accord because he comments that he was a bit distressed when our group was split, but this did not prevent the collaboration continuing: My group was split this week, leaning and talking to each other. In the following week, Terry notes again that people were leaning over and helping each other, and even in the sixth interview, he notes that it makes me work more when someone has gone out of their way to help me; working with others is a motivating thing.
Despite an apparently strong collaborative influence on his learning, Terry's concluding comments, however, seem to indicate a strong internal locus of control.

*When I first started I felt outwardly confident but I was still conscious of the fact that it had been a while since I'd had exposure to computing; thinking I might be completely swamped by this; now I realise that it's not impossible to master—you just do it and do your best.*

In summary, Terry’s initial attitude in the direct instruction context appeared to be one of confidence - *not intimidated or out of control or don’t know what I’m doing*, and positive approach to computers - *see them as useful:* ..... *I need to be up with new developments in technology.* Having experienced DOS in the first class and not really mastered it, however, he felt *a bit wobbly on DOS.* Similarly, after experiencing difficulty with word processing (erasing document and learning to use tabs) he comments: *I haven't lost control yet, but could be on the verge; ..... competent but in danger of being incompetent; ..... felt really confident before; now I see so much that I don’t know, my confidence is lower*  Terry shows that perceptions of control and mastery cannot be measured at one point only (in a quantitative sense) as these cognitions clearly fluctuate according to the difficulty of particular experiences. To assess this young man as a confident computer user, therefore, would be an over generalisation.

**Case Study 6 (Nathan).**  A male “beginner” with less than ten hours previously learning to use a computer, Nathan has moderate to high levels of anxiety (score >2) on twelve of the thirteen items at pretest (all except “Nervous stomach”). At posttest, there was no change in anxiety levels on five items (“Being evaluated on my computer competence”; “Learning a new computer application”; “Learning about computers without structured guidance”; “Insecure”, and “Nervous stomach”) or on those relating to Sense of Control or Computing Self-Concept (“I feel in control of what I have to do”; “People will notice if I make a mistake”; “I am very confident when it comes to working with computers”), a decrease in anxiety and negative self-talk on three items (“Getting feedback on my computer skills”; “Using computerised equipment”; I think using a computer would be very hard for me”, and “Relaxed”), and an increase on one item (“Lack of concentration”). There was only marginal change in levels of anxiety and cognitions across the four scales which remained predominantly high from pre- to posttest. Although this male student’s experience of different uses of computerised technology is as great as that of other students who rate themselves as “advanced” or “intermediate” in experience, Nathan considers himself a “beginner”. This is somewhat puzzling as progressively throughout the
interview sessions, he reports a growing mastery over some of his initial, self-expressed computerphobia (*fear of wiping a whole lot of information*), and especially after he has experienced success with database and spreadsheet applications: *I'm a bit more headstrong now; before I was afraid of wiping things. There are a heap of people underneath me now in the class - it feels good.* This growing confidence, however, is not expressed in relation to a public demonstration of computing skills in the practical test that is to occur soon after this student comments.

*I'm feeling better now about using the computer but not happy about doing tests - I feel pretty good when I'm not under pressure, but in an exam situation, I'm not sure how I'll go. The written exam will be O.K. because there are no computers involved.*

As for the impact of the direct teaching method used in this student's classes, *“it is straight-through demonstration followed by practical exercises done alone. There's never any discussion in our class. If you just follow what the teacher is doing you should get through it.”* There is evidence, however, (as with Case Study 5) of an informal spontaneous group that this student is part of and from whom he gets help: *everyone helping each other out.* In addition, the teacher obviously provides a great deal of personal assistance by *concentrating on our group and our difficulties.*

In summary, this most anxious student of all the case studies has considerable State Anxiety in Computing Situations and a poor Sense of Control remaining at the end of his computer training course. The question remains, therefore, as to why the direct instruction teaching approach did not reduce this anxiety as the literature would suggest. Perhaps he would have benefitted more from the social support and collaboration of the cooperative learning context as his instructor suggests when describing him as *the most animated student in this (direct instruction) group - he would fit in well into the cooperative group.*

There appeared, therefore, to be a number of negative features of the direct instruction approach in terms of Nathan's motivation and anxiety. In particular, these related to his lack of perceived control over the tutorial content and its presentation: *Lapses in concentration are producing difficulties* is how Nathan referred to the frustrations and anxiety created by the problems (i.e., *getting lost*) he was having in the course.

For this highly anxious, inexperienced male student, however, the transmission approach created a great sense of isolation and frustration. As he reported after his second class: *I was frustrated and lost because I had no idea what to do. The teacher is assuming knowledge. I can't handle it on my own ... I'm*
guessing how to do it ... The tutor or other students telling me what to do helps for the moment, but doesn't help me understand it for next time. He makes a similar comment later in the course: Getting help from the teacher, with her doing it for you, doesn't feel like you're learning, just going through the motions to keep up.

Nathan averts to his apprehensions regarding computing at the outset and refers to a previous humiliation in learning about computers: have had a computerphobia - fear of wiping a whole lot of information. His concern initially (with regard to learning about DOS) appears to be with the speed at which he perceives his (direct instruction) group is being taught. He frequently refers to being left behind; making too many mistakes; assuming that you've already got experience. An important observation that he makes in relation to the teaching strategy used in this group is that he is not learning because he can't see the purpose: When I can't see the purpose, I don't take it all in; things that are helter skelter make me more anxious. In this context, it would appear that there was no structure evident in the teaching at this point which would have reduced Nathan's anxiety (highly anxious individuals prefer structured teaching).

Nathan's observations that in the fourth week of the course it was scary when everyone was lost (while trying to synthesise their learning of wordprocessing skills and apply them to the presentation of their CV) may indicate that, for the highly anxious or inexperienced students in the direct instruction group, the lack of opportunity to make “sense” of what they were learning in a structured way was exacerbating their anxiety: Scared stiff this week; making silly mistakes (Nathan). As he explains in a previous interview, When I can't see the purpose, I don't take it all in; things that are helter skelter make me more anxious. In terms of information-processing theory, anxiety is interfering with initial processing of the new information and contributing to his sense of lack of control.

It is relevant here to correlate Nathan's observations with those of the instructor in the same week when she writes that:

Some students were completely lost again this week and I needed to be all over the room assisting students to keep up, particularly John and Alex* who seemed a bit stressed. Stephen* and Nathan got lost; it does not worry them, they think it is funny. They seek assistance when this happens and help one another. Alex doesn't always ask for help, so I check his screen as I pass and stop to assist (usually every time I pass). I get the general idea that students in this group do not fully understand what they are doing. This is a problem with direct instruction - I have noticed this in previous semesters. It is particularly noticeable with word processing as there are so many features to cover. This group is not used to contributing in class, and it is
like extracting teeth to get them to answer a general question like ‘look at the template and tell me what combination of keys are necessary to press’. The direct instruction model is used with this group and is the same as other semesters, however I have never liked it. It is OK while I am telling them what key to press, but I get the impression that when they are on their own they do not know what to do.

*Note: Alex and Stephen dropped out of the course after the first four weeks

The direct instruction approach appears to be a “mixed blessing” for someone like Nathan. In the final interview, he indicates that his motivation is to complete the course has been a negative one - it was not to learn for the sake of learning, let alone to excel, but rather, trying to get this computing course over and done with - that's not very nice is it?

Whereas the computer anxiety that Nathan expresses initially appears to be related to his lack of experience (he had spent less than ten hours learning to use a computer), by the middle of the course he notes that he is becoming a bit more headstrong and can see what I'm doing and why - can see why it's good. Interestingly, he comments at the same time that I need people around for reassurance. Weeks earlier he had recognised that social support from classmates was an important factor when he felt overwhelmed as he did in the third week of the course:

Feeling the pressure - there's a lot to do; feeling not good about not keeping up - starting to worry; not feeling as though I'll get it all done easily; not so embarrassed to ask people - feels better when I ask others ... but ... sometimes getting help (with someone else doing it for you) doesn't feel like you're learning, just going through the motions to keep up; feeling bad, left behind - not that sure of myself; feels better when I ask others; feels really good to go at my own pace."

The lack of structured social support in this class may well be contributing to Nathan's anxiety as he is not comfortable asking for help: I feel as if I'm asking too much, though.

In all, Nathan may well have benefitted from both metacognitive strategy training to develop a sense of control over his learning, and the social support of peers learning cooperatively together to reduce his high anxiety.

**Case Study 7 (Lisa).** This female student has had considerable computing experience as she records in her logbook: *I find that most of the work we are covering I've done in the Higher School Certificate elective course.* At pretest she
has low levels of anxiety and negative self-talk on eleven of the thirteen items, very low positive cognitions on one item ("I feel in control of what I have to do") and moderate anxiety on another ("I am very confident when it comes to working with computers"). Certainly, the level of Lisa's prior experience would account for the low levels of anxiety on the Gaining Initial Computing Skills scale which relates to anxiety about demonstrating competence, handling equipment, receiving feedback and learning basic computing skills. However, this student shows a strong sense of lack of personal control over computing, with high levels of negative cognitions being reported again at posttest. Similarly, her lack of confidence in computing situations, expressed as a considerable degree of uncertainty about her ability to solve computer problems and to help others use computers, also remains at posttest. Furthermore, although her initial level of State Anxiety in Computing Situations was relatively low (mean scale score 1.5), at the end of the course her anxiety score on this scale had increased to a moderate level (mean scale score of 2.25).

Despite her apparent initial familiarity with computers, Lisa seems to lack confidence towards the end of the course. This is implied in her comment that it is helpful to make sure that I'm doing the right thing; comparing myself with the people around me.

Lisa's motivation in the course is to pass, not to excel, despite the fact that she has not had difficulties with computing throughout the course. She is guarded in her aspirations for the practical test, expressing concern that if I get too confident, things might fall apart on me ... I can see myself making really stupid mistakes. This may account for the rise in the level of anxiety on the Distractability scale.

It could be surmised that the direct instruction teaching strategy used in this student's course did not help to reduce her initially negative self-talk with regard to a sense of control in computing situations, nor to enhance the development of a strong sense of computing self-concept. An illuminating comment in her logbook regarding the direct instruction teaching method used may have considerable bearing on why she has poor perceptions of control: My tutorial is so boring; we just sit there for two hours in front of the computer like puppets waiting all the time to be told what to do next. For such a student who likes to think through it myself, not being told to push this button and that button, this certainly provides a different interpretation of the step-by-step approach that other more highly anxious students describe as beneficial in terms of reducing their anxiety (albeit, not in terms of enhancing their personal sense of control or self-efficacy) for example, in Case Studies 4 and 8.

**Case Study 8 (Kylie).** Kylie, a female "beginner", has a mixture of levels of anxiety and negative cognitions across the thirteen items at pretest, although her
mean scale scores show generally moderate to high levels (scores >2). At posttest, there was no change in level of anxiety or negative cognitions on ten of the items, four of which were initially high (“Being evaluated on my computer competence”; “Learning about computers without structured guidance”; “I feel in control of what I have to do”, and “I am very confident when it comes to working with computers”), a decrease in two (“Using computerised equipment”, and “I think using a computer would be very hard for me”), and an increase on one item (“Learning a new computer application”). Her initial concerns centred around being evaluated on computer competence and learning about computers without structured guidance and her high levels of anxiety in these areas remained at posttest, as did her perception of lack of control and poor computing self-concept. The State Anxiety in Computing Situations scale revealed that Kylie’s initially moderate level of emotionality remained at posttest.

As for the impact of direct instruction in her computing classes, Kylie’s interviews reveal that she was very dependent on the “step-by-step” approach taken by the teacher.

*The most helpful part of the course is the instructions being written on the board to be followed step-by-step, and R. coming around and checking. It’s good when it’s on the board because if it’s just explained it can be too fast and I get lost. This way we can do things at our own pace. R. checks each step.*

For Kylie, there is a need for “step-by-step” instruction and time to practise and complete activities at her own pace. She becomes anxious when too much information is presented.

*It was excellent to do things in your own time (when R. had written all the instructions on the board); not uptight, don’t leave things out (when I can work at my own pace) - My main worry is hurrying to catch up; being left behind. When too much information is presented it’s too overwhelming.*

Although not intentionally part of the instructional approach adopted in her tutorials, Kylie comments on the benefits she feels in terms of anxiety reduction provided by informal collaboration and spontaneous groupwork.

*I used to wait before, to ask for help. I feel stupid asking R. the simple things so I talked to the guy next to me, we were both making mistakes; that makes me feel*
better - it's not so bad - more fun this week, having someone next to me to muck around with.

Despite increased motivation and better understanding, she still feels anxious in the fifth week of the course (I walked in feeling pretty anxious; I feel stupid asking R. the simple things), and even more so as the practical skills test approaches in the tenth week. This anxiety appears to be a function of her dependence on the instructor for help which does not foster a sense of mastery, confidence or mutual collaboration. When asked how she will solve the difficulties she experiences in relation to doing particular computing tasks on her own, Kylie refers frequently to asking her instructor or seeing her outside the class time: The tutor ... always very helpful - can always talk to her and see her after class.

The structured nature of the teaching seemed to provide a lot of "psychological support" for Kylie: The most helpful part of the course is the instructions written on the board to be followed step-by-step, and the tutor coming around and checking.

With teacher-directed instruction in a computing course, students typically wait for individual attention which takes time and may fall behind the rest of the class in assigned class activities: When I used to make a mistake and correct it myself, R. would go on and I'd get left behind and get anxious ... I got behind the class - so far behind. For Kylie, the direct instruction strategy works well as long as the instructor is available immediately when the difficulty arises. Once she begins to fall behind the group in step-by-step instruction, she panics and gives up: Nervous; not confident with tabs so tutor helped. Got behind the class; so far behind that just gave up and sat there frustrated for the rest of the tutorial - missed the DOS revision for the test.

**Perceptions of Advantages and Disadvantages of Each Teaching Model from the Instructor's Perspective**

Table 7B.6 represents excerpts from the instructor's weekly tutorial diary in which are recorded her reflections on the group dynamics, problems and positive outcomes of both instructional approaches. The key points that she raises are discussed below.
<table>
<thead>
<tr>
<th>Tutorial content</th>
<th>Group dynamics</th>
<th>Implementation of instructional strategy</th>
<th>Problems</th>
<th>Positive outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOS (Coop)</td>
<td>students put forward their ideas without prompting</td>
<td>students reminded to be creative in answers to questions</td>
<td>Melissa and Yonneka [hi anx] did not participate in class discussion</td>
<td>students relaxed; atmosphere cheerful</td>
</tr>
<tr>
<td>(Direct)</td>
<td>lot of prompting to get answers</td>
<td>some students needed constant help from tutor - <em>I seemed to be all over the room</em></td>
<td>minimal communication between students; <em>very hard to extract any answers to my questions</em></td>
<td></td>
</tr>
<tr>
<td>WordPerfect (Coop)</td>
<td>students like to talk to one another about what they are doing</td>
<td>students formed groups of three; discussion of questions with those had not previously sat with</td>
<td>Yonneka [hi anx] reluctant few students consulted me with problems - seemed to work it out between themselves</td>
<td></td>
</tr>
<tr>
<td>(Direct)</td>
<td>little student involvement</td>
<td>much less time taken to cover the content than for Coop group</td>
<td><em>I was all over the room assisting students who were lost; students in this group do not fully understand what they are doing - some seem a bit lost</em></td>
<td></td>
</tr>
<tr>
<td>DBase (Coop)</td>
<td><em>this group seems like a 'group' - they talk to and assist each other</em></td>
<td><em>all students made their own notes on the questions without prompting from me; split into 5 groups who each worked on one question</em></td>
<td></td>
<td>even the loners are joining in the discussion; absenteeism is very low</td>
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Table 7B.6 Excerpts from Instructor's Weekly Tutorial Diary: Study I (cont.)

<table>
<thead>
<tr>
<th>Tutorial content</th>
<th>Group dynamics</th>
<th>Implementation of instructional strategy</th>
<th>Problems</th>
<th>Positive outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBase (Direct)</td>
<td>this group is a group of individuals - very little contact with one another except for Nathan [hi anx case study] who is the most animated student in the group - he would fit in well with the Coop group</td>
<td>we finished early - no talking, everyone typing and keeping up, no questions! &quot;Do they understand? students worked individually at their own pace from the overhead without any tutor input - I walked and prompted if they were on the wrong track</td>
<td>absenteeism high in this group</td>
<td>no talking; everyone keeping up; &quot;this group is so quiet you can hear a pin drop!&quot;</td>
</tr>
<tr>
<td>Spreadsheet (Coop)</td>
<td>more discussion between the students on the questions and higher noise level than usual; several students have gained considerable confidence in recent weeks; mutual helping between students as needed, without prompting from tutor</td>
<td>Lotus 123 is not &quot;user friendly&quot; - most of the tutorial was direct instruction (tute 1); students formed groups themselves and began working on revision questions (tute 2); tutorial was a mixture of direct teaching for new features and self-directed practice</td>
<td>program crashed - lost a lot of tutorial time; some content rushed and will need revision in next class (tute 1);</td>
<td>answers to questions showing some thought - (not the most obvious ones) Yonneka [hi anx] wanted to contribute answers for the first time (tute 2); students discussed questions with each other across the room without speaking to me - this was good&quot;; ..very satisfying to me to see how the students were working together and not referring to me at all</td>
</tr>
<tr>
<td>(Direct)</td>
<td>atmosphere is very quiet; a little communication occurs between some weak students and more competent ones who give help when asked</td>
<td>using direct instruction the tutorial content was covered in one hour - proceeded to the next week's tutorial</td>
<td>I seem to be the focal point for help in this group, whereas in the Coop group I feel more in the background - they ask others or go ahead</td>
<td></td>
</tr>
</tbody>
</table>

210
<table>
<thead>
<tr>
<th>Tutorial content</th>
<th>Group dynamics</th>
<th>Implementation of instructional strategy</th>
<th>Problems</th>
<th>Positive outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphs) (Coop)</td>
<td>most students wanting to offer answers in discussion, even those previously anxious [e.g., Yomnka]</td>
<td>direct instruction used to introduce graphs, then students left to work out and practice how to apply the concept to other graphs - they used their notes and helped each other; generic questions stems handed out and their use in the review period explained - students would be in small groups which would remain constant for the two-week review; using the question stems, they would question each other and then offer one question per group for the class to discuss; students asked to take question stems home to prepare their own questions for the next tutorial</td>
<td>this was an enjoyable class for me with a very cooperative atmosphere; there was a low level of noise throughout</td>
<td></td>
</tr>
<tr>
<td>(Direct)</td>
<td>no talking in this group; most coped well - some were a bit lost</td>
<td>students wait for me to come to them before they ask for help</td>
<td>I felt that I needed to give instructions to this group</td>
<td>tutorial ran very smoothly - all work completed</td>
</tr>
<tr>
<td>Skills Review</td>
<td>students consulted each other before asking me, calling across the room to offer advice or ask for help</td>
<td>four self-chosen groups formed [it is worth noting that all of the case studies formed one group]; each group seemed to have a leader who directed the discussion - no prompting from me; each group which posed a question provided the answer for the class; handouts with questions given out by tutor; students made their own notes on these without prompting</td>
<td>atmosphere very light-hearted</td>
<td></td>
</tr>
<tr>
<td>(Coop)</td>
<td>very quiet atmosphere; students put hands up to ask tutor how to complete tasks; still a group of individuals with little contact</td>
<td>review questions asked of students individually</td>
<td>like extracting blood from a stone; students not ready teach when their turn to give answers or spoke barely audibly; errors</td>
<td>group not a problem to - do everything asked of them</td>
</tr>
</tbody>
</table>
Training in Self-Questioning Develops Content Knowledge, Self-Efficacy and Self-Regulated Learning Skills

From the observations of the instructor, there was no doubt that the training in using generic question stems and the practice within cooperative group settings, assisted their review of procedural computing knowledge as well as in developing a sense of confidence relative to students in the direct instruction group.

The cooperative learning group were able to answer questions much better and more quickly than the direct instruction group. A number of students in the direct instruction group were unable to answer, and were quite embarrassed about it, saying, 'I don't know.' A few in the cooperative learning group who could not answer the specific question I asked, said, 'I'm not sure, come back to me.' I felt encouraged by this as it showed they had higher self-confidence than the direct instruction group.

An important observation in her closing remarks in the diary at the end of the course, however, pertained to the lack of opportunity for the students in the intervention group to practise self-questioning - learning to use the generic question stems towards the end of the course came possibly too late to be beneficial. The following excerpt sums up her final thoughts:

HIGHLIGHT: The way the students in the intervention handled the questions in the Review Period - shows they are really thinking. Answers to questions showed some thought (ie, not going for the most obvious answer). Students discussed answers between each other across the room without speaking directly to me - this was good.
DOWN SIDE: I don't think they had enough time to learn questioning using the question stems during the Review Period- there was just too much content to revise. The questions I gave them each tutorial after a suitable amount of content had been covered, and at the start of the next class as a review, seemed to help them in their own questioning and discussion. Maybe they should start much earlier getting the question stems or hand in something written (their own questions) to the tutor each week.
OVERALL: Cooperative Learning Group showed increasing self confidence and more of the students were willing to tackle problems without consulting me.

It is worth noting here that in her final reflections, the instructor observed that student gains in motivation (attributable to increased self-efficacy and control perceptions) were reflected in the retention rate of students in the cooperative self-
regulated group relative to that of the comparison group: Nine of the fifteen (60%) in the former group chose to take the more advanced computing subject in the following semester compared with five from the remaining twelve (42%) in the direct instruction only group.

**Students are More Active and Involved with Cooperative Groupwork**

When fostering cooperative groupwork there will be a degree of noise due to student talking and movement which may be disconcerting for students and teachers who are unfamiliar with such interaction. The instructor noted in her diary, however, that this noise decreased progressively to quite a low level throughout the course.

On the other hand, the instructor found that although it was very quiet in the direct instruction group - *This group is so quiet - you can hear a pin drop!* - it was frustrating to teach them because of their lack of responsiveness.

> What can I say? *We finished early - no talking again, everyone typing and keeping up; no questions. Do they understand? ... This group is not used to contributing in class like the other group, and it is like extracting teeth to get them to answer a general question.*

Even during the skills review period directly leading up to the practical computing skills test, the instructor notes how this group were still dependent on her for help - *a group of individuals with very little contact with one another*

It is clearly more rewarding for the instructor to facilitate the learning in the cooperative learning group.

> *The students appeared relaxed and the atmosphere was cheerful ... It was very satisfying to me to see how the students were working together and not referring to me all the time. And on other occasions: This was an enjoyable class for me with a very cooperative atmosphere; Few students consulted me with problems - seemed to work it out between themselves.*

On the other hand, the direct instruction group *do not fully understand what they are doing - some seem a bit lost - I was all over the room assisting students who were lost.*

This observation suggests the possibility that the instructor was more positively oriented to the cooperative self-regulated group. Such a possibility
prompted the author to ensure greater fidelity of implementation of treatment in the follow-up study described in the next chapter.

Instructor's Role Varies According to Teaching Method: Facilitator for Cooperative Group and Expert Trainer for Direct Instruction Group

Training (instructor modelling and student practice) in the use of higher-order questions within tutorials requires considerable teacher preparation. Furthermore, pausing at regular intervals in a tutorial after content delivery and student practice of skills to ask higher-order questions and to use these as review, is time-consuming and slows down content delivery. Particularly at the start of the course, this is because students are at different levels of keyboard proficiency - some have to wait and get bored; others become anxious because they are behind.

In a different way, direct instruction is also demanding for the instructor as a lot of inexperienced and anxious students require help simultaneously: *I feel worn out after this class with so many calls for help and such uncertainties.*

There was a noticeably higher weekly attendance at tutorials throughout the course in the cooperative learning group than in the direct instruction group: *Absenteeism is very low in this group compared to the other group.* This was related to the enthusiasm and commitment to each other shown by students in the former group.

*Some of the students knew how to do the tasks and applied it to their work and then turned to the other students who needed help and advised them how to do it - there was no prompting from me to do this. On more than one occasion I noticed that, at one stage, a particular student would know how to do the task and help someone else; on other occasions this was reversed.*

**Conclusion**

Undoubtedly, the most important conclusion that can be drawn from the findings presented in this chapter is that constructs such as anxiety with its multidimensional facets, sense of control, self-concept and motivation are not fixed entities and do vary according to particular contexts and for particular individuals. To quantify these constructs at a specific point in time may certainly be helpful for "diagnostic" purposes in experimental research. However, a pretest-posttest research design alone will not be able to provide a picture of the complexity of such cognitive
and affective variables, and of the ways in which they may interact and fluctuate over time.

Another important conclusion can be drawn from a comparison of the survey data (used as both a quantitative and qualitative tool) and the in-depth interview and student logbook transcripts of the case study sample, along with the instructor’s weekly tutorial diary: That to gain an understanding of how students who are learning computing skills gain metacognitive awareness of a learning strategy and its use in a self-regulatory fashion; how they experience anxiety and varying cognitions (positive and negative); and the ways in which these are related to their learning, one needs to evaluate their experiences over a period of time, in varying circumstances, and spoken in their own “voice”.

It became evident over time that those who appeared outwardly confident and capable at the outset, such as Terry, (direct instruction group) could actually lose confidence progressively: I felt really confident before but now I see so much that I don’t know, my confidence is lower. On the other hand, others such as Yonneka (cooperative learning group) could be judged as extremely anxious and lacking in confidence at the start of the course yet show increasing sense of control (although her anxiety remains in relation to public evaluation of her skills) as the course progresses to the stage that she says at the end: I’ll continue on with another computer course next semester - there’s no other subject I’d rather take.

Such insights can only be gained through qualitative research methods such as those used in the present study which provide a richer picture of the complexities of human thinking and emotions that may not be evident in a comparison of pretest and posttest survey data gathered at the beginning and end of a lengthy period of learning.

Table 7B.7 provides a summary of the main points that emerged from the qualitative data gathered from student in-depth interviews and logbooks and from the instructor’s weekly tutorial diary.
Table 7B.7
Summary of Data from Student In-Depth Interviews and Logbooks and Instructor’s Weekly Tutorial Diary

Direct Instruction
• Sense of control over learning is absent in teacher-led instruction
• Sense of self-efficacy varies considerably depending on the subject matter
• Reception learning is boring and unmotivating
• Anxiety is related to dependence on the instructor in direct instruction
• Spontaneous groupwork emerges even within teacher-led instruction
• Attendance problems in direct instruction groups are related to lack of student motivation and commitment
• Instructor’s role is one of expert trainer

Cooperative Self-Regulated Groupwork
• Groupwork helps learning, enhances motivation, builds confidence, and dissipates anxiety
• Growing self-efficacy comes from structured groupwork and training in the use of generic question stems
• Students develop skills in problem-solving
• Students are more active and involved with cooperative groupwork
• Instructor’s role is one of facilitator

Metacognitive Strategy Training
• Metacognitive training in self-questioning enhances self-regulation and learning
• Training in self-questioning develops content knowledge, self-efficacy and self-regulated learning skills
• Reciprocal questioning develops self-questioning skills and builds positive cognitions
• Mutual “helping” relieves anxiety and builds confidence
• Anxious students can avoid embarrassment through reciprocal peer questioning
• Positive cognitions can develop even when anxiety is reported

Importantly, the results highlight that the two instructional approaches have a differential appeal and impact on individuals depending on their levels of experience, competence, and initial levels of anxiety and cognitions (positive and negative). This is a significant finding as it underlines the importance of conducting aptitude-treatment-interaction studies to evaluate the efficacy of alternative teaching methods for computer training settings.
Positive Cognitions Can Develop Even When Anxiety is Reported

Furthermore, from the evidence described above in the cases of both a high anxious female student (Yonneka) and a low anxious male student (Andrew), it would appear that some students can express a developing sense of mastery and confidence (positive cognitions) during their computing course, yet report anxiety relating to the demonstration of computer competence in a test situation. Where these might seem to be contradictory when measured quantitatively, as in the aptitude-treatment-interaction study, (high anxious students in the intervention group expressed anxiety on the Fear and Feedback scales) the detailed analysis of student thinking obtained through the weekly interviews helps to clarify any apparent ambiguity. The Practical Test was a public display of a range of computing skills for which grades were to be awarded by the instructor during the examination: the Fear scale measured both fearful cognitions about damaging the computer and public embarrassment in computing situations, while the Feedback scale related to receiving feedback on computing skills, clearly related to test or performance anxiety, and not inconsistent with a sense of control or mastery over the computer.

Spontaneous Development of Groups within the Direct Instruction Group: Implications for Research Re-Design

The analyses of the transcripts coming from the direct instruction group indicated that “help” groups evolved spontaneously as the computing course progressed. This suggests that students learning to use computers naturally feel the need to ask each other for help and to offer help when required.

There were no explicit instructions for the direct instruction class to work collaboratively as there were in the cooperative group. In fact, it was intended that the instructor adopt the traditional teacher-directed approach where students worked independently or referred to her for help. The emergence of spontaneous “help” groups in the direct instruction group (a diversion from the original research design for the intervention in Study 1) could have confounded group differences and aptitude-treatment-interaction effects based on teaching approach, viz., direct instruction with a focus on individualisation and implicit competitiveness, versus cooperation in its learning and social sense. Indeed, both achievement results and interaction effects for the cooperative learning group in Study 1 were limited and inconsistent.

In this sense, the qualitative data collection and analysis were very valuable in assessing the validity of the quantitative results from this first study and the appropriateness of the methodology. As “help” groups emerged spontaneously within the direct instruction group they would have the effect of restricting the
difference between the intervention and comparison groups, reducing the distinctiveness of the two conditions (even though the spontaneous groups were unstructured and did not receive the metacognitive strategy training). Similarly, the tendency for the instructor to volunteer assistance may have limited the degree to which the intervention group were self-reliant. The issue of fidelity of implementation, therefore, was raised as a methodological concern.

Finding this information out through qualitative means enabled me to modify the design of the second aptitude-treatment-interaction study where greater instructor control was to be exerted to restrict the spontaneous forming of “helping” groups so that it was possible to examine potential aptitude-treatment-effects of the instructional intervention without this potential confound. As for the intervention, once again, the qualitative data (this time from the instructor’s tutorial diary) indicated that students were not gaining sufficient experience and practice in the metacognitive strategy training in self-questioning which occurred too late in the course to be beneficial. Changes that were made to the methodology of the second ATI study as a consequence of the qualitative analyses are described in Chapter Eight.

As for corroboration of the findings from the first ATI study, evidence from the qualitative analyses of the data derived from the case study participants from each of the groups in the study provides strong support for the following assertion: That for students undertaking a lengthy computer training course, and particularly for those with high initial anxiety levels and low computing self-efficacy, an instructional approach in which they receive teacher-led instruction to present new content in addition to metacognitive strategy training in the use of peer- and self-questioning within a cooperative self-regulated learning environment, is of greater value than traditional direct instruction alone for the important reasons outlined below.

**Cognitive, Affective and Social Benefits**

The analyses of the qualitative data clearly demonstrate the advantages to be gained for individuals from cooperative, metacognitive strategy training, viz., development of feelings of self-efficacy and mastery; enhanced motivation; enhanced goal setting, the implementation of learning strategies, and a degree of self-monitoring and self-regulation.

It is also clear that as students in the cooperative group develop group and collaborative skills their confidence as learners grows and their feelings of anxiety diminish as a function of their sense of mutual support among their peers. These affective and social benefits occur simultaneously with their developing
implementation of self-questioning as a learning strategy and encouragement to be self-reliant within their allocated groups. Case study students indicated that they found the collaborative environment stimulating and supportive, which enhanced feelings of enjoyment in the course.

Two clear findings emerge from the case study interviews and logbooks. The first is that previous experience with technology accounts for a considerable degree of motivation to learn computing, even for the initially anxious student. The second is that the formal learning of computing skills may contribute to anxiety reduction for only some students and that despite such experience, perceptions of personal control and a computing self-concept are not guaranteed.

The qualitative analyses indicated that even the four case study participants who appeared low anxious on the psychometric survey reported some levels of anxiety throughout the course depending on classroom circumstances. Such anxiety did not appear to be detrimental to the motivation or learning of these students and, in fact, appeared to be facilitative. For the initially high anxious students, on the other hand, factors causing anxiety and negative cognitions appeared to reduce motivation and achievement for those in the direct instruction group but not for those in the cooperative learning setting where training was given in strategies of self-regulation and metacognition. It is feasible that training in such strategies helps enhance for the highly anxious what “comes naturally” to the low anxious, namely, a sense of control and self-efficacy. Anxiety, therefore, is not debilitating for these individuals.

In sum, there was much that was gleaned from the qualitative research that was consistent with the previous data collected in the aptitude-treatment-interaction research. What is evident to the present researcher, however, is that it may be wiser to try to understand why quantitative findings do not appear to support a priori hypotheses, or may be less conclusive than predicted, than to dismiss these findings outright. Equally important are the corroboration of findings gleaned through quantitative research tools and the opportunity to obtain a more fine-grained picture of human learning, thinking and affect. Such was the case on both counts in the present study.
CHAPTER EIGHT

Effects of Metacognitive Strategy Training Within a Cooperative Group Learning Context on Computer Achievement, Anxiety and Cognitions Revisited: An Aptitude-Treatment-Interaction Study

It will be remembered that the aptitude-treatment-interaction study presented in the first part of the previous chapter (Chapter Seven Part A) produced some unexpected findings, namely, no significant overall group differences in achievement, anxiety or cognitions and few aptitude-treatment-interaction effects. Additional insights were gained from the qualitative analyses of the data gathered from participants and instructor in the second part of this study (discussed in Chapter Seven Part B) which was designed to explore both the ways in which individual students gained computer competency within the two instructional approaches and the processes underlying their implementation. As a consequence of both investigations, questions about the complexities of the interactions between anxiety, negative and positive cognitions and achievement were raised as well as concerns about the fidelity of implementation of the intervention. It was considered important, therefore, to conduct a second study. This was to involve the same instructor teaching the same computer training course as previously but with two new groups of students, and an intervention that was redesigned in significant ways.

In effect, Study 2 was designed to replicate Study 1 but to strengthen it, primarily in terms of the metacognitive training component of the cooperative intervention. Because the description of the measures, most of the procedures, and the analyses are the same as in Study 1, the reader is referred to the earlier description of the methods. Here I focus on differences between the methods of the two studies.

Method

The intervention adopted in Study 1 was redesigned to address the following three methodological concerns: a) The need for earlier and more extensive training

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1 The research reported in this chapter and the first part of the previous chapter (i.e., ATI studies 1 and 2) are currently in press. McInerney, V., McInerney, D. M., & Marsh, H. W. (1997). Effects of Metacognitive Strategy Training Within a Cooperative Group Learning Context on Computer Achievement and Anxiety: An Aptitude-Treatment-Interaction Study. Journal of Educational Psychology, 89, x-xx.
in the use of higher-order self-questioning than had occurred in the experimental treatment, and regular practice by students in its use throughout the course, thereby strengthening the metacognitive strategy training component of the cooperative intervention. This was seen to be the most important aspect of the redesigned intervention; (b) Possible instructor response effects, that is, the general tendency for the instructor to offer direct help rather than fostering independent or collaborative learning, according to the treatment group; and (c) The occurrence of spontaneous collaboration and helping behaviours in both groups, with the consequent effect of diluting the contrast between the direct instruction group (not receiving structured groupwork) and the cooperative self-regulated group.

The manner in which these concerns were addressed in Study 2 was as follows: First, the major difference between the two studies was that the metacognitive training (the individual and cooperative use of generic question stems) was given much more emphasis in Study 2 than in Study 1, by introducing it at the start of the course rather than towards the end, as in Study 1. It was felt that the weak treatment effect in Study 1 in terms of achievement gains may have been attributable to this aspect. The cooperative self-regulated group was also to record personal reflections on their learning using four self-regulatory questions related to difficulties they experienced in the computing class. These were to be shared with members of their cooperative group in the following week (see Table 8.1). The repeated practice in making weekly tutorial reflections using structured questions was expected to develop self-regulation by helping students monitor their learning and thereby foster perceptions of mastery over computing skills which were reinforced by the cooperative group problem-solving in class time.

Second, there was a more rigorous control for instructor involvement. In particular, the instructor was advised not to circulate through the groups offering help (as had been reported by case study students in both groups in Study 1), but rather, to provide individual help only when students specifically requested it in the direct instruction group, and to encourage group problem solving before calling on her for help, in the cooperative group (refer to Appendix C4 for details of the procedure to be adopted by the instructor).

Finally, as for spontaneous helping behaviours in the direct instruction group (which occurred frequently enough to be mentioned in the case study interviews on a number of occasions), these were to be minimised by instructor reminders to students to work quietly on their own unless they actually needed her assistance.
Table 8.1

Metacognitive Strategy Training Procedure

1. Copies of generic question stems adapted from the work of King (1991a & b, 1992, 1993, 1994) were distributed to all students at the start of their first tutorial (see Table 7A.1 in Chapter Seven Part A for question stems).

2. The purpose of these question stems was explained in terms of their use in facilitating problem solving, and in helping students to clarify their understanding and take responsibility for some of their own learning.

3. Examples of how these questions might be written were provided by the instructor, that is, modeling of question completion in relation to computing content. The instructor proceeded to pose specific content-related questions using some of the question stems several times throughout a tutorial each week.

4. Explanations of how these questions were to be used were given to students in this way:
   - students should write one question using a prompt from the generic question stems at the end of each tutorial, and write an answer to it as well;
   - these questions and answers should then be shared by students with the members of their small groups, that is, to be read out and discussed;
   - in addition, one other question should be selected and completed for "homework" in the Reflection section of the students' class folders.
   - At the end of the tutorial, in the last 10-15 minutes or so, the overhead transparency on which the four self-regulatory questions were written was projected and explained in the following way:
     - the questions are to be copied into the Reflection section of the students' class folders;
     - the questions are designed as part of a problem solving strategy to assist students in focusing on what they are, and are not, learning at particular times, and in planning a course of action with regard to any difficulties;
     - at the start of each week's tutorial, students will share their answers to the self-regulatory questions with members of their small group first, then in discussion with the rest of the class.

The self-regulatory (metacognitive) questions were:
   a) "What did I learn this week in my computing class?" (monitoring)
   b) "With what did I have difficulty this week?" (monitoring)
   c) "What types of things can I do to deal with this difficulty?" (problem solving/planning)
d) "What specific action(s) am I going to take this week to solve any difficulties?" (planning)

These should form the basis of a review of content preceding each week's tutorial input by the instructor.

**Participants**

Details of participants are the same as for Study 1, except that the groups differed slightly in gender mix: Intervention group N = 15 (8 males, 7 females) and comparison group N = 15 (6 males and 9 females). The average age of the students was 22 years.

**Analyses**

The rationale and procedure for conducting the analyses in Study 2 were identical to those adopted in Study 1.

**Results**

Preliminary two-group t-tests were conducted to evaluate the equivalence of the two groups at pretest. There were statistically significant group differences (p < .05, two-tailed) on the prior competency self-rating scales, with the direct instruction group having significantly higher-order scores on three of the four self-rated competencies (DOS, wordprocessing, and spreadsheet applications, but not databases). However, there were no statistically significant group differences on any of the pretest anxiety scales or positive cognition scales. Whereas there were some group differences in self-rated competency at the start of the study, these differences were controlled as part of the multiple regression approach to analysis of covariance (i.e., self-rated pretest competency was used as a covariate in the analyses).

In Study 2 (see Tables 8.2 and 8.3) there were four significant main effects (shown as "Group") and seven significant interaction effects at posttest. These effects are summarised in terms of three major categories of outcome variables: anxiety, positive cognitions, and achievement test scores.

**Anxiety Outcomes**

There were significant ATI effects for five of the six anxiety scales, Learning, Competence, Equipment, Feedback, and Skills, all relating to aspects of learning and demonstrating computing skills (see Tables 8.2 and 8.3). In three of these interactions (Learning, Feedback and Skills), students in the direct instruction group who were initially most anxious (i.e., with pretest mean scores of "4" and "5")
experienced significantly decreased levels of anxiety (p < .05) at posttest compared to high anxious students in the cooperative intervention group (see Table 8.3). In contrast, initially low anxious students in the direct instruction group (i.e., with a pretest mean score of “1”) experienced greater levels of anxiety at posttest than low anxious students in the cooperative group. There were significant mean differences on the Learning, Competence, Feedback and Skills scales (see Table 8.3). Hence, at least in terms of anxiety, high anxious students tended to be more advantaged by direct instruction whereas low anxious students tended to be more advantaged by the cooperative intervention. There was, however, no significant main or interaction effect for the Fear scale (see Table 8.2).

**Positive Cognitions**

Students in the cooperative group had significantly higher Computing Self-Concept at posttest than students in the direct instruction group, and this difference did not interact with pretest self-concept (see Table 8.2). There was a significant ATI for Sense of Control (see Tables 8.2 and 8.3) such that students with initially low levels of Sense of Control were marginally (.05 < p < .10) advantaged by being in the cooperative group, whereas students with initially high levels of positive cognitions did not differ significantly between the two groups.

**Achievement Outcomes**

Students in the cooperative group had significantly higher achievement outcomes for the two folio assignments and for the research report, but not for the practical computing test (see Table 8.2). For the second folio assignment, there was an ATI. In follow-up analyses the largest differences occurred for cooperative group students with initially low self-ratings of computer competency (i.e., for pretest mean scores of “1” and “2”). There were no statistically significant ATIs for any of the other achievement outcomes.

**Qualitative Evidence of Self-Regulation and Motivation**

From the qualitative evidence reported anecdotal by the instructor in a follow-up interview at the end of the course, it appears that the effects of the improved intervention substantially influenced the ability of students to ask higher-order questions of themselves and their group. She commented that questions generated by students during the computing skills review prior to the Practical Test were qualitatively different from the first study in which only some students (those who she found out later were acting as case-studies) were able to generate higher-order questions, while the others created mostly factual recall questions such as:
• "How would you move a file from A:\ to your A:\ WordPerfect subdirectory?";
• "What are the steps in adding footnotes to your document?";
• "Show surname, numbers and start data for those whose monthly salary is greater than $500."

In the first study, it seems likely that the self-monitoring and self-evaluation of learning fostered through the regular interviews, as well as the keeping of a reflective logbook by the case-study students, supported the development of higher-order questioning. In the second study, on the other hand, in which all students in the intervention were required to keep a reflective folder and to regularly engage in peer- and self-questioning, the generation of deeper level questions was evidenced by the majority of students in the cooperative, self-regulated group during the exam review. Examples of such questions included:

• "Which is the best way to move back through sub-directories?";
• "What is the main idea of using REVEAL CODES in WordPerfect?";
• "The company has decided to deduct $50 from the salary of employees on leave. Display records for employees on leave whose reduced salary is more than $500";
• "Why is the plus sign important when using a formula in a Lotus spreadsheet?"

One concern, however, that the instructor raised in her evaluation of the research merits attention in the context of the implementation of the intervention. This relates to the fidelity with which students in the second intervention actually recorded their self-questions and answers in their Reflective Folder. As she indicates in the excerpt from her interview below, there was no way to enforce or check that they did so. In terms of fostering self-regulation, this part of the intervention could only be encouraged verbally by the instructor and monitored superficially - the onus was on the students themselves to carry it out.

Reflections does not seem to attract a lot of writing. I'm not sure whether they do not know what to write or think the topic is easy. Looking back on the semester, this cooperative learning group is a more serious and quiet group than last year. The introduction of the students presenting questions that they had written at home in their Reflective Folders was not a complete success and may need a different
approach. Often only one question per group per week was forthcoming. Each week I would ask extra questions to fill in for those not asking a question. They had quite a bit of exposure to what type of question and how to formulate questions, but for some reason were unable (or unwilling?) to actually ask questions. The only reason I could put forward is the lack of time, as the content material is extensive and maybe the students are suffering from information overload. There is no way to overcome this, if this is the reason. Reflections: I don't think they often wrote anything meaningful - maybe they should hand in something to the tutor.

As discussed in earlier chapters (see Chapter One and Chapter Seven Part A), student motivation was expected to increase as a function of increased control over their learning for those receiving the cooperative intervention. One significant consequence of low perceived self-efficacy and low sense of control is reduced intrinsic motivation. Once they had mastered the computing “basics” required for graduation, student motivation to continue with computing studies was expected to be evident in their enrolment in a subsequent, more advanced computing course. As with Study One, a higher proportion of the cooperative self-regulated group, namely fourteen out of fifteen (93%), were reported by the instructor as having enrolled in the follow up semester-long computer course. This was compared with ten out of the fifteen students (67%) in the direct instruction group. While tests of significance were not conducted on these, it would appear that there was a noticeably higher proportion of the cooperative self-regulated group motivated to continue with computing. This is even more noteworthy considering their significantly lower level of initial computer competence relative to the direct instruction group.
Table 8.2

Summary of Beta Weights from Multiple Regression Analyses in Study 2

<table>
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<tr>
<th>Outcome</th>
<th>Total</th>
<th>Prior</th>
<th>Pretest</th>
<th>Group</th>
<th>Interaction</th>
</tr>
</thead>
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<tr>
<td></td>
<td>MR p</td>
<td>beta p</td>
<td>beta p</td>
<td>beta p</td>
<td>beta p</td>
</tr>
<tr>
<td><strong>Anxiety Ratings</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning</td>
<td>.78 .00</td>
<td>.13 .47</td>
<td>.57 .00</td>
<td>-.18 .22</td>
<td>.60 .00</td>
</tr>
<tr>
<td>Competence</td>
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<td>.01 .97</td>
<td>.49 .02</td>
<td>-.22 .20</td>
<td>.29 .08</td>
</tr>
<tr>
<td>Equipment</td>
<td>.41 .33</td>
<td>.27 .36</td>
<td>.43 .14</td>
<td>-.17 .43</td>
<td>.43 .06</td>
</tr>
<tr>
<td>Feedback</td>
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<td>.13 .54</td>
<td>.38 .06</td>
<td>.01 .95</td>
<td>.51 .01</td>
</tr>
<tr>
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<td>.14 .50</td>
<td>.47 .02</td>
<td>-.19 .23</td>
<td>.53 .00</td>
</tr>
<tr>
<td>Fear</td>
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<td>.01 .95</td>
<td>.45 .03</td>
<td>.15 .42</td>
<td>.15 .42</td>
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<td><strong>Positive Cognitions</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pos Control</td>
<td>.43 .26</td>
<td>.00 .99</td>
<td>.28 .14</td>
<td>.06 .76</td>
<td>-.33 .08</td>
</tr>
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<td>.30 .20</td>
<td>.33 .04</td>
<td>-.17 .28</td>
</tr>
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<td><strong>Achievement</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MR p</td>
<td>beta p</td>
<td>beta p</td>
<td>beta p</td>
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</tr>
<tr>
<td>Prac Test</td>
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<td>Res Report</td>
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<td>.20 .32</td>
<td>.46 .03</td>
<td>-.13 .53</td>
<td></td>
</tr>
</tbody>
</table>

Note.
Prior = self-rating of prior computer competency, a general covariate used in all analyses. Pretest = specific pretest corresponding to the outcome measure. Group (1 = direct instruction comparison group, 2 = cooperative intervention group). Interaction = aptitude-treatment-interaction (Group x Pretest) p = p-value (two-tailed). All betas are unstandardized. However, because all outcome and predictor variables were standardized (M = 0, SD = 1) prior to analysis, they are like standardized coefficients (see Aiken & West, 1991 for discussion of this strategy).
Table 8.3
Summary of Group Differences (Coop Intervention and Direct Instruction Comparison) and Significance Levels (p-values) at Different Levels of Pretest Variables for those Outcomes with ATI Effects in Study 2

<table>
<thead>
<tr>
<th>Levels of Pretest Variables (that vary from 1 to 5)</th>
<th>Pretest</th>
</tr>
</thead>
<tbody>
<tr>
<td>p 2 p 3 p 4 p 5 p M SD</td>
<td></td>
</tr>
</tbody>
</table>

**Study 2**

**Anxiety Ratings**

| Learning  | -1.23 .00 | -0.33 .13 | 0.57 .04 | 1.47 .00 | 2.38 .00 | 2.07 0.95 |
| Competence| -1.13 .04 | -0.67 .05 | -0.22 .41 | 0.23 .55 | 0.68 .25 | 2.73 1.01 |
| Equipment | -0.94 .07 | -0.20 .51 | 0.53 .28 | 1.27 .13 | 2.00 .09 | 1.94 0.87 |
| Feedback  | -0.77 .05 | -0.02 .93 | 0.72 .05 | 1.46 .01 | 2.21 .01 | 2.05 0.93 |
| Skills    | -1.28 .00 | -0.46 .04 | 0.35 .17 | 1.16 .01 | 1.98 .01 | 2.26 0.83 |

**Positive Cognitions**

| Pos Control | 1.33 .09 | 0.50 .22 | -0.33 .43 | -1.17 .16 | -2.00 .13 | 2.47 0.60 |

**Achievement**

| Folio 2a    | 3.37 .00 | 2.04 .01 | 0.72 .51 | -0.61 .73 | -1.93 .43 | 2.08 0.98 |

**Note.**

Group differences for posttest outcomes were evaluated at different levels along the pretest continuum that varied from a minimum of 1.0 to a maximum of 5.0 (i.e., scale scores were based on ratings from a 5-point response scale). Positive group differences mean that the cooperative intervention group scored higher (i.e., higher levels of anxiety for anxiety ratings and higher levels of positive cognitions for positive cognition ratings), whereas negative group differences mean that the direct instruction group scored higher. Multiple regression tests of statistical significance (Aiken & West, 1991, pp. 132-133) were conducted at each pretest level and are summarised by two-tailed p-values. For all other variables, the ATIs involve pre- and posttests on the same variable, whereas the pretest for this analysis is a pretest self-rating of prior competency (on a one-to-five response scale). The posttest outcome variable has $M = 10.75$ and $SD = 1.98$.  

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Discussion

With the metacognitive component in the intervention strengthened in Study 2, achievement on three of the four measured criteria was affected positively by the intervention. As for positive cognitions, the finding in Study 1 that cooperative, self-regulated training advantaged those with initially low sense of control was not only replicated, but data also showed a significantly improved computing self-concept for those initially lacking confidence and proficiency with computers. In all, such students gained a sense of personal autonomy over learning through training in strategies for monitoring and regulating their own understanding of skills and concepts.

On the other hand, for those with feelings of embarrassment about making mistakes in public (as in Study 1), or those with initially high levels of anxiety in relation to learning computing skills and being evaluated on one’s competence (as in Studies 1 and 2), receiving direct instruction in a step-by-step transmission mode from a perceived “expert”, namely, the computing instructor, reduced anxiety. This can be understood in terms of the low level of prior experience that these anxious students reported. For such individuals, placing them in a situation where they need to rely on others (in a group) who have perceived limited expertise to help them understand basic computing skills would not be expected to reduce their self-reported anxiety about learning. Despite this, their achievement was not impeded in Study 1, and was clearly enhanced in Study 2.

In the anxiety research literature (Naveh-Benjamin, McKeachie, & Lin, 1987; Tobias, 1986; Wigfield & Eccles, 1989) there are suggestions that a direct instruction teaching strategy should be more effective than cooperative learning in reducing anxiety for highly anxious students. These include step-by-step instruction and the opportunity for guided and independent practice. In both Studies 1 and 2, there is support for these expectations in that initially high anxious students from the direct instruction groups were less anxious at posttest than high anxious students from the cooperative group, especially in relation to gaining initial mastery of computing skills. At least in terms of anxiety outcome variables, there was no evidence of the benefits of the cooperative intervention compared to the direct instruction group for the initially high anxious students. The initial part of the content delivery in both instructional approaches was, of course, a transmission approach, and anxious case study students from the direct instruction group reported in their interviews that they appreciated the step-by-step instruction they received. What they didn’t find helpful was the waiting and feeling “silly” asking for help each time they didn’t know what
to do. It is reasonable to assume that the anxiety that was dissipated was a function of the high level of instructional support provided by the structure (cf. Clark, 1982).

Advocates of cooperative learning, on the other hand, emphasise the motivational value of using cooperative goal structures (Slavin, 1990) where a social reward system evolves during learning, compared with competitive or individualistic goal structures in which academic reward systems apply (Kagan, 1994). Furthermore, researchers studying self-regulated learning emphasise the importance of gaining a sense of self-efficacy through perceived control over one's learning. In this context, it has been shown that a high sense of control precedes a high self-concept of one's competence (Krampen, 1991). In relation to gaining computing skills, the results of Study 2 show that metacognitive training in the use of higher-order questioning within a cooperative classroom structure increases both student sense of control and enhances computing self-concept.

**Important Considerations Regarding Outcomes of the ATI Studies**

It is difficult to evaluate the extent to which university assessment requirements for tests of computing skills may have diluted the impact of the intervention in the present research, in that this ran counter to the goal orientation fostered in thirteen weeks of tutorials based on cooperative, socially interactive learning (cf. Ames, 1992) While both groups performed equally well on the practical computing skills tests, the nature of the exam procedure requiring students to demonstrate a range of computing skills on a series of tasks delivered by the computer and assessed immediately by the instructor in the presence of the other students may have been less appropriate for students in the cooperative self-regulated group than for those receiving direct instruction. The latter group may have been better prepared for an individualised competitive mode of graded performance in a context of social comparison due to the learning style that was fostered in their tutorials.

Certainly in terms of anxiety, it is hard to know the extent to which the posttest measures on the CALM instrument may have reflected student concern about the practical computing test that was imminent (the following week), rather than the various dimensions of computer anxiety. The assessment practices that the students underwent in both ATI studies rewarded individual achievement in competitive rather than cooperative goal structures. This may have limited the effectiveness of the intervention. As McCombs and Marzano (1990, p. 66) point out, "... the environment cannot reinforce metacognitive and cognitive skills by threatening self-beliefs and evaluations. This speaks against the use of grades or tests to norm students - to evaluate them in a comparative manner. In effect, norm-referenced
testing and normative grading practices impact metacognitive and cognitive skill development for students who characteristically do poorly on tests and grades." In other words, there is the possibility that those who already suffered from test or evaluation anxiety may not have benefitted from the metacognitive strategy training as much as predicted in such an evaluative climate.

As for positive cognitions, on the other hand, the interpretation of the findings is less problematic. Students who received the strengthened intervention increased their self-concept of ability in computing. Similarly, those who did not have a sense of control or mastery over computing at the start of the computing course certainly gained it after they received the intervention but not if they received the transmission approach to instruction. In terms of Bandura's self-efficacy theory, "self-concept largely reflects people's beliefs in their personal efficacy" (1997, p11). "To build a sense of controlling efficacy, people must develop skills for regulating their own motivation and behaviour. They must learn how to monitor the behaviour they seek to change, set short-range attainable subclass to motivate and direct their efforts, and enlist positive incentives and social supports to sustain the effort needed to succeed" (1997, p. 286). Many of these elements were provided through the metacognitive strategy instruction intervention.

In terms of achievement goal theory, this gain in positive self-referent cognitions could be explained as a function of the perceived mastery goal orientation that characterised the cooperative self-regulated groupwork in which the focus was on the effort to learn and the value of learning computing skills (cf. Ames, 1992; Blumenfeld, 1992). According to Ames (1992), such a mastery orientation is a necessary mediator for self-regulated learning to occur and fosters positive achievement activity. While mastery goals were also emphasised in the direct instruction classrooms, a performance goal orientation dominated: the outcomes of poor performance were more salient than for the cooperative groups as they reflected individual lack of ability and/or effort in an evaluative context, namely that of the teacher as "expert" and other more competent peers. After all, everyone could see what was on your screen when you were proceeding in a "lock-step" manner through a series of steps in a computer application - mistakes are visible to all, even from across the room. Most important is the students' perceptions of which goal orientation predominates in the classroom, even when both mastery and performance goals exist in the same setting (Blumenfeld, 1992). The case study interviews clearly demonstrated that for those in the cooperative learning group, mastery was the focus and mistakes were accepted as part of the learning, or laughing, as was often the case!
What are the Implications for Computer Training?

Previous research has demonstrated that there is a clear causal relationship between anxiety motivated by fear of failure in performance-related situations (such as computing), attributions of low ability, perceptions of low self-efficacy and lack of belief in one’s competence to master the situation (Bandura, 1977b, 1988, 1993; Hodapp, 1989). If computer instructors want to reduce such initial student anxiety and negative cognitions so that students can concentrate on the business of learning computing skills effectively, the findings from the present two studies strongly suggest that they should provide content-specific metacognitive strategy instruction through modeling, coaching and practice, in conjunction with computing skills instruction. In addition, in terms of achievement gains and increasing perceptions of control and computing self-efficacy, such instruction should be within a socially and emotionally supportive (cooperative) classroom where the emphasis is on mastery rather than on performance.

Some would argue that students undertaking basic computer skills courses should be grouped according to prior experience or other indicators of ability, with course content, pace and class interactions being tailored to each group (Lee, Pliskin & Kahn, 1994). While this strategy might reduce factors which contribute to performance anxiety in computing such as emphasis on one correct answer, time pressure, and public (on-screen) humiliation, it is not feasible to organise such groupings within the typical university setting (Keeler and Anson, 1995).

More practically, the use of cooperative structures can provide a learning environment conducive both to fostering the construction of knowledge from the shared experiences of peers with different expertise, and to enhancing positive cognitions about computing. While this approach places the learner in a more “threatening” intellectual position because their reliance on the instructor (who knows all) is transferred to themselves and to the group, one could speculate that it nevertheless engenders a sense of control and self-efficacy, that is, feeling good about oneself, as a function of both the socially supportive classroom setting and the acquisition of self-monitoring learning strategies which engender a sense of autonomy. Those students who receive traditional instruction (teacher-directed) are far less self-reliant and more dependent on the instructor for help with problems. In terms of instructor time and availability, it is clearly better economics to design basic computer skills courses using cooperative team structures. In terms of effective learning, teaching students to self-regulate and monitor their learning of computing skills through the strategies of self-and reciprocal peer-questioning, clearly has multiple benefits. In this context, the instructor reported that those initially high anxious students in the intervention from both studies who enrolled in computer
programming a year later were the "natural leaders" when it came to problem-solving tasks in groups, developing strategies and formulating questions that might shape the analysis of the problem, while the others sat quietly, bereft of ideas and waiting to be told what to do.

Conclusion

The existence of aptitude-treatment-interactions in both studies reported in this and the previous chapter would suggest that those involved in the design of computer training programs for undergraduate students should take the inexperienced, high anxious student who lacks perceptions of self-efficacy and self-concept of ability in computing into better consideration when planning their instructional approach. While it must be acknowledged that the samples in the two ATI studies were relatively small and that the findings from these studies cannot be generalised to the wider population, it is clear, nonetheless, that the findings from the redesigned study did replicate many of those from the first, and in some cases, were significantly stronger. Such robust results from aptitude-treatment-interaction research would imply that the findings have potentially powerful implications for instructional approaches in introductory computing.

Overall, the present research has shown that students receiving metacognitive training in a cooperative learning environment achieve as well as or better than those taught by a transmission approach. It is not entirely clear, however, why in the second study, the high anxious students in the intervention remained anxious relative to the comparison group with regard to various aspects of gaining initial computing skills (handling equipment, receiving feedback on one's skills and being evaluated on one's competence), except that where prior knowledge and skills are low, as with novices, instructional support from an expert may be preferable to constructivist learning environments where there is more complexity and lack of structure (Jonassen, 1992).

The finding of anxiety remaining high for students with initially high levels in the cooperative learning group can best be interpreted in the light of the qualitative data gathered from case studies and the instructor. It is not surprising that those who were anxious about receiving feedback on their computing competence expressed such anxiety in the face of an impending practical computing skills test. Both the high and low anxious students interviewed from the intervention group reported their concerns about the skills test. After having experienced cooperative groupwork for the course of their training, it is possible that they were more unfamiliar with and
concerned about an evaluative “public” and individual performance of their expertise than students used to individualised computer interaction. As Morris and Fulmer’s (1976) study showed, levels of worry remain stable or increase from pre- to post-exam periods until feedback on correctness of responses is received, after which it decreases. Although it was anticipated that such anxiety would be dissipated by a socially supportive learning context in which one's computing difficulties were shared openly with a group, this clearly did not eventuate for these adult learners in an evaluative university environment.

Why was it that initially high anxious students in the direct instruction group expressed less of this type of anxiety than the intervention group? Evidence from the instructor's diary indicated how dependent many students in this group were on her for individual (private) help to the extent that some were afraid to execute a command by pressing the “enter” key until they received her approval: “Some students needed constant help from me and I seemed to be all over the room. Joseph, Marcela and John appeared a bit lost and kept putting their hand up for me to assist them.” Not having experienced failure or the need for problem solving when things “go wrong” may well serve to protect the initially anxious computer user from concerns about external evaluation and embarrassment. It may also inhibit the development of a sense of self-efficacy as was shown in both studies for those in the direct instruction groups, and self-concept in relation to computing as was the case in the second study.

Further research using focus group and case study interviews with students of both high and low levels of prior experience, anxiety and negative and positive cognitions is warranted in order to shed more light on questions that remain to be explored: The relationship between positive cognitions, anxiety and achievement for adult learners undertaking computer skills training, and the extent to which anxiety in this context is facilitating rather than debilitating.

In conclusion, results from the multimethod research techniques used in the present studies provide support for the educational value of including cooperative self-regulatory components into traditional methods of teaching computing skills to those adult learners who lack confidence and perceptions of control in computing situations, or who fear public embarrassment while learning. Learning outcomes in terms of both personal (self-concept and self-efficacy) and achievement gains are strongly predicted with such an instructional approach. It would seem that providing instruction in thinking about one’s cognitive activities as well as specific higher-order cognitive skills for learners in a computer training context enhances their level of performance both directly and by raising beliefs of personal efficacy (cf. Bandura, 1997).
For the anxious learner, or for those who need reassurance in the form of step-by-step instruction from an expert in the initial stages of gaining computing skills, the findings from this research suggest that traditional teacher-led instruction has clear benefits. On the other hand, when such individual help is not immediately available, or when the student is insecure about admitting lack of understanding and feels powerless or dependent on the instructor for help, perceptions of self-reliance and self-efficacy will suffer from such an instructional approach.
CHAPTER EIGHT

Effects of Metacognitive Strategy Training Within a Cooperative Group Learning Context on Computer Achievement, Anxiety and Cognitions Revisited: An Aptitude-Treatment-Interaction Study

It will be remembered that the aptitude-treatment-interaction study presented in the first part of the previous chapter (Chapter Seven Part A) produced some unexpected findings, namely, no significant overall group differences in achievement, anxiety or cognitions and few aptitude-treatment-interaction effects. Additional insights were gained from the qualitative analyses of the data gathered from participants and instructor in the second part of this study (discussed in Chapter Seven Part B) which was designed to explore both the ways in which individual students gained computer competency within the two instructional approaches and the processes underlying their implementation. As a consequence of both investigations, questions about the complexities of the interactions between anxiety, negative and positive cognitions and achievement were raised as well as concerns about the fidelity of implementation of the intervention. It was considered important, therefore, to conduct a second study. This was to involve the same instructor teaching the same computer training course as previously but with two new groups of students, and an intervention that was redesigned in significant ways.

In effect, Study 2 was designed to replicate Study 1 but to strengthen it, primarily in terms of the metacognitive training component of the cooperative intervention. Because the description of the measures, most of the procedures, and the analyses are the same as in Study 1, the reader is referred to the earlier description of the methods. Here I focus on differences between the methods of the two studies.

Method

The intervention adopted in Study 1 was redesigned to address the following three methodological concerns: a) The need for earlier and more extensive training

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1 The research reported in this chapter and the first part of the previous chapter (i.e., ATI studies 1 and 2) are currently in press. McInerney, V., McInerney, D. M., & Marsh, H. W. (1997). Effects of Metacognitive Strategy Training Within a Cooperative Group Learning Context on Computer Achievement and Anxiety: An Aptitude-Treatment-Interaction Study. *Journal of Educational Psychology, 89*, x-xx.
in the use of higher-order self-questioning than had occurred in the experimental treatment, and regular practice by students in its use throughout the course, thereby strengthening the metacognitive strategy training component of the cooperative intervention. This was seen to be the most important aspect of the redesigned intervention; (b) Possible instructor response effects, that is, the general tendency for the instructor to offer direct help rather than fostering independent or collaborative learning, according to the treatment group; and (c) The occurrence of spontaneous collaboration and helping behaviours in both groups, with the consequent effect of diluting the contrast between the direct instruction group (not receiving structured groupwork) and the cooperative self-regulated group.

The manner in which these concerns were addressed in Study 2 was as follows: First, the major difference between the two studies was that the metacognitive training (the individual and cooperative use of generic question stems) was given much more emphasis in Study 2 than in Study 1, by introducing it at the start of the course rather than towards the end, as in Study 1. It was felt that the weak treatment effect in Study 1 in terms of achievement gains may have been attributable to this aspect. The cooperative self-regulated group was also to record personal reflections on their learning using four self-regulatory questions related to difficulties they experienced in the computing class. These were to be shared with members of their cooperative group in the following week (see Table 8.1). The repeated practice in making weekly tutorial reflections using structured questions was expected to develop self-regulation by helping students monitor their learning and thereby foster perceptions of mastery over computing skills which were reinforced by the cooperative group problem-solving in class time.

Second, there was a more rigorous control for instructor involvement. In particular, the instructor was advised not to circulate through the groups offering help (as had been reported by case study students in both groups in Study 1), but rather, to provide individual help only when students specifically requested it in the direct instruction group, and to encourage group problem solving before calling on her for help, in the cooperative group (refer to Appendix C4 for details of the procedure to be adopted by the instructor).

Finally, as for spontaneous helping behaviours in the direct instruction group (which occurred frequently enough to be mentioned in the case study interviews on a number of occasions), these were to be minimised by instructor reminders to students to work quietly on their own unless they actually needed her assistance.
Table 8.1
Metacognitive Strategy Training Procedure

1. Copies of generic question stems adapted from the work of King (1991a & b, 1992, 1993, 1994) were distributed to all students at the start of their first tutorial (see Table 7A.1 in Chapter Seven Part A for question stems).

2. The purpose of these question stems was explained in terms of their use in facilitating problem solving, and in helping students to clarify their understanding and take responsibility for some of their own learning.

3. Examples of how these questions might be written were provided by the instructor, that is, modeling of question completion in relation to computing content. The instructor proceeded to pose specific content-related questions using some of the question stems several times throughout a tutorial each week.

4. Explanations of how these questions were to be used were given to students in this way:
   - students should write one question using a prompt from the generic question stems at the end of each tutorial, and write an answer to it as well;
   - these questions and answers should then be shared by students with the members of their small groups, that is, to be read out and discussed;
   - in addition, one other question should be selected and completed for "homework" in the Reflection section of the students' class folders.
   - At the end of the tutorial, in the last 10-15 minutes or so, the overhead transparency on which the four self-regulatory questions were written was projected and explained in the following way:
     - the questions are to be copied into the Reflection section of the students’ class folders;
     - the questions are designed as part of a problem solving strategy to assist students in focusing on what they are, and are not, learning at particular times, and in planning a course of action with regard to any difficulties;
     - at the start of each week’s tutorial, students will share their answers to the self-regulatory questions with members of their small group first, then in discussion with the rest of the class.

The self-regulatory (metacognitive) questions were:
   a) "What did I learn this week in my computing class?" (monitoring)
   b) "With what did I have difficulty this week?" (monitoring)
   c) "What types of things can I do to deal with this difficulty?" (problem solving/planning)
d) "What specific action(s) am I going to take this week to solve any difficulties?" (planning)

These should form the basis of a review of content preceding each week’s tutorial input by the instructor.

Participants

Details of participants are the same as for Study 1, except that the groups differed slightly in gender mix: Intervention group N = 15 (8 males, 7 females) and comparison group N = 15 (6 males and 9 females). The average age of the students was 22 years.

Analyses

The rationale and procedure for conducting the analyses in Study 2 were identical to those adopted in Study 1.

Results

Preliminary two-group t-tests were conducted to evaluate the equivalence of the two groups at pretest. There were statistically significant group differences (p < .05, two-tailed) on the prior competency self-rating scales, with the direct instruction group having significantly higher-order scores on three of the four self-rated competencies (DOS, wordprocessing, and spreadsheet applications, but not databases). However, there were no statistically significant group differences on any of the pretest anxiety scales or positive cognition scales. Whereas there were some group differences in self-rated competency at the start of the study, these differences were controlled as part of the multiple regression approach to analysis of covariance (i.e., self-rated pretest competency was used as a covariate in the analyses).

In Study 2 (see Tables 8.2 and 8.3) there were four significant main effects (shown as “Group”) and seven significant interaction effects at posttest. These effects are summarised in terms of three major categories of outcome variables: anxiety, positive cognitions, and achievement test scores.

Anxiety Outcomes

There were significant ATI effects for five of the six anxiety scales, Learning, Competence, Equipment, Feedback, and Skills, all relating to aspects of learning and demonstrating computing skills (see Tables 8.2 and 8.3). In three of these interactions (Learning, Feedback and Skills), students in the direct instruction group who were initially most anxious (i.e., with pretest mean scores of “4” and “5”)
experienced significantly decreased levels of anxiety (p < .05) at posttest compared to high anxious students in the cooperative intervention group (see Table 8.3). In contrast, initially low anxious students in the direct instruction group (i.e., with a pretest mean score of “1”) experienced greater levels of anxiety at posttest than low anxious students in the cooperative group. There were significant mean differences on the Learning, Competence, Feedback and Skills scales (see Table 8.3). Hence, at least in terms of anxiety, high anxious students tended to be more advantaged by direct instruction whereas low anxious students tended to be more advantaged by the cooperative intervention. There was, however, no significant main or interaction effect for the Fear scale (see Table 8.2).

Positive Cognitions

Students in the cooperative group had significantly higher Computing Self-Concept at posttest than students in the direct instruction group, and this difference did not interact with pretest self-concept (see Table 8.2). There was a significant ATI for Sense of Control (see Tables 8.2 and 8.3) such that students with initially low levels of Sense of Control were marginally (.05 < p < .10) advantaged by being in the cooperative group, whereas students with initially high levels of positive cognitions did not differ significantly between the two groups.

Achievement Outcomes

Students in the cooperative group had significantly higher achievement outcomes for the two folio assignments and for the research report, but not for the practical computing test (see Table 8.2). For the second folio assignment, there was an ATI. In follow-up analyses the largest differences occurred for cooperative group students with initially low self-ratings of computer competency (i.e., for pretest mean scores of “1” and “2”). There were no statistically significant ATIs for any of the other achievement outcomes.

Qualitative Evidence of Self-Regulation and Motivation

From the qualitative evidence reported anecdotal by the instructor in a follow-up interview at the end of the course, it appears that the effects of the improved intervention substantially influenced the ability of students to ask higher-order questions of themselves and their group. She commented that questions generated by students during the computing skills review prior to the Practical Test were qualitatively different from the first study in which only some students (those who she found out later were acting as case-studies) were able to generate higher-order questions, while the others created mostly factual recall questions such as:
• “How would you move a file from A:\ to your A:\ WordPerfect subdirectory?”;
• “What are the steps in adding footnotes to your document?”;
• “Show surname, numbers and start data for those whose monthly salary is greater than $500.”

In the first study, it seems likely that the self-monitoring and self-evaluation of learning fostered through the regular interviews, as well as the keeping of a reflective logbook by the case-study students, supported the development of higher-order questioning. In the second study, on the other hand, in which all students in the intervention were required to keep a reflective folder and to regularly engage in peer- and self-questioning, the generation of deeper level questions was evidenced by the majority of students in the cooperative, self-regulated group during the exam review. Examples of such questions included:

• “Which is the best way to move back through sub-directories?”;
• “What is the main idea of using REVEAL CODES in WordPerfect?”;
• “The company has decided to deduct $50 from the salary of employees on leave. Display records for employees on leave whose reduced salary is more than $500”;
• “Why is the plus sign important when using a formula in a Lotus spreadsheet?”

One concern, however, that the instructor raised in her evaluation of the research merits attention in the context of the implementation of the intervention. This relates to the fidelity with which students in the second intervention actually recorded their self-questions and answers in their Reflective Folder. As she indicates in the excerpt from her interview below, there was no way to enforce or check that they did so. In terms of fostering self-regulation, this part of the intervention could only be encouraged verbally by the instructor and monitored superficially - the onus was on the students themselves to carry it out.

Reflections does not seem to attract a lot of writing. I'm not sure whether they do not know what to write or think the topic is easy. Looking back on the semester, this cooperative learning group is a more serious and quiet group than last year. The introduction of the students presenting questions that they had written at home in their Reflective Folders was not a complete success and may need a different
approach. Often only one question per group per week was forthcoming. Each week I would ask extra questions to fill in for those not asking a question. They had quite a bit of exposure to what type of question and how to formulate questions, but for some reason were unable (or unwilling?) to actually ask questions. The only reason I could put forward is the lack of time, as the content material is extensive and maybe the students are suffering from information overload. There is no way to overcome this, if this is the reason. Reflections: I don't think they often wrote anything meaningful - maybe they should hand in something to the tutor.

As discussed in earlier chapters (see Chapter One and Chapter Seven Part A), student motivation was expected to increase as a function of increased control over their learning for those receiving the cooperative intervention. One significant consequence of low perceived self-efficacy and low sense of control is reduced intrinsic motivation. Once they had mastered the computing "basics" required for graduation, student motivation to continue with computing studies was expected to be evident in their enrolment in a subsequent, more advanced computing course. As with Study One, a higher proportion of the cooperative self-regulated group, namely fourteen out of fifteen (93%), were reported by the instructor as having enrolled in the follow up semester-long computer course. This was compared with ten out of the fifteen students (67%) in the direct instruction group. While tests of significance were not conducted on these, it would appear that there was a noticeably higher proportion of the cooperative self-regulated group motivated to continue with computing. This is even more noteworthy considering their significantly lower level of initial computer competence relative to the direct instruction group.
Table 8.2

Summary of Beta Weights from Multiple Regression Analyses in Study 2

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Note.
Prior = self-rating of prior computer competency, a general covariate used in all analyses. Pretest = specific pretest corresponding to the outcome measure. Group (1 = direct instruction comparison group, 2 = cooperative intervention group). Interaction = aptitude-treatment-interaction (Group x Pretest) p = p-value (two-tailed). All betas are unstandardized. However, because all outcome and predictor variables were standardized (M = 0, SD = 1) prior to analysis, they are like standardized coefficients (see Aiken & West, 1991 for discussion of this strategy).
Table 8.3
Summary of Group Differences (Coop Intervention and Direct Instruction Comparison) and Significance Levels (p-values) at Different Levels of Pretest Variables for those Outcomes with ATI Effects in Study 2

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**Study 2**

**Anxiety Ratings**

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**Achievement**

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**Note.**

Group differences for posttest outcomes were evaluated at different levels along the pretest continuum that varied from a minimum of 1.0 to a maximum of 5.0 (i.e., scale scores were based on ratings from a 5-point response scale). Positive group differences mean that the cooperative intervention group scored higher (i.e., higher levels of anxiety for anxiety ratings and higher levels of positive cognitions for positive cognition ratings), whereas negative group differences mean that the direct instruction group scored higher. Multiple regression tests of statistical significance (Aiken & West, 1991, pp. 132-133) were conducted at each pretest level and are summarised by two-tailed p-values. For all other variables, the ATIs involve pre- and posttests on the same variable, whereas the pretest for this analysis is a pretest self-rating of prior competency (on a one-to-five response scale). The posttest outcome variable has M = 10.75 and SD = 1.98.
Discussion

With the metacognitive component in the intervention strengthened in Study 2, achievement on three of the four measured criteria was affected positively by the intervention. As for positive cognitions, the finding in Study 1 that cooperative, self-regulated training advantaged those with initially low sense of control was not only replicated, but data also showed a significantly improved computing self-concept for those initially lacking confidence and proficiency with computers. In all, such students gained a sense of personal autonomy over learning through training in strategies for monitoring and regulating their own understanding of skills and concepts.

On the other hand, for those with feelings of embarrassment about making mistakes in public (as in Study 1), or those with initially high levels of anxiety in relation to learning computing skills and being evaluated on one’s competence (as in Studies 1 and 2), receiving direct instruction in a step-by-step transmission mode from a perceived “expert”, namely, the computing instructor, reduced anxiety. This can be understood in terms of the low level of prior experience that these anxious students reported. For such individuals, placing them in a situation where they need to rely on others (in a group) who have perceived limited expertise to help them understand basic computing skills would not be expected to reduce their self-reported anxiety about learning. Despite this, their achievement was not impeded in Study 1, and was clearly enhanced in Study 2.

In the anxiety research literature (Naveh-Benjamin, McKeachie, & Lin, 1987; Tobias, 1986; Wigfield & Eccles, 1989) there are suggestions that a direct instruction teaching strategy should be more effective than cooperative learning in reducing anxiety for highly anxious students. These include step-by-step instruction and the opportunity for guided and independent practice. In both Studies 1 and 2, there is support for these expectations in that initially high anxious students from the direct instruction groups were less anxious at posttest than high anxious students from the cooperative group, especially in relation to gaining initial mastery of computing skills. At least in terms of anxiety outcome variables, there was no evidence of the benefits of the cooperative intervention compared to the direct instruction group for the initially high anxious students. The initial part of the content delivery in both instructional approaches was, of course, a transmission approach, and anxious case study students from the direct instruction group reported in their interviews that they appreciated the step-by-step instruction they received. What they didn’t find helpful was the waiting and feeling “silly” asking for help each time they didn’t know what
to do. It is reasonable to assume that the anxiety that was dissipated was a function of the high level of instructional support provided by the structure (cf. Clark, 1982).

Advocates of cooperative learning, on the other hand, emphasise the motivational value of using cooperative goal structures (Slavin, 1990) where a social reward system evolves during learning, compared with competitive or individualistic goal structures in which academic reward systems apply (Kagan, 1994). Furthermore, researchers studying self-regulated learning emphasise the importance of gaining a sense of self-efficacy through perceived control over one's learning. In this context, it has been shown that a high sense of control precedes a high self-concept of one's competence (Krampen, 1991). In relation to gaining computing skills, the results of Study 2 show that metacognitive training in the use of higher-order questioning within a cooperative classroom structure increases both student sense of control and enhances computing self-concept.

**Important Considerations Regarding Outcomes of the ATI Studies**

It is difficult to evaluate the extent to which university assessment requirements for tests of computing skills may have diluted the impact of the intervention in the present research, in that this ran counter to the goal orientation fostered in thirteen weeks of tutorials based on cooperative, socially interactive learning (cf. Ames, 1992). While both groups performed equally well on the practical computing skills tests, the nature of the exam procedure requiring students to demonstrate a range of computing skills on a series of tasks delivered by the computer and assessed immediately by the instructor in the presence of the other students may have been less appropriate for students in the cooperative self-regulated group than for those receiving direct instruction. The latter group may have been better prepared for an individualised competitive mode of graded performance in a context of social comparison due to the learning style that was fostered in their tutorials.

Certainly in terms of anxiety, it is hard to know the extent to which the posttest measures on the CALM instrument may have reflected student concern about the practical computing test that was imminent (the following week), rather than the various dimensions of computer anxiety. The assessment practices that the students underwent in both ATI studies rewarded individual achievement in competitive rather than cooperative goal structures. This may have limited the effectiveness of the intervention. As McCombs and Marzano (1990, p. 66) point out, "... the environment cannot reinforce metacognitive and cognitive skills by threatening self-beliefs and evaluations. This speaks against the use of grades or tests to norm students - to evaluate them in a comparative manner. In effect, norm-referenced
testing and normative grading practices impact metacognitive and cognitive skill development for students who characteristically do poorly on tests and grades." In other words, there is the possibility that those who already suffered from test or evaluation anxiety may not have benefitted from the metacognitive strategy training as much as predicted in such an evaluative climate.

As for positive cognitions, on the other hand, the interpretation of the findings is less problematic. Students who received the strengthened intervention increased their self-concept of ability in computing. Similarly, those who did not have a sense of control or mastery over computing at the start of the computing course certainly gained it after they received the intervention but not if they received the transmission approach to instruction. In terms of Bandura’s self-efficacy theory, “self-concept largely reflects people’s beliefs in their personal efficacy” (1997, p11). “To build a sense of controlling efficacy, people must develop skills for regulating their own motivation and behaviour. They must learn how to monitor the behaviour they seek to change, set short-range attainable subclass to motivate and direct their efforts, and enlist positive incentives and social supports to sustain the effort needed to succeed” (1997, p. 286). Many of these elements were provided through the metacognitive strategy instruction intervention.

In terms of achievement goal theory, this gain in positive self-referent cognitions could be explained as a function of the perceived mastery goal orientation that characterised the cooperative self-regulated groupwork in which the focus was on the effort to learn and the value of learning computing skills (cf. Ames, 1992; Blumenfeld, 1992). According to Ames (1992), such a mastery orientation is a necessary mediator for self-regulated learning to occur and fosters positive achievement activity. While mastery goals were also emphasised in the direct instruction classrooms, a performance goal orientation dominated: the outcomes of poor performance were more salient than for the cooperative groups as they reflected individual lack of ability and/or effort in an evaluative context, namely that of the teacher as “expert” and other more competent peers. After all, everyone could see what was on your screen when you were proceeding in a “lock-step” manner through a series of steps in a computer application - mistakes are visible to all, even from across the room. Most important is the students’ perceptions of which goal orientation predominates in the classroom, even when both mastery and performance goals exist in the same setting (Blumenfeld, 1992). The case study interviews clearly demonstrated that for those in the cooperative learning group, mastery was the focus and mistakes were accepted as part of the learning, or laughing, as was often the case!
What are the Implications for Computer Training?

Previous research has demonstrated that there is a clear causal relationship between anxiety motivated by fear of failure in performance-related situations (such as computing), attributions of low ability, perceptions of low self-efficacy and lack of belief in one's competence to master the situation (Bandura, 1977b, 1988, 1993; Hodapp, 1989). If computer instructors want to reduce such initial student anxiety and negative cognitions so that students can concentrate on the business of learning computing skills effectively, the findings from the present two studies strongly suggest that they should provide content-specific metacognitive strategy instruction through modeling, coaching and practice, in conjunction with computing skills instruction. In addition, in terms of achievement gains and increasing perceptions of control and computing self-efficacy, such instruction should be within a socially and emotionally supportive (cooperative) classroom where the emphasis is on mastery rather than on performance.

Some would argue that students undertaking basic computer skills courses should be grouped according to prior experience or other indicators of ability, with course content, pace and class interactions being tailored to each group (Lee, Pliskin & Kahn, 1994). While this strategy might reduce factors which contribute to performance anxiety in computing such as emphasis on one correct answer, time pressure, and public (on-screen) humiliation, it is not feasible to organise such groupings within the typical university setting (Keeler and Anson, 1995).

More practically, the use of cooperative structures can provide a learning environment conducive both to fostering the construction of knowledge from the shared experiences of peers with different expertise, and to enhancing positive cognitions about computing. While this approach places the learner in a more "threatening" intellectual position because their reliance on the instructor (who knows all) is transferred to themselves and to the group, one could speculate that it nevertheless engenders a sense of control and self-efficacy, that is, feeling good about oneself, as a function of both the socially supportive classroom setting and the acquisition of self-monitoring learning strategies which engender a sense of autonomy. Those students who receive traditional instruction (teacher-directed) are far less self-reliant and more dependent on the instructor for help with problems. In terms of instructor time and availability, it is clearly better economics to design basic computer skills courses using cooperative team structures. In terms of effective learning, teaching students to self-regulate and monitor their learning of computing skills through the strategies of self-and reciprocal peer-questioning, clearly has multiple benefits. In this context, the instructor reported that those initially high anxious students in the intervention from both studies who enrolled in computer
programming a year later were the "natural leaders" when it came to problem-solving tasks in groups, developing strategies and formulating questions that might shape the analysis of the problem, while the others sat quietly, bereft of ideas and waiting to be told what to do.

Conclusion

The existence of aptitude-treatment-interactions in both studies reported in this and the previous chapter would suggest that those involved in the design of computer training programs for undergraduate students should take the inexperienced, high anxious student who lacks perceptions of self-efficacy and self-concept of ability in computing into better consideration when planning their instructional approach. While it must be acknowledged that the samples in the two ATI studies were relatively small and that the findings from these studies cannot be generalised to the wider population, it is clear, nonetheless, that the findings from the redesigned study did replicate many of those from the first, and in some cases, were significantly stronger. Such robust results from aptitude-treatment-interaction research would imply that the findings have potentially powerful implications for instructional approaches in introductory computing.

Overall, the present research has shown that students receiving metacognitive training in a cooperative learning environment achieve as well as or better than those taught by a transmission approach. It is not entirely clear, however, why in the second study, the high anxious students in the intervention remained anxious relative to the comparison group with regard to various aspects of gaining initial computing skills (handling equipment, receiving feedback on one's skills and being evaluated on one's competence), except that where prior knowledge and skills are low, as with novices, instructional support from an expert may be preferable to constructivist learning environments where there is more complexity and lack of structure (Jonassen, 1992).

The finding of anxiety remaining high for students with initially high levels in the cooperative learning group can best be interpreted in the light of the qualitative data gathered from case studies and the instructor. It is not surprising that those who were anxious about receiving feedback on their computing competence expressed such anxiety in the face of an impending practical computing skills test. Both the high and low anxious students interviewed from the intervention group reported their concerns about the skills test. After having experienced cooperative groupwork for the course of their training, it is possible that they were more unfamiliar with and
concerned about an evaluative "public" and individual performance of their expertise than students used to individualised computer interaction. As Morris and Fulmer's (1976) study showed, levels of worry remain stable or increase from pre- to post-exam periods until feedback on correctness of responses is received, after which it decreases. Although it was anticipated that such anxiety would be dissipated by a socially supportive learning context in which one's computing difficulties were shared openly with a group, this clearly did not eventuate for these adult learners in an evaluative university environment.

Why was it that initially high anxious students in the direct instruction group expressed less of this type of anxiety than the intervention group? Evidence from the instructor's diary indicated how dependent many students in this group were on her for individual (private) help to the extent that some were afraid to execute a command by pressing the "enter" key until they received her approval: "Some students needed constant help from me and I seemed to be all over the room. Joseph, Marcela and John appeared a bit lost and kept putting their hand up for me to assist them." Not having experienced failure or the need for problem solving when things "go wrong" may well serve to protect the initially anxious computer user from concerns about external evaluation and embarrassment. It may also inhibit the development of a sense of self-efficacy as was shown in both studies for those in the direct instruction groups, and self-concept in relation to computing as was the case in the second study.

Further research using focus group and case study interviews with students of both high and low levels of prior experience, anxiety and negative and positive cognitions is warranted in order to shed more light on questions that remain to be explored: The relationship between positive cognitions, anxiety and achievement for adult learners undertaking computer skills training, and the extent to which anxiety in this context is facilitating rather than debilitating.

In conclusion, results from the multimethod research techniques used in the present studies provide support for the educational value of including cooperative self-regulatory components into traditional methods of teaching computing skills to those adult learners who lack confidence and perceptions of control in computing situations, or who fear public embarrassment while learning. Learning outcomes in terms of both personal (self-concept and self-efficacy) and achievement gains are strongly predicted with such an instructional approach. It would seem that providing instruction in thinking about one's cognitive activities as well as specific higher-order cognitive skills for learners in a computer training context enhances their level of performance both directly and by raising beliefs of personal efficacy (cf. Bandura, 1997).
For the anxious learner, or for those who need reassurance in the form of step-by-step instruction from an expert in the initial stages of gaining computing skills, the findings from this research suggest that traditional teacher-led instruction has clear benefits. On the other hand, when such individual help is not immediately available, or when the student is insecure about admitting lack of understanding and feels powerless or dependent on the instructor for help, perceptions of self-reliance and self-efficacy will suffer from such an instructional approach.
CHAPTER NINE

Summary and Conclusions

Over the past decade there has been an increasing number of studies that have examined the effects of computer training on computer anxiety or negative computer attitudes, as they have been broadly defined, only to produce conflicting findings. Given that the relationship between "attitude" and behaviour has been shown to be neither linear nor straightforward (Ajzen & Fishbein, 1977; Collis, 1985; Kay, 1992), the aim of the author was to try to unravel some of the complexities underlying these constructs in a computer setting with the view to contributing to the knowledge base from which a robust theory might emerge.

These are early days in the development of a theory of how adult learners undertaking computer training actually learn best. The factors that help them learn or that cause them to experience anxiety, those that raise their perceptions of control and mastery in such a learning situation as well as those that influence their self-concept of computing ability have been key foci of this Dissertation. In addition, the design of a reliable measure for assessing all of these variables has been central to the research.

Certainly many questions have been raised by the investigations undertaken for this Doctoral Dissertation. Many of these have been explored as they have occurred in particular studies. Others remain to be considered in the context of a final overview of the research. The purpose of this chapter is to discuss the strengths and weaknesses of the investigations undertaken and in doing so, to address some of these remaining questions. Implications for educational provisions in computer training settings and for future research directions are also presented.

Summary of Research

The following represents an overview of the key components of the research conducted for this Dissertation, each of which was derived from that preceding it.

- An exploratory descriptive (pilot) study was conducted with one group undertaking training in a specific computer-related task using a traditional transmission approach. Anxiety and cognitions were measured using an existing
computer anxiety instrument. Questions that were explored: What is the nature and extent of anxiety and negative cognitions with regard to computers in the sample group? What are the correlates of these constructs? Does the training approach make a difference to the anxiety, and cognitions of students? Does the nature of the computer-related task make a difference? Does it matter whether the computing skills are evaluated and graded? Is the computer anxiety instrument adequate? This pilot study demonstrated the need for a reliable measure of computer anxiety and indicated potential interactions between anxiety and training approaches.

• A measure of anxiety and cognitions relating to learning to use computers - the Computer Anxiety and Learning Measure (CALM) - was designed on the basis of a substantial review of the theoretical literature and existing measures of computer attitudes and anxiety. Question that was explored: Does this instrument have validity and reliability as measured by exploratory and confirmatory factor analyses? Are the constructs invariant across different groups of undergraduate students?

• A series of descriptive investigations into the existence of anxiety and cognitions relating to learning to use computers (using the Computer Anxiety and Learning Measure) in four university faculties explored a range of possible correlates. Questions that were explored: What is the nature and extent of anxiety and negative cognitions with regard to computers in this sample? Are there similarities or differences in these constructs across different faculties? What are the correlates of these constructs? Are there similarities and differences in these correlates across the different faculties?

• Comparisons of the training approaches used by different faculties were made. Questions that were explored: What are factors underlying computer anxiety for students from the perspective of their instructors? Do faculties differ in their approaches to computer training? What are the advantages and disadvantages of the various approaches in terms of the theoretical literature relating to effective learning and anxiety management, especially in relation to structured and unstructured teaching approaches?

• An aptitude-treatment-interaction study was designed with two groups from one of the faculties investigated in the previous study in which a traditional approach to teaching was used. Two alternative approaches to instruction were examined:
direct instruction and direct instruction plus metacognitive strategy training in self-questioning within a cooperative learning context. Questions that were explored: Does instructional approach interact with initial levels of computer anxiety and negative cognitions? How do student anxiety, cognitions and achievement vary after these treatments? Does the intervention reduce anxiety and negative cognitions and enhance achievement?

- Simultaneously with the aptitude-treatment-interaction study, qualitative investigations were conducted with high and low anxious students receiving both instructional approaches as well as with the instructor. Questions that were explored: Can in-depth, contextual, longitudinal and developmental approaches to data gathering add to the understanding of the behaviour of the participants in the study? Can the difference in the effects of the two instructional approaches be better understood if the perspective of the instructor is taken into account?

- A second aptitude-treatment-interaction study with two new groups of students from the same faculty and using the same instructor was designed and implemented. The metacognitive training intervention was redesigned and methodologically strengthened as a function of the findings of the previous study and the qualitative data. Questions that were explored: Does instructional approach interact with initial levels of computer anxiety and negative cognitions? How do student anxiety, cognitions and achievement vary after these treatments? Does the intervention reduce anxiety and negative cognitions and enhance achievement? Did the strengthened intervention improve the performance of students with negative cognitions and anxiety with regard to learning about computing? Did the strengthened intervention give more confidence in the ATI findings?

**Findings**

- Different facets of computer anxiety were identified by using an existing instrument that conceptualised computer anxiety as a multidimensional construct: Learning about Computers Anxiety, Computer Equipment Anxiety, Computer Message Anxiety, and Observing Computers Anxiety. After computer training it appeared that teacher trainees became less anxious than those in a comparison group on two scales: Computer Message Anxiety and Observing Computers Anxiety. Significant interactions occurred between the other anxiety scales and self-ranked computer competence. Prior computer experience, ownership of
personal computer, and gender were found to be significant correlates of computer anxiety. From the results of the pilot study it appeared that anxiety as measured by an existing computer anxiety instrument can be reduced for some individuals through a transmission approach to training, but that for others it remains high. It appeared likely that the nature of the instructional approach taken in the training course and its evaluative components might be significant factors in alleviating or exacerbating computer anxiety.

- The Computer Anxiety and Learning Measure (CALM) was designed as a multidimensional instrument comprising eleven factors subsumed into four scales: Gaining Initial Computing Skills; Sense of Control; Computing Self-Concept; and State Anxiety in Computing Situations. Goodness-of-fit indices indicated that the model provided a very good fit to the data. Factorial analyses of invariance showed that the model was generalisable across different groups.

- Over half of the four-faculty sample expressed moderately high to very high anxiety in the areas of demonstrating computer competence, learning about basic computer functions, and receiving feedback on computer skills, with slightly less than half expressing moderate to very high anxiety about handling computer equipment. Negative cognitions were expressed in relation to perceptions of control and computing self-efficacy by almost a quarter of the 794 students surveyed. On the State Anxiety in Computing Situations scale the numbers of students who showed high anxiety was relatively low. Investigations of faculty-differences showed that prior computer experience, ownership of personal computer, and hours spent learning to use a computer varied significantly by gender and faculty major, and that these interacted with levels of anxiety and cognitions as measured by the CALM instrument.

- Qualitative analysis of interview data from four faculty computing coordinators provided evidence of distinctly different approaches to computer training for undergraduates beginning their university studies. These varied from relatively unstructured cooperative groupwork in which students were to learn to use educational software for teaching purposes through to didactic approaches to learning about a range of application and business software. Evaluation of student performance similarly varied from a group presentation of a collaborative project within one faculty to a series of graded assignments, quizzes or exams which were individual and competitive in the others. It was clear that irrespective of faculty, many students experienced a considerable degree of anxiety and negative
cognitions while learning computing skills, and that this was a function of a complex set of factors: lack of prior experience (mature-aged learners and females seemed to be most affected); poor keyboarding skills; pressure of time for students to practise skills; lack of instructor expertise and confidence; lack of sufficient individual support for students in large classes.

- In the quasi-experimental aptitude-treatment-interaction study there were a number of significant interaction effects. Students with initially low positive cognitions were advantaged by being in the cooperative group, while those with high levels of positive cognitions were advantaged by being in the direct instruction group. There were no significant differences on achievement scores between the group receiving the direct instruction approach and that receiving the cooperative learning intervention. Anxiety about receiving feedback on skills and fear of making mistakes in public were not reduced for initially high anxious students in the intervention group but were for the direct instruction group.

- Qualitative analyses of in-depth case study interview and logbook data revealed that there was some discrepancy between the intended intervention and the instructor-mediated intervention. It was also clear that categorising students as having anxiety and negative or positive cognitions on the basis of the CALM survey data was supported to a considerable extent by the interview data and instructor diary. However, the use of the CALM as the sole means of understanding these constructs was not justified. The qualitative data highlighted how the manifestation of these constructs varied according to previous positive and negative experiences with technology; specific task difficulty and technical difficulties experienced during the course; student personality (for example, trait anxiety; a predisposition to test anxiety; preference for individual, collaborative or teacher-directed learning); and the stage of learning particular skills. It also indicated that the development of spontaneous cooperation among students in the direct instruction group and self-regulatory strategies in the case studies in both groups may have potentially diluted the effect of the intervention.

- There were a large number of significant ATI effects in the second aptitude-treatment-interaction study in which the intervention was strengthened. For those with initially low positive cognitions, the intervention increased their sense of control relative to those in the comparison group and reduced their fear of making mistakes in public. A main effect for computing self-concept was found with students receiving the cooperative intervention having higher levels of positive
cognitions on this construct than those in the direct instruction group. Students with high anxiety on most factors of the Gaining Initial Computing Skills scale maintained relatively high levels of anxiety in the cooperative group, while those with low anxiety were advantaged. There were significant differences between the two groups on most achievement scores, with the group receiving the intervention outperforming the comparison group. The two groups achieved equally well on the practical computing skills test.

Qualitative Data Helps to Clarify the Context of Computer Training

For the research conducted towards this Dissertation to have contextual validity, it was important to understand the computer training programs in operation within the four faculties of the University. This was best done through relatively unstructured interviews with those responsible for designing and administering these courses. The data collected from these interviews provided a rich and detailed source of information about the teaching and learning of computing skills in each of the faculties as well as perceptions about the causes and remedies of computer anxiety. Such data helped the author identify differences and similarities in approaches to teaching computing, and to formulate hypotheses as to the possible links between instructional method, computer anxiety and achievement. Without these insights, the aptitude-treatment-interaction studies would not have been as carefully designed.

Strengths of the ATI Research

Notwithstanding the limitations of any research that is exploratory and based on relatively small sample sizes, I would maintain that through the two ATI studies I have shown that significant metacognitive strategy training effects can be measured and replicated (considerably strengthened) - a most unusual occurrence in the ATI literature (Rettinger, Waters, & Poplin, 1989; Smith & Sechrest, 1991; Speece, 1990; Tobias, 1989a; Violato, 1988).

The random assignment of whole groups to treatments for whom the instructor was constant strengthened the test of the intervention. As Pressley and Harris (1994) point out, every instructor will construct an intervention differently as will every student interpret it differently. Ensuring that the instructor was the same in both studies had the potential advantage of controlling for variations of implementation. While there was no way of controlling for different student
interpretations, the replication of the first study with two new groups from the same population provided a way of statistically minimising any differences.

**Qualitative Techniques Strengthen the ATI Research**

One of the strengths of the research undertaken was the incorporation of qualitative data. By exploring the nature of the intervention and comparison treatments from both the perspectives of the instructor and selected students in each group, insights were gained into the ongoing cognitive, motivational and affective processes of the participants who represented the sample for whom the intervention was targeted.

The qualitative data that were collected in the first ATI study provided an important opportunity to take cognisance of the range of student and instructor experiences within the two treatments and to modify the research design for the second study so that the contrast between the treatments was strengthened. An important feature of the qualitative research design was the careful selection of the case study students. In the first tutorial, two pairs of high anxious and two pairs of low anxious students from each group were chosen at random from those whose mean scores on the CALM surveys placed them at the extremes (low and high) of the anxiety and negative cognitions scales. These case studies were to act as comparisons and to protect the research from bias by deliberate sample selection. While only having four in each treatment might appear a small number, in reality, this represented 25% of the sample in each group and could be seen as one of the strengths of the design.

Another strength was that the tape-recording, transcription and summarising of the interview data were conducted rigorously by the trained interviewer who was "blind" to the purpose of the ATI study and to which categories the students belonged in order to avoid my biases as much as possible. At the second stage, however, I personally listened to all the tape-recordings myself in the week that they were recorded to ensure that the coding and interpretation of the transcribed data which I systematically undertook were based on true versions. In this process I gained important insights into the emerging personal stories of how each student experienced learning about computing at university.

An important methodological design concern arose from the use the qualitative techniques themselves. It became apparent that case study students in both treatments began to develop self-regulatory behaviours progressively through practice in responding to interview questions relating to monitoring and self-management of difficulties, as well as by recording reflections regarding their learning experiences in a logbook using a semi-structured question format that
focussed their responses on self-regulatory cognitions. In the second ATI study, lack of resources prevented the collection of longitudinal interview and logbook data from case studies so that this methodological confound was eliminated. However, because the evidence was strongly suggestive that the case studies received additional training in self-regulation and higher-order self-questioning over and above the students in the cooperative group, the second study ensured that the revised and strengthened metacognitive training strategy was implemented in the first week of the course and was regularly practised and monitored throughout the semester. It is of interest here to quote the final logbook entry of one of the “anxious” case studies (Melissa):

In conclusion, I did enjoy doing this diary/journal as it gave me a record to see if I was improving week to week and see my attitudes towards computers as a whole changing!

While the theoretical base underlying the quasi-experimental research in this Dissertation related to alleviating anxiety and increasing positive cognitions and achievement in computing situations was tested by quantitative means, the qualitative data provided evidence to modify the theory to some extent and construct an alternate theory. This related to the reporting of anxiety and negative cognitions in the data for those whose pretest surveys showed low anxiety levels and whose computer competence was high. For these individuals, many of them “eager adopters” of technology (Rosen & Weil, 1995c) as borne out by the interview data, it was shown that the training environment can actually increase their anxiety and lower their achievement if it is a traditional transmission approach rather than a cooperative learning environment in which they receive metacognitive strategy training in self-regulation and self-questioning. Furthermore, these individuals who are stereotypically “loners” in the computer training setting vary considerably in their learning behaviour depending on the teaching approach used and their response to training in self-questioning and cooperative groupwork. The data also pointed out that anxiety is not a static phenomenon that comes or goes away after a treatment, nor that confidence and self-efficacy perceptions depend on anxiety. These are important data for theory building. To better understand them is a matter for future qualitative investigation.

Instructor-mediated interventions which effectively enhance positive cognitions and achievement in naturalistic computer training settings have significant applied educational value and external validity in terms of research design. One could say with conviction, therefore, that the strengthened intervention utilised in the second ATI study, which was derived from both theory and research, has been shown to be a potentially powerful one.
Strengths of the Computer Anxiety and Learning Measure (CALM)

One clear finding that has emerged from this Dissertation is that computer anxiety is a multidimensional construct of some complexity which includes situation-specific anxieties concerning aspects of learning about and being evaluated on computing; cognitions relating to self-perceptions of control, confidence, and computing ability; fear of making mistakes and of being embarrassed; as well as aspects of emotionality, worry, physiological symptoms and distractability. The multidimensional CALM measure allows the investigator to assess which aspects of anxiety are most salient for a particular individual or group. With such a profile, the type of training that might be most appropriate is more easily determined.

Construct Validity of CALM Scales

The reliability and validity of the Computer Anxiety and Learning Measure was tested in a number of the studies reported in this Dissertation, namely, in the descriptive study of the student population in the four faculties, and in the ATI studies. The evidence that the instrument measured the constructs that it was designed to came from a number of sources. The first was the qualitative data in which molecular analyses of the CALM surveys from the case studies were found to converge with longitudinal in-depth interview data. The second came from the administration of the CALM in the two ATI studies in which the patterns of students identified as high and low anxious correlated with those who reported high and low competency on the Computer Competency Checklist (Lawson & McInerney, 1994). Such support for predicted group differences also provides evidence of convergent validity (Pedhazur & Schmelkin, 1991; Marsh, 1995).

As mentioned in earlier chapters, the ATI findings were also to be used as indicators of the construct validity of either the two factor or the one factor plus method effect (artefactor) models of the Sense of Control and Computing Self-Concept scales. For Sense of Control, the evidence for a two factor model was clear. Both Positive Sense of Control and Fear (Negative Sense of Control) distinguished between the groups. This is not surprising given that earlier CFAs (Chapter Four) showed the existence of two distinct factors. Such a finding strengthens the argument for the discriminant validity of the two factor model.

For the Computing Self-Concept scale, on the other hand, there was no strong evidence for the existence of two separate positive and negative factors, as also shown by earlier CFAs. In fact, the significant main effect for Computing Self-Concept in the second ATI study, (as defined by the model in which only positively-worded items loaded on a single substantive factor with negative items loading on a
"method artefactor" rather than a separate negative factor), once again supports the
discriminant validity of the positive factor. Both ATI studies, therefore, provided
evidence for the existence of separate positive and negative factors in the Sense of
Control scale, and only one (positive item) factor in the Computing Self-Concept
scale.

As for the other factors, it seems that the State Anxiety in Computing
Situations scale did not discriminate between high and low anxious individuals
sufficiently in the ATI studies. It is for future research to determine if it has any
predictive validity over and above the other scales. The convergent and divergent
validity of the CALM relative to other measures have also yet to be demonstrated.

Implications for Educational Provision in Computer Training
Settings

The results from the research conducted for this Dissertation suggest a
number of important implications for educational provision in computer training
settings. The first of these is the value of using a reliable instrument to measure
initial student levels of computer anxiety and computer-related cognitions before
they undertake a computer training course. As shown by the aptitude-treatment-
interaction studies, such a measure should reflect the multidimensionality of these
constructs, as does the CALM, in order to maximise the match between teaching
approach and individual student needs (where this is practicable). If nothing else,
computer instructors who take care to assess student anxiety and cognitions at the
start of a course will be more aware of, and be able to more sensitively respond to
student concerns about gaining initial computing skills, thereby maximising their
achievement.

The second implication for improving educational practice relates to the
evidence of relationships between both student ownership of personal computer and
levels of prior computing experience, and their anxiety and negative cognitions while
learning computing: those who do not own a computer, have not done a previous
formal course in computing, or perceive themselves as “beginners”, experience high
levels of anxiety and poor perceptions of control and self-concept in computing
contexts which are detrimental to their learning. It would seem desirable, therefore,
to explore the possibilities of designing non-threatening “bridging courses” for such
students in preparation for the compulsory coursework that they are to undertake
where their performance is assessed and graded competitively. In such courses,
beginners could gain familiarity with the specific technology that they would meet
later in their coursework but in an exploratory way without pressures of time and external evaluation.

Females enrolled in the four faculties studied in the present research were found to have less prior experience with computers and less ownership of their own computers than males to differing extents depending on faculty major. As these variables interacted with levels of anxiety and negative cognitions in computer-related studies, it would seem important for educators to be aware that some students will be advantaged over others both within and across different faculties when students are required to complete compulsory computer training courses or to demonstrate specific computer competencies for graduation.

In this context of the relationship between student prior experience with computers and their confidence and self-efficacy, there would also seem to be merit in advising students on enrolment in university studies that ownership of their own computer would be advantageous. Given the rapidity with which technological changes are made, it would be worth establishing an inexpensive lease/or purchase with buy-back system for students enrolling in computer courses.

A third implication of significance to the educator emerged from the findings of the two aptitude-treatment-interaction studies which clearly showed that for novices expressing initial negative cognitions about their ability to learn computing skills, training in the metacognitive strategies of self-regulation and self-questioning was highly beneficial. This training should be provided within a supportive and cooperative learning environment where collaborative answering of higher order questions is modelled by the instructor and practised by the students within structured small groups.

As for those students with initially high negative cognitions (such as "I'm afraid I'll wreck the machine"), that is, those who have a sense of fear, the instructor's adoption of direct instructional techniques would be advantageous. Specifically, step-by-step instruction and readily available individual expert help (which could also take the form of peer-tutoring as long as the attitude of the tutor was not patronising) should be provided to maximise learning and minimise anxiety caused by feelings of helplessness and memory overload. Once student computing proficiency and self-perceptions of mastery and self-concept increase, however, or where they are already in place, such teacher-led instruction should give way to training in self-regulation of learning (through peer- and self-questioning) within a cooperative context. The evidence from the ATI studies was clear: the achievement of ALL students undertaking a semester-long computer training course, irrespective of their initial proficiency, anxiety or cognitions, will certainly be equivalent, and most likely be advantaged by such an instructional approach.
A final implication for educational practice that is derived from the research in this Dissertation pertains to the evaluation of students' competence in their computing studies. The issue of the negative consequences of external (rather than self-) evaluation of skills mastery is not a new concern in educational settings. Especially where such evaluation is in a public forum in which different levels of ability will be evident (such as in a computer laboratory), it is an extremely important one, however, as it has ramifications for anxiety and perceptions of self-efficacy and self-concept, as well as consequences for achievement. To be evaluated on one's apparent proficiency in the use of computer technology is a requirement of most computer training courses at university. Whether this needs to be done competitively is a question that educators should seriously consider. The qualitative data gathered in this research indicated that students who experience difficulties with equipment or new applications while learning computing skills in an evaluative and competitive environment feel intimidated by both their instructors and other students who have more expertise because they fear being embarrassed at making mistakes in public. This is particularly the case in large classes and where the instructor is perceived as a computer expert who is "looking over their shoulder, watching what they were doing". It would seem educationally more desirable that evaluative measures should not detract from learning and its enjoyment: guided self-evaluation, structured collaborative projects monitored by the instructor, and training in self- and peer-questioning could serve as effective evaluative techniques that would minimise anxiety and help foster self-efficacy perceptions and confidence.

Recommendations for University Computer Training Programs

The nature of four different university computer training programs was elaborated earlier in Chapter Six. Suggestions for modifications to these programs can be made on the basis of the findings from the ATI research. In particular, it is evident that a teaching approach that incorporates structured guidance (step-by-step presentation followed by guided practice and expert help from instructor or peers trained in cooperative skills, as required) reduces the anxiety and improves the performance of novices who are initially highly anxious. Those programs in which direct instruction is provided such as in the faculties of Business/Technology and Arts/Social Sciences will suit such learners in the initial acquisition of computing skills. This is not the case for those who have low anxiety to start with - these learners in such programs will be disadvantaged in terms of their anxiety (which will probably rise). For such low anxious students, it is preferable to adopt an instructional approach that is less structured in its presentation of content but that fosters self-regulation through training in metacognitive skills of self-questioning.
within a cooperative learning context. The relatively unstructured computer training program adopted by the Faculty of Education in which students work collaboratively in learning and in satisfying assessment requirements would benefit such initially low anxious students if the intervention strategy were also incorporated.

In terms of enhancing positive cognitions of computer-related control, self-efficacy and self-concept in the expectation that these will lead to improved learning and performance, none of the faculty computing programs provides the type of cognitive and metacognitive training in self-regulation that was clearly beneficial for all students in the second ATI study. It would be strongly recommended that all programs introduce the intervention at the start of the course.

Limitations of the Research

Gender Differences

Gender differences were identified in the pilot study and the descriptive study of student differences. While there is a possibility of gender difference interacting with treatment in the ATI studies, the relatively small sample did not permit the exploration of any effects in a meaningful way. Nor did the qualitative data suggest that the experiences of anxiety or negative and positive cognitions varied with gender, but rather, that individual differences were more a function of personality, extent of formal and informal computer interactions, and previous positive and negative experiences in using computers. Furthermore, any practical value of identifying gender differences was limited in the real-world of computer training courses: gender segregated courses were unlikely in a university context. Nevertheless, further investigation of gender differences may prove beneficial in the design of courses, and the use of longitudinal qualitative techniques to explore such questions would be recommended.

Fidelity of Implementation

The monitoring of the instructor-mediated intervention in the first ATI study was done directly through the instructor’s tutorial diary in which details of implementation and the operation of each tutorial were recorded, and indirectly through student interviews. The instructor explained that she was unwilling to keep a diary in the second study as it was too time consuming to do so. She did, however, meet with the researcher periodically during the course to report on how the intervention was progressing and any difficulties that she and the students in both groups were experiencing. At the end of the course, she met again with the
researcher for an extensive debriefing session and provided her perceptions of the outcomes of the research.

The strength of the intervention in the second ATI study may have been partly due to the fact that the instructor was more familiar with administering it after her experience with the first study. While this does not detract from the positive findings, (in fact it adds support to the educational value of the research as it shows that with extra practice an instructor can significantly improve the delivery of a complex strategy), it does confound the extent to which the redesign of the intervention was the sole contributing factor. While there were clear advantages in having the same instructor in the two studies, therefore, there is, nonetheless, a limitation in the generalisability of the findings as a consequence.

One concern about implementation relates to the fidelity with which students in the second intervention actually kept the Reflective Folder. Other than through the encouragement of the instructor, there was no way to stringently enforce that students recorded their self-questions and answers in this folder. There was no way of checking. It was only the informal verbal reports of the instructor that enabled this part of the intervention to be monitored. Future research might build in peer monitoring of these weekly reflections.

**Qualitative Research**

While the research was clearly strengthened by the inclusion of the qualitative data, there were a number of possible limitations in the design used. The first was that the semi-structured nature of the interview sessions in the first ATI study may have restricted discussion of other areas of relevance from the perspective of the students. Additionally, the bias of the questions to reflect a priori theory may have been a limitation. On both of these counts, the advantages seemed to outweigh the disadvantages: the questions were sufficiently general to allow individual elaboration, and the danger of extreme subjectivity was avoided. As one of the aims of the qualitative research was to look for patterns of responses in relation to particular aspects of learning computing skills within each of the treatments, the questions used in the interviews were designed to direct responses into specific areas of interest.

**Theoretical Issues Relating to Anxiety and Cognition**

The discussion of the complex relationship between anxiety, cognition and learning has a history that harks back to the work of Yerkes and Dodson (1908) who proposed that heightened arousal could enhance the learning of simple responses but
adversely affect that of complex tasks (see Chapter One). The specific question of cognitions as a cause or consequence of anxiety (i.e., does a thought precede a feeling or vice versa?) has been debated in the anxiety literature for almost two decades (Edelmann, 1992). This question is of particular relevance to the present research. The assumption underlying the metacognitive strategy training intervention was that student cognitions regarding their self-efficacy and self-concept would be enhanced as a function of self-regulation over their learning of new computing skills (a cognitive-behaviourally based treatment). These cognitions were predicted to reduce anxiety in the learning situation and to improve performance. This perspective follows the theories put forward by Lazarus (1982, 1984) and Scherer (Leventhal & Scherer, 1987; Scherer, 1984, 1992) who maintain that whether anxiety reactions occur depends on how events are cognitively appraised: “If available coping resources are perceived as inadequate, or an event is appraised as threatening or potentially harmful, then negative emotions may result” (Edelmann, 1992, p.12). An alternative perspective which challenges such a linear causal model of anxiety is that of Zajonc (1980, 1984) who believes that thoughts are not necessarily the cause of anxiety: affect can be separate from and independent of conscious cognition. In this view, anxiety reactions can be produced without the individual being consciously aware of their source and involve some degree of preconscious or pre-attentive cognitive processing in which bias in processing information related to personal threat occurs (Brewin, 1988). Following from this proposition, therefore, cognitive-based treatments alone for anxiety that is debilitating may not be as effective as those which include behavioural elements (Edelmann, 1992).

One of the most important findings from the ATI research in this Doctoral Dissertation was that when prior competence in using computers is controlled, students’ initial aptitudes - multidimensional aspects of computer anxiety and positive and negative cognitions - interact significantly with teaching method. Those who received the metacognitive strategy training within cooperative groups scored significantly better on achievement tests, and gave evidence of enhanced perceptions of control and mastery, as well as self-concept of ability in computing situations than did those who received a transmission approach to instruction. Some aspects of computing anxiety were still reported at the end of the computer training course by those who had been initially highly anxious and had received the metacognitive intervention, despite an apparent rise in their positive cognitive self-appraisals. The paradox is that even with such anxiety, the performance of these students was significantly better than that of students who did not receive such metacognitive training or who had low anxiety to begin with. It could be argued from such findings that the anxiety experienced by these students did not interfere with learning and
might have even contributed to it in the way that Yerkes and Dodson (1908) described. Given that Bloom and Hautaluoma (1990) found that, even after computer anxiety (worry) is significantly lowered this does not translate into improved performance, such findings appear important. Certainly, it would seem that Zajonc’s argument that emotion and cognition can function as independent subsytems has support from this ATI research.

The research of Deffenbacher (Deffenbacher, 1978, 1986; Deffenbacher & Hazaleus, 1985) has demonstrated how worrisome cognitions (generated in response to fear-producing stimuli) have the greatest detrimental effect on performance. It would seem that for the initially anxious students in the second ATI study, the reduction of fear as a function of the intervention might have been the key factor in reducing generalised negative thoughts about mastery and control in computing situations, and in facilitating performance. The anxiety that was reported by these individuals at the end of the computer training course related to specific aspects of learning and demonstrating computing skills, namely, learning about basic computer functions; demonstrating competence with computers; handling computer equipment; and receiving feedback on one’s computing skills from classmates and instructor. As the content of the items in these anxiety factors relate almost exclusively to computing performance demand (see Appendix A2), it is highly likely that they have a great deal in common with test anxiety. Most recently, Williams (1996) has shown that students who perceive themselves as more capable of self-regulated learning have higher domain-specific academic performance, and that the association is unaffected by amount of test anxiety. It will be remembered that increased efficacy for self-regulated learning was expected to be gained through the metacognitive strategy training intervention. Such efficacy perceptions would seem to have been gained by those who most needed to benefit from them - the initially highly anxious learner with little computing expertise.

**Directions for Future Research**

Undoubtedly the complex ways in which different dimensions of computer anxiety interact with performance and cognitions as described above is an area for future researchers to explore, especially with a view to the practical applications of findings in computer training settings.

Although much work has already been done in this regard through the confirmatory factor analyses reported in Chapter Four, the multidimensionality of the Computer Anxiety and Learning Measure (CALM) could be further investigated in
relation to the specificity of its scales in this context. Clark (1988) points out the
care needed in the measurement of anxious cognitions and the extent to which the
subjective meaning placed on negative self-statements by an individual relates to
changes in affect: some people make negative self-statements but do not become
anxious because their belief in these statements is not great - a numbers of factors
interact here, namely, the degree of such belief, emotional intensity, and sense of
controllability. The converse would also seem to follow logically: expressions of
anxiety may not necessarily preclude positive self-statements as was shown in both
the ATI studies and the qualitative case study participant interviews.

It was noteworthy that, unlike the anxious students in the first study, those
receiving the enhanced metacognitive intervention in the second study did not
express fear of making mistakes in public or of damaging the computer. In all, on
the basis of the findings, it could be concluded that whatever "anxiety" students in
the intervention reported at the end of the course, this was not debilitating in terms of
performance. In fact, one could argue that it was quite the contrary; that the anxiety
was actually facilitating, as discussed earlier. To draw strong conclusions, however,
it would be necessary to replicate the present study with a larger sample and a
modification of student assessment procedures to determine if student self-efficacy
and achievement in the cooperative self-regulatory group would be even further
enhanced, and anxiety further reduced.

In trying to unravel the complexities of the role of anxiety in computer-
related performance, it is useful to consider the work of Williams (1992) and
Bandura (1993). Bandura cites numerous studies which show that individuals "base
their actions in threatening situations on their coping efficacy (perceived efficacy to
exercise control over a threat) rather than on anxiety arousal" (1993, pp. 133). Put
simply, it is perceived efficacy that predicts behaviour, not anxiety. Similarly, there
is strong evidence that anxiety does not predict avoidant behaviour if the individual
expresses self-perceptions of control (Williams, 1992). This is in keeping with the
ATI findings from both studies in relation to anxious individuals in the cooperative
learning treatment retaining some anxiety, yet gaining in positive cognitions. It is
also in keeping with the qualitative evidence from the instructor's diary that students
in the direct instruction group who dropped out before the first assessment task rather
than risk failure in the course had no sense of control in the computing situation.

*Alex is particularly lost and I need to assist him regularly - he presses
combinations of keys unknowingly and gets into parts of the program that
are not being covered - he appears stressed but doesn't say anything in
class. In class, I usually need to stop and assist him each time I pass him
- he doesn't always signal for help or ask other students.*
In other words, it seems logical to argue that even though anxiety in an evaluative computing situation is experienced, if the individual believes that they can control the situation (after all, they have received training in self-monitoring, planning and problem-solving), then their motivation to perform and their information processing ability will not suffer (Schwarzer, 1996). A likely series of cognitions in this scenario would be as follows: “Yes, I admit to being concerned about demonstrating my computing competence in public, but I know I can do this. The anticipation that I have is not distracting my thoughts.” This is in keeping with the research on cognitive-behavioural and self-efficacy training discussed in Chapter One. Qualitative techniques would allow future researchers to further investigate the interplay between evaluation anxiety in computing and the development of self-efficacy and self-concept of computing ability.

Although it would have been desirable to assess the long-term transfer of the metacognitive strategy training to another computer learning situation, this was not possible in the ATI research which was limited to a one-semester course. Future research should also look at possible ways of testing for the retention of computing skills without the possible contamination of exam anxiety on performance. Certainly, it would be seem to be desirable to test for anxiety and cognitions related to learning computing at a point further removed from the necessity to publicly demonstrate such skills. On the other hand, perhaps in the world of rapidly advancing technological changes the two will remain interconnected. In any case, within the present research, follow-up was not possible as the practical computing skills test was held in the final tutorial of the course.

Methodological Directions

Qualitative data. The findings from the two ATI studies have demonstrated the need for future research to examine qualitative data collected longitudinally and developmentally in order to further investigate the interplay between anxiety and the cognitive processes involved in perceptions of control and ability in computing situations, especially where these extend over a period of time. The data from the case study sample in the first ATI study clearly demonstrated what Zeidner (1995, p. 125) has to say about coping strategies: “coping is a process embedded in context and responses, therefore, may not only vary across contexts, but also may change over time in response to external conditions and as a function of the skill with which it is applied.” Such complexities will not be easily understood through experimental or descriptive quantitative research alone.
Fidelity of Implementation. Future research needs to incorporate strategies which allow for effective evaluation of the authenticity and quality/integrity of instructor-mediated intervention. One such strategy would be to schedule regular meetings with the instructor throughout the computer training course to discuss implementation techniques and any difficulties experienced, and to provide guidance and support. Another would be to have an observer monitor the implementation of both treatments on random occasions. A third possibility would be to videotape classes periodically where this could be done unobtrusively so as not to contribute to the anxiety of students or the instructor, or alternately, create a "halo effect" unless both treatments were taped on the same occasions.

One way for future research to address the issue of potential selectivity of responses obtained through semi-structured interviews would be to conduct focus group interviews prior to, during (early and late in the course), and at the completion of the course. Another way would be to have all students keep a logbook throughout the course. Unfortunately, this tool may be contaminated if students feel that there is no incentive to record their thoughts and feelings, if they see the logbook as an assessment item, or if its purpose is not made clear.

Finally, future research could consider the replication of the intervention used in the second ATI study within a different learning context where external, normative evaluation is not a potentially compounding factor - a setting such as an inservice training program for teachers or nurses, or those in a business training environment. This way both the CALM instrument and the intervention could be validated, and the generalizability of the intervention with multiple instructors could be tested.

In conclusion, the research encompassed in this Doctoral Dissertation is strongly suggestive that effective instructor-mediated computer training interventions for students assessed as high in anxiety and low in positive cognitions with regard to learning computing skills can be designed and implemented. Furthermore, an additional contribution of the research has been the design of a theoretically and statistically sound measurement instrument whose multidimensional structure can be relied upon to identify those individuals whose negative affect and cognitions are impediments to motivation and learning. Such advances on current knowledge could provide those responsible for the design and implementation of computer training programs for adult learners with effective tools for classroom practice.
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APPENDICES

APPENDIX A: DESIGN OF THE COMPUTER ANXIETY AND LEARNING MEASURE (CALM)

Appendix A1

Original Computer Anxiety and Learning Measure (CALM) Consisting Of 111 Items

LEARNING TO USE COMPUTERS SURVEY

SURVEY NUMBER ________________

The purpose of this questionnaire is to examine the range of beliefs and feelings students have towards computers and technology. The survey will take approximately thirty minutes to complete. In order to analyse the data we need a range of demographic information. Your confidentiality and anonymity will be preserved in any reports. Only those members of staff involved in the research program will have access to the data.

Thank you for your cooperation in completing this questionnaire.

NAME: ___________________________________________ ID: _____________

AGE: ________________ SEX: Male 1 Female 2 (circle)

LANGUAGE BACKGROUND: English 1 non English 2 (circle)

IF NON ENGLISH, WHICH LANGUAGE? ________________________________

TYPE OF SCHOOL ATTENDED (circle) :
Co-ed boys 1 Co-ed girls 2
Single-sex boys 3 Single sex girls 4
Government 1 Non-Government 2
TER score: ________________ HSC English mark: ________________
HSC Maths mark: ________________ HSC Science mark: ________________
Entry to University: TER 1 RET 2 OTHER 3 (circle)
Do you own a personal computer? YES 1 NO 2 (circle)
If you answered "yes" to the above question, what type of computer?

How is this computer mainly used?
Games 1  Wordprocessing 2  Spreadsheets 3  Many applications 4

If you answered "no" to the above question, would you purchase one in the next year if money was not a consideration?
YES 1  NO 2  (circle)

How would you rate your computer experience? (circle).
- Beginner (no experience or games only) 1
- Intermediate (familiar with one application only such as a word processor or spreadsheet) 2
- Advanced (familiar with a number of applications) 3

Using the following scale indicate how many times you have used computerised technology in the following ways?

<table>
<thead>
<tr>
<th>Never</th>
<th>Sometimes</th>
<th>Frequently</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

___ Used computers at high school
___ Played computer games
___ Used automated banking machines
___ Used CD ROM searches
___ Used computerised library card catalogue
___ Programmed a microwave oven
___ Programmed a VCR
___ Used computers in a job
___ Used a word processor (typing on a computer)
___ Loaded or run software
___ Used a computer printer

How many hours have you spent so far learning to use a computer? (circle)
Less than ten 1  Twenty to fifty 3
Ten to twenty 2  More than fifty 4
PART A

The items in this questionnaire refer to things and experiences related to computing that may cause anxiety or apprehension.

Please indicate the EXTENT to which each of the following propositions describes how anxious (nervous) you are at this point in your life.

<table>
<thead>
<tr>
<th>Not at all</th>
<th>A little</th>
<th>A fair amount</th>
<th>Much</th>
<th>Very much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

1. Taking a course in a computer language
2. Learning to use the computer in private
3. Taking a test on my computer competence
4. Working in a job that requires some computer experience
5. Working on an unfamiliar computer
6. Getting 'error' messages from the computer
7. Being unable to receive information because the computer is down
8. Learning to write a computer program
9. Erasing or deleting material from a computer file
10. Taking a class about the use of computers
11. Learning computer terminology
12. Reading a computer manual
13. Watching someone else work on a computer
14. Using computerised equipment
15. Learning how a computer works
16. Using a computerised library catalogue
17. Making a backup copy of a file
18. Working in a group at the computer
19. Working individually at the computer
20. Having the instructor/teacher watching while I use the computer
21. Teaching someone else about computers
22. Remembering the sequence of commands to carry out a procedure
23. Having someone watch me while I work on a computer
24. Learning the operating system of a computer
25. Learning a new computer application
26. Dealing with computer malfunctions
27. Dealing with "viruses" or "bugs" in the program
28. Printing off documents
29. Being evaluated on my computer competence
30. Using a "mouse"
31. Using a text interface rather than a graphics interface
32. Coming back to use a computer after an absence
33. Learning about computers without structured guidance
34. Being taught step by step correct computer procedure
35. Presenting work completed on a computer
36. Talking with people about computers
37. Being taught how to use a computer by a peer
38. Getting feedback from my teacher on my computer skills
39. Getting feedback from my peers on my computer skills
40. Collaborating with a friend while learning to use a computer
41. Getting feedback on my computer skills
**PART B**

Please indicate how often you have the following thoughts when you use a computer or think about using a computer.

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>A little</th>
<th>A fair amount</th>
<th>Much</th>
<th>Very much</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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<td>3</td>
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<tr>
<td>4</td>
<td></td>
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<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. I can master the computer
2. I am going to make a mistake
3. Everyone else but me knows what they are doing
4. I feel stupid about computing
5. People will notice if I make a mistake
6. I am totally confused
7. I know I can do it
8. I am willing to give it a try
9. I'm afraid I'll wreck the program
10. I can get help if I get stuck
11. I won't understand how to use it
12. What if I hit the wrong key
13. I'm too embarrassed to ask for help
14. Others have learned this and so can I
15. I feel overwhelmed by how much I don't know
16. I will be able to get the computer to do what I want
17. I might break the machine
18. I will understand what to do
19. I feel in control of what I do
20. I feel confident about my ability with computers
PART C

Using the following scale please indicate how much you agree or disagree with the following propositions

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Agree</th>
<th>Unsure</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

_1._ I am no good with computers
_2._ It wouldn't worry me to try a new problem on a computer
_3._ I am sure I can do work with computers
_4._ I am not the type to do well with computers
_5._ I think using a computer would be very hard for me
_6._ I am very confident when it comes to working with computers
_7._ I can get good grades in computer courses
_8._ I am sure that I could learn a computer language
_9._ I don't think I could handle a computer course
10._ I feel threatened when other people talk about computers
11._ I avoid using computers as much as possible
12._ I need an experienced computer user nearby when I use a computer
13._ I can make the computer do what I want
14._ I need help when I use the computer
15._ I am confident storing important information on a computer
16._ I am sure I could solve any problems I had while I was using a computer
17._ I can help others solve computer problems
18._ If something went wrong with the computer I don't feel that I could do anything about it
19._ I am sure that I can help others learn to use the computer
20._ I am not worried about having to solve computer problems without help
PART D

Using the following scale indicate how often you have the following feelings or symptoms when you use a computer or think about using a computer.

<table>
<thead>
<tr>
<th>Almost never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

_1_ Nervous stomach, "butterflies"
_2_ Hot and sweaty
_3_ Heart palpitations
_4_ Feelings of unease
_5_ Lack of concentration
_6_ Distractible
_7_ Tense
_8_ Calm
_9_ Self-confident
10 Worried about possible problems
11 Irritable
12 Dry mouth
13 Sweaty palms
14 Happy
15 Comfortable
16 Enthusiastic
17 In charge
18 Threatened
19 Secure
20 Insecure
21 Helpless
22 Regretful
23 Upset
24 Restful
25 Anxious
26 Relaxed
27 Worried
28 Rattled
29 At ease
30 Content
Appendix A2

Final Version of Computer Anxiety and Learning Measure
(After item deletion following confirmatory factor analyses. Items relating to each factor are shown with numbers as they were on the original scale of 111 items).

LEARNING TO USE COMPUTERS SURVEY

SURVEY NUMBER ______________

The purpose of this questionnaire is to examine the range of beliefs and feelings students have towards computers and technology. The survey will take approximately twenty minutes to complete.

In order to analyse the data we need a range of demographic information. Your confidentiality and anonymity will be preserved in any reports. Only those members of staff involved in the research program will have access to the data.

Thank you for your cooperation in completing this questionnaire.

NAME: ______________________________ ID: ______________

AGE: _______________ SEX: Male 1 Female 2 (circle)

LANGUAGE BACKGROUND: English 1 non English 2 (circle)

IF NON ENGLISH, WHICH LANGUAGE? ___________________________

TYPE OF HIGH SCHOOL ATTENDED: (If more than one, use multiple columns and specify years at each school) (circle).

<table>
<thead>
<tr>
<th>School 1 Yrs</th>
<th>School 2 Yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-ed</td>
<td>1</td>
</tr>
<tr>
<td>Single-sex boys</td>
<td>2</td>
</tr>
<tr>
<td>Single sex girls</td>
<td>3</td>
</tr>
<tr>
<td>Government</td>
<td>1</td>
</tr>
<tr>
<td>Non-Government</td>
<td>2</td>
</tr>
</tbody>
</table>
TER or Aggregate: ____________  HSC English mark: ______
HSC Maths mark: ____________  HSC Science mark: ______
Entry to University:  TER 1  RET 2  OTHER 3  (circle)
Do you own a personal computer? YES 1  NO 2  (circle)
If you answered "yes" to the above question, what type of computer?

How is this computer mainly used? (Circle more than one if necessary)
Games 1  Wordprocessing 2
Spreadsheets 3  Programming 4  Many applications 5

If you answered "no" to the above question, would you purchase one in the next year if money was not a consideration?
YES 1  NO 2  (circle)

How would you rate your computer experience? (circle).
- Beginner (no experience or games only) 1
- Intermediate (familiar with one application only such as a word processor or spreadsheet) 2
- Advanced (familiar with a number of applications) 3

Using the following scale indicate how many times you have used computerised technology in the following ways:

<table>
<thead>
<tr>
<th>Never</th>
<th>Sometimes</th>
<th>Frequently</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

___ Used computers at high school
___ Played computer games
___ Used automated banking machines
___ Used CD ROM searches
___ Used computerised library card catalogue
___ Programmed a microwave oven
___ Programmed a VCR
___ Used computers in a job
___ Used a word processor (typing on a computer)
___ Loaded or run software
___ Used a computer printer

How many hours have you spent so far learning to use a computer?

Less than ten  1  (circle)
Ten to twenty  2
Twenty to fifty  3
More than fifty  4

PART A: GAINING INITIAL COMPUTING SKILLS

The items in this questionnaire refer to things and experiences related to computing that may cause anxiety or apprehension.

Please indicate the EXTENT to which each of the following situations described below would make you anxious at this point in your life.

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>A little</th>
<th>A fair amount</th>
<th>Much</th>
<th>Very much</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

SCALE 1: COMPETENCE WITH COMPUTERS

_3__ Taking a test on my computer competence
_4__ Working in a job that requires some computer experience
_6__ Getting 'error' messages from the computer
_21_ Teaching someone else about computers
_26_ Dealing with computer malfunctions
_29_ Being evaluated on my computer competence
_33_ Learning about computers without structured guidance

SCALE 2: HANDLING COMPUTER EQUIPMENT

_14_ Using computerised equipment
_28_ Printing off documents
_30_ Using a "mouse"
_35_ Presenting work completed on a computer
SCALE 3: RECEIVING FEEDBACK ON COMPUTING SKILLS

_37_ Being taught how to use a computer by a peer
_38_ Getting feedback from my teacher on my computer skills
_39_ Getting feedback from my peers on my computer skills
_40_ Collaborating with a friend while learning to use a computer
_41_ Getting feedback on my computer skills

SCALE 4: LEARNING ABOUT BASIC COMPUTER FUNCTIONS

_1_ Taking a course in a computer language
_11_ Learning computer terminology
_12_ Reading a computer manual
_15_ Learning how a computer works
_24_ Learning the operating system of a computer
_25_ Learning a new computer application

PART B: SENSE OF CONTROL

Please indicate how often you have the following thoughts when you use a computer or think about using a computer.

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>A little</th>
<th>A fair amount</th>
<th>Much</th>
<th>Very much</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

SCALE 1: POSITIVE SENSE OF CONTROL

_1_ I can master the computer
_7_ I know I can do it
_16_ I will be able to get the computer to do what I want
_18_ I will understand what to do
_19_ I feel in control of what I do
_20_ I feel confident about my ability with computers
SCALE 2: FEAR

_3_ Everyone else but me knows what they are doing
_5_ People will notice if I make a mistake
_9_ I'm afraid I'll wreck the program
_12_ What if I hit the wrong key?
_13_ I'm too embarrassed to ask for help
_17_ I might break the machine

PART C: COMPUTING SELF CONCEPT

Using the following scale please indicate how much you agree or disagree with the following propositions

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Agree</th>
<th>Unsure</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

COMPUTING SELF CONCEPT (POSITIVE ITEMS)

_6_ I am very confident when it comes to working with computers
_7_ I can get good grades in computer courses
_15_ I am confident storing important information on a computer
_16_ I am sure I could solve any problems I had while I was using a computer
_17_ I can help others solve computer problems
_19_ I am sure that I can help others learn to use the computer

COMPUTING SELF CONCEPT (NEGATIVE ITEMS)

_1_ I am no good with computers
_4_ I am not the type to do well with computers
_5_ I think using a computer would be very hard for me
_9_ I don't think I could handle a computer course
_11_ I avoid using computers as much as possible
PART D: STATE ANXIETY IN COMPUTING SITUATIONS

Using the following scale indicate how often you have the following feelings or symptoms when you use a computer or think about using a computer.

<table>
<thead>
<tr>
<th>Almost never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

SCALE 1: WORRY
_4_ Feelings of unease
_10_ Worried about possible problems
_18_ Threatened
_20_ Insecure
_21_ Helpless
_27_ Worried
_28_ Rattled

SCALE 2: HAPPINESS
_14_ Happy
_15_ Comfortable
_19_ Secure
_26_ Relaxed
_29_ At ease
_30_ Content

SCALE 3: PHYSIOLOGICAL SYMPTOMS
_1_ Nervous stomach," butterflles"
_2_ Hot and sweaty
_3_ Heart palpitations
_12_ Dry mouth
_13_ Sweaty palms

SCALE 4: DISTRACTABILITY
_5_ Lack of concentration
_6_ Distractable
APPENDIX B: QUALITATIVE DATA COLLECTION

Appendix B1

Interviews with Computer Training Course Coordinators from Four Faculties: Education, Arts and Social Welfare, Health, and Business and Technology

*Phil Nanlohy (Faculty of Education)

* Val
Phil what was the purpose of the aliens project please?

* Phil
The aliens project was part of an introductory unit in the teacher education program. The unit was to do with maths and literacy - Foundation of the math and literacy so it was called. Now our purpose in introducing a computer component into this was three fold. Firstly there was a competency requirement from the University that are not introduced at that stage was coming up, secondly the general understanding that the use of technology such as computers is normal within everyday school life so we believe that we should be modelling this in the students right from the beginning and thirdly that it was believed that the validity to use, particularly a word processor would be useful for the students in their own writing during their time at the University. We were not trying simply to teach people how to use a word processor, however it was not skill training. The purpose of what we were doing was to integrate into a curriculum package a number of different computing type activities. Another reason for doing the aliens project was that we hope that the students would perceive it as something of use to them in their future role so that they could see that it wasn't just a bit of computing but it was classroom computing and it was classroom computing that was relevant to the particular course that they were studying.

* Val
Would you mind just briefly describing was the aliens project was aimed to do?

* Phil
Okay. The original aim of the project was that students in the teacher education course would be aliens and would respond to letters from students who would be seeking information about aliens that lived on a certain planet. The basic resource for all of this was a collection of computer files that are known as Space Station Alpha. These were written and designed by Greg Butler to be put into the public domain to enhance the sales potential of a particular product ie Microsoft Works, to make Microsoft Works more useful to classroom teachers. We took that set of files with its 8 activities and chose from those files those activities that fitted into the overall plan of the Foundations of Literacy and Mathematics. So for example where there was a discussion of the use of spreadsheets in the mathematics components so we used those, but we just didn't follow those activities as they were we developed our own activities for this program. As it happened the letters to schools component of this didn't work, it didn't work because of the logistics of getting letters from 30 odd students or as we broke it down into 4 groups of students within each one of those 30 odd groups...sorry let's start that again, there were 4 or 5 groups within each group of 20 students. I don't actually have a name for our groups of students let's say them sections as they used to be called in Teachers College.
* Val
You mean like Chardonnay or whatever

* Phil
Yes, packages, I think they are called. So there were 8 packages and there were 4 or 5 groups within each package. Each one of those would produce a letter. That letter was sent out on telecommunication on a network called Key Link to those schools that had registered to be part of Aliens project. Some of those schools wrote back and the problem lay in the time delay between when our students would write a letter and get back, which was usually 2 or 3 weeks. Now they had expected that what would happen was that they would write a letter and the next time they came to the computer there it would be and for that reason there was a certain amount of frustration built up in the students that it wasn't working as advertised. The component that did work and kept on working was that in order to play the aliens the students had been asked as an assignment item to design and develop a alien culture so that they would choose from the planets listed in space station Alpha files, look at the information about the planet that was contained in those files and then develop a culture or civilisation for that environment and this they did.

* Val
And they did this through collaborative work?

* Phil
Yes, I think that was another challenge for them. Most of these students had never worked in that way before. Those that had come from a high school situation had come from an education system that was highly competitive in which all students are fighting against all other students for the most highest mark. Those students who were mature age students had come from an education system in which cooperation was always seen as the way of motivating students and cooperative learning therefore was strange to most of them. The upshot was that some groups found working in a cooperative team to be a new and stimulating challenge for them and got a lot out of it, those were the sorts of groups where the people got on socially and personally, there were a small minority of groups where there was significant conflict within the group and that this impinged upon their ability to effectively complete the task.

* Val
Did it effect in any way do you think their computer competency or their acquisition of those sorts of things that you were hoping. I mean the incidental almost learning of computing skills that should have been going on?

* Phil
If I gave the impression that the computer skills were incidental that would be wrong. They were certainly well intended, they were planned and structured. What happened was that in response to the students needs and concerns, we had to change that plan twice. The plan itself was not unachievable. Similar plans had been put in practice before with practicing teachers and with undergraduate students and they have worked. It just seemed that this particular group of students facing the combination of Literacy and Mathematics and then computing thrown in and then the need to work in cooperative groups it added to their problems. The computing skills that they took were overt and as the revisions happened they became more and more concentrated to specifically word processing.

* Val
Were their skills planned or scheduled in their occurrence.

* Phil
Certainly were. But again that plan changed. Originally the intention was that each of the groups had their own lecturer and that lecturer would be delivering the computing component as well as delivering every other component. What happened was that after the first week there was an inservice course for the lecturers in the first week, sorry before the first week, and the person who was responsible for the computer component attended each of the first week's tutorials, he had his own group but he also assisted six out of the other seven groups. The seventh group being taken by a lecturer who was computer literate. What transpired was that that lecturer then had to take all of the tutorials for those seven groups and this continued for the first half of the semester. In that time much discussion was held between the lecturers as to why it was that they weren't coping - weren't confident, as most of them use word processors for their own purposes and it was a matter of being confident of teaching an area in which they felt that they didn't have the expertise and being able to satisfy the students needs in that area.

* Val
Were there skills machine specific. Was that part of the problem I mean that they were confident with.

* Phil
No, because some of them were using the kinds of machines and in fact the same program, as we were using as Microsoft Works on Macintosh. Some of them were unfamiliar with that program and unfamiliar with Macintosh. What happened in the second half of the semester then was that in order to encourage, shall we say, these lecturers to actually do it themselves the lecturer who was responsible and who had been taking those tutorials sat and wrote a script. The script was then published in a number of ways. The script and the prepared files that went with the script were put onto the network so that they were accessible by the students. The pages of that script were then photocopied and blown up to A3 size and these were posted on the wall of the computer room so that any of the students or the lecturer could simply look up on the computer room wall and see what to do next. The script was in a very specific, procedural, that kind of approach. Where it was needed certain parts of that such as snap shots of the screen, such as lists of attributes, I can remember as one of the examples, the attributes of the different characteristics of characters, paragraphs and documents were put into a chart. Now, where those sorts of condensed pieces of information were needed, overheads were made of that so that the lecturer could speak to those overheads.

* Val
Must have been an awful lot of preparation for the person in charge.

* Phil
For the person who had that responsibility it was about 10 hours a week preparation which was in fact more preparation than what he'd been doing before of actually taking the tutorials himself. But the advantage that was seen of that was that it was giving responsibility for the lecture back to the individual lecturers.

* Val
Would they perceive it that way and relate to it that way?

* Phil
In discussion they indicated that they were happy with that. The other advantage of it was that the notes were then published in an electronic form as well as being on the wall for the students so it gave them additional support. It wasn't that they were sitting waiting for the next instruction from the lecturer and the lecturer felt that this was very very good because his particular lecturing style was not, do this, then do this, then do this such as the procedures were. But by publishing those procedures
those people could take control of their own level and proceed at their own pace and they could have a backup to use when they were no longer in the presence of that or any other tutor. The other thing that should be said is that in addition to those supports, that lecturer could interlace a peer tutoring program. A peer tutoring program was aimed most particularly at those students who showed the most anxiety in using the technology and using the word processor program involved.

* Val
So these were literally paired with another, with a peer.

* Phil
No. It was more structured than that. What happened was that the lecturer advertised for other students who were literate in this particular program, arranged funding through the student services bureau and that allowed him to pay those tutors $11.77 per hour for 5 hours. Those tutors then were placed with five students who had requested this assistance and that lecturer then played a coordinating role. Essentially the advertising went up, there were two sets of forms on his door, one set of forms for the tutors, one set of forms for the tutees. When enough forms for a group to be formed were shoved under his door he would ring the next tutor on the list and give all of the forms - a photocopy of all the forms, to the tutor and it is then the tutors responsibility to contact those and to organise the lessons. Now the evaluations of that process were very positive.

* Val
For both parties do you think?

* Phil
Both parties, yes. The people who would join the tutoring all offered to do it again, and at that level of money it's not because it was very remunerative. It was because it gave them a different role to play within the University within their course. For the people who undertook the course, and that was also extended in the second semester to the early childhood computing course where there was a skills focus and from both the groups of students who undertook that then to there was a number of observable outcomes. One was that they went back into those original classes being much more confident and became role models and tutors to the people around them, people who hadn't taken up that opportunity. The second outcome was that they were most successful in that course because they were then able to get on with the course content, the course focus, and not be so hindered by the technicalities of running the gear. Another outcome was that the cooperative way of learning, the sharing of problems and experiencing solutions was then more able to become a feature of those particularly classrooms.

* Val
Can I just ask you, those 5 students that were tutored were they from a number of groups?

* Phil
It varied. On that form the person who was organising it had indicated a list of who you would like to be in your group so that meant that they tended to come from the same group. Sometimes, desperate people were put together because there weren't just a group for them but those groups seemed to function quite well. But on the whole it was social grouping that occurred. Social grouping that was initially based on the package or section grouping but people who wanted to go and do this together and that was certainly evident in the early childhood group.
Val
I am just wondering when you said 5 students, did you mean 5 students out of the whole of that intake?

Phil
No. They were groups of 5 students per tutor.

Val
So how many numbers of students were contacted?

Phil
There was one group formed that didn't actually function so that brings it to 5 groups for the first round and I think there were 3 groups in the second round, so that's 8 groups - that's 40 students. 40 students out of a cohort of 200.

Val
In groups of about 5 per tutor? Thank you for clarifying that. You said that the level of perceived expertise amongst the lecturers varied, did it in reality as well and did you address that? I know you said you had an in-service at the outset, did you have a number of inservices throughout the course for the staff?

Phil
The services were offered but they weren't taken up. In the same way there was a number of meetings held particularly for the FLM course and they were attended by a very small number of those lecturers. To some extent that was because there were 3 of the lecturers were part time and it is not really appropriate to expect them to come in unpaid when they get paid for their tutoring with such a pittance anyway.

Val
Did you feel that their level of...lack of confidence infiltrated what the students perceive is a lack...I don't know a lack of what...?

Phil
It was only one of many factors. There is the converse of that and that is that if a lecturer is open with his students about what they don't know and then makes attempts to find out what the answer is and particularly in an area like computing they can be forgiven for that because they are not expected to know about computing then that does build a more cooperative working environment and in some cases, one case in particular I can think of that operated. In other cases though where there was already a level of anxiety amongst the students and I am again thinking of a particular case in point where there was one part time tutor who started the course and who put almost no value on the computing part of it and withdrew and her feelings about it were obvious to the students, she left half way through the course and another part time person came in who was supportive of the idea and was trying to do it but had a particularly aggressive group of objectors within her group who took it upon themselves to take the opportunity to put her through the wringer. That particular lecturer I had comforted at the end of a number of computing tutorials because she was in tears and this is a person who had been working with drug referral agencies and other high stress environments and was a cooperative person but there was a particular group of students in her section who were very aggressive in the way they approached her and chose to particularly target her inadequacies with the computing.

Val
If you had to describe the learning environment of the computing component would you have described it as a mastery one or a performance one or somewhere between those two? I wonder about the assessment component.

* Phil
Can you define what you meant by mastery?

* Val
In a mastery learning climate your allowed to make mistakes and they're integral to learning, in a performance one every mistake means your a failure and you are perceived as a failure to yourself objectively and that's measured by any assessment component that's imposed on the learning.

* Phil
Ok, well then there certainly was not that sort of assessment so it was not the performance style. In terms of mastery, yes it was towards that but I wouldn't have used those terms. I would have used terms such as integrative, cooperative, problem-based, projectory to, those sorts of words that described learning environment in which the students have the highest amount of control and which the purpose of the learning and the direction of the learning, and the outcome to the learning are as openly displayed as possible.

* Val
To what extent have you adopted the same approach to your new course coming up or how have you changed it if at all?

* Phil
Because of the experience of the last course, because of the experience of the aliens project not working ..

* Val
When you say it didn't work have you had objective measures of that? I mean, assessment grades were good, how do you mean not working, anxiety levels?

* Phil
No, in terms of assessment there was the normal distribution. What I meant by not working was the communication between schools and students. The aliens project as such refers to the telecommunications project between schools and university. That component didn't work and it not working did not impinge largely upon the students' performance. Their assignment was not dependent upon that work. It not working I think probably increased their anxiety about what it was that they had to do, what was required in assessment items of this course in general not only the computing one. It was clarified a couple of times throughout the course because of the anxiety the students had. But getting back to how much then that integrated this time I would say very little. There is this time a computing component of the Foundations of Literacy in Maths Course but the assessment has been changed markedly. There will not be an aliens project or a large project of that description. It has been changed so that it is more in line with a parallel course that the students are doing with is an Inquiry course so that the major assessment item will be two-fold in that there will be an investigation, an inquiry into the students family, ancestral background and that that will be an opportunity for the students to create a sustained piece of writing. The other side of it will be a mathematical inquiry in which the students will be given some examples of mathematical inquiries and will then create and pursue and document their own inquiry.
Val  
How does the computing come into this?

Phil  
The computing then will be a one hour tutorial that will be a much more computers across the curriculum kind of approach that then is used to illustrate the kind of curriculum issues and classroom issues that are discussed in the mathematics and literacy lectures and tutorials of that week. There won't be a unified theme through all of that. Wordprocessing will still be a major part of that course and the other thing that we are discussing at the moment is the possibility of including problem solving and logo particularly used to investigate the properties of plain geometric shapes as the other major component of that course.

Val  
How are they going to do the wordprocessing then, is that going to be a structured series of lessons?

Phil  
Yes it will be. It will be essentially the same as what happened in the second part of the course previously. Although that's still undecided at this stage because the set of lesson notes that were designed and created for the last time were going to be used, but in the meantime there have been new lecturers on staff who have requested that that particular program be upgraded to a more modern version for their particular courses and that would necessitate the rewriting of all of those notes and there simply won't be the time to do that so if the upgraded program is used then it would be less focussed on a particular set of prepared notes but on what the lecturers were doing at the time.

Val  
I know you are pressed for time, I just want to clarify then what they will receive this coming semester in computing will be still a one hour tutorial over the semester but they will have a look at software that applies across the curriculum?

Phil  
Lets say that there is four things to say. As you have said there is a one hour tutorial but add to that that the computing time that has been booked is two hours but the lecturer will only be there for one hour but there will be an extra hour following immediately on that has been booked so that those students can stay there which was a major criticism from the students last time they would just be getting in to it and they would have to go. Obviously this would also encourage autonomy and use of the stuff that they learn in the wordprocessing to complete there other major projects.

Val  
And make mistakes in private while they learn.

Phil  
Exactly, and to help each other and all of those sorts of things. The second thing to say is that whilst there would be a major focus on wordprocessing and probably logo, there would also be that that would not take up a whole tutorial. That most probably each week there would be a demonstration of a program such as playroom or publishing centre or a program that could be linked very closely with the particular sort of curriculum objectives that have been discussed that week. Some of the problem-solving programs from Sunburst and Wings for Learning would be another example of where it would fit in with the problem-solving section of the course. The whole course these days is not being organised so much in literacy and mathematics as two separate entities but as an attempt to integrate that there are a number of main ideas 6 or 7 of those which will occupy a fortnights worth of time

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and the mathematical implications and the literacy implications of those main ideas would be explored week in week about. The next thing to say is that the computing this time should also be supported by the peer tutoring program, that's dependant upon funding being available, if funding is available then that will be provided and the last thing to say is that given that the peer tutoring can get going, or perhaps even without the peer tutoring we will attempt to use more than the one platform so that we would use DOS machines as well as MAC machine. Many of the students have DOS machines at home.

* Val

Thank you for your time.

*Lex Melville (Faculty of Arts and Social Sciences - includes Faculty of Health courses)

*Val
....3 component in first year or an electable both. I know that there is a computer competency requirement.

*Lex
As of last year it wasn't compulsory it was completely rebuffed.

*Val
Oh really! So that's going to colour alot...So the first year students I surveyed would have only had some proportional limit of actually doing computing they weren't all required to like teach or anything.

*Lex
No. We are only talking about Arts people.

*Val
Yes. Why?

*Lex
Well last year there was a small ......component.

*Val
That's what I was going to say, general studies was going to be out there.

*Lex
Well there was some in there but who knows it was something like 30 - 40% of students, of arts students....

*Val
So autumn 92 the first year people and there was some 100 odd of whatever I surveyed, there was only a small minority then that would have taken computing as an elective?

*Lex
No if they took it they would be taking it as .....see our BA degrees ...an elective, so they choose one of the subjects in terms ,,
*Val
Now, would I be able to find our who those people were because that's going to make probably alot of difference to, I think their anxiety levels because I did all of the arts students, only some proportion of which you are telling me would have done some computing last year?

*Lex
Well, they only did it because they wanted to not because they had to.

*Val
That's right, you see ours had to do it. We all have to in education we all have to do it and Phil tried something fairly novel which turned out to be very...it didn't work. It was a result of the anxiety that developed, the aliens...he tried to network with schools, get the students to learn to use the word processing to communicate with kids out in the schools to tie in because our computing thing was integrated with literacy and maths and so he tried to do it in a non threatening way the levels of anxiety were quite up particularly with mature-aged people so then we would use the peer tutoring to try....

Okay so would you have any figures on this?

*Lex
Well, if they came from our Faculty and they were enrolled in computing they were electives.

*Val
No I wouldn't have known because I did an arts group that was thinking or somebody's mass lecture, all of the first year students in the arts...so not all of them were in computing.

*Lex
What subject was that in?

*Val
It was a psyche I think....no it wasn't a lady, it was a gentleman...a more senior person in arts

*Lex
Mark Griffithson?

*Val
It wasn't Mark Griffithson but he organised it for me. It was a psyche lecture though. A psychological lecture. Okay, so ...

*Lex
There would have been a reasonable carryover if they were doing, well any of those students I would say they were doing psyche and they said that they were doing computing they would have done it as an elective.

*Val
As an elective. Okay.

*Lex
There is in fact psyche as an elective basically. That last year I believe it was...this year it's not so much that people that are becoming psyched are also involved in professional studies...it is more compulsory.

*Val
Okay so would you have any idea of how many hours a week they did? These sorts of questions I was wondering about was how it was presented basically..

*Lex
Well it was one hour lecture and two hour tutorial. The lecture had some connection to the tutorial which was practical.

*Val
The tute was a prac.

*Lex
The lecture had some theory but also it was reluctant to have....it was the theory aspects of the ....the different parts...

*Val
Was than given as a mass?

*Lex
Yes

*Val
Would you be aware of what software because we had a lot of problems with the JX's?

*Lex
In the first half of the year we had JX's simply because we were forced to and in the second half we used PS2's.

*Val
But that wouldn't have touched these....

*Lex
No, but it was a full year subject that is another thing which ...it is 12 months and we are talking about the first half of the year.

*Val
Yes, see what I wanted to get from you, or from Graham, is to get their grades because from all the other Faculties so far, I have got their grades and am comparing that with what level of anxiety....

*Lex
How are you going to connect those up with the individual surveys, have you got them student name or something?

*Val
I have all their ID's, all their names and they have all completed consent forms and I can access that and I am going in by ID's and putting in their grades actually ...next door. A research assistant is helping me match...Business & Tech gave me a spreadsheet....
*Lex
Oh if it's on a spreadsheet, yeh..

*Val
Yeh, and we have just merged it with the ....and it's coming up very well so then we can do comparisons..and we will see...

*Lex
Although there won't be grades with the first half of this year..

*Val
Why, because you didn't do periodic assessments?

*Lex
Well there, yes there was a mark out of 90 well they were marked over the year out of 200, and by the end of the first semester they had 90 first marks.

*Val
So can I get them?

*Lex
Yes.

*Val
Just so I can make a comparison and also the form here.

*Lex
Yes ......I can get something - there were a few cobwebs..

*Val
Would you have that or do you want me to get them from Grant?

*Lex
I think Graham has the originals if you want an electronic version.

*Val
I wouldn't mind a paper one as well. Sometimes we find the gaps in what we are doing is trying to match their names.

*Lex
Yeh. There could be something which ......there are some copies.

*Val
From you or Graham.

*Lex
Probably Graham.

*Val
Thank you. I'm a real nag.

*Lex
We will have to go down to the office together I think.
*Val
Well you are not far away I can just walk past you every day, knock on your door and...you are never there. Okay so it is Graham probably...

*Lex
For the electronic, for sure.

*Val
Okay, a spreadsheet. Okay, so it was a full year course and that there are grades that I can tap into. Oh yeh, old software. Were they just using it to, were they doing it across the board sort of using spreadsheets and database things or just wordprocessing?

*Lex
No, wordprocessing is for tutes and database is for second semester.

*Val
Did you tap into what level of experience they had because in my survey I have actually asked them that, particularly for the non-English speaking background, people over at Business and Tech, that is going to be an important factor. I have got here - do they own a PC and how would you rate your experience blah blah blah?

*Lex
Well, what we assume and we tell them this at the start, we assume that you have no knowledge and experience in computers and we start from the beginning.

*Val
Okay, and that's what Business and Tech said as well. And yet they were saying that only ...of the students appeared to be very confident, in fact cocky.

*Lex
Oh yes, some certainly were. That showed up for a while and after a few weeks they tended to disappear with most of them. The occasional one didn't.

*Val
Did you mainly have men, women or a mixture?

*Lex
I would say, I don't know, I would say a proportion I would think 50/50, it certainly wasn't predominantly one or the other. Might have been 45/50, I don't know, but it was around this figure.

*Val
So I am just wandering that if you said it was an elective if that would have made a difference to the number? Males tend to be with Business & Tech.

*Lex
No, I'm not sure about what the ratio is in the Faculty with..... ......orientation as an elective.

*Val
Did you, like what?

*Lex
Well they can't often decide what way to do it ......we impress that it might be useful to them.
*Val
Okay, can you tell me which sorts of things that you .....?

*Lex
Oh, the fact that it is obviously the skills that you can obtain which will be of use later on, to make them employable later on, no matter what you are doing. And that they will put this to good use in the time that they are at University for assignments etc.

*Val
Where they required to present their assignments wordprocessed, do you know? They were.

*Lex
Yes, yes.

Val
Is that right across Arts?

*Lex
No, no. Only in our subject, yes. In our subject, after all they were doing it so they should produce what they are doing.

*Val
Yes, I was just wondering whether generally they were required?

*Lex
I don't think so.

*Val
I know some places they do.

*Lex
I think that started to come off, certainly not at this stage.

*Val
And, can you make an observation on whether they appeared to be more or less anxious?

*Lex
Oh, there was certainly some anxious ones and I suppose the anxious ones were the mature-aged ones that had absolutely no experience, a lot of school leavers do have some experience, but that is very patchy and trying to know what level they are at, they have certain...of a keyboard and their transfers is debatable, some of them are good and some of them are not and so that's the reason we sort of can't comment.

*Val
So the level of anxiety would have dissipated for those mature-age people, or not particularly?

*Lex
Oh yes, it probably does for the first week or two, maybe not..it starts to rise a bit then it drops off. But I usually find that this seems to be the case every semester,
what we are going through at the moment, it is around about week 5 and 6. They all os us....and they start to achieve...

*Val  
When you say, they are starting to achieve, what sort of indicators are there of that?

*Lex  
Well, there are exercises. Weekly exercise for them, they are suppose to do those and present them about half semester.

*Val  
Present how?

*Lex  
As a folio. They needed....

*Val  
So it's a self-evaluation as well as..?

*Lex  
Well, it is to that expense they know they have to presumably have this commitment made, they must not be ....that seems to be, particularly with mature-aged ones, ......that sort of....week starts to rise around week 2,3 4 and 5 and then....

*Val  
And when those people get really anxious, what sort of mechanisms are there, can they buddy-up or do they work one to a machine?

*Lex  
They certainly do, there is work between...., work in small groups, but they also have access to the tutors as well. We are available at all time all they have to do is come and ask and they will be told.

*Val  
Do they tend to do that?

*Lex  
Yeh, a lot of them, some don't but there is an occasion when one or two come and they find out what it is and that's spread around to their particular groups and so on.

*Val  
One thing we found really a problem when the aliens thing was trialled last year, was that Phil was the only one who really knew what was going on and we had several groups .....the lecturers who were taking the tutorial groups were really not very comfortable with what was going on either and that communicated and the anxiety was really shot. How were your groups taught? Were they taught by largely the same people?

*Lex  
Yes, well there were 4 of us involved in the teaching on both campus' and we had a lot of part-time lecturers, we were a reasonably cohesive group I suppose because we talked to each other being a smallish group ....we get through the subject.

*Val  
Did you actually meet?
*Lex
Oh yes, we did meet at times, there was a coordinator, if he didn’t call the meeting, I don’t think he actually did, I had to make them several times to talk about what would happen next and what’s happening now and what the problems were. I mean there was fairly constant communication, formal communication.......  

*Val
It's a good subject, Lex is telling me why this is a good subject and why it is working really well.

*Lex
Well it has been developed over a period of time, so that’s been time. We have got for the most part a really dedicated team of people, and a lot of those are new because of retirements they have come to ...this is really a good subject, to some extent and the reason why we are saying that is that it is being spoilt by the fact that the computing centre is .... development and so we say this first hand, we may be being paranoid about it thinking, well maybe it is us that is the problem and not the TSCC and they are now telling us the same things now without any prompting, so...

*Val
When you say it is a good subject and you say you have a dedicated team, Business & Tech for example, had a very structured approach and they found that that would work for them, they actually had a handout, an outline, a text book and they said these are the exercises that you do periodically and what have you.

*Lex
Yes. It’s pretty structured, yes. But the sort of example that I have seen this semester, as we say we have more than double the number of students, so we have 9 staff to be involved in teaching on both campus' most of them part-timers, they’re quite prepared to come in at other times, I mean we have people coming in on Saturday’s, students and so on and part-timers.

*Val
They’re keen!

*Lex
No, they are coming in on their own time to do this type of thing to help the students. Only by appointment, they say you arrange with me and Saturday is the only day I can come in.

*Val
Really.

*Lex
 Yep. A person who is working on both campus', she starts on Thursday at 6 pm and goes to 10 pm. No, from 4 pm, she has 3 classes in a row. It is difficult. She is in on Thursday at 9 o’clock in the morning helping students. I’ll say, what are you doing here? She says she has arranged to help the students. I said you are not expected to do this sort of thing. But I mean, and that’s the same, particularly with these part-timers, they’re all falling over themselves to come and help and they want to make a success of the thing and it’s good in that sense.

*Val
Now they are acting, can I just pick up on what you said before about peer tutoring, just the very mention of it, now are they acting as a peer tutor?

*Lex
No, well they are doing it in small groups, I suppose they are doing a similar sort of job, peer tutoring. And in fact I have told the students we have arranged this and we have a roster of times during the week, probably something like about 30 hours during the week when they can actually be assured that someone is going to be there.

*Val
How interesting, and that's on the door so they can, yes I was intrigued by that..

*Lex
Yes, we haven't done that before but we have done it now because of the vast range of ... it seems ....

*Val
Oh right, okay. And...

*Lex
Yes, that's right and we are not held.......and its compulsory in that case next semester you, um....

*Val
I think it was once.

*Lex
Well yes, we ran that as a 3 week subject in the middle of the year.

*Val
Oh, you actually ran it for them. And yet not all attended?

*Lex
No not all of them did it no, but it was an elective.

*Val
It was an elective for nurses as well?

*Lex
Yes, this year it has all become compulsory for first years.

*Val
Through their choice?

*Lex
Yes, through their choice.

*Val
So it has become compulsory for Arts as well this year..as an elective but huge numbers because of the competency?

*Lex
They're choosing to do this. They are given the opportunity of doing this subject and getting some points up for and your also get the knowledge and competency or you just do the competency some other way. You get nothing, no credit other than just a
tick against your name which I suppose either as an elective or something will be used....

*Val
Do you recommend your people buy a computer?

*Lex
If first year, not really. By the time they get to third year, a lot of them have they would see the sense in it, I don't discourage it. We work on the assumption that they have to have access here ..... 

*Val
When I was overseas doing some work on this they were making it compulsory in some Universities..

*Lex
Yeh, well, they will decide....

*Val
Don't you think it will elevate ....

*Lex
Oh, it will obviously. But then on the other hand, we don't have that sort of policy here, we should be supplying sufficient facilities for a student to be able to work.

*Val
So what do you have to outlay, do you have a buy any of the software.

*Lex
No, everything is provided.

*Val
A text book?

*Lex
They purchase the text which will do them for....

*Val
Do you know what that is?

*Lex
........

*Val
Okay

*Lex
I think it was.

*Val
Yes that sounds familiar name

*Val
Okay. Do you set exercises from that?
*Lex
There is readings from it, yes. There are chapter reads which sort of covers some of the work that is covered in lectures. There is not a lot of theory in parts, but there is also......

*Val
Do they use it, I mean it is expensive to buy isn't it.

*Lex
About $40. I think so, they certainly need to use it in terms of preparation for an exam and so forth yes.

*Val
Are the exams happening when? Right at the end, not mid-semester?

*Lex
Well there is a mid-semester one in the first year when we talk about '92, there was a mid-semester and now we have in fact, come back to one semester subjects, breaking a full year into two halves and ......

They are subject to a prac test.

*Val
They do a prac test, when is that, at the end?

*Lex
Yes, for 40 marks ...there is a prac test which is not difficult but sorts those that don't want to be doing it.

*Val
Would they know in advance what sorts of things....?

*Lex
Yes they know what's in it, yes basically.....it is simply a set of exercises with questions involving the packages they have been using.

*Val
So delete a file won't...

*Lex
No. .......

*Val
Your not out to trick them?

*Lex
No. It's all pretty basic, I mean, there might be four modules worth 5 marks each and 4 of those marks .......something a bit more difficult.

*Val
And these are all individual things, they don't present as a group? You see, in aliens they were all presented as a group, they had to do a group project....

*Lex
No. It is all individual. In fact, we do this in the last week of semester usually. It takes ........it takes organisation, it is fairly intensive. It involves a team effort from all the people.

*Val
Is there a subject outline I can get hold of for that semester?

*Lex
Yes

*Val
Would you have it and can I get a copy of that?

*Lex
Yes, it will be on file.

*Val
Peer tutoring, I keep coming back to that. The question is because I saw this in Mac2 last week and I rang Robyn because I actually want to set up a study next year, the beginning of next year with our Education people here to just really try scientifically to work out whether or not computing ....... or trying to work out with Business and Tech, or whoever, who wants to run it with me, and they want to know whether it works as well because they are putting time and money into it to it and want to see if we can control an experiment.....how do you feel?

*Lex
Well, it's fine I mean, but I think it is a private thing for the student to decide on, we provide, we believe that we provide sufficient for them, support, and if they don't think that is enough or they want to try that, they are free to do so. I point out to them there is a commitment in terms of money. I say to them basically, your enrolled in this subject we've got staff available and you should be okay and that may be an extra but don't simply ignore the fact that you have things to do with other people.....they can possibly use that as an excuse.......a lot of them are very reluctant to approach, the first years, they are not sure of the ethics of it and the formality and so on. I have people coming to me and saying, you are not my tutor but can I talk to you?

*Val
And they would have because you are so expert, whereas the peer tutor is probably not as threatening because they are not so expert and also an age.

*Lex
Yes I know, well I have been told by staff that some of the comments that students make of me, in particular, is that they can approach me because.......they can approach them more ...

*Val
Okay, because they are part-time staff, or because they are younger?

*Lex
Well, they are invariably younger, and I suppose they have more contact with them because they are their tutes.
*Colleen Puttee (Faculty of Business and Technology - Accountancy)

* Val
Now what I want to know is what component the computing plays in the Business and Technology course and Colleen is looking for a quiz that checks the computing component. The group that was surveyed last year what were they actually doing, Introductory Accounting.

* Colleen
Yes, Introductory Accounting A which is the first phase of accounting and that virtually introduces them to the financial aspect of accounting. They are only going to learn virtually how to set up accounting books and how to process transactions.

* Val
Now in that subject they have to do some computing.

* Colleen
Yes they actually spend one hour in a lab every week and that one hour in a lab is suppose to give them sufficient background of an accounting package it will allow. Now that's not talking about the components of a computer, they will do that in a computing subject, I think it is called Computing 1.1

* Val
And that's not associated with this course.

* Colleen
It is associated with the course, but not the accounting subject. We don't teach that as such. That's taught by the computing staff. You may want to talk to them.

* Val
Yes I will.

* Colleen
They teach computing to 1st year. What we try to do is adapt I suppose the computing skills to accounting or show how it can be used in accounting.

* Val
Can you tell me the name of that package.

* Colleen
Yes, it would be in the course outline. Last year I think we used Quiggley Quills. Quiggley Quills is just one of the accounting packages we use. Naturally we have to try and change that each year.

* Val
In the case of failed students?

* Colleen
Well yes, so that students can't get hold of prior copies and solutions and the idea with Quiggley it is suppose to teach them basically the practical aspects of accounting, not only from a manual view but being able to adapt to computers themselves. As you see I have quite a few accounting packages we can use. Most of the publishers have 3 or 4 of them.

* Val
How many hours of lectures with you do they have on accounting per se?.
Colleen
On accounting we give a 2 hour lecture and then we have a 1 hour tutorial followed by a 1 hour practical and usually the tutorial and practical are joined so that they have a 2 hour stint in accounting.

Val
Of that 2 hours, is one of those in the lab?

Colleen
Yes, one of those hours is in the lab. So give or take 50 minutes because it takes a few minutes to get there.

Val
And that's usually on this Quiggley package.

Colleen
Yes, that's right. You are working actually on a practical package. Initially we use another system called Anthony and Anthony is just accounting theory on computer and it's actually a question answer setup where it asks you a question, or asks you to fill in the missing blanks and the students that way are learning the accounting theory on the computer as well. It gives them a good summary of what they are suppose to have learnt.

Val
And that's in addition to these...

Colleen
Yes then you move onto your actual package and the idea is that we ask them to compile the package both manually and on the computer so that they can, manually of course takes a lot more time and effort but then they can adapt and see how the computer improves the manual system.

Val
Now have you found in your observations that they take a fair amount of getting use to, the computing part or do they adapt fairly confidently.

Colleen
The young ones the day time students usually are okay, some of the part time, the older part time students, the older day time students have difficulty with it although they are quicker learners so they pick it up quickly but initially they're not sure of what it is about and of course you have to spend a little more time with them going through the actual computer itself and understanding what the computer is about and what it can do for you.

Val
Who does that?

Colleen
The tutor.

Val
There is a tutor specifically for the computing component.

Colleen
Yes each tutor we have, or each person on the staff, and usually first year you have about half a dozen staff to cover first year, because we have large numbers, each tutor
will run a tutorial and a prac and they will follow through. They will have the same
tutor for both so that the tutor is suppose to be conversant with the package and be
able to answer questions in that but there is no formal lecture on computing.

* Val
Who oversees all of this?

* Colleen
The subject coordinator.

* Val
Who is that?

* Colleen
Me. That was me at that stage or last year it was me but at this point in time there
will be 2 of us that have been working strongly on the first year subject, that was
Greg Langmore and myself.

* Val
Ok. I'm still curious about the tutorial and the prac part of it, so there are 6 tutors that
are looking at..or some tutors will do a number of first year groups.

* Colleen
Of the 6 they will all do some first year.

* Val
So they will all do computing and their expertise in that may vary or is that
monitored?

* Colleen
Yes.

* Val
Are they inserviced themselves?

* Colleen
They have training, the same as I would have it, they would have their degree
already, the tutors.

* Val
I just meant in the package.

* Colleen
Well each one of the staff members would take it home and make sure they prepared
it before taking it to the tutorial.

* Val
We had difficulties with Education because our 7 tutors vary widely in the
proficiency of wordprocessing on the MAC for example and that was communicated
to the students in terms of anxiety.

* Colleen
We have had a couple that don't understand computers on the staff. Yes there is a problem there and what we have to do is try to counteract that with some of the other tutors going in and also giving assistance if we are finding that one of the tutors doesn't really understand computing then we may swap and they might do tutorials and the other tutor will take on the practical aspects, those that are more conversant with computers.

* Val
Yes we found exactly the same thing happening in Education and in fact our computing person actually took the staff away and inserviced them, he found that was most efficient weekly prior to the tutorial and in some instances took over the tutorials because they were just very uncomfortable and they were making the students very anxious so he felt that that helped and the students did also.

* Colleen
Most of us have already been drilled for some years, we needn't necessarily have picked up the packages and we most probably haven't done packages ourselves, but we'd know the background to them and most of the packages are reasonably well established packages. In fact, last year we actually didn't use Quiggley Quills in the Autumn we used a package that was written by Greg Lamb who is my co-ordinator for the subject, between us we take over. It was using or adapting Greg's own computerised package of Quiggley Quills, so Quiggley Quills in itself is a manual package - it is a manual set of books that you have to go through. Now what Greg has done, he had adapted a computerised package which incorporates ledgers and journals and so forth and we used Quiggley Quills in the accounting package so we were lucky in a sense that Greg and another friend of his had written the package and therefore we could use Greg's expertise if we struck a problem. So most of the computerised skills come from the package Greg had written and therefore he made sure we all understood what he was doing.

* Val
Alright, now you said also before that the students did a computing component in addition to what they were doing for accounting which was run by the computing staff.

* Colleen
That's right. That is actually on computing and I'm pretty sure they learned the basic programming and so on.

* Val
Is that a requirement for your Faculty.

* Colleen
Yes, it is a prerequisite.

* Val
It is a prerequisite.

* Colleen
They must do that subject to get their degree. In fact up 'til now they had two computing subjects to do.

* Val
So last year's group have had 2 computing subjects. So that would be what proportion of their time in a week? Do you know how many hours it was?
* Colleen  
I think computing was 4 hours as well so, they only did 1.1 of course in the first semester.

* Val  
What does 1.1 mean?

* Colleen  
The introductory computing aspect. The other one is like becoming 1b following on from the first one. That's been eliminated now.

* Val  
So when this group were doing the course last year, the group that I surveyed, they would have done in addition to the one hour a week with you plus 2 hours lecture and 1 hour they would have done a 2 hour a week computing?

* Colleen  
Yes, I think it is 4 hours. 2 hour lecture followed by 2 hour tutorials on computers. But you would have to check that with the computing department.

* Val  
Would you have a recommendation of the person that I could contact?

* Colleen  
I could ring the Secretary and ask her who was in charge last year. Keith Simpson would be a good one to talk to. He would know.

Review Tests. They did 3 review tests, 2 of which were on computers so in other words we set up some multiple choice questions on computers, they were asked to go in there in an exam condition and answer 20 questions, having been set up in such a manner that once they have finished answering the questions they would be automatically told their results and they have feed-back straight away as to what the results were and where they have got the incorrect answer.

* Val  
In what way could they prepare for this test?

* Colleen  
Well they study the subject, that was all. They just prepared their notes from the lectures.

* Val  
So their computing skills or lack of would not have effected their result?

* Colleen  
No, it would not have effected.

* Val  
So it was just a different format?

* Colleen  
It was only just arrow keys and so forth. I suppose it was the fear of the computer.
Indeed, I have read research that that sometimes has a lot of effect as well whether or not they get a pencil and paper version of the test or a computerised version of the test.

* Colleen 
Yes. I think that did frighten them a little bit.

* Val 
And at what stage did they get those tests.

* Colleen 
The first one was in week 4 I think and the other one that was done on the computer would have been about week 8 or 9, week 11 I'm sorry. The middle test was an actual written exam.

* Val 
So it wasn't...

* Colleen 
It wasn't held in the labs, no.

* Val 
Did it ask them anything about their computing.

* Colleen 
No. Doesn't ask computer ones. Once in week 5 and week 11, we ask those.

* Val 
And they got immediate feedback on both?

* Colleen 
That's right. They were randomly selected tests so that the person next to you didn't have the same questions and so forth.

* Val 
And have you usually done that?

* Colleen 
We have done it in the past, yes. It is just a matter of whether we can get a package like it, as Grant set this up for us as he is more computer literate than the rest of us and prior to that Harry he could do it as well and it involved the questions and getting it all typed in and sorted out.

* Val 
And he actually teaches in the subject as well?

* Colleen 
Yes, he's worked in the subject as well. He did some of the lectures and so on.

* Val 
I thought he would take tutorials or do the tutorials.

* Colleen
Yes we take tutorials as well as give the lectures. That keeps us in touch as a rule of what is going on in the classrooms as well.

* Val
And how big are the classes, you said they were large?

* Colleen
20. We couldn't up until last year have more than 20 because of the restrictions in the laboratory but now I think there is 24 but we still try to keep the numbers down to about 20 because that...
* Val
That's one to a machine?

* Colleen
Yes, and sometimes that's difficult in labs because your time is so limited, if a lot of them don't understand something you find you are running around the room trying to help.

* Val
So do you ever take over a group and say look you are all having a similar problem?

* Colleen
Yes, there are instances where there has been a major drawback or a hickup, so you say hang on, everyone stop, we will run through this procedure now. This is what you have to do, these are the steps you have got to come through.

* Val
Do you ever find a need or that they want to work collaboratively with a tutor of some type or teacher?

* Colleen
Yes they do. I think the labs usually work well from the point of view that you will always have one or two that are computing major students and they will keep doing more computer and combined with the knowledge of someone else that has an accounting understanding they can work well between them amongst their peers.

* Val
Do you mind them doing that?

* Colleen
No we encourage them to work together, we try to make sure at the same time that they do their own work but the aim is that if someone else understands it and can teach them, that's fine so long as it is the right thing they are teaching them. We don't make the labs quiet and silent we try to keep the noise down in fact, they get a bit excited. I think if you make it more relaxing it is not as pressured or intense.

* Val
We find that with our anxiety over there, we had some students who are quite proficient that ended up being paid as tutors by the end of the semester. They found money for them because there was such anxiety particularly with an older women and other students.

* Colleen
I think they have got to have someone else they can relate to, and when there is 20 in the room it is very difficult to get to every one at the same time and when you have got through one group your time has run out to go and show the others and with
everything they do of course it been saved and they don't want to lose it, they might have problems that they pick up, is it the package incorrect which means are they wiping the whole program that they are working on, then you have to go through all again with them to get them to load up but I know I did strike in a couple of tutorials there are some that are very good, and it would have been wise to have them as demonstrators if they could. As usual tight budget restrictions didn't allow.

* Val
Would it be possible for me to meet Greg, do you think or is he busy?

* Colleen
I don't think Greg is in today, I haven't seen him. I don't think he is in on Tuesdays. I can organise for you to meet him another time.

* Val
I was coming across to Pat's research session with a Linda ..... who is going to talk about qualitative research and I'm looking forward to that and I think that is next Thursday from 10.00 to 12.00 so I was coming after that.

* Colleen
I am pretty sure Greg is in on Thursdays.

* Val
I wonder if you could check the time to see Keith as well.

* Colleen
I will just give Keith a ring and see if he did do it.

* Val
Could you in fact ask him if I would be able to organise to do the same thing on the staff, the instrument last night was finely refined with Herb Marsh's help and ready now to do it and it .... the staff to see to what extent they are anxious as well.

* Colleen
You might mention the fact that I didn't do computing...

* Val
Yes, I'm self-taught about 3 years ago and even now as I go......

* Colleen
Yes, I have picked up qualities like Greg and Ray which are simply wonderful...and on one of his rams is ...how do you do this because he is the only one that seems to be conversant with it all. Otherwise I hadn't used a computer until I started my degree which was not so long ago and when I went through my degree they only had 6 computers amongst a class of 27, so naturally we didn't get hands-on experience and talking about fear of computers.

* Val
Do these students fail Business & Technology or their Accounting subject anyway if they don't demonstrate proficiency with computing?

* Colleen
Usually in the labs rather than fail them, what we do in the past, what we have done is, we can fail them through students..... if I said you give them a quizz your
demonstration quiz and they don't seem to be able to do it sometimes it is total fear of the question that they are not confident in themselves, so we say go away, come back and see me tomorrow morning and we will do it again and we give them some other menial task to do so that you try not to fail them in the labs unless they really don't want to pass. But I have not noticed anyone failing the lab component.

* Val

Thank you for your time.

*Keith Simpson (Faculty of Business and Technology - Computing)

*Val
Introducing Keith Simpson who looked after last year the first year computing strand of the Business and Tech students took last year. Keith can you tell me what those students did in those 4 hours per week?

*Keith
Yes, the four hours involved 2 hours of lectures in a mass lecturing situation where there were 300-400 odd students in one venue being lectured to. One of the other hours comprised of an hour session in a computer laboratory doing practical exercises and the fourth hour was a tutorial session with a class size of generally between 20-25 students.

*Val
Did you say the lecture was up to 300 students?

*Keith
Yes

*Val
Can I ask you in that lecture what sorts of material was presented. I mean would these over the semester you presented them specifically with accounting or business types of packages or were there more general things like word processing spreadsheets. What?

*Keith
The course is divided into two main strands. There is a theoretical component and a practical component. The theoretical component was background to computing; some of the jargon involved in computing; some of the underlying concepts of computing, you get into the nuts and bolts side of things to a certain degree, discussing types of hardware, specific types of hardware as well as printers.

*Val
So that would be presented in lecture time?

*Keith
That would be done in lecture time. That was then reinforced in tutorial time as well so for that component for the theoretical component that would have been half of the overall subject and the other aspect, the practical aspect was concentrated on in the laboratories and that involved teaching the students to gain a knowledge to begin with wordprocessing, using the Word perfect package.

*Val
Word perfect, and that's with IBM?

*Keith
Yes.

*Val
.....We had a lot of trouble with the hardware at our place.

*Keith
Yes, mainly we were using the PST's actually and that was quite good ....was a problem. We had the wordprocessing, we also had the spreadsheets using Version 2.2 of Lotus and also we spent just a week or two on DOS we tried to give them a little bit of a grounding on how to drive a computer in a simple version.

*Val
How long would they have spent on wordprocessing and spreadsheet? Equal?

*Keith
Approximately equal times, possibly a week more in spreadsheets than wordperfect, we felt that wordperfect is an easy program and wordprocessing is exceptionally easy to grasp than spreadsheets. Probably would have been 5 weeks on wordperfect and 6 weeks on spreadsheets and just a couple of weeks on DOS.

*Val
Did you find they had bought with them a high level of expertise anyway or experience with any of these things or did that vary very much?

*Keith
It varied a fair bit. None had a high level of expertise, I felt anyway. What we have found but with wordperfect especially, it is a friendly sort of package the main problem that students would have with a package like that is just remember key stroke combinations and after a while they get a little bit more comfortable with what they need to do with the package and it is a little bit more easier for them to use. The problem that we have found with computing, that I have particularly noted is that students seem to feel they can pick up things quicker than they do and they have this perception I think where they think they know more than they do and we found this recurring semester after semester where we would have, say, a wordprocessing assignment to do where we would want them to put a border around the page or might want them to have headings in a particular text size, we might want it bolded or italicised or whatever, and nothing particularly untoward, nothing they hadn't covered in classes, and they would leave it then too late to start it, and then find they actually don't know how to do this, and so we would have this situation where a lot of students would come, they had left it too long, they felt they actually knew more than they actually did. That was something I had seen a lot of times and I have seen it over a couple of semesters.

*Val
I'm intrigued that you say that because it really contradicts the expectations you would have except for this Faculty probably. Are you talking generally about all of the students you have, or are these more the Business and Tech people ..or is this largely the group you have?

*Keith
That's the only group I have.

*Val
Okay, so their sense of confidence is unusually high would you think?

*Keith
It is, but it is not realistic. It oversteps the bounds of what they actually know. Now I think a bit of this problem with first years is that things seem to be left a little bit late and I think part of this is that they find work is much looser in a tertiary environment than in a household environment and I think a lot of them are still coming to terms with, that a lot of their activities are self directed at University and it would be nice somewhere down the track for the students to have that sort of instruction early on in the piece so we don't have to put up with this later on.

*Val
So you are finding you are cram teaching or not necessarily, or they are just wouldn't achieve at the level that they should have.

*Keith
And really that they are capable of and in the end work was...it wasn't bad but if they had been more consistent in their own work, but as I said a lot of it comes back to that they thought that they knew more.

*Val
Do the majority of them own a computer, do you know?

*Keith
We haven't done surveys to give us specific percentages, so it would be hard to even guess, but I would guess probably 20-30% but that is really....

*Val
..No, but it seems that somewhere along the way they have received, or they have a very positive feeling about their own ability with computers even though they are coming in cold aren't they, most of them from high school?

*Keith
Yes, although I know primarily in prior years...

*Val
Just last year's group I'm looking for because that's the one I surveyed...the beginning of last year, I think you shared it with Leila?

*Keith
Yes, in first semester and shared it with Leila. What is happening but the students are getting progressively more and more.....fluent as semesters gone by. The current bunch I know that is beyond what we are discussing now, the class I just come from, the students generally knew the keyboard.

*Val
Does that make a difference to their levels of confidence or levels of anxiety, do you think?

*Keith
I would guess so in that I think frustration wise it would have to make a difference. If the student is not familiar with the keyboard and has to search around for every time they want to press a key I am sure that slows down the whole process of what they are trying to achieve and frustration wise I am sure that doesn't help.

*Val
Keith to what extent do the students work with a peer or with a collaborative group, or do they only work one to a machine?

*Keith
It is one to a machine but peer wise invariable the students will pair off or be in groups of three but there is very very few students...

*Val
And you don't discourage that?

*Keith
No definitely not, definitely not. We find that really, and even in terms of assignments, we recommend to students that you can discuss things, toss around ideas, obviously what is ultimately submitted must be the students own work, but we try and emphasise the working together as a means of sharing a common pool of mind.

*Val
Is it possible for you to tell me please how they were assessed on their computing skills over the semester?

*Keith
All right. For the first semester..

*Val
And is their an outline...

*Keith
Yes, I was just about to say to refresh my memory of it.

*Val
Would you like to look?

*Keith
Yes

*Val
Keith was just saying that students in the first year introductory to computing subject aren't assessed as to their entry levels on computing, it's just an introductory course and it is presumed that most people are the same level. Is that right?

*Keith
Yes. Which is virtually no exposure to computers so we can start...

*Val
So you are treating them as novices?

*Keith
Yes as total novices. Otherwise you find some students..you might find 10-20% of students might find the subject totally boring, their motivation levels are then dropped markedly, because they have been their and done that.

*Val
Conversely, what about their anxiety levels if they are beginners, you are starting at a level they can cope with presumably?
*Keith
Yes, we try to start really at the bottom and try to take it as easy steps as possible so we don't have people being totally turned off by it because they don't understand it. We try and be as approachable as possible.

*Val
So do they have extra time in the labs outside of your tutorial time, if they want?

*Keith
Yes, we have a number of laboratories at this University so that at any time there is generally at least one laboratory available. Laboratories that the students use for our subjects...I think there are four of the six laboratories have the software that we covered. The labs are open as well 'till 10 o'clock at night. That is not totally useful for those students that rely on public transport but the labs are open as well on weekends.

*Val
I just wondered to what extent they took advantage of that? The use of the labs..

*Keith
I don't think enough until immediately prior to some assessment task is due.

*Val
And do you have tutors in their at the times that the labs are open or are they just going in there to explore?

*Keith
It is open slather. There is supervision as such at the front desk but only...

*Val
So they are in there on their own basically?

*Keith
Yes.

*Val
And if they need extra help, how are they able to get that?

*Keith
By approaching staff member involved in that subject as a first point of contact, you recommend to students to see the tutor and we try to reinforce the idea that they go up the ladder if they don't get satisfaction from the tutor.

*Val
All right, so you coordinate it and you took lectures, do you actually take tutes as well?

*Keith
Yes.

*Val
And how many of you were there that took tutorials and participated in the subject?

*Keith
In first semester there was a student population in excess of 500. The lectures had to be offered twice, the same lecture was offered twice just because the largest theatre here only seats 300. We had some serious hassles to begin with because administratively, the timetabling wasn't done in a great fashion and what actually happened was they decided to try and get all the students into one session. We were offering the subject part time as well, for part time students and the first weeks of the semester was a schmozzle because we were having students sitting in the aisles, the lecture theatre was just chocker-block. Safety wise, that wasn't on, it violates a few rules and regulations and so we were having to enforce the situation and ask students to leave from sitting in the aisles. That browned-off a lot of students immediately. Finally we organised another session so that the same lecture was presented 3 times a week and at that stage there was probably 100 students that said they would find something that was more interested.

*Val
But they had no option, they still had to do the subject?
But their attitude was soured?

*Keith
Yes very much and attendance at lectures consequently dropped markedly towards the end of the semester when we had probably no more than 20-25% of the students attending the lectures.

*Val
Over the 3 lectures, or did they prefer...

*Keith
All of them.

*Val
Okay so 25%-30% attending lectures, because of overcrowding facilities at the start. So motivation and attitude was deteriorating.

*Keith
So, 70% of the students weren't getting the lecturing input. I made a point of putting lecture notes in the closed reserve in the library so they could borrow them for a limited period of time but what I did with my lecturing notes was that they were ....themselves they were actually exactly the same material that we had covered in the lecture but I would tend to reinforce that I might have something displayed on an overhead, then I would discuss that with students to take notes.

*Val
Were they examined or assessed on the lecture content?

*Keith
Yes because the lecture content covered the theoretical aspects of it.

*Val
Right, so they were doing themselves a disservice by not coming?

*Keith
Very much so. The attitude seems to be that because a role isn't taken in the lectures that's possibly what went wrong.

*Val
Yes, we take roles.
*Keith
Yes, well we don't. When we have lectures we might have 300 students in them it is not worthwhile.

*Val
Yes, well we might have only 150. Interesting, well thank you for that, that's very important.

*Keith
In tutorials definitely roles are taken and so the attendances are higher, as they should be.

*Val
Yes, but they were assessed on the theoretical as well as the practical component?

*Keith
Yes, on the theoretical component. To assess on the practical components of the course we would have a practical quizz. So for the wordprocessing side, for example, we would go from the document and they have to tidy up the document. We weren't testing the typing skills, so we didn't make them type a large great document we would hinder those that couldn't type..

*Val
So that was already set up for them..

*Keith
Yes, they had to retrieve a file, make some modifications to it, create some headings, justify it in a particular way, set up some margins..

*Val
They all did the same?

*Keith
Yes, well there were variations to the same quizz..

*Val
All done in the same setting...all done at the same tutorial?

*Keith
Yes, in a particular week and so there was different exercises that they had to do, all drawn roughly the same sort of thing..

*Val
Nobody to look, nobody could help each other?

*Keith
No, the main problem that we did have was because we are limited to class sizes of 25, totally due to the number of terminals in the laboratory, it would have been nice to test everyone in one hit, we had to test it over a period of an entire week in that practical session for that week and so what generally happened was that the marks increased as we went through the week.

*Val
I'm not sure how you say you assessed them, you personally individually, or each tutor came around and watched each student perform?

*Keith
No, they performed a series of tasks on this document that they retrieved, then they submitted a disk at the end of the hour that they had done the work on, then we imported the disks and marked them...

*Val
I don't understand how they couldn't have all done that in the one tute?

*Keith
Well, no. The point I am trying to get across, not particularly well, is that they had obviously talked amongst themselves about what to expect, and so those students that had sat earlier on...

*Val
Oh, I'm sorry, so the tutorial groups down one end of the week were better than those at the other end? I thought it was the students themselves.

*Keith
Yes, well you could look at that the other way, we could say you disadvantage the students...I really don't know why we ran into that problem. Students will talk amongst themselves. We tried to reinforce the idea that they are doing themselves a disservice by telling their mates what's in the exam but ultimately it might mean that they....

*Val
I wonder if a few.....scores would have made any difference?

*Keith
Yes, there must be a better way of telling them that. It is hard with a class size of 25.

*Val
Okay, so that was the wordprocessing part. The spreadsheets?

*Keith
They were in a very similar fashion. We presented them with a, once again, we give them the data they needed, then they required a certain amount of formatting of the spreadsheet, some calculations, some columns typed, some tables, maybe some very basic statistical functions...

*Val
Did you find the same effect with the spreadsheet as with the wordprocessing?

*Keith
Yes.

*Val
The same. The students that got it later on did very well.

*Keith
They had discussed amongst themselves what...

*Val
So they knew to prepare for it?

*Keith
They knew what sort of things to prepare for. We made multiple versions...there was probably at least 7/8 combinations so it wouldn't which one they were going to get but they would have a pretty good idea of what sort of things were covered and that was a little bit strange because we really had told them all what sort of things they should be looking at so the students who were here at the beginning of the week would have had a pretty good idea of what to expect anyway, there was meant to be no surprises.

*Val
Okay, did many students drop out of the subject altogether, or drop out of because of anything to do with computing do you think?

*Keith
No, and they don't really have much choice anyway, they have to do the subject.

*Val
Do they have to pass?

*Keith
Yes. Pass is mandatory in this subject and the subject is mandatory to the degree.

*Val
And what degree is that?..

*Keith
The students would be doing either a Bachelor of Science, or a BSc (Dip Ed) or a Bachelor of Commerce, Bachelor of Business and Accounting.

*Val
So they would all have to pass this introductory course with you?

*Keith
Yes, it is a core subject for them.

*Val
So if they fail that, they repeat?

*Keith
Yes, they have to do it again. And for some students, obviously for computing major students in Bachelor of Business and Bachelor of Science degrees, it would hold them back, so they need to get through it because it is a foundation course. For the accounting students I am pretty sure it is a prerequisite for many of their subjects, because of the computer base so they need to have completed the computing 1.1.

*Val
Do they do any programming anywhere along the way?

*Keith
Not in computing 1.1. That's only tackled in the next subjects along - 1.2 and that subject is only in the current degree structure, is only really tackled by students who are majoring in computing.

*Val
Do you know if any of your first year people or at least that semesters students have had any programming experience? Do they get that at school, do you know?

* Keith
I believe there is a one unit subject in computing and .......

* Val
I just wondered if that made them more confident I have read a lot of work in research that says that if you have had particularly if you are a male have had some programming experience you feel like you can do everything with computing. It's a perception, sometimes unrealistic.

* Keith
Definitely some of the students had a lot more confidence than others and I think those that had done some computing in high school towards their HSC with computers did seem to be the ones that were very confident on the keyboard but they might not be able to touch type but they too can type very quickly and they would know where the keys are, that would make it a little bit easier for them. I really think familiarity with the keyboard is really very important, I have seen many many times where students are not familiar at all with the keyboard and you can see they are getting frustrated themselves because the screen tells them to press a certain key and they have to spend 30 seconds looking for that key, and keyboard confidence and keyboard skills I think is an underrated skill.

* Val
Believe me in the literature it is not. It has been shown very clearly linked with computer anxiety and that’s why a lot of the push particularly in the States is to have the keyboard in schools.

* Keith
That's what's happening now. In fact we have competency requirements for computing 1.1 now, and that's what's currently being taken by the students for using keycoach and in week 9 they have to, I think they only have to achieve 10 words per minute and 95% accuracy.

* Val
So they do that on entry. They start to do this as part of the 1.1.

* Keith
Yes

* Val
And then they go to wordprocessing?

* Keith
Yes

* Val
So how many weeks do they do this touch typing or is it concurrent?

* Keith
No it is not concurrent we have got limitations, there is 6 laboratories and all the faculties are requiring more and more access to the laboratories, the computer labs and to begin with B&T were the largest user of the computing centre, Arts and general studies, Education are starting to catch up now so the load on the computing centre is increasing all the time, I believe they're building another computing centre
down at Milperra just for that reason and time will come in the not too distant future when the same sort of thing might have to happen here. The free time available in the labs is becoming less and less.

*Val
So you are not looking to encouraging people to buy their own machines. In America they have made it required in some Universities.

*Keith
Yes I have heard that.

*Val
How do you feel about that. It would certainly take the pressure off.

*Keith
My recommendation to students is to, if a student approaches me saying they are thinking about a computer or should I buy a computer, my response to that would normally be yes highly recommended. It would stand them in good stead for virtually any consultancy you might be taking.

*Val
And also I have found, and you would probably agree it takes away that awkward, embarrassing, making mistakes in public sort of time when you can do it at home, making mistakes and not look like such an idiot.

*Keith
Yes that's an interesting point actually. A common feeling that I've seen with a lot of students was in quizzes, especially in practicum quizzes, to leave them alone. I've occasionally walked around to make sure no mischief is going on but generally speaking it is better for me to sit up the front of the laboratory so they didn't have this perception I was looking over their shoulder.

*Val
Really.

*Keith
Yes, that was very common because I did it for the first quizz and students didn't like this, especially in an examination in a practical exam they didn't like the feeling I was looking over their shoulder watching what they were doing.

*Val
What quizz are you talking about?

*Keith
In the practical quizzes.

*Val
The document they were actually working on? They didn't want to be watched while actually working on it?

*Keith
Yes. They didn't like that at all or the spreadsheet. That just ties in with what you have just said, they really didn't like that, it really put them off. I don't know if that was a reflection on their confidence, whether they didn't feel confident...
*Val
Something I have found is that, I feel is a very important factor, if they felt that, rather than getting feedback, if they perceive it as being evaluated it can be very inhibiting.

*Keith
Yes, a few students said they didn't actually like this standing behind them.

*Val
And do they actually ask you for help, at stages, or would they prefer to do it on their own?

*Keith
When we are doing a practicum during practicals, yes quite often they ask for help. We run a demonstrator system here where there will be the tutor and there will also be, in practicals, a demonstrator employed who is normally a second or third year computing student and...

*Val
So in that classroom each one of the tutes will have this demonstrator?

*Keith
There will be two staff members there to give the students a hand in that we found that 22 or 25 students, one person is not enough, there might be a lot of questions, you get run off your feet and you might not get to everybody so we have found this...

*Val
So this demonstrator is paid, or they get credit?

*Keith
They're paid.

*Val
They are just teed up for these tutorials? Right.

*Keith
Just for the practical sessions.

*Val
And students relate well to them?

*Keith
Yes seems to go quite well. Occasionally we will have the situation where the demonstrator is a little bid uppity, cocky, but generally speaking they are good and I think the students relate well to them too.

*Val
What about the expertise of your own tutors, do they vary? We found at our place for example, in education, that some were very comfortable with the wordprocessing and others were as scared as the students were and communicated that. Well, I guess in the computing department this wouldn't be as much a problem?

*Keith
Yes, it's not, I don't think that has been a problem at all and the packages we have been working on, the word perfect I don't think anyone has a problem, occasionally you might run across a problem you are not familiar with, a particular circums
operations and the idea is to achieve something, but it would be just a matter of, I will have a look in the book and find out, there is no, I don't think there is any great problems there.

* Val
So your not communicating anxiety yourselves as our people did, particularly the nurse educators, they're as intimidated by the computing technology as the students?

* Keith
No I don't think that is the case at all.

* Val
Thanks for your helpful insights.
Appendix B2

Memorandum to Case-Study Participants in Aptitude-Treatment-Interaction Study 1

MEMORANDUM

TO: Student name
FROM: Valentina McInerney
DATE: 9th March, 1994
SUBJECT: Reminder of information for students participating in the computing case studies

Dear student name,

Thank you for your willingness to participate in the case studies related to your computing studies. As I outlined in our brief meeting, in order to better understand what will be happening in tutorials from week to week we will be asking four students in each group to meet with (Interviewer) once a week to talk about what happened in class. In addition, we will be asking these students to keep a LOGBOOK in which they record the following as soon as possible after each tutorial

PART A. Description of each computing session

1. What (the instructor) taught.

2. What you (and others) did.

3. What happened with equipment (hardware and software).

4. Any other details that are a purely objective description (not your opinion) of what happened in the class time.

PART B. Impressions

1. What you learned.

2. What you had difficulty with or did not understand.

3. How you felt before, during and after the tute (positive and negative).

4. What direction you might take on the basis of the experiences of the tutorial both in thoughts and actions. This can be referred to as an ACTION statement.
This logbook should be written in a small (48 page approx.) exercise book and should be brought to the interview session each week. It may be used to refer to during the interview as well as being collected from time to time.

Feel free to write your own comments or to ask any questions at any stage throughout your logbook, even if they do not strictly conform to the suggested headings given above.

Welcome to the research project and thanks again for your involvement.

Valentina McInerney
Appendix B3

Interview Questions in Aptitude-Treatment-Interaction Study 1

1. What do you THINK about the course so far?

2. How do you FEEL about the course so far?

3. What did you LEARN in this week's class?

4. Do you like getting COMMENTS from the other students/the instructor while you are working?

5. Can you see any DIFFERENCE IN YOUR ATTITUDES from previous tutorials?

6. How would you RATE YOURSELF on the skill that you have learned this week?
   • "Happy to show others how to do it." (Very capable)
   • "Can manage to do it on my own." (Just comfortable)
   • "Couldn't do it on my own." (Not mastered)

7. What did you have DIFFICULTY with this week?

8. Do you feel that you can HANDLE THIS DIFFICULTY on your own?

9. What COULD YOU DO about this (difficulty)?

10. Where WILL YOU GO from here?

The following are additional questions which were added to the interview schedule mid-way through the computing subject, just after the submission of the first assessment item, but before grades had been awarded. Instructions to the interviewer are shown in italics.

1. Last week you had to hand in your first assignment, the Folio. How did you prepare for this:
   • alone?
   • in collaboration with a friend?
   • in a group?

2. How did you feel about the quality of this Folio?
2. How did you feel about the quality of this Folio?
   • very pleased?
   • just O.K.?
   • not very pleased?

3. Why did you feel this way? (Ask for an explanation of their answer to Quest. 2 and ask for an estimate of how much time and effort they put into the assignment).

4. How well do you think you will do in this first assignment?

5. Give yourself an estimated mark out of 15.

6. This week in tutorials, the instructor put up some problems on databases for the class to solve. Could you do these? (Prompt whether they could do the problem alone, or not, and whether being able to discuss it with someone else would help).

   For the following students only (those in the intervention group), ask the next two questions:

   a) How do you find working in groups to answer questions and solve class problems?

   b) What do you think about getting help from and giving help to other students in the tutorials? (Prompt here for the following):

      • those who prefer to work alone or are too shy to ask for or to offer help;
      • any perceived advantages and disadvantages of collaborating.
Appendix B4

Case Study Participant Interviews Conducted over Eleven Weeks During the Subject “Introduction To Computers”

The following extracts represent the summaries of weekly, half-hour interviews collected from the case study participants (two high-anxious1 and two low-anxious2) in each of the two treatments over the semester-long computer training course (Introduction to Computers). These summaries were compiled by a trained interviewer/research assistant who was responsible for conducting the semi-structured interviews using a schedule of questions (see Appendix A3). All taperecordings were listened to, in full, by myself as a check on the validity of the summary transcriptions made for the NUD.IST statistical analyses. At the conclusion of the final interview with each student, I present an overview of what I think are the key issues raised by each case study in relation to their experiences of anxiety, positive and negative cognitions, motivation and learning in the context of the instructional approach adopted in their computing tutorials.

An Important Note Regarding the Interview Process Itself

For students in both the experimental and control groups, the interview process itself may well have fostered the development of the student self-regulation and metacognition in that:

1. The schedule of interview questions required students to focus on their thoughts and feelings in relation to the tutorial content and the teaching approach used (group or individual problem solving); to rate their competence in the particular topic under study using a self-rating key; to identify any difficulties that they were experiencing; and to develop an "action" plan of what they could, and would do, to address this difficulty over the following week, when their progress in this regard would be discussed at the next interview. It is hypothesised that the rapport that developed between the interviewer and student was an important factor in the development of this process of metacognitive self-regulated awareness.

2. The logbook that students kept each week of the course was designed along similar lines as the interview. Students were, however, encouraged to decide for themselves whether they wanted to discuss the entire tutorial for that week, or to focus on a particular aspect. In any case, they were to focus on their thoughts, positive/negative feelings, and an "action" statement. I collected these logbooks for content analysis mid-way through and at the end of the course.

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1 The data from interviews with one high anxious student (Nathan Richman in the Direct Instruction group) were not collected for two weeks as he did not attend his scheduled class because of illness and was not available for interview. He made up the work by attending alternate classes.
2 The data for two low anxious students (Andrew McDonald in the Cooperative Intervention group and Lisa Kavanagh in the Direct Instruction group) were not transcribed for the four weeks in the middle of the course. Both of these students were very confident and already familiar with the tutorial content during this period and had little to say in interview. These data are available on audiotape but due to limited resources to pay for transcription, they are not included here.
CASE STUDIES

Michael Darby: LOW ANX; COOP SELF-REGULATED GROUP

Wednesday 16th March 1994
1st Interview
Tape 1 Side A  000-104

THOUGHTS
think the course is good

FEELINGS
less tense; more confident; not as scared of touching the keyboard;
prefer to work on my own sometimes
wary of new things-always potentially difficult

TUTORIAL CONTENT
Word Perfect: files, subdirectories

COMMENTS & CLASS DISCUSSION
teacher comments- don't mind being corrected
peer comments- good if you need help

DIFFERENCES IN ATTITUDES
not really; more confident; not as scared of the computer

COMPETENCE RATING
Happy to show others, with my notes beside me

DIFFICULTIES
typing
remembering the function keys and what they do;
handled difficulty from last week on my own- practised on my own,
using the manual

WHAT HE COULD DO
ask other to help

WHAT HE WILL DO
practise typing

Michael Darby
Wednesday 23rd March 1994
2nd Interview
Tape 2 Side B  000-125

THOUGHTS
working pace can be better when on my own; looking up difficulties independently;
individually it is good;
having time to review at the beginning of each session is good to pick up on things
missed or skimmed, refreshes my memory- ready to go on;
finding short cuts, exploring things further

FEELINGS
daunted at so many menus to keep going back to;
good- managing to get most of it;
once I have the hang of it I feel better;
fairly confident, keeping up with it
good in a group;
appreciating the good cross of ideas in the group work-
TUTORIAL CONTENT
Word Perfect- centering, headings, bold print, margins, highlighting, moving text

COMMENTS & DISCUSSION
most people are getting the discussion questions right;
most people are understanding things;
I think they're good; talking reinforces my learning;
I feel OK when someone else has the same problem;
our group was fine, they were going at the same pace;
some people thought of things I didn't;
I get a good cross of ideas

ATTITUDES
liking both group work and individual work;

COMPETENCE RATING
WP- 7 out of 10
I'd be able to show someone else how to do it,
maybe not teaching someone everything but helping them
out if they're in trouble

DIFFICULTIES
didn't get a chance to follow up from last week;
remembering commands and functions- need the template;
remembering how to get to a menu-
able to check things on my own or ask Robyn/others

WHAT HE COULD DO
look up the manual or notes

WHAT HE WILL DO
practise; ask Robyn or the others if having little difficulties

Michael Darby
Wednesday 30th March 1994
3rd Interview
Tape 3 Side B  300-455

THOUGHTS
teamwork is good, helping each other, contributing knowledge and gaining it; noisy though;
on my own I can experiment, explore options, fiddle around, see what happens, learn
more things by myself
keeping average due to new work constantly

FEELINGS
alright in group work
good- enjoying both group and individual work
getting better at using the template for functions

TUTORIAL CONTENT
typing up a Resume, CV, with columns, bold, italics

COMMENTS & DISCUSSION
discussion questions a bit stupid, silly, answers were obvious

ATTITUDES
same
the course isn't as bad as I thought when I first started
not being thrown in at the deep end; a lot easier; there's a lot more help from people
and the tutor than I expected
COMPETENCE RATING
about average, a 7 or an 8

DIFFICULTIES
menus, functions, needed help from Robyn;
little things- getting into wrong menus;
can handle it on my own

WHAT HE COULD DO
re-read notes

WHAT HE WILL DO
organise and re-read notes; learn commands after tutorials; get things clear;
the folio exercises and assignment

PRIOR EXPERIENCES
explored machines when I was young;
thought about machines, computers, calculators;
have always been interested in how things work

Michael Darby
Wednesday 20th April 1994
4th Interview
Tape 5 Side A 000-107

THOUGHTS
tutorial was a bit confusing;
wish I had more information on it;
data base stuff is new;
activities were general, not specific- a bit confusing;

FEELINGS
not too bad;
worried about getting a virus on the disk;
feel OK about data bases but had no idea at the beginning;
I don't feel sure of what I'm doing but I know how to do it;
I feel part of the group;
I'm not afraid to ask for help or to offer help

TUTORIAL CONTENT
data bases- what they were, set up examples like a company pay-roll; ways of
creating, changing them and printing them

COMMENTS & DISCUSSION
it was good talking between people;
you get other ideas; I help people and they help me;
the class is more of a team- everyone's helping each other

ATTITUDES
feeling more confident;
enjoying it more, typing has improved;
I feel like a '10' when I know how to do it but back down to a '5' when it's new

COMPETENCE RATING
able to do it on my own with my notes;
I need to read up a bit more about it

DIFFICULTIES
bad experience in the lab- the screen was shaking;
checked for viruses with Robyn;
no real difficulties with data bases, it's just new
WHAT HE CAN DO

WHAT HE WILL DO
keep up to date with exercises, to hand in as an assignment;
read up on references and class notes, know commands and go to the computer
prepared

Michael Darby
Wednesday 27th April 1994
5th Interview
Tape 5 Side B 311-534

THOUGHTS
data base work is complicated and specific;
a bit confusing;
It's hard not having a lot of time to get in and practise

FEELINGS
feeling not too bad;
I'm enjoying it, I'm comfortable with the computer, in control;
enjoying group work;
it's frustrating not getting time to use the computers

TUTORIAL CONTENT
data bases, commands

COMMENTS & DISCUSSION
answered questions in groups- it was good to correlate ideas

ATTITUDES
I'm able to understand the purpose more this week, I can see practical applications;
I've had a fresher approach to dBases- I understand it more after the lecture

COMPETENCE RATING
able to do it myself,
don't want to show anyone else how to do it

DIFFICULTIES
complicated commands, tedious, time consuming;

WHAT HE CAN DO
do the activities- read a bit more; leave extra time to look it up

WHAT HE WILL DO
the activities regularly

FOLIO PREPARATION
I did a lot of it on my own during the holidays. I chatted to other people about it,
comparing work; it was a topic of conversation in class and the labs; but no real
collaboration

FOLIO QUALITY
it was a good quality; I put a lot of work in and presented it well
I was pleased with it; I put as much as I could into it;
I did my best

ESTIMATED MARK out of 15
10-12

PROBLEM SOLVING
I could do the problems in the group, different people knew different parts to the
answer
GROUP WORK
it's good to correlate ideas; I'm enjoying group work;
generally people just help each other, it's not like thinking I need help or I'll help you;
group work and individual work both have their pluses and minuses

Michael Darby
Wednesday 4th May 1994
6th Interview
Tape 6 Side B  372-535

THOUGHTS
it was a rushed tute today;
computers breaking down defeats the thought that computers can help us;
not as enjoyable, not enough time to think and let it settle

FEELINGS
not too bad;
comfortable;
good about the folio mark;
wondering if was worth all the work;
hate it now

TUTORIAL CONTENT
Lotus spreadsheets- a lot of theory;
talked about the folio

COMMENTS & DISCUSSION
discussion questions- not as much this week due to people trying to figure it out;
people not as involved;
a couple of questions I needed the discussion to work out the answers;
I feel comfortable in groups and happy to discuss

ATTITUDES
I'll probably be more used to it next week;
getting used to new things, at first I'm unsure of my ability to learn it all;
data base confidence is up, fresh in my mind

COMPETENCE RATING
6 out of 10;
able to do it on my own;

DIFFICULTIES
couldn't access it properly
new work; getting into menus and submenus;
able to work it out on my own

WHAT HE CAN DO
look at notes

WHAT HE WILL DO
do the activity- keep folio up to date

ASSIGNMENTS
Folio mark- 12.5;
happy with that, better than what I had expected

Michael Darby
Wed 11th May 1994
7th Interview
Tape 7 Side B  068-222

THOUGHTS
wasn't sure what to expect;
some people were getting ahead- it was a bit confusing;
notes could be a bit more specific
today's tute would have made previous activity easier;
I would've preferred getting that information earlier

FEELINGS
a little apprehensive with new things;
fairly confident since completing activity 8 on my own;
trying to keep it up- folio due in two weeks

TUTORIAL CONTENT
spreadsheets- copied a file;
fiddled around with an expense account;

COMMENTS & DISCUSSION
the questions were mainly discussed- not a lot of people there;
little bit of discussion to help each other out;
we didn't know all the answers in our group, discussion got the general ideas

ATTITUDES
I'm seeing more practical use now, it's not so abstract;
don't feel apprehensive about doing it on my own;
more confident;

COMPETENCE RATING
Able to do it on my own, checking with my notes

DIFFICULTIES
data base folio exercise- little tiny things;
commands are no problem but using correct abbreviations, spaces, punctuation etc.

WHAT HE CAN DO
finish folio

WHAT HE WILL DO
do activity 9, do a bit of extra work for extra marks

Michael Darby
Wednesday 18th May 1994
8th Interview
Tape 7 Side B  580-end  Tape 8 Side A  000-045

THOUGHTS
the class was OK; it wasn't too hard, quite easy

Review questions:
I suppose they will be helpful;
the questions asked will be something the whole class is unsure of;
that's good because Robyn can answer it all for us at once or someone else can answer it;
good to clarify things

Prac Review:
is a bit ambiguous

Report:
I went over the limit- I hope I'm not penalised for it;
it was quite high quality- for having no knowledge of the topic; I spent a lot of time on it

FEELINGS
I enjoyed it;
very pleased with Report assignment; quite happy with it;
not too concerned about the written exam;
Prac Review is all I'm really concerned about;

TUTORIAL CONTENT
Lotus- graphs- labelling them

COMMENTS & DISCUSSION
review questions weren't started this week;

ATTITUDES
I'm now able to sit down and play around with it;
I am actually able to do practical things- it's not so abstract for me

COMPETENCE RATING
Happy to show others

DIFFICULTIES
printer not working properly
The I could ask someone after they'd done their exam about the structure of it
the Prac Review is a bit ambiguous;
I could ask someone after they'd done their exam about the structure of it

WHAT HE COULD DO & WHAT HE WILL DO
practise Lotus from last week;
try to get everything done for Folio 2;
graphs of Lotus

Michael Darby
9th Interview
Tape 8 Side B  327-761  Tape 9 Side A  000-023

THOUGHTS
Folio 2 is handed in;
refreshing the work in reviews increases my confidence; the work has a fresh look;
it helped me remember the format and structure of the work;

Groupwork:
in a group thinking process we were applying knowledge in new ways;
we exchanged ideas- through trialling together we had to make changes, fine tuning
things that you may not see on your own; you get different perspectives;

FEELINGS
good; pretty confident;
doing well;

TUTORIAL CONTENT
continued Spread sheet review; dBase- create and use
in groups we had to come up with a question for the class;
in the middle of this review we did folio work because of the time lag between people
in the group and in the class working faster than the others

COMMENTS & DISCUSSION
working in groups to form questions and answer them;

ATTITUDES
I'm more confident from the Prac Review of dBase;
still happy about Lotus

COMPETENCE RATING
Happy to show others today's work;
Able to help others with bits of course work;

DIFFICULTIES
None
WHAT HE COULD DO & WHAT HE WILL DO
nothing to do with computers other than tidy up my notes

Michael Darby
10th Interview
Wednesday 1st June 1994
Tape 9 Side A 647-763  Tape 9 Side B 000-083

THOUGHTS
WP was a bit hard, since it's been so long;
I found it complicated but managed to follow it;
I'd forgotten a lot of it;
Group work:
asking people for help is much better; it's a lot quicker;
if you get something wrong there's nothing wrong with saying "I got it wrong", you
should be able to ask for help;
being embarrassed to ask for help... that's what makes people more tense;
you remember it more;
they're not anxious about or worried about learning about computers, it doesn't turn
them off when they know they can actually ask for help;
if they feel like they can't ask for help, like they're the only ones doing it wrong then
they'll be less likely to go along with the computer course

FEELINGS
WP- a little bit edgy; I felt like I was starting again;
Group work:
asking people makes you more at ease;
I don't feel like I'm the only one making mistakes;
not embarrassed to ask for help; I feel more comfortable
I'm more interested and more active in it, rather than isolated- it's not just me;

TUTORIAL CONTENT
WP- typing out a page;
DOS- review sheet of commands

COMMENTS & DISCUSSION
everyone was asking everyone else how to do it;
the whole class knew the lot- different people knew different parts;
students posed questions as they had issues/ problems when they'd completed a
section

ATTITUDES
I've realised there's a lot more in WP than I thought, more that can be tested;
I can see more practical applications; I'm buying a computer- I wouldn't have bought
one before the course;
I feel more comfortable about buying a computer, now that I know about them;
I'm really happy about that- I'm looking forward to using that

COMPETENCE RATING
I don't think I'd be very confident showing someone DOS

DIFFICULTIES
not remembering little things/ commands
could handle it on his own- overcame them eventually;

WHAT HE COULD DO & WHAT HE WILL DO
dBase & WP- study a bit hard for;
go over notes- make summary sheet

Michael Darby
11th Interview
Wednesday 8th June 1994
THOUGHTS
I expected the Prac Exam to be hectic but it wasn't; it was a bit confusing, it wasn't as hard as I thought or as complicated most helpful parts of the course were learning step by step and having more of a group environment- helping each other out; I don't like the idea of a computer marked exam- I wish there was double checking

FEELINGS
a bit worried; quite relieved, quite pleased with it; I don't have to worry as much- my marks are going well; I'm a lot more confident with computers, happy that I have a basic knowledge; quite happy to go on and develop what I've learnt in a computer course

TUTORIAL CONTENT
Prac Review Exam

COMMENTS & DISCUSSION
N/A

ATTITUDES
I feel more comfortable with computers; feel more in control now; saving and wiping was my biggest fear- no longer

COMPETENCE RATING
Happy to show someone most of the course work- I have to ask others parts I don't know

DIFFICULTIES
None

WHAT HE COULD DO & WHAT HE WILL DO
study for written test over the weekend

SUMMARY:
At the beginning of the course Michael was "tense" and lacking confidence: "scared of touching the keyboard"; "wary of new things - always potentially difficult". As a child he had "explored machines" and had always been "interested in how things work".

As for his attitude to individual or group work, in the first three interviews, he expressed a preference for working alone - "individually it is good" - where he could work at his own pace, look up difficulties independently, "experiment, explore options, fiddle around, see what happens, and learn more things by myself." This preference for working alone may be related, in part, to Michael's deafness; it was necessary for his tutor to communicate to Michael through a special microphone which transmits sound to his hearing aid. He is especially adept, however, at lip-reading, which enabled him to participate effectively as a group member, and ultimately, the leader of his group.

With the increasing difficulty he experienced in the course (namely, with database and spreadsheet) he began to shift to greater dependence on the group: "help", both giving and receiving, is frequently referred to (16 times) in the interviews from this point. In the fourth interview, Michael describes his difficulty with learning about databases ("I feel like a '10' when I know how to do it, but back down to a '5' when it's new") and the technical problems that he experienced - a shaking screen and a fear that his work on disk would be contaminated by a virus. The following are some of the references made to "helping": "teamwork is good - helping each other, contributing knowledge and gaining it - noisy though" (this comment may relate to his hearing difficulty); "I feel part of the group - I'm not afraid to ask for help or to offer help".
Of particular interest are Michaels's comments about the benefits of groupwork/collaboration in building confidence. These were made in the final session of the review period, i.e., that in which structured groupwork was designed around the use of generic question stems in order to revise the coursework for the exam in the following week:

"Asking people for help is much better; it's a lot quicker ..... If you get something wrong there's nothing wrong with saying 'I got it wrong'; you should be able to ask for help ..... Being embarrassed to ask for help - that's what makes people more tense ..... You remember it more ..... They're not anxious about or worried about learning about computers; it doesn't turn them off when they know they can actually ask for help ..... If they feel like they can't ask for help, like they're the only ones doing it wrong, then they'll be less likely to go along with the computer course ..... Asking people makes you more at ease ..... I don't feel like I'm the only one making mistakes; not embarrassed to ask for help; I feel more comfortable; I'm more interested and more active in it, rather than isolated - it's not just me."

In regard to the learning benefits of using generic question stems and structured groupwork, Michael notes that "Everyone was asking everyone else how to do it; ..... the whole class knew the lot - different people knew different parts ..... In a group thinking process, we were applying knowledge in new ways; ..... we exchanged ideas - through trialling together we had to make changes, fine tuning things you may not see on your own; ..... you get different perspectives. I appreciate the good cross of ideas in groupwork; ..... talking reinforces my learning; ..... some people thought of things I didn't; ..... I needed the discussion to work out the answers" (to the questions written by the group, using the generic question stems).

Keywords: Help (receive and give); time; practice.

Yonneka Overduin: HI ANX; COOP SELF-REGULATED GROUP

Wednesday 16th March 1994
1st Interview
Tape 1 Side A 183-288

THOUGHTS
I'm starting from scratch
think I'll get used to things in the next couple of weeks

FEELINGS
worried at first, starting to feel better; getting the hang of it
first two weeks I felt unorganised; the step by step teaching helps me feel better, no need to panic
I feel better having people next to me to talk to in case I make a mistake;
they can show me how to fix it
more confident

TUTORIAL CONTENT
learnt the basics (WP) from scratch;

COMMENTS & DISCUSSION
I like reassurance - it's good to have help
laughing between students is good, you can laugh at your mistakes;
helps relaxation and builds up confidence, seeing someone else's mistake
it's good to ask each other questions and the teacher, especially to find out
how to do things
I normally ask people what to do; I'm sitting next to people who know
a lot about computers

ATTITUDES
I didn't know anyone at first, now I have friends it's a little bit better
the class isn't as bad as I expected; it's step by step and OK to handle
it doesn't seem as impossible as I thought it would be
COMPETENCE RATING
Could do it on my own, needing to use my notes
Couldn't show someone else how to do it, could help them a little bit

DIFFICULTIES
spell check;
booting the system- remembering the keys to use
not able to handle it on my own

WHAT SHE COULD DO
ask someone else to help, use notes to practise

WHAT SHE WILL DO
write out notes; read textbook

Vonneka Overduin
Wednesday 23rd March 1994
2nd Interview
Tape 2 Side B 555-757

THOUGHTS
I don't like being asked to answer questions in class;
it's a good class, step by step;

FEELINGS
lost a few times
OK; worried about getting to the next section;
afraid the teacher would go too fast;
confused about commands;
not too concerned when it's step by step;
having to answer questions in class makes me more nervous
too afraid to say anything that might be wrong;
actually discussing it was good

TUTORIAL CONTENT
letter formatting, setting margins, fonts, line spacing (WP)

COMMENTS & DISCUSSION
people next to me were helpful;
everyone's the same (worried);
doing questions with a partner was good- it helped me relax;
having a partner helps in having more confidence and to relax more
I think I won't make as many mistakes;
it helped getting someone else's opinion that was the same as mine

ATTITUDES
I've realised it's a bit more in-depth, harder

COMPETENCE RATING
probably could do it on my own using the template and thinking it through properly

DIFFICULTIES
remembering commands;
getting lost;
setting out the letter incorrectly- paragraphs, copying blocks: that was hard
I mucked that up;

WHAT SHE COULD DO
wrote out all the commands but still can't remember them all;
read the textbook, hasn't helped all that much;
practise
WHAT SHE WILL DO
write out notes, read through them;
concentrate more next week;
try to remember them all

Yonneka Overduin
Wednesday 27th April 1994
3rd Interview
Tape 6 Side A 098-173

THOUGHTS
tutorial was too fast

FEELINGS
at first OK but then I had trouble and had to restart;
confused, a bit worried about falling behind

TUTORIAL CONTENT
reveal codes (WP)

COMMENTS & DISCUSSION
lecturer was helping me out;
I got help from people next to me

ATTITUDES
I'm starting to understand computers now

COMPETENCE RATING
able to do it on my own;
after the activities I did help someone

DIFFICULTIES
reveal codes, setting out the document- tabs, margins;
didn't get to do much of the CV;
not able to cope on my own, I was helped a few times;
Lecturer helped me in the holidays

WHAT SHE COULD DO
finish off tutorial work and activities

WHAT SHE WILL DO
finish tutorial work and activities

PRIOR EXPERIENCES
none; I've never had a go on a computer;
I was too scared that I'd break it;
I'd never used one in high school, no need to, only games;
no experience with machines or technical things as a child- not that I can remember;
I made things like houses but nothing too technical;
video machine purchase- I'd go for one with gadgets -I'd pick it up after
a while with the instructions, step by step

Yonneka Overduin
Wednesday 27th April 1994
4th Interview
Tape 6 Side A 174-284

THOUGHTS
I had no idea of data bases;
I knew that they'd go through it step by step;
not sure of what to expect

FEELINGS
felt good knowing that it would be step by step; unsure of the whole subject; I enjoyed it, it was fun; relieved

    TUTORIAL CONTENT
simple commands, dBase 4

    COMMENTS & DISCUSSION
whole class had discussion questions, so I wasn't worried about whether she'd ask me to answer

    ATTITUDES
I expected it to roll along and I'll learn it, because I've done some computing now

    COMPETENCE RATING
Happy to show others with my notes beside me

    DIFFICULTIES
no difficulties; but at first I had trouble remembering how to get into it and set out commands I could handle them on my own

    WHAT SHE CAN DO
not much

    WHAT SHE WILL DO
not much

Vonneka Overduin
Wednesday 27th April 1994
5th Interview
Tape 6 Side A  285-448

    THOUGHTS
I understand when I learn it my own way

    FEELINGS
alright; relaxed; enjoying it; not really worried, only a small amount

    TUTORIAL CONTENT
data base exercises

    COMMENTS & DISCUSSION
started off with discussion questions; it was good because it was practical; group work was fine, I didn't mind it

    ATTITUDES
more confident; more used to using a computer;

    COMPETENCE RATING
Happy to show others last week's work with notes; Able to do it on my own, this week

    DIFFICULTIES
the language is totally different to WP; can handle it on my own

    WHAT SHE CAN DO & WHAT SHE WILL DO
I've made an arrangement to go with a friend each week to work in the computer room, doing activities and assignments; write out notes
FOLIO PREPARATION
mainly alone, with a bit of help from lecturer

FOLIO QUALITY
really pleased with it, very proud of it; it was set out exactly like they wanted;
I'd worked fairly hard on it, five hours at a time;
I think I'll get an average mark

ESTIMATED MARK out of 15
10-13

PROBLEM SOLVING
I needed other people a bit;
when we get more involved, I have more confidence

GROUP WORK
when we put our opinions together and get three different responses,
we try all three and get to the answer faster;
it builds up my confidence faster,
I'm not afraid of people finding out that I can't do things, or embarrassed;
I don't mind getting help- if they can help me that's good

Yonneka Overduin
Wed 4th May 1994
6th Interview
Tape 7 Side A 094-179

THOUGHTS
penalty for Folio: it's ridiculous to miss out on 10% on little things for assignments;
it seems so easy to get lost in a program;
I knew what I was doing when I was told to do it, but wouldn't know
other uses for it outside;
Lotus is similar learning to WP- just different combinations of commands

FEELINGS
I felt mad that I had to resubmit the assignment;
I felt alright after class but I didn't really know what to use Lotus for

TUTORIAL CONTENT
started Lotus (Spreadsheet)

COMMENTS & DISCUSSION
we had discussion questions in groups;
it was alright, I got to talk to someone different;
I needed help from the others to work the questions out

ATTITUDES
no change lately- not in the last couple of weeks;
it's been OK- not too difficult

COMPETENCE RATING
not able to do it on my own- I need notes or help from someone

DIFFICULTIES
using so many different commands is tricky; hard to remember;
can handle it on my own with notes

WHAT SHE CAN DO & WHAT SHE WILL DO
catch up on activities;
write notes out

FOLIO
resubmit- missed one part out, the directory

Yonneka Overduin
Wednesday 11th May 1994
7th Interview
Tape 8 Side A 318-426

THOUGHTS
Lotus seems harder than WP;
it was OK during the lesson;
the activity was difficult

FEELINGS
assignment grade returned after resubmit: depressing, frustrating-
sounds lower for losing marks (10 down to 8.5);
after the lesson it felt harder to do it myself;
I wasn't worried about the other things in the course but Lotus is harder

TUTORIAL CONTENT
Lotus- practising using spreadsheets and formatting them

COMMENTS & DISCUSSION
I could do the discussion questions on my own, but the group could ensure I was right;
they helped me by saying "Yeah that's right"

ATTITUDES
Lotus is hard and it's a lot more involved;

COMPETENCE RATING
Able to do it on my own, with information and instructions- I may need help

DIFFICULTIES
not when we went through it but I can see myself getting lost without help;
I need someone who knows to help me

WHAT SHE CAN DO & WHAT SHE WILL DO
activities; a lot more work on the computer;
I haven't been able to catch up

Yonneka Overduin
Wednesday 18th May 1994
8th Interview
Tape 8 Side A 427-565

THOUGHTS
it's gradually getting more difficult;
I'm not looking forward to the Prac Test;
I know I'll get really uptight and tense about it-
I won't be as good as other people

FEELINGS
more worried about Lotus;
not looking forward to Prac Test

TUTORIAL CONTENT
Review- activity to do on my own- I couldn't start it;

COMMENTS & DISCUSSION
similar questions to the week before, I could answer most of them
on my own going through;
having someone to talk with is good because a friend can help me and test
different ways to do things
ATTITUDES
increased my worry a bit because I can't grasp the Lotus program

COMPETENCE RATING
Able to do it on my own with practice

DIFFICULTIES
still can't remember how to do things;
now there's more to remember- it's overloading;
graphics difficult

WHAT SHE CAN DO & WHAT SHE WILL DO
read through instructions;
work through activities with a friend;
go through instructions while I practise;
a lot of revision for Pract test- dBase, Lotus;
DOS is reasonably OK

ASSIGNMENTS
I was happy with the quality of Folio 2 and Research Report;
I didn't really worry about the Report- I spent a lot of time researching
but not as much time as the Folio

Yonneke Overduin
Wednesday 1st June 1994 for Wednesday 25th May
9th Interview
Tape 9 Side B 472-735

THOUGHTS
I didn't think I'd have the Folio done; I was thinking of that more than anything
Groupwork;
making up questions in class was alright- not very hard to make up questions;
some were tricky;
emphasising things helped me to remember;
talking out loud helps me to remember better than studying;
having people there helped me if I didn't know the exact answer; it wasn't
as nerve racking;

I should be OK in the Prac Review;
if I take in enough examples I should be OK

FEELINGS
OK

TUTORIAL CONTENT
Revision of dBase

COMMENTS & DISCUSSION
groups making up questions for the class to try and answer;
I needed the group to work;

ATTITUDES
not really any changes;
still worried about the Prac exam

COMPETENCE RATING
able to do it on my own mostly

DIFFICULTIES
I have trouble with a few of the commands;
I have coped on my own with notes and the review sheets of the commands
WHAT SHE COULD DO & WHAT SHE WILL DO
nothing really

Yonneka Overduin
Wednesday 1st June 1994
10th Interview
Tape 9 Side B 472-735

THOUGHTS
I totally forgot about DOS things;
I was hoping to go through Lotus- it is harder
Group work:
posing my own question helped me to solve a problem with the rest of the class;
groups asked questions that I wasn't sure of- so the class helped me find those out

FEELINGS
very worried about the Prac exam;
I'm not sure if I'll pass;
I haven't had enough time to study;
I feel pretty confident with WP but not the rest

TUTORIAL CONTENT
WP- typed out a letter using function keys;

COMMENTS & DISCUSSION
we made up questions in groups;
I was still getting through DOS when they started the group work;

ATTITUDES
more confident about DOS

COMPETENCE RATING
WP- happy to show others;
DOS- able to do most of it on my own

DIFFICULTIES
Lotus- line graph;

WHAT SHE COULD DO & WHAT SHE WILL DO
summarise tutorial notes- write out notes to take in

Yonneka Overduin
Wednesday 8th June 1994
11th Interview
Tape 10 Side B 161-244

THOUGHTS
I expected the test to be much harder; it wasn't extra difficult;
I got a mark higher than I'd expected in the test- 20.5 rather than 17;
I should do OK in the course- shouldn't be too bad;
I received 12.5 for Folio 2- about what I was expecting

FEELINGS
before the Prac Test I was really worried;
I felt good after the first exercise;
felt fairly pleased with how I went, I feel like I did the best I could;
relieved- happy that I passed;
I expect about 50-60% in the written test (on lecture content)

TUTORIAL CONTENT
Prac Review Exam
COMMENTS & DISCUSSION

N/A

ATTITUDES
none really since last week; just relieved now- one exam down

COMPETENCE RATING
WP, DOS: happy to show others;
Lotus: probably able to show others;
dBase: able to do most of it on my own

DIFFICULTIES
dBase commands

WHAT SHE COULD DO & WHAT SHE WILL DO
organise notes, do summaries; go through text book;

* I'll continue on with another computer course next semester-
there's no other subject I'd rather take *

SUMMARY:

Yonneka was very worried about the course, at first, because she had had no
previous experience with computers at school, nor with technical machines or gadgets
as a child: "I was too scared that I would break it (the computer)."
She gained reassurance progressively from 2 aspects of the teaching approach:
i) the "step-by-step" or structured approach which is typically preferred by test
anxious individuals; and,
ii) the groupwork: "I like having people next to me to talk to in case I make a mistake.
Laughing between students is good, it helps relaxation and builds up confidence
seeing someone else's mistake."

"I don't like being asked to answer questions individually in class. When we put
our opinions together to answer a (higher-order, lecturer prompted) discussion
question and get three different responses, we try all three and get the answer faster;
it builds up my confidence faster. Because the whole class is given the same
discussion questions, I am not worried that the lecturer might ask just me to answer.
Talking out loud helps me remember things better than studying alone."

Three weeks before the Prac Test, Yonneka seemed to waver in her confidence.
She made comments like "I'm not looking forward to the Prac Test; I know I'll get
really uptight and tense about it; I won't be as good as other people."
She made comments like "I'm not looking forward to the Prac Test; I know I'll get
really uptight and tense about it; I won't be as good as other people."

The most immediate and likely factors related to this negative self-talk appeared
to be the following:

1. The need to resubmit the first assignment over a minor technicality with penalty of
10% (1.5 marks): Her comments were that it was "depressing and frustrating
because her mark out of 15 "sounds lower" at 8.5 compared to a previous 10.
Compare this with comments made three weeks earlier at the completion of this
assignment:
"I am really pleased with it; very proud of it; it was set out exactly like they wanted;
I've worked fairly hard on it, five hours at a time: I think I'll get an average mark."

In this same interview, she commented that she was feeling "relaxed" in the course
and "enjoying it ..... not really worried, only a small amount." She was finding DBase
4 "fun" and "simple in its commands"; ..... she reported that she felt more confident
and more used to using a computer; ..... happy to show others how to do the work and
to do it on her own." In the tutorial context, Yonneka states: "I am not afraid of
people finding out that I can't do things, nor embarrassed." Compare this with her
anxiety prior to the Prac Test, described earlier.

2. She was experiencing difficulty with learning the Lotus spreadsheet application;
need for a lot of practice and revision. This coincides with the entry in her
lecturer's diary which details technical difficulties at the start of the tutorial (error messages and fileserver crash) with consequent rush to cover the scheduled content after the considerable delays. In addition, she comments that "Lotus 123 is not a 'user-friendly' program by any means; there are a lot of keystrokes to learn, so most of this tutorial was direct instruction."

Once again, reassurance seemed to come from the structured groupwork and the training in the use of generic question stems:

"Posing my own questions helped me to solve a problem with the rest of the class; also, groups making up questions (that facilitated revision) on things that I wasn't sure of for the whole class to try and answer; so the class helped me find those out. Emphasising things helped me to remember. Having people there helped me - if I didn't know the exact answer it wasn't as nerve wracking."

Yonneka's struggles with gaining computing skills in a setting which was structured both in its presentation of content (yet not teacher-directed), and in the interaction fostered between students in their active construction of computing knowledge, were positive in outcome. Her comments in the final interview immediately after the dreaded Prac Test indicated the advances she had made in computer self-efficacy and confidence: "Before it I was really worried, but I felt good after the first exercise (DOS); I feel like I did the best I could. I got a mark higher than I'd expected - 20.5 rather than 17. I received 12.5 for the second Folio - about what I was expecting."

It is worth noting the observation made by Yonneka's lecturer in her weekly tutorial diary that Yonneka began to show greater confidence in the ninth tutorial (there were thirteen in all) which was the last dealing with new content (Lotus): "Yonneka spoke up and wanted to answer a number of questions in this tutorial. This is the first time she has wanted to contribute. She seemed more confident today."

As for her overall self-rating of competence at the end of the course, it was as follows: "Wordprocessing and DOS - happy to show others; DBase - able to do most of it on my own; Lotus - probably able to show others."

And her thoughts on future computing?: "I'll continue on with another computer course next semester - there's no other subject I'd rather take."

Keywords: Help; mistakes; step-by-step.

Melissa Harold: LOW ANX - COOP SELF-REGULATED GROUP

Friday 18th March 1994
1st Interview
Tape 1 Side A 292-520

THOUGHTS
I like it, it's interesting
I thought it would be more like high school, boring, not very practical;
it was good;
it's been worth me doing it;
it's more detailed than I thought it would be

FEELINGS
I like tutorials better than lectures;
I'm not embarrassed to ask for help

TUTORIAL CONTENT
DOS commands

COMMENTS & DISCUSSION
I'm getting to know the people in groups;
I like getting comments;
I ask Robyn for help;
students help each other;
I like working with people- it's good to work with anyone
but especially someone more capable than me;
we answered the questions quickly, good revision

ATTITUDES
definite change, I didn't want to do it before, but I like it;
it's interesting, not as boring as I thought it would be

COMPETENCE RATING
probably could do it myself, but I may need more time;

DIFFICULTIES
remembering what commands to use in DOS

WHAT SHE COULD DO
go over it again with Robyn;
share ideas with people in my class, ask them for help;

WHAT SHE WILL DO
practise on my dad's laptop, do an assignment using WP

Melissa Harold
Wednesday 23rd March 1994
2nd Interview
Tape 2 Side B 125-349

THOUGHTS
practise with word processing has helped;
class is good when it's step by step

FEELINGS
wasn't looking forward to it;
not as confident with the mouse;
bit more confident since practising on a lap top;
felt good in class, liking it more, interesting;
haven't really been a computer person;
I can't get behind because then I get stressed and I'm always trying to catch up
feeling good in discussions

TUTORIAL CONTENT
review of DOS; word processing- making a new file, moving blocks of text, copying;
saving bibliography

COMMENTS & DISCUSSION
people beside me help me a lot, talking makes things clearer; I can see why I'm doing
things, the purpose;
asking for help from other students when something's hard;
everyone asks everyone else, it's good;
it's a bit of a pain not being able to talk across room;
it's much better than trying to figure it out yourself, which could take ages, it keeps
me from getting behind;

ATTITUDES
can see the usefulness in computers;
liking computers more, not a waste of time;
can see the reason for doing it now; it's more relevant;
practise with WP made the difference, I can make more professional looking
documents;
I'm impressed with the efficiency of technology;
bit more confident with DOS

COMPETENCE RATING
would be able to do it on my own; but not too confident in showing someone else in
case of mistakes;

DIFFICULTIES
lost the title page, wasn't saved from last week;  
still forgetting how to do things, to type in DOS commands  
no real difficulties  
I need Robyn to go over things with, don't see the use in the textbook; I could go over  
some notes or could ask someone in class  

WHAT SHE COULD DO and WHAT SHE WILL DO  
ask Robyn, go over things again  

Melissa Harold  
Wednesday 30th March 1994  
3rd Interview  
Tape 3 Side B  458-709

THOUGHTS  
everything seems simple and quicker to do, rather than waiting for Robyn;  
straight forward for something that's so complex,  
not too much jargon now  

FEELINGS  
feeling more confident, from practise on the weekend;  
concerned about the prac exam;  
liking it more;  
only worry at the moment is the folio assignment - making too many mistakes in it  

TUTORIAL CONTENT  
on our own this week- CV, with tabs, underline, bold;  
needed Robyn to start us off;  

COMMENTS & DISCUSSION  
checking work with others, always talking to other people to make sure I'm doing it right  
questions- it's good to discuss them to get the answer;  

ATTITUDES  
I used to ask Robyn a lot, but now I'm asking a few questions to other students;  
I'm more confident, sometimes able to do it on my own;  
attitudes have changed tremendously, at first I didn't like computers at all,  
I was afraid of big mistakes, like wiping files. I avoided using them, didn't  
see a need for them;  
I didn't like my TAFE computer course at all;  
I expected the course to be terrible, the lectures were boring I hated it  
but the tutorials make it better - you can see the application and the purpose  

COMPETENCE RATING  
WP- more confident to show someone else if I had to;  
DOS- would be able to use it myself- not able to show anyone else  

DIFFICULTIES  
none this week in WP;  
DOS commands- still can't remember them  
since last week did assignment on computer, more prac of WP  

WHAT SHE COULD DO & WHAT SHE WILL DO  
work on folio, do the CV on computer; do activities  

PRIOR EXPERIENCES  
curiosity throughout childhood, was always fiddling and experimenting;  
but I had some bad experiences, breaking equipment so I wasn't very  
successful in my experiments  
video machine purchase- I would buy one with lots of gadgets  

Melissa Harold  
Wednesday 20th April 1994
4th Interview
Tape 5 Side A  109-237

THOUGHTS
didn't have the lecture on data bases as I had expected;
wasn't sure what to expect in tutorial;
WP is much more useful for me than dBase;
not sure what I'll use dBase for;

FEELINGS
OK; not too bad;
not too nerve racking;
after class fine, not worried;
surprised, didn't know what to expect in tutorial from the lecture;
disappointed that the lecture wasn't on data bases

TUTORIAL CONTENT
data base- making records, editing, deleting;
reviewed WP;
what's the purpose of it

COMMENTS & DISCUSSION
WP- bit harder questions to discuss- didn't know the answers to them;
dBase- class discussion- teacher led us into it;

ATTITUDES
becoming a bit of a computer head, they're good things;
using a notebook computer at home now;
experimenting more, I'll sit at the computer and play with it;
bit more confident

COMPETENCE RATING
able to do it myself;
not confident to show someone else

DIFFICULTIES
we didn't know what we were doing at the beginning;
so Robyn gave us a mini lecture and led us through it

WHAT SHE COULD DO
bring up the files from today and play

WHAT SHE WILL DO
have a look at the other assignment;
have a look at the activities

Melissa Harold
Wednesday 27th April 1994
5th Interview
Tape 5 Side B  535-end  Tape 6 Side A  000-098

THOUGHTS
didn't really use dBase 4 a lot, didn't see the practical use of it as much as WP;
dBase 4 assignment- folio exercises will be harder to get time on the computers

FEELINGS
surprised that we only did 2 weeks on dBase;
pretty confident- because we've done a certain amount I'm more used
to using the computer;
more sure of myself;
good, when our group figured out the answer first;
afraid to answer in class;
I like the course;
not feeling as keen and confident to do Lotus- I hated it before
TUTORIAL CONTENT
finishing off dBase 4

COMMENTS & DISCUSSION
did questions on dBase 4- our group figured out the answer first- that felt good;
no one's volunteering answers though- I'm still afraid of getting it wrong

ATTITUDES
still say I like computers more (at home);
not really sure of how I'll use dBase;
I've done Lotus before and I didn't like it so I'm not so keen to do the tutorial now

COMPETENCE RATING
able to do it on my own;
not happy to show others in case I make a mistake;

DIFFICULTIES
remembering little details of commands, the vocabulary- I just don't use it

WHAT SHE COULD DO & WHAT SHE WILL DO
the research assignment, look up information for it;
the folio activities that are already behind

FOLIO PREPARATION
by myself at home a lot;
with a friend in the holidays at Uni; in groups in class;

FOLIO QUALITY
quite pleased with it- it was very neat for me;
I think I answered all of the questions but missed a little part of a question;
I spent quite a lot of time on it;
it turned out better than I thought- it looked good
in the class I think it will be about average

ESTIMATED MARK out of 15
10/11

PROBLEM SOLVING
on my own I couldn't do them, in a group we could do them all

GROUP WORK
it was good because you could sort it out first rather than just diving into it;
you get to find out how to do it and experiment;
I'd rather work in groups because you get more opinions;
myself thinking about it would have taken a lot longer;
it's not as boring- everyone still pays attention;
I like it, it's helpful;
I'd rather learn asking people next to me- it saves time and saves Robyn

Melissa Harold
Wednesday 4th May 1994
6th Interview
Tape 6 Side B 535-744

THOUGHTS
having to resubmit is annoying- it's been a dampener on the morning;

FEELINGS
not good;
I'm mad about having to resubmit;
not too impressed;
it was good working in groups- I like having a discussion
TUTORIAL CONTENT
Lotus- talking about what Lotus was; did a bit of work printed a thing out;

COMMENTS & DISCUSSION
review questions on dBase was alright; easy questions on Lotus; it was good working in groups- I like having a discussion

ATTITUDES
I really liked WP; dBase was alright; Lotus is more practical for me than data base; I didn't like Lotus before; the lectures and explanations have made a difference

COMPETENCE RATING
Happy to show others but menus are a bit difficult

DIFFICULTIES
menus getting mixed up; I could cope on my own but I like to ask others for reassurance

WHAT SHE COULD DO
practise it

WHAT SHE WILL DO
get into assignment

Melissa Harold
Wednesday 11th May 1994
7th Interview
Tape 7 Side B 366-452

THOUGHTS
with the other assignment we could do a bit in class, but this one is speeding up- a lot of work; the Report assignment is done but I don't know how I'll go I don't want a resubmit

FEELINGS
not too bad because I haven't done anything; getting too stressful; claustrophobic with all the work; relieved when I handed in the Report;

TUTORIAL CONTENT
N/A (missed tute and lecture)

COMMENTS & DISCUSSION
N/A

ATTITUDES
I'm getting more stressed about the course

COMPETENCE RATING
Able to do most

DIFFICULTIES
the pressure

WHAT SHE COULD DO & WHAT SHE WILL DO
folio assignment and dBase work
Melissa Harold  
Wednesday 18th May 1994  
8th Interview  
Tape 8 Side A  045-180  

THOUGHTS  
Lotus is not that difficult;  
the pressure is coming now- assignments and test;  
I shouldn't fail- I don't want to do it again  
I missed a tutorial... but I understood the work by the end of the lesson;  
I can't afford to miss another tute- missing a tute leaves you too far behind;  
doing a Lotus spreadsheet ourselves should be helpful- instead of studying yourself you get everyone's ideas;  

FEELINGS  
not as confident this week- missed last tutorial;  
wasn't too bad by the end of the lesson;  
feeling alright about the course  
ot not feeling too good about folio 2, worried about getting the Lotus commands right  
DOS is a big worry; hope it will be alright  
ot not feeling really good about the Prac Review  

TUTORIAL CONTENT  
spreadsheets-graphs  

COMMENTS & DISCUSSION  
few questions on Lotus, I didn't know them- my partner told me the answer  
I was lost in the group questions- I needed the group to answer them  

ATTITUDES  
feeling more negative about this folio than the other;  
pressure to pass  

COMPETENCE RATING  
able to do it myself, might have to ask occasionally  

DIFFICULTIES  
mainly because I was away and didn't know it;  
I was lost in the group questions  

WHAT SHE COULD DO & WHAT SHE WILL DO  
activities for folio 2  

Melissa Harold  
Wednesday 1st June 1994 for Wednesday 25th May  
9th Interview  
Tape 9 Side B  084-193  

THOUGHTS  
I liked the class, dBase review was pretty good  
group questions- testing everything, we got straight to what we needed to know;  
because we did it as a class, there wasn't the pressure of one person answering;  
we figured it out in a group;  
the others went off and asked the question;  
the questions were all at different levels;  
the guys knew what they were doing- they helped us with the answers  

FEELINGS  
not too bad,  
a bit stressed with folio completion, anxious to get the folio done;  
pretty good
TUTORIAL CONTENT
think of a questions in groups, revision

COMMENTS & DISCUSSION
we answered the questions as groups
(see above comments)

ATTITUDES
changed for the better;
with the folio I was stressed thinking the course was a waste of time,
"why am I doing this?"; now it's changed
I still use a computer at home- confident;
I'm a faster typer now

COMPETENCE RATING
able to do it myself

DIFFICULTIES
not really

WHAT SHE COULD DO & WHAT SHE WILL DO
nothing- do other things

Melissa Harold
Wednesday 1st June 1994
10th Interview
Tape 9 Side B 084-193

THOUGHTS
this week was a shocker;
WP was good;
DOS- I hate it- the commands are terrible, I just can't understand the terminology
counting down in my head to the Test will probably be the worst thing;
I'll probably just pass everything; it's a bit of a stress;
I'd rather not know the mark for each activity as we go through the Prac Test;
It's nerve racking- it'll make me cautious, taking more time

FEELINGS
not as confident this week; I don't like DOS;
I don't feel too bad in the course- I'm passing it;
I'm a bit worried about next week
I'm not looking forward to sitting next to someone who's really good;
I'm pretty stressed

TUTORIAL CONTENT
DOS sheet of commands
COMMENTS & DISCUSSION
it wasn't as groupy this week; we posed some questions;
Robyn would go through and explain it all;
she singled us out to answer questions I counted down to my question
and figured it out before she asked me

ATTITUDES
last week I was more confident about computers in general;
the loss is due to DOS- I hate it and don't understand it- there's too much jargon

COMPETENCE RATING
able to do it on my own asking people occasionally

DIFFICULTIES
the whole DOS system
I'm needing help
WHAT SHE COULD DO & WHAT SHE WILL DO
study up for Prac Test especially DOS;
be prepared

Melissa Harold
Wednesday 8th June 1994
11th Interview
Tape 10 Side A 606-end Tape 10 Side B 000-068

THOUGHTS
the Prac Test wasn't too bad; better than I thought- easier;
it was alright;
I ran out of time
the most helpful part of the course was- the group work; I got input
from others, you weren't put on the spot;
-step by step learning;
there wasn't that feeling of competition when you were talking and helping each other
I liked the course, how it was set out- how Robyn set up the classes-
the discussion in groups and the step by step learning;
it was easy for someone who hadn't done it before;
I didn't like the idea of the Prac Exam- we were like little guinea pigs

FEELINGS
I was a bit disappointed in that;
I was pretty nervous, stressed throughout, especially getting marks as I went along;
now I'm relieved that's it's finished;
happy that it's over;
everyone knew everyone's marks so you felt like you were competing
with the others even though you weren't;
I was pleased with the folio- I went well in that

TUTORIAL CONTENT
Prac Exam

COMMENTS & DISCUSSION
N/A

ATTITUDES
I have a greater appreciation of computers; the practical side to computers- the programs themselves;
I'm more confident, more sure of what I'm doing

COMPETENCE RATING
WP- Happy to show others
dBase, DOS, Lotus- able to do it on my own

DIFFICULTIES
just the actual stress of the exam

WHAT SHE COULD DO & WHAT SHE WILL DO
a lot to learn

SUMMARY:

Compared with the other students in her group, Melissa had considerably more previous experience with computers at the commencement of this subject, having studied computers at high school and completed a TAFE course in computing, as well as practising at home on her father's laptop.

At first her attitude was confident and positive (low anx) - "I like it (the subject), it's interesting, not boring - practical. She is not embarrassed to ask for help but relies on the tutor rather than other students as she prefers to have help from "someone more capable than me". In class she sits next to Yonneeka, an unconfident beginner who is shy about asking for help, preferring to wait for the tutor to be
passing by or helping someone close by before asking. Melissa's dependence on the tutor continues in the second interview: "I need R. to go over things again". However, she now begins to refer to groupwork: "people beside me help me a lot; it's good asking for help from other students when something's hard - makes things clearer; I can see why I'm doing things, the purpose (this is important to Melissa).

Although she mentions in the first interview that "I like working with people - it's good to work with anyone but especially someone more capable than me", by the third interview, Melissa has shifted her reliance for help from the tutor somewhat to the group: "I used to ask R. a lot, but now I'm asking a few questions to other students. Everything seems simple and quicker to do, rather than waiting for R. Two weeks later, Melissa comments that "I'd rather learn asking people next to me - it saves time and saves R.; I'd rather work in groups because you get more opinions; myself thinking about it would have taken a lot longer time; it's not as boring. I could cope on my own (with spreadsheets) but I like to ask others for reassurance."

Attitude shift throughout the subject: Although not anxious, Melissa expressed a negative attitude at first: "didn't like computers at all; afraid of big mistakes like wiping files - avoiding using them." By the fourth interview, "I'm becoming a bit of a computer-head; they're good things". She has begun to use a notebook computer at home and experimenting ("playing") with it.

At the beginning of the first Review session, Melissa comments with regard to the use of generic question stems in groups: "we got straight to what we needed to know; because we did it as a class, there wasn't the pressure of one person answering; we figured it out as a group." (Note: in relation to group composition and ability, Melissa's next comment is important: The guys (Michael Darby and Andrew Macdonald) knew what they were doing - they helped us (Melissa and Yonneka) with the answers."

During the second Review session, Melissa began to show clear signs of test anxiety prior to the following week's Prac Test. Comments made were largely negative:

"this week (tutorial) was a shocker"; "DOS - I hate it - the commands are terrible, I can't understand the terminology"; "It's nerve wracking (getting marks progressively for each component of the test)"; "I'm a bit worried"; "I'm pretty stressed". It is important to note that Melissa is greatly concerned about the public nature of the test: "I'm not looking forward to sitting next to someone who's really good (fear of comparison)". Following the Prac Test, Melissa reports that during the exam she felt "pretty nervous; stressed throughout, especially getting marks as I went along." this sense of comparison and competition was mentioned several times throughout this final interview: "Everyone knew everyone else's marks so you felt like you were competing with the others, even though you weren't."

At the end of the subject, Melissa expresses a very positive attitude towards the groupwork which shows her shift from dependence on the traditional teacher-directed model of learning: "The most helpful part of the course was the groupwork; I got input from others; you weren't put on the spot." In terms of her dislike of competition, groupwork was clearly a preferable alternative: "There wasn't that feeling of competition when you were talking and helping each other."

Keywords: purpose; application; practical; useful; relevant; interesting; not boring (these all relate to the way in which the subject was taught, demonstrating the relevance of computers, and developing motivation in the students); with regard to groupwork, "talking" and "help" occur frequently.

**Terry Funnell: LOW ANX - DIRECT INSTRUCTION GROUP**

**Thursday 17th March 1994**

1st Interview  
Tape 2 Side A 000-172

**THOUGHTS**
like the course;  
thought it would be intensely boring, just another machine;  
Robyn's process is logical, breaking up information;
course is slower than normal
prefer Apple Macintosh to IBM

FEELINGS
surprised, interested and intrigued;
not overwhelmed;
not intimidated or out of control or don't know what I'm doing;
bit wobbly on DOS;
feel OK to ask for help;
familiar with equipment

TUTORIAL CONTENT
word processing- typing letter, saving, spell check, printout, created subdirectories;
review of DOS

COMMENTS & DISCUSSION
like getting comments; like being noticed- I'll do things a bit differently to gain attention; like being given extra instructions to go ahead in the work, when finishing quickly; there's no/little comments between students- just questions from another student

ATTITUDES
more of an affinity with computers, see them as useful for more than I'd previously experienced;
am wider eyed- more aware;
I need to be up with new developments in technology, I like to keep up

COMPETENCE RATING
WP- Happy to show others
DOS- not able to show others

DIFFICULTIES
none with WP
DOS- copying and renaming files
can handle it on my own

WHAT HE COULD DO
practise it more
pay more attention, can't bluff your way through

WHAT HE WILL DO
practise
reinforce work one more time, read textbook

Terry Funnell
Thursday 24th March 1994
2nd Interview
Tape 3 Side A 392-end Tape 3 Side B 000-013

THOUGHTS
other students are having major hassles;
moving blocks of text seemed like a waste of time, I saw better ways of doing things;
processes seem more complex using a computer;
can see the use of the word processing but seems too labour intensive;
need to re-learn habits- ie. focus on the mechanics of the program rather than being distracted by spelling & grammar;
helping another student all the way through made me miss instructions;
I need to learn and then reinforce that learning

FEELINGS
falling asleep, uninterested, bored;
was looking forward to the 20 mins at the end of the lesson to practise, but didn't get it- was disappointed;
haven't lost control yet, but could be on the verge;
competent but in danger of being incompetent, need to work to keep up;
feel in the middle of the class in terms of ability

TUTORIAL CONTENT
more WP this week, editing, fonts, bolding

COMMENTS & DISCUSSION
asked the student beside me for help;
very little talking in the class

ATTITUDES
WP on the computer seems too labour intensive;
felt really confident before, now I see so much that I don't know,
my confidence is lower;

COMPETENCE RATING
Happy to show others

DIFFICULTIES
not having major difficulties, making minor mistakes;
would've gone to Robyn;
erasing document from screen, managed to get it back on my own, retrieve document;
tab setting, had extra numbers; asked Robyn but didn't get an answer;
wasn't sure of how I'd made the error
WHAT HE COULD DO
read over notes, work on the computer

WHAT HE WILL DO
read over notes, work on the computer; concentrate;
get time to myself on the computer to fix up mistakes

Terry Funnell
Thursday 31st March 1994
3rd Interview
Tape 4 Side A 323-end Tape 4 Side B 000-027

THOUGHTS
difficulties from last weeks not so hard now;
something's clicked and it has become automatic

FEELINGS
more confident- everything's caught up again;
feels good when everyone shows and shares with each other, whoever
discovered it first showed it to the rest of us;
confidence with machines is up again after wavering;
not as interested in the subject, WP has become tedious;
not particularly looking forward to class and new work

TUTORIAL CONTENT
more WP, title page, resume;
worked together with others, rectified situations together;

COMMENTS & DISCUSSION
comments between students at work stations;
everyone showed and shared with each other this week

ATTITUDES
haven't gotten lost as I thought I would;
overall interest in subject has decreased slightly;
DOS was new and novel, WP has become tedious, class is like
a typing pool, very routine;
I think I'll get over the slight decrease;
confidence with machines has gone up and down; started high, stayed high, last week wavered, this week back up; complications from last week actually discouraged me from

COMPETENCE RATING
Happy to show others this week's work
Happy to show others last week's work, even though he wasn't able to then

DIFFICULTIES
not getting time at the end of the lesson;
printout are really squashed;
no major problems; any small ones I fixed myself;
still haven't looked at the textbook

WHAT HE COULD DO
assignment work

WHAT HE WILL DO
folio assignment over the holidays

PRIOR EXPERIENCES
hand held games in primary school;
always involved with gadgets and equipment, trying to improve
Circuit boards and amplifiers, car repairs;
techno wizz of the family
video machine purchase - one that was functional & the best

Terry Funnell
Thursday 21st April 1994
4th Interview
Tape 5 Side A 398-757

THOUGHTS
lesson was boring and short; work is basic;
I expected something more visual, more exciting but it just didn't happen

FEELINGS
good;
unimpressed and disappointed with data bases;
bored in class, not too bad, distracted;
bet distressed when our group was split;
I feel like I am back to the stage at the beginning of semester: I think
I know everything and can do it

TUTORIAL CONTENT
data bases

COMMENTS & DISCUSSION
my group was split this week, leaning over and talking to each other;
group work stops me going off on tangents and making mistakes;
I conform more in a group and go with them;
we work better as a group, individuals don't make as many mistakes;
the 'clan' in the room has become global, everyone in class is
helping and asking everyone else now;
more of a common bond in class now;
I kept looking at the screen next to me to check work

ATTITUDES
WP is getting really useful;
I'm pretty sick of learning things in a school environment;
I'm experimenting with new things - this has my confidence up;
by going through handouts and practicing functions have meant
that my problems have pretty much disappeared
COMPETENCE RATING
Happy to show others

DIFFICULTIES
none, other than going ahead too soon

WHAT HE CAN DO
won't do database work

WHAT HE WILL DO
some WP work or maybe some database activities

Terry Funnell
Thursday 28th April 1994
5th Interview
Tape 6 Side B 000-169

THOUGHTS
class this week was better, pace has picked up a bit;
I got something useful out of class;

FEELINGS
pretty good;
more interested

TUTORIAL CONTENT
data base in more detail; questions- problems to solve;

COMMENTS & DISCUSSION
people were leaning over and helping each other;
Robyn was directing us and helping us if we got stuck

ATTITUDES
felt like I could get more use out of data bases this week;
I liked this week's class better because it was faster

COMPETENCE RATING
able to do it myself

DIFFICULTIES
nothing insurmountable;
a few little mistakes, but the computer corrected me;
mistakes were caused by the fact I was going too fast and messing up
I can handle it on my own using computer prompts;

WHAT HE CAN DO & WHAT HE WILL DO
have another session by myself to go over what I've done, spend
a few hours on the computers, do activities

FOLIO PREPARATION
alone

FOLIO QUALITY
pleased, but some things came out differently than what I expected;
I showed individuality in the presentation; I put a lot of work into
the presentation but only an average effort in working it out; effort
was a 6 or 7 out of 10;

ESTIMATED MARK out of 15
9/10

PROBLEM SOLVING
could do most independently; I got answers off someone else for some

GROUP WORK
there is none except when we ask each other something

Terry Funnell
Thursday 5th May 1994
6th Interview
Tape 7 Side A 362-585

THOUGHTS
dBase seemed too short;
this week’s class was pretty good- fast paced, a lot of information packed in;
not sure of how much I'll use spreadsheets;
the course is not bad;
it makes me work more when someone has gone out of their way to help me;
working with others is a motivating thing

FEELINGS
unsure of future, not looking positive; (unsure of financial ability to stay);
my interest in Uni is on a downslide;

TUTORIAL CONTENT
Lotus- spreadsheets; getting into it, entering information, basic editing

COMMENTS & DISCUSSION
not much really;
Robyn talked to us about what to do;
just non-verbal acknowledgements between the class

ATTITUDES
feeling stupid for not handing folio in;

COMPETENCE RATING
Happy to show others

DIFFICULTIES
no problems with the week to week class;
assignments- I have a lack of motivation and purpose- outside things are taking over;
have to work it out on my own

WHAT HE CAN DO & WHAT HE WILL DO
got off my butt to do things- get assignments done and done well;
come over at the same time as the others in class to work in the labs;
got notes from another woman in class- research notes;

Terry Funnell
Thursday 19th May 1994 for Thursday 12th May
7th Interview
Tape 8 Side B 046-148

THOUGHTS
didn't put research report in

FEELINGS
pretty good;
having no problems with the work;
don't like assignments, don't like to do them

TUTORIAL CONTENT
not in class

COMMENTS & DISCUSSION
not in class

ATTITUDES
I still like the course the class work is interesting;
the assignment thing is getting in the way; it's just not worthwhile doing it

COMPETENCE RATING
not in class

DIFFICULTIES
no difficulties

WHAT HE CAN DO & WHAT HE WILL DO
nothing

ASSIGNMENTS
submitting folio soon;
Robyn requires to see folio 2 before handing in

Terry Funnell
Thursday 19th May 1994
8th Interview
Tape 8 Side B  149-256

THOUGHTS
the work is interesting but easy;
I don't think the work is particularly difficult;
I wish there weren't any assignments

FEELINGS
swamped incredibly;
disappointed in myself for not having moved my butt till now

TUTORIAL CONTENT
graphs on Lotus

COMMENTS & DISCUSSION
a fair bit;
a lot of people asking Robyn and each other how to do things;
it was pretty good having a definite problem and seeing how to do it

ATTITUDES
no change in regard to class work;
assignment work- I've woken up to the fact that I have to be more responsible and put
my head down and not throw the first semester away;
I'm looking on the bright side of Uni- working to pass

COMPETENCE RATING
Happy to show others

DIFFICULTIES
None

WHAT HE CAN DO & WHAT HE WILL DO
come over tomorrow and on Saturday to get a whole bunch of things done;
hand in a whole lot of assignments

PRAC TEST
feeling good about preparing for it;
it's a chance to get instantaneous results; preparation for it won't be a hassle;

WRITTEN TEST
don't have too much of a problem with it;
feel pretty confident having to answer anything on the course

Terry Funnell
Thursday 26th May 1994
9th Interview
Tape 9 Side A  147-387

THOUGHTS
everyone was scrambling to finish the folio;
I should do pretty well in the exam;
I should finish within the time;
Prac exam no problem;
the review didn't help me a great deal- but it was good to set a time limit
and get Robyn's input on a few things;
I should've started work earlier- there are huge amounts of people in labs

FEELINGS
indifferent- lower priority for class work, distracted by folio work;
disrupted in class by other students doing assignment work

TUTORIAL CONTENT
review dBase;
choice of topic to review;
practise run through; we were supposed to be doing it individually but some
people were looking at other's monitors when having difficulty;
folio work

COMMENTS & DISCUSSION
between our small group- discussing folio stuff and dBase review

ATTITUDES
work ethic is starting to kick in- avoiding failing;
still wishing they didn't give us assignments;
I'm finding spreadsheet work more useful;
I'd consider using it at home

COMPETENCE RATING
Happy to show others (and have been)

DIFFICULTIES
none from class

WHAT HE COULD DO & WHAT HE WILL DO
spend a fair bit of time in the labs

Terry Funnell
Thursday 2nd June 1994
10th Interview
Tape 10 Side B  161-315

THOUGHTS
overall the course has been good for me to do;
it's good to go over stuff you've learnt just to keep it in your brain;
it's been really interesting;
I've chosen to do the second semester course in computing;
WP review didn't do much for me- I pretty much knew it all;
DOS- questions asked to people in class- I slipped up in my answer;
it refreshed my memory from a while ago

FEELINGS
glad that the exams are coming up;
I like doing exams;
pretty good, pretty confident about the Prac Test;

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conscious of the need to do well;
I'm looking forward to the end of the course

TUTORIAL CONTENT
WP- OHP instructions, take it like an exam;
DOS- went through sheet of commands

COMMENTS & DISCUSSION
nothing too specific- just between me and the people either side - people asked me for help;
DOS- if someone answered wrongly someone else would answer

ATTITUDES
no change towards the class;
I realise I have to do really well due to mucking other things up

COMPETENCE RATING
WP- Happy to show others;
DOS- could probably show most but not all

DIFFICULTIES
typing seems to have slowed down

WHAT HE COULD DO & WHAT HE WILL DO
go to lab and do some stuff; put myself through activities;
finish folio and research report and hand in

Terry Funnell
Thursday 9th June 1994
11th Interview
Tape 8 Side B 149-256

THOUGHTS
Prac Test was good; easier than I had expected; easier than Review
not much of a problem;
I didn't expect to do as well as 24.5;
I'm happy to do the next computers course- interesting to see what they'll do next

FEELINGS
everyone was a bit worried;
I felt pretty good- not worried;
after test- pretty good because I did pretty well- glad it's over;
feel confident with a computer; glad that I've done the course, where I've learnt a lot;
don't feel nervous about the written exam

TUTORIAL CONTENT
Prac Review Exam

COMMENTS & DISCUSSION
N/A

ATTITUDES
when I first started I felt outwardly confident but I was still conscious of the fact that it had been a while since I'd had exposure to computing;
thinking I might be completely swamped by this;
now I realise that it's not impossible to master- you just do it and do your best

COMPETENCE RATING
Happy to show others

DIFFICULTIES
remembering dBase dot prompt

WHAT HE COULD DO & WHAT HE WILL DO
folio 1 hand in Research report hand in;
go over notes from lectures

**SUMMARY:**

Terry's early experiences with technology are considerable compared to most other students in the two groups: "techno wizz of the family; always involved with gadgets and equipment - trying to improve circuit boards and amplifiers, car repairs; hand held games in primary school."

At first, Terry's attitude was one of confidence - "not intimidated or out of control or don't know what I'm doing"; and positive approach to computers - "see them as useful: ..... I need to be up with new developments in technology". Having experienced DOS in the first class and not really mastered it, he felt "a bit wobbly on DOS"; ..... then after experiencing difficulty with word processing (erasing document and learning to use tabs) he comments- "I haven't lost control yet, but could be on the verge; ..... competent but in danger of being incompetent; ..... felt really confident before; now I see so much that I don't know, my confidence is lower."

When asked whether he liked receiving comments from the lecturer or other students while he worked, Terry replied that there was no/little discussion between students and that there was generally little talking in class (although he had asked the student beside him for help). This comment was made in the first two interviews.

In the third interview Terry's confidence is up again. It is interesting to note that after this week's class he comments on the degree to which the class collaborated: - "It feels good when everyone shows and shares with each other: whoever discovered it first showed it to the rest of us; ..... worked together with others; rectified situations together; ..... everyone showed and shared with each other this week; ..... there were comments between students at work stations." Is this why his spirits are higher this week?

With regard to this reference to groupwork, in the fourth interview, Terry comments at length on the collaborative spirit in the class: ..... "the 'clan' in the room has become global: everyone in class is helping and asking everyone else now; more of a common bond in class now; ..... I keep looking at the screen next to me to check work; ..... groupwork stops me going off on tangents and making mistakes. It appears that Terry (if not others) had formed a "group" of their own accord because he comments that he was "a bit distressed when our group was split", but this did not prevent the collaboration continuing: "My group was split this week, leaning and talking to each other." In the following week, Terry notes again that "people were leaning over and helping each other", and even in the sixth interview, he notes that "it makes me work more when someone has gone out of their way to help me; working with others is a motivating thing.

Despite an apparently strong collaborative influence on his learning, Terry's concluding comments, however, seem to indicate a strong internal locus of control - "When I first started I felt outwardly confident but I was still conscious of the fact that it had been a while since I'd had exposure to computing; thinking I might be completely swamped by this; now I realise that it's not impossible to master- you just do it and do your best.

It appears that this "direct instruction" group was not without considerable opportunity for discussion and collaboration. In the eighth interview, Terry avers to the fact that "a lot of people were asking R. and each other how to do things." Even in the following week's review, he says that "we were supposed to be doing it individually but some people were looking at other's monitors when having difficulty." Feeling confident in his own ability at this point, he was happy to show others what to do.

As there were no explicit instructions for this class to work collaboratively as in the other group, in fact, the lecturer was to adopt the traditional teacher-directed approach where students worked alone or referred to her for help - could this diversion from the experimental design not confound group differences based on teaching approach, viz. direct instruction with a focus on individualisation and competition versus cooperation? Certainly, it would seem to suggest that students learning to use computers feel the need to ask each other for help and to offer help when required.
As for the Prac Test, Terry has no exam anxiety although "everyone was a bit worried" - "glad that the exams are coming up; I like doing exams"; he is confident about doing well: "pretty confident about the Prac Test." (He scored 24.5 out of 25). His attitude throughout has been one of a sense of control over his own achievements or lack of them: he recognises the need to spend time practising and to read the textbook - "mistakes were caused by the fact that I was going too fast and messing up; need to have another session by myself to go over what I've done and spend a few hours on the computers, do activities."

Keywords: fast pace (Terry frequently comments on his need for pace and excitement in his learning; he also refers to a preference for something "visual" to break the monotony); boring; just another machine; course is slower than normal; tedious; the class is like a typing pool, very routine (with reference to word processing).

Kylie Lovell: HI ANX; DIRECT INSTRUCTION GROUP

Thursday 17th March 1994
1st Interview
Tape 2 Side A 301-424
THOUGHTS
course is OK, bit hard so far;

FEELINGS
OK, good if I can understand it, feel like I can do it;
frustrated if I can't do it;
the activities are hard, not sure what the lecturer wants

TUTORIAL CONTENT
formatting disks, functions of DOS, copies, subdirectories;

COMMENTS & DISCUSSION
teacher helped us;
other students help when I can't do it

ATTITUDES
liked it heaps the first week, thought I'll be able to do this;
second week harder to understand, had problems
my motivation has changed, wanting to work all the harder because
it's getting more difficult, persistence

COMPETENCE RATING
Couldn't show someone else

DIFFICULTIES
copying files from master disc to back up;
remembering commands;

WHAT SHE COULD DO
practise, play around with the program, use them more

WHAT SHE WILL DO
practise on the computer at home;
ask friend for help.

Kylie Lovell
Thursday 24th March 1994
2nd Interview
Tape 3 Side B 191-297
THOUGHTS
course is getting more interesting

FEELINGS
missed tutorial, found this week difficult, feeling anxious, took a while to catch up;
up tight at the beginning of class, lost;
got easier, feel a lot better- understand it now;
feeling a bit more confident, not so upset if something goes wrong;
more interested;
bored and overwhelmed when too much information is presented

TUTORIAL CONTENT
WP- underline, bold

COMMENTS & DISCUSSION
Robyn gave instructions, step by step;
talking between students now, I ask little questions to the guy next to me

ATTITUDES
course is becoming more interesting for me, but boring when too much
information is presented, too overwhelming;

COMPETENCE RATING
Happy to show others

DIFFICULTIES
still getting things mixed up

practised Keycoach from last week, that helped and I read over some notes

WHAT SHE COULD DO
find someone to help;
trial and error practise;
notes to help me memorise it

WHAT SHE WILL DO
catch up reading, going over activities

Kylie Lovell
Thursday 31st March 1994
3rd Interview
Tape 4 Side B  233-387

THOUGHTS
when Robyn has written all the instructions on the board and we can do
it at our own pace, things are much better, I don't get left behind
it was excellent to do things in your own time

FEELINGS
pretty good when I printed out my title page;
much better, not left behind, not uptight, don't leave
things out (when I can work at my own pace);
main worry is hurrying to catch up, being left behind;
uneasy when everyone else's page was different
happy when things worked out

TUTORIAL CONTENT
other functions of top keys, thesaurus, hanging indent,
title page printout; CV printout

COMMENTS & DISCUSSION
I ask Robyn for help

ATTITUDES
when I used to make a mistake and correct it myself, Robyn would go on
and I'd get left behind and get anxious: that's better now;
now that I know how to do things with the instructions, it feels good;
now I'm looking forward to next week, more interesting things to do
with the function keys

COMPETENCE RATING
able to show someone else the basic things and I could
work out the function keys;
but in starting and retrieving work, going into wrong directories, I could only
do on my own

DIFFICULTIES
trouble retrieving things, went into the wrong directory;
moved wrong paragraph, spaces wrong, created more
problems; I asked Robyn for help
heaps of trouble with the tabs, Robyn showed me how to do it;

WHAT SHE COULD DO
write up assignments on computer- use different functions;
go and see Robyn during the holidays

WHAT SHE WILL DO
as above

PRIOR EXPERIENCES
a little bit of experimenting, mucking around with backs of radios- pulling
them apart;
I had three brothers that I did that with;
video machine purchase- one with more gadgets as long as there were
instructions that I could understand

Kylie Lovell
Thursday 21st April 1994
4th Interview
Tape 5 Side B  201-311

THOUGHTS
the course is getting better; it used to be boring and tedious, now
there are more interesting things;

FEELINGS
OK; once I know how to do it feels good;
being able to do something more interesting and better looking is good;
I walked in feeling pretty anxious;
I feel stupid asking Robyn the simple things

TUTORIAL CONTENT
add new files to dBase 4, delete and print

COMMENTS & DISCUSSION
it's easier to ask someone else or wait until Robyn stops talking to
show someone else

ATTITUDES
it's becoming more interesting and I'm understanding more now

COMPETENCE RATING
able to do it myself

DIFFICULTIES
getting into the program;
can't solve it on my own
WHAT SHE COULD DO
practise, ask Robyn

WHAT SHE WILL DO
see Robyn; start on activities, repeat things over

Kylie Lovell
Thursday 28th April 1994
5th Interview
Tape 6 Side B  254-371

FEELINGS
OK because it's the second time doing databases;
feeling a bit better

Tutorial Content
data bases- modify records, display, use, add, delete;

Comments & Discussion
we had exercises to do, Robyn was checking on how we were going;
I talked to the guy next to me, we were both making mistakes;
that makes me feel better- it's not so bad

Attitudes
more fun this week, having someone next to me to muck around with;
I'm not so nervous, I don't mind doing the work now

Competence Rating
able to do it myself and show someone if I had something to prompt me

Difficulties
starting up

What She Could Do & What She Will Do
keep working on it

Folio Preparation
with a friend

Folio Quality
some parts I was really pleased with, I took time with it to make it look
good; other parts were rushed because it was boring and I was tired of it;
I could've done better;
I think I'll pass

Estimated Mark out of 15
8/9

Problem Solving
I could do it on my own but if I had a mistake I would check with others-

Kylie Lovell
19th May 1994
7th & 8th Interviews
Tape 8 Side B  326-527

*08 Thoughts
Pretty good today - work getting better, more interesting

*08 Feelings
Really enjoyed the work; usually have problems getting started, remembering what to do. No problems today - really proud of myself. Could show the person sitting next to me how to retrieve files - pretty confident about that.

*08COMMENTS & DISCUSSION

None - worked through it on my own. This gets boring. The person who usually sits next to me was away - usually have a bit of a talk and a joke.

*08COMPETENCE

Could do it on my own and show someone

*08ATTITUDES

Usually we are learning commands but don't see the results. This is pretty boring. Doing graphs was exciting because could see the results and play around with them.

*08DIFFICULTIES

Printer - but this was not my fault. Otherwise no problems

*08WHAT WILL DO

Folio 2 activities and practise for the Prac. Test

Kylie Lovell
Wednesday 25th May 1994
9th Interview
Tape 9 Side A 486-647

*09THOUGHTS

More confident than before, at the start. I can do things more without referring to notes

*09FEELINGS

OK - have completed the same types of activities on database as in the Prac. Test - not stressed now because similar types of questions will be on Prac. Test

*09TUTORIAL CONTENT

Prac. Review

*09COMMENTS & DISCUSSION

None - we worked alone

*09ATTITUDES

Prac. Review helped me by reinforcing what I've already learned - repeating and practising. I don't need to look up my notes now. I am getting prepared now so that I won't be stressed later. Robyn helps by describing what to do step-by-step on the board. It's good when it's on the board because if it's just explained it can be too fast and I get lost. This way we can do things at our own pace. Robyn checks each step. I used to wait before, to ask for help.

*09COMPETENCE
Could show someone else

*09DIFFICULTIES

Not many at present

*09WHAT COULD DO

Ask brother for help at home, or whoever sits next to me in class

*09WHAT WILL DO

Practise - ready for Prac. Test

Kylie Lovell
Thursday 2nd June 1994
10th Interview
Tape 10 Side B 520-609

*10THOUGHTS

Course is good

*10FEELINGS

Nervous; not confident with tabs so Robyn helped. Got behind the class; so far behind that just gave up and sat there frustrated for the rest of the tutorial - missed the DOS revision

*10DISCUSSION & COMMENTS

None

*10ATTITUDES

Lost confidence from last week

*10COMPETENCE

Need help

*10DIFFICULTIES

Went over problem areas at home with brother

Kylie Lovell
11th Interview
Tape 10 Side B 609-end

*10THOUGHTS

Most helpful part of the course is the instructions written on the board to be followed step-by-step, and Robyn coming around and checking

*10FEELINGS

Very nervous during Prac. Test - didn't really understand the questions for DOS. Got better as moved on to next section. I lose time in a test by trying to work out where I am going wrong. Relieved now that test is over.

*10ATTITUDES

Was nervous at start of the course - now understand how helpful computers
can be and
what they can do. I'm more inclined to use a computer now. Robyn always
very helpful -can always talk to her and see her after class. Instructions
always written down.

SUMMARY:

Kylie appears initially to have a strong sense of her own ability to master
learning computing skills, i.e., an internal locus of control - "I liked it heaps the first
week, thought I'll be able to do this; second week harder to understand - had
problems; my motivation has changed, wanting to work all the harder because it's
growing more difficult - persistence". However, already by the second interview (third
week of the course), she is expressing anxiety. This is mentioned again in the
following two weeks until references begin to be made to her liking "working with
people" and how she could deal with difficulties by "sharing ideas with people in my
class; asking them for help".

Although in the "direct instruction" group, Kylie refers to a degree of
collaboration in the group: "other students help when I can't do it." After the second
interview (third week of the course), she notes that there is "talking between students
now; I ask little questions to the guy next to me." She feels embarrassed asking the
lecturer for help: "I feel stupid asking R. the simple things; it's easier to ask someone
else or wait until R. stops talking to show someone else."*

By mid course, (fifth interview), it is evident that, despite an apparent initial
self-sufficiency in learning, the benefits of cooperative learning (although not
intended for this group) are being experienced by Kylie at a stage when she is
becoming anxious: "It was more fun this week, having someone next to me to muck
around with; I'm not so nervous, I don't mind doing the work now. Kylie comments
that during the revision of databases, "we had exercises to do and R. was checking on
how we were going. I talked to the guy next to me - we were both making mistakes;
that makes me feel better - it's not so bad."

In terms of her motivation, Kylie shows an internal locus of control, attributing
success to effort so that when she is describing her problems with computing in the
first interview, she says: "My motivation has changed, wanting to work all the harder
because it's getting more difficult."

For Kylie, there is a need for step-by step instruction and time to practise and
complete activities at her own pace. She becomes anxious when too much
information is presented: "It was excellent to do things in your own time (when R.
had written all the instructions on the board); not uptight, don't leave things out - My
main worry is hurrying to catch up, being left behind. When too much information
is presented it's too overwhelming."

As the course progresses, Kylie shows increasing intrinsic motivation in
learning: "the course is getting better; it used to be boring and tedious, now there are
more interesting things ... and I'm understanding more now"; I was nervous about
using computers at start of the course - now I understand how helpful computers can
be and what they can do. I'm more inclined to use a computer now." Nevertheless,
she still feels anxious in the fifth week of the course ("I walked in feeling pretty
anxious; I feel stupid asking Robyn the simple things"), and even more so as the
practical skills test approaches in the tenth week. This anxiety appears to be a
function of the instructional strategy used in the course, that is, dependence on the
tutor for help which does not foster a sense of mastery, confidence or mutual
collaboration. When asked how she will solve the difficulties she experiences in
relation to doing particular computing tasks on her own, Kylie refers frequently to
asking her tutor or seeing her outside the class time: "The tutor ... always very helpful
- can always talk to her and see her after class."

In all, for this student, the direct instruction strategy works well as long as the
tutor is available immediately when the difficulty arises. Once she begins to fall
behind the group in step-by-step instruction, she panics and gives up: "Nervous; not
confident with tabs so tutor helped. Got behind the class; so far behind that just gave
up and sat there frustrated for the rest of the tutorial - missed the DOS revision for the
test."
The structured nature of the teaching seemed to provide a lot of psychological support for Kylie: "The most helpful part of the course is the instructions written on the board to be followed step-by-step, and the tutor coming around and checking."

Keywords: anxious, uptight, nervous, worry, uneasy; (coursework) - boring, slow, dull, hard, difficult; overwhelmed, work interesting.; (relief from anxiety) - do things in your own time, work at my own pace, not left behind;

Nathan Richman: HI ANX: DIRECT INSTRUCTION GROUP

Thursday 17th March 1994
1st Interview
Tape 1 Side B  000-220

THOUGHTS
the course is fairly thorough;
quick, leaves some people behind, assumes you've already got experience
can't see the purpose in some of it, why do it?
like the course, but it's a lot of work

FEELINGS
happy, glad to do it
anxious, nervous, making too many mistakes
getting behind, left out
when I can't see the purpose I don't take it all in, things that are helter skelter
makes me more anxious
feeling OK to ask some questions but silly to ask others
fairly competent with Word Perfect
irritated in lecture- it's too early and irrelevant

TUTORIAL CONTENT
DOS
word processing
typing

COMMENTS & DISCUSSION
feedback comments give you a nudge along

ATTITUDES
sceptical at first due to a previous humiliation in learning computers;
but here everyone chips in and helps you

COMPETENCE RATING
DOS- Could show others, but not know why we do things
Word Perfect- Could show others

DIFFICULTIES
remembering commands
understanding DOS- the why's
keeping up
typing

WHAT HE COULD DO
practising
reading over sheets and textbook

WHAT HE WILL DO
organise time to do these things

Nathan Richman
Thursday 24th March 1994
THOUGHTS
compared to DOS, I can see what's happening and why
WP is pretty easy, I'm keeping up with the pace in class
lecture is too early, too distracting, not real learning just taking down
notes to read later

FEELINGS
understanding Word Perfect more;
feeling the pressure - there's a lot to do;
feeling good about understanding more;
feeling not good about not keeping up;
starting to worry;
not feeling as though I'll get it all done easily;
more confident this week, willing to experiment more;
not so embarrassed to ask people, feel as though I'm asking too much;
sometimes getting help (with someone else doing it for you)
doesn't feel like you're learning, just going through the motions to keep up;
freaked out by assignments - resubmits, failures, afraid of not doing
enough to satisfy marker

TUTORIAL CONTENT
few new functions, fonts

COMMENTS & DISCUSSION
benefits of group discussion vary according to the person you're with and their
capabilities

ATTITUDES
more confident with WP;
not so embarrassed to ask people for help

COMPETENCE RATING
this week DOS - not confident to show others at all, compared to last week;
WP - confident, more willing to show others

DIFFICULTIES
lapses in concentration are producing difficulties
getting lost but Robyn helps
have read up on difficulties with DOS but they're not resolved
Robyn was helpful in class this week, she was concentrating
on our group and our difficulties

WHAT HE COULD DO
got more practice in before the holidays

WHAT HE WILL DO
find time to go down to the Computer Centre
practise and do exercises

Nathan Richman
Thursday 31st March 1994
3rd Interview
Tape 4 Side A 114-322

THOUGHTS
people confused this week, everyone all over the place

FEELINGS
feeling bad, left behind, dumb with the typing;
scary when everyone was lost;
not that sure of myself;
feels better when I ask others;
feels really good to go at my own pace
more and more anxious about the folio, unclear of what's expected;
feeling OK other than that;
worried when the "expert" doesn't know what to do;
afraid of wiping a whole heap of information

**TUTORIAL CONTENT**
CV- how to prepare it
cover page for the folio
WP- every command, using them, see them in practice, whole picture

**COMMENTS & DISCUSSION**
asking questions- queries from Robyn, everyone helping each other out

**ATTITUDES**
was scared stiff this week, but getting more confidence now;
when comparing myself to people who already know it,
I think I'm aiming too high, expecting too much

**COMPETENCE RATING**
WP- alright to help others, overall I'm okay

**DIFFICULTIES**
silly mistakes- hitting return not shift
can handle the difficulty on my own

**WHAT HE COULD DO**
practise typing skills

**WHAT HE WILL DO**
practise typing, catch up work, do assignment activities

**PRIOR EXPERIENCES**
always played around with video games, toys, gadgets;
have had a computer phobia though, fear of wiping a whole
lot of information
video machine purchase-complexities and intricacies are OK
to deal with, no, simple things are good too

**Nathan Richman**
**Thursday 21st April 1994**
**4th Interview**
**Tape 5 Side A 238-398**

**THOUGHTS**
tutorial was a bit boring;
there are a heap of people underneath me now in the class
the folio has helped things fall into place

**FEELINGS**
pretty good, more confident;
I'm understanding a whole lot more going in to class;
it feels good to have heaps of people underneath me;
big stress before the holidays though;
knowing where to go in the program makes me feel better;
it's a bit overwhelming having a whole lot of information at once

**TUTORIAL CONTENT**
data bases

**COMMENTS & DISCUSSION**
none
ATTITUDES
bit more headstrong now; before I was afraid of wiping things; more naive;
now I feel able to show other people WP and DOS;
I can see what I'm doing and why- can see why it's good

COMPETENCE RATING
WP and DOS I can show others now;
data base- I could do it myself, but I need people around for reassurance

DIFFICULTIES
I've been able to work out the trouble with DOS;
still having trouble remembering DOS or WP commands;
it's hard to keep up to date with the folio
typing is letting me down

WHAT HE CAN DO
read over notes and put it into practise

WHAT HE WILL DO
understand data bases; do assignment on computer to practise

Nathan Richman
Thursday 5th May 1994
7th Interview
Tape 7 Side A  179-270

THOUGHTS
Thought I did alright on the Folio - put a lot of time and work into it

FEELINGS
Confident with DBase - simply a matter of learning commands. Anxious about
having to hand in the Folio but I compared mine with others and thought I'd pass - it
looked better than a lot of others

TUTORIAL CONTENT
Database

COMMENTS & DISCUSSION
No discussion in class but I worked with a group of others outside of class on some of
the activities for the Folio - I did my own work for three of them but we helped each
other on the little things for the rest

ATTITUDES
Tired of all the work - there's not enough time to cover everything. Wouldn't mind a
rest

COMPETENCE RATING
DBase is easy. Can do it on my own

DIFFICULTIES
None

WHAT HE CAN DO
Not leave everything to the last minute for the next assignment

WHAT HE WILL DO
Get started straight away

Nathan Richman
Thursday 12th May 1994
8th Interview
Tape 7 Side A  270-362
THOUGHTS
Bit sick of doing computers after the assignment - don’t feel like getting straight back into it again - it’s boring and repetitive

FEELINGS
Very disappointed in the mark for the Folio because I tried so hard (10 1/2/15) - lost marks because they were pedantic about the bibliography - didn’t really have anything to do with how well I did on the computing. Lotus is fairly easy, so I’m taking it easy

TUTORIAL CONTENT
Lotus spreadsheets

COMMENTS & DISCUSSION
No discussion between students in class or questions asked by the tutor. We worked basically straight out of the textbook and from demonstration

ATTITUDES
My attitudes have changed. I am not scared of computers now - it’s all pretty easy. I’ve gotten over the computers versus people sort of attitude and feel more confident now. A bit sceptical about the whole computer course though. For all the work, it’s still not good enough (the assignments)
At least I’m not scared to type up an essay now - I’ll do it myself instead of paying someone to do it - even though it takes a lot of time

COMPETENCE RATING
Can do it on my own with a little help to remember which key does what

DIFFICULTIES
None

WHAT HE CAN DO
Try to catch up before the test

WHAT HE WILL DO

Nathan Richman
25th May 1994
9th Interview
Tape 8 Side A  565-end

*09THOUGHTS
Did the course so that I could be a bit more competent with computers, not to excel
It’s not as is you have to do anything difficult - it’s just memory - which commands to use

*09FEELINGS
Quietly confident - Lotus is not a hard program to run

*09TUTORIAL CONTENT
Lotus spreadsheets

*09COMMENTS & DISCUSSION
None - straight - through demonstration by Robyn (teaching strategy) followed by practical exercises done alone. There’s never any discussion in our class
If you just follow what Robyn is doing you should get through it

*09ATTITUDES
More confident than with databases - you can just feel your way through the program - can’t get lost because it’s menu-driven, not command-driven

*09COMPETENCE
Could do it on my own and help someone else to some extent
*09 WHAT COULD DO & WILL DO
Practise and read over notes. Finish Folio 2

Nathan Richman
Thursday 2nd June 1994
10th Interview
Tape 10 Side A 000-059

*10 THOUGHTS
Boring Prac. Review - way we did it a bit silly because Review followed what we just
finished in the last tutorial yesterday

*10 TUTORIAL CONTENT
Written instructions put upon board and we all had to do that individually

*10 COMMENTS & DISCUSSION
No comments or discussion

*10 FEELINGS
Won't get a good mark in the Folio - pressed for time.

*10 ATTITUDES
Feeling better now about using the computer but not happy about doing tests -
feel pretty good when I'm not under pressure - in exam situation, not sure how'll go

*10 COMPETENCE
In Dbase not quite sure that I could show anyone - I needed a bit of help
Lotus fairly self explanatory

*10 DIFFICULTIES
Only getting the Folio in

Nathan Richman
Thursday 2nd June 1994
11th Interview
Tape 10 Side A 060-160

*11 THOUGHTS
Marking system in this course very pedantic - makes people anxious over trivia

*11 TUTORIAL CONTENT
WordPerfect and DOS - Instructions given on a sheet and overhead and followed
step-by-step. The revision helped me to remember and learn

*11 FEELINGS
Pretty good. Found the "Help" screen for WordPerfect so I'm pretty confident now
The more you do something in computing, the easier it gets. Not nervous about the
Prac. Test yet, but I will be. Written exam will be OK because there are no computers
involved

*11 ATTITUDES
Trying to get this computing course over and done with - that's not very nice is it?

*11 COMPETENCE
More confident with DOS and WordPerfect than database. Expecting to get about 13
or 14 out of 20 in the Prac. Test. Just about average in the class and the course.

*11 DIFFICULTIES
None this week

*11 WHAT WILL DO
Revising everything and trying to relax at the moment

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SUMMARY:

Nathan averts to his apprehensions regarding computing at the outset and refers to a previous humiliation in learning about computers: "have had a computerphobia - fear of wiping a whole lot of information". His concern initially (with regard to learning about DOS) appears to be with the speed at which he perceives his (direct instruction) group is being taught. He frequently refers to being "left behind"; "making too many mistakes"; "assuming that you’ve already got experience". An important observation that he makes in relation to the teaching strategy used in this group is that he is not learning because he can’t see the purpose: "When I can’t see the purpose, I don’t take it all in; things that are helter skelter make me more anxious". In this context, it would appear that there was no structure evident in the teaching at this point which may have reduced Nathan’s anxiety.

As for collaboration (although not intended as part of the teaching strategy), Nathan admits in the second interview that he is "not so embarrassed to ask people (for help)". However, he makes an important observation; "sometimes getting help - with someone else doing it for you - doesn’t feel like you’re learning, just going through the motions to keep up". In other words, if being in a collaborative group means that others show you what to do, active construction of meaning (learning) does not necessarily follow, but, rather, the same sort of rote learning or imitation that occurs through direct instruction.

Nathan’s observations that in the fourth week of the course it was "scary when everyone was lost" (while trying to synthesise their learning of wordprocessing skills and apply them to the presentation of their CV) may indicate that, for the highly anxious or inexperienced students in the direct instruction group, the lack of opportunity to make "sense of" what they were learning in a structured way was exacerbating their anxiety: "Scared stiff this week; making silly mistakes" (Nathan). As he explains in a previous interview, "When I can’t see the purpose, I don’t take it all in; things that are helter skelter make me more anxious." In terms of information-processing theory, anxiety is interfering with initial processing of the new information and contributing to his sense of lack of control.

In the earlier part of the course, Nathan confesses that he has trouble remembering all of the commands for the DOS and wordprocessing applications. By the ninth interview, however, he has gained confidence from having switched to a menu-driven application (spreadsheets) from command-driven "just memory" ones that had been taught to that point: "You can just feel your way through the program - can't get lost."

As for his motivation to learn computing, Nathan points out towards the end of the course that it was not "to excel", but rather, "so that I could be a bit more competent with computers." By the final interview, Nathan’s motivation is clearly a negative intrinsic one "Trying to get this computing course over and done with - that’s not very nice is it?"

Whereas the computer anxiety that Nathan expresses initially appears to be related to his lack of experience (he had spent less than ten hours learning to use a computer), by the middle of the course he notes that he is becoming "a bit more headstrong" and "can see what I’m doing and why - can see why it’s good." Interestingly, he comments at the same time that "I need people around for reassurance." At end of the course, Nathan’s computer anxiety in relation to learning about basic computer functions has lessened somewhat, however, he still expresses anxiety about demonstrating his computing skills in the practical test that is approaching: "I’m feeling better now about using the computer but not happy about doing tests - I feel pretty good when I’m not under pressure, but in an exam situation, I’m not sure how I’ll go ... The written exam will be O.K. because there are no computers involved."

It is important to note that, for Nathan, who is highly computer anxious to start with and who remains anxious (albeit, less so) at the end of the computer training course, social support from classmates is an important factor when he feels overwhelmed as he does in the third week: "feeling the pressure - there’s a lot to do; feeling not good about not keeping up - starting to worry; not feeling as though I’ll get it all done easily; not so embarrassed to ask people - feels better when I ask others
... but ... sometimes getting help (with someone else doing it for you) doesn't feel like you're learning, just going through the motions to keep up; feeling bad, left behind - not that sure of myself; feels better when I ask others; feels really good to go at my own pace." The lack of structured social support in this class may well be contributing to Nathan's anxiety as he is not comfortable asking for help: "feel as though I'm asking too much, though."

Keywords: anxious, nervous, confused, scared stiff, pressure, getting lost, getting behind, not keeping up.

Andrew McDonald: LOW ANX; COOP SELF-REGULATED GROUP

Wednesday 16th March 1994
1st Interview
Tape 1 Side A 105-181

*01THOUGHTS
the course is a bit slow; have already learnt most of these things

*01FEELINGS
no worries; comfortable with the work; easy
better courses will come later

*01TUTORIAL CONTENT
revision of DOS
Word Perfect- function keys

*01COMMENTS & DISCUSSION
tutor comments- step by step directions more than feedback
questions are easy; good for the others if they're having difficulty

*01ATTITUDES
no change

*01COMPETENCE RATING
Could do it on my own- before course
Happy to show others- now

*01DIFFICULTIES
none, can handle the work on my own

*01WHAT COULD DO
no difficulties

*01WHAT WILL DO
do more subjects on computing;
do exercises from tutorial

Andrew McDonald
Wednesday 23rd March 1994
2nd Interview
Tape 2 Side B 350-555

*02THOUGHTS
it's easy to keep up with

*02FEELINGS
good; tired in tutorials
lectures- easy, getting everything down
*02TUTORIAL CONTENT
Word Perfect- italics, blocks, bolding, copying, paragraphs
Bibliography- practice for assignment
changed the letter, page numbers

*02COMMENTS & DISCUSSION
discussion questions easy; sort of helpful, don't do any harm
everyone speaks- says what they think;
answers are pretty easy
*02ATTITUDES
no change
some new work is a bit more challenging/useful

*02COMPETENCE RATING
Happy to show others

*02DIFFICULTIES
error in printing out between computers;
handle it mostly on my own or ask Robyn for help

*02WHAT COULD DO
try printing something else out

*02WHAT WILL DO
work on computer at home

Andrew McDonald
Wednesday 30th March 1994
3rd Interview
Tape 4 Side A 000-113

*03THOUGHTS
course is a bit slow, a bit boring; mainly revising work

*03FEELINGS
alright, didn't get to finish the work
group work doesn't bother me, but when helping other people get bored
pretty good about assignments
not terribly excited; OK; it takes up some time

*03TUTORIAL CONTENT
more Word Perfect for folio; title page fixed up, line spacing, bold, enlarging resume
worked at our own pace
new work for me- Replace and Indent functions
learnt more functions, becoming quicker at using them

*03COMMENTS & DISCUSSION
discussion questions- no disadvantage in them, no real benefit
questions are basic and easy to answer

*03ATTITUDES
becoming quicker at using the functions
don't need template any more
had used word processing before but not this regularly
still same attitudes, same confidence, positive attitudes

*03COMPETENCE RATING
Happy to show others
same as last week

*03DIFFICULTIES
no difficulties to follow up on
haven't followed up on any work since last week

*03WHAT HE COULD DO
folio assignment and exercises

*03WHAT HE WILL DO
folio assignment and exercises during holidays
essay assignment, research and write it

*03PRIOR EXPERIENCES
have had a computer since I was very small- typing out programs and playing games as I grew up;
played around with equipment, technical toys and games with my brother
would buy a video machine with lots of gadgets and intricacies

Andrew McDonald
Wednesday 18th May 1994
8th Interview
Tape 8 Side A 045-180

*08THOUGHTS
Very good today - graphs in Lotus, just messing around.

*08TUTORIAL CONTENT
Lotus

*08FEELINGS
Fairly happy but don't like thought of Prac. Test.

*08DISCUSSION & QUESTIONS
Knew the answers to the questions that the groups asked myself.
Checking answers to questions in a groups is good because it confirms whether you're on the right track or not.
Good to ask someone next to you if you forget how to do something.
(Regarding metacognitive questions - i.e., generic question stems) - a sheet of questions handed out by Robyn -
told to use them for study purposes for Prac. Review. Students to write their own questions on DOS and WordPerfect at home, and to bring them to the Prac. Review.
Helpful to make up questions for yourself as it helps you to realise what you do know and still don't know.
Using the sheet of questions as a basis (prompt) helps you with ideas about what you might still have trouble with and to use these as a review for the Prac. Test.
Group helps you check on your answers.

*08ATTITUDES
The more you do on something the more confident you get.

*08DIFFICULTIES
None

Andrew McDonald
Wednesday 25th May 1994
9th Interview
Tape 9 Side A 024-146

*09THOUGHTS
Everything under control.

*09TUTORIAL CONTENT

*09FEELINGS
Relieved that Folio completed. I'm always worried about tests no matter how small - always stressed out even though I know the work
- purely because it's a test.

*09GROUPWORK/QUESTIONS
Used generic questions on sheet to think up questions for the class. Thinking up questions is helpful because it forces you to think about what you don't understand. This is the question that you put forward from the group for the class to discuss. Me and Michael didn't know about graphs so that was our question for the group. Groupwork helps everyone because if anyone doesn't know something the others can help in the group or the whole class - questions put up on the board. Don't mind working with other people.

*09ATTITUDES
No change - happy that the work is all up to date, especially Folio.

*09COMPETENCE
Could show someone - was helping everyone around me today with graphs.

*09DIFFICULTIES
None

*09WHAT WILL DO
Work towards Prac. Review

Andrew McDonald
Wednesday 1st June 1994
10th Interview
Tape 9 Side B  357-472

*10THOUGHTS
Course is good - comprehensive - shows you basics of all aspects of computing

*10FEELINGS
Happy - everything finished in my work
Not too worried about Prac. Test

*10TUTORIAL CONTENT
WordPerfect and DOS Review

*10GROUPWORK/QUESTIONS
Questions to be posed by each group. Michael and I thought up questions for the group because we weren't able to sit together as a group. Melissa and Yonneka didn't know what to ask - Michael and I didn't really have any legitimate question either because the review was pretty comprehensive - just made something up. Still a useful process - good practice for what will be in the Prac. Test

*10ATTITUDES
Bit more relaxed - no more assessments due in computing.
Happy with Research Report results

*10COMPETENCE
Could show others

*10DIFFICULTIES
No difficulties

*10WHAT CAN DO
Revision - going through notes and booklets have been given

**SUMMARY:**
Andrew has used a computer since childhood: "typing out programs and playing games as I grew up; played around with equipment, technical toys and games with my brother." Not surprisingly, he finds the computing course slow and boring as he has "already learnt most of these things." As for cooperative groupwork, he clearly is an independent learner, commenting that "groupwork doesn't bother me, but when helping other people I get a bit bored."

It is important to note that factual recall and higher-order discussion questions were used by the instructor throughout the tutorial to check for student understanding (i.e., revision) in the experimental group. This modelled the use of questioning as a metacognitive strategy which was later practised as reciprocal peer-questioning during the review period prior to the students' practical exam. The degree to which these questions challenged students is of interest. In the case of Andrew, his attitude in the first interview was that "They're good for the others if they are having difficulty". In the second interview, he acknowledges that although "discussion questions are easy, they are sort of helpful .... everyone speaks and says what they think. By the third interview, he has decided that there is "no disadvantage in them, but no real benefit; the questions are basic and easy to answer (for him)." By the eighth interview, however, (after considerably more practice in use of questioning) Andrew concedes that, despite the fact that he feels that he already knows the answers to questions, "checking answers to questions in a group is good because it confirms whether you're on the right track or not. It's good to ask someone next to you if you forget how to do something."

At the end of the course, his attitude to the use of generic questions stems strongly indicates their value to him, even though his computing self-efficacy is strong: "A sheet of questions was handed out by the tutor - we were told to use them for study purposes for the Prac. Review. Students had to write their own questions on DOS and WordPerfect at home, and to bring them to the Prac. Review. It was helpful to make up questions for yourself as it helps you realise what you do know and still don't know. Using the sheet of questions as a basis (prompt) helps you with ideas about what you might still have trouble with and to use these as a review for the Prac. Test. The group helps you check on your answers. Used (generic) questions on sheet to think up questions for the class. Thinking up questions is helpful because it forces you to think about what you don't understand. This is the question that you put forward from the group for the class to discuss. Me and Michael didn't know about graphs so that was our question for the group. Groupwork helps everyone because if anyone doesn't know something the others can help in the group or the whole class - questions are put up on the board." This is in contrast to his earlier (third interview) comment that groupwork doesn't bother me" but that he became "a bit bored when helping people."

In relation to anxiety, Andrew confesses to suffering from test anxiety even though he has experienced no apparent difficulty with the computing course: "I'm always worried about tests no matter how small - always stressed out even though I know the work - purely because it's a test."

Keywords: boring, slow, no worries, no difficulties, easy.

Lisa Kavanagh: LOW ANX; DIRECT INSTRUCTION GROUP

Thursday 17th March 1994
1st Interview
Tape 2 Side A  174-298

*01THOUGHTS
liking the course, it's alright;
bit slow; revision of Year 11 & 12;
understand everyone else needs this pace

*01FEELINGS
OK, good;
like to feel up to date with new technology;
worried I'll fall behind and won't catch up;
like new things, like learning new things;
the computer's just there, if it blows up it blows up;
like being familiar with the work, like I can do it

*TUTORIAL CONTENT
Word Perfect- copying out letters, storing, finding, clearing them
DOS

*COMMENTS & DISCUSSION
if I'm lost then comments from the teacher help, or I look next to me

*ATTITUDES
no differences, feeling as though the course is alright, but a bit slow

*COMPETENCE RATING
Could do it on my own, but I'm not comfortable showing other people
because then I make mistakes

*DIFFICULTIES
making mistakes;
knowing when to push Enter;
screen went blank, thought I'd lost everything;
could handle it on my own with a template on the computer;
ask other students who looked like they knew what they were doing;
look next to me

*WHAT COULD DO
practise

*WHAT WILL DO
go to the computer room to practise the activities

Lisa Kavanagh
Thursday 24th March 1994
2nd Interview
Tape 3 Side B 014-105

*THOUGHTS
course is not really exciting, OK, not challenging;
boring, dull

*FEELINGS
not really excited, bored;
not keeping up with the activities, not too worried yet;
assignments are getting closer, a bit of pressure
*TUTORIAL CONTENT
WP, same
new functions enhancing, enlarging, bolding

*COMMENTS & DISCUSSION
help other students in class, I talk to them

*ATTITUDES
no real change

*COMPETENCE RATING
Happy to show someone else if I could remember what keys to push

*DIFFICULTIES
not keeping up with activities;
didn't get to practise in the computer room, haven't gone very far since last week

*WHAT COULD DO
catch up

*02WHAT WILL DO
planning on coming in early to catch up on the activities

Lisa Kavanagh
Thursday 31st March 1994
3rd Interview
Tape 4 Side B  028-115

*03THOUGHTS
it's good- it's all working out since the assignment;
everything's working;
I like to think through it myself, not being told push this button, push this button

*03FEELINGS
better, like I've done something;
not bored;
don't feel as dragged, not as slow;
checking with people feels good because I felt like I knew something;
not so worried because I've started the assignment

*03TUTORIAL CONTENT
nothing new, a task to do at your own speed

*03COMMENTS & DISCUSSION
checking with people, asking for help when I have a problem;
I ask people beside- see if they know what they're doing;
it's good because I felt like I knew something;
group work is alright, OK, helpful to make sure I'm doing the right thing, comparing

*03ATTITUDES
no real changes, just feeling that I could do something, mastering some sort of skill;
about the same

*03COMPETENCE RATING
Happy to show others
still a bit unsure of last week's work

*03DIFFICULTIES
hardest thing is to remember key combinations

*03WHAT COULD DO
write them (key combinations) down and try to keep track of them

*03WHAT WILL DO
haven't thought that far

*03PRIOR EXPERIENCES
played games and stuff,
video machine purchase- lots of gadgets

Lisa Kavanagh
Thursday 26th May 1994
9th Interview
Tape 9 Side A  388-486

*09THOUGHTS
Work not too hard. Had a few problems with database exercises. Silly mistakes.

*09FEELINGS
Feel good about the Prac. Test - should pass - shouldn't be that hard.
Making silly mistakes in the Prac. Review threw me off. I can see myself making
really stupid mistakes.

*T09 TUTORIAL CONTENT
Folio 2 work and review for the Prac. Test

*T09 COMMENTS & DISCUSSION
Review supposed to be done individually - but I asked people next to me for help with what to do - we were watching each other. Gets me out of trouble if I'm stuck.

*T09 ATTITUDES
No change since last week

*T09 COMPETENCE
Could do it by myself

*T09 DIFFICULTIES
Not having difficulties - worried because of this - I get too confident, things might fall apart on me

*T09 WHAT WILL DO
Make sure I have all my notes ready to take to the Prac. Test

Lisa Kavanagh
Thursday 2nd June 1994
10th Interview
Tape 10 Side A  315-426

*T10 THOUGHTS
Remembered most of the work for the DOS and Wprocessing revision - I was pleased with myself. By doing the practice alone - left to my own devices - I figured that I could manage the test. I liked working at my own speed. Don't really want to know how I compare with other people

*T10 FEELINGS
Feel O.K. about the Prac. Test Left it too late to get a good mark on the Research Report but expect to get a pass

*T10 TUTORIAL CONTENT
2nd week of Prac Review - DOS and WordPerfect

*T10 COMMENTS & DISCUSSION
Tutor asked us questions. Other students asked me what to do

*T10 ATTITUDES
Feeling good because the course is nearly over

*T10 COMPETENCE
Could show others what to do

*T10 DIFFICULTIES
Pressing some of the wrong symbols - took me a while to figure it out

*T10 WHAT WILL DO
Preparing myself for the test - getting notes and studying

Lisa Kavanagh
Thursday 9th June 1994
11th Interview
Tape 10 Side B  430-520

*11 THOUGHTS
I did well - I got full marks which I didn’t expect but I had time to fix up my mistakes
Got Folio 2 back with 13/15. I was ecstatic

*FEELINGS
I feel good because it’s all over but I was really worried throughout the test about the
next part - unsure about what to expect

*TUTORIAL CONTENT
Yesterday was the Prac Test.

*COMMENTS & DISCUSSION
N/A

*ATTITUDES
I still feel the same about computers as when I started - I didn’t really do anything
during the course that I didn’t already know something about

*COMPETENCE
More confident now - I know what I’m doing now

*DIFFICULTIES
The most helpful part of the course was being near other people, talking to them and
helping them out The course was meant to be totally basic, that’s why I didn’t like it
much

*WHAT WILL DO
Need to prepare for the written exam - read the textbook and my notes

SUMMARY:

Lisa likes to "feel up to date with new technology" and "learning new things". While she reports early experience with computers (playing games), her lack of anxiety seems to come from a recognition the "The computer is just there - if it blows up it blows up." Unfortunately, for her, it appears at the outset, that the course is merely a revision of high school computing and she comments frequently in the first few interviews on how boring and unchallenging the content is. For such a student who likes to "think through it myself, not being told to push this button and that button", the course appears to have become more stimulating as the weeks progress and she notes that she doesn't feel "dragged, ... as slow ... or bored". Despite her apparent initial familiarity with computers, Lisa seems to lack confidence towards the end of the course. This is implied in her comment that it is "helpful to make sure that I'm doing the right thing, comparing with the people around me."

While there is no formal groupwork, as such, in this student's tutorials Lisa makes an important observation regarding the formation of spontaneous groups for help and reassurance within the direct instruction group. For example, in the third interview, she comments that she likes to "check with people" for two reasons - firstly, to ask for help "when I have a problem, to see if they know what they're doing ... group work is ... helpful to make sure I'm doing the right thing - comparing"; and secondly, "it feels good because I feel like I know something". In the review period prior to the practical skills test, Lisa also refers to the tendency for informal networks to emerge: "The review was supposed to be done individually, but I asked people next to me for help with what to do - we were watching each other. Gets me out of trouble if I'm stuck."

Lisa's motivation in the course is to pass, not to excel, despite the fact that she has not had difficulties with computing throughout the course. She is guarded in her aspirations for the practical test, expressing concern that if "I get too confident, things might fall apart on me ... I can see myself making really stupid mistakes."

Keywords: Boring, slow, not hard, checking with people, help.
Appendix B5

Weekly Diary of the Tutorial Instructor in Aptitude-Treatment-Interaction Study 1

Group 2: (Cooperative)
Group 1: (Direct Instruction)

TUTORIAL 3 - DOS AND WP

Group 2: 9-11 am Wednesday (Cooperative)

Tutorial time: 1 hour 50 minutes

DOS review involved me asking students to tell me the commands necessary to perform certain tasks - students put forward their ideas for the commands without a lot of prompting.

The first version of the job application letter was undertaken with direction. The first version of the title page was done with minimal direction from me. Consultation between students took place during this task.

Most students contributed to the questions and seems happy to do so.

Ning Zhao joined the class today - he was involved in a car accident in Week 1. He sat next to Hanna Haddad who helped him during the tutorial. I met with Ning after class to run him through Tutorial 1 - he completed the competency checklist and survey as well as Keycoach. I will be meeting with him again next week to cover Tutorial 2.

Bill Kurdi also joined the class today - he is a repeat from last year, although he did not tell me this. He kept up with what we were doing, however did not speak to other students. Hanna was sitting next to him and I noticed that she tried to involve him in the discussions. I will need to keep an eye on him over the next few weeks to try to get him involved. I asked him to see me between 11 and 12 to get him to do the surveys and keycoach - he did not show up - need to see him next week.

When pausing to ask the questions I asked the students to discuss the answers with the person next to them. The questions were on overhead and the students wrote them in their books (I didn't ask them to do this). They did talk to the students next to them.

Michael Darby and Andrew McDonald contributed the most to the questions. Jessica Cumin and Hanna Haddad also were quite open in their answers. Students overall wanted to speak.

I needed to remind them to be creative with their answers when we were discussing Q6 (Why is it important to spell check your document before printing?) and not simply go for the most obvious answer (To make sure there are no spelling mistakes). This question led to the most discussion - we got into areas such as saving paper, document presentation and making a good impression. A number of students discussed this and Jessica Cumin said it was an environmental issue.

Q8 and Q9 were not presented as the content of these questions were discussed earlier in the tutorial, ie use of paper with Q6, and Q8 came up when a number of students encountered this screen prompt when resaving their work.

Joanna Rigas, Melissa Harold, Kirsty Macryannis and Yonneka Overduin did discuss the questions, however did not participate in the class discussions.
All in all the questions were well received. Students appeared relaxed and the atmosphere was cheerful. There was a low level of talking during the tutorial - I kept the door closed. I may need to try to make the questions harder in the future. I will just run with standard of questions for Tutorial 4.

Good contribution to the general questions (eg. which key do I press to do this task?) from students - many students called out the answer.

Two male students (Kamahl Abbass and Glen Tankard) from the 1-3 pm class asked if they could join the 9-11 am class. I agreed, and will ask students to form groups of three to try to get more involvement, particularly Bill Kurdi.

**Group 1: 1-3 pm (Direct Instruction)**

Tutorial time: 1 hour 40 minutes

DOS review conducted the same and for Group 2 - however a lot of prompting was necessary on my part to get the answers.

The first version of the job application letter and the first version of the title page were undertaken with direction. Some students needed constant help from me and I seemed to me all over the room. Joseph Giunta, Marcela Herrera and John Mamalioga appeared a bit lost and kept putting their hand up for me to assist them.

I reminded students if they were having problems to see me between 11 and 12 noon in Lab 1 on Wednesdays.

Alex Izossimov is particularly lost and I need to assist him regularly - he presses combinations of keys unknowingly and gets into parts of the program that are not being covered - I have seen this happen before with other people - he appears stressed but doesn't say anything in class. He comes to the Computer Centre to practise Keycoach and I have spoken to him. He is keen to learn and I have tried to re-assure him that it will all come together. However, it may take some time. In class, I usually need to stop and assist him each time I pass him - he doesn't always signal for help or ask other students.

This class was very quiet, minimal communication between students. Also, minimal contribution to general questions that I asked them (eg. which key do I press to do this task?) - very hard to extract any answers.

### TUTORIAL 4 - WP

**Group 2: 9-11 am Wednesday**

Tutorial time: 2 hours

This tutorial seemed a bit chaotic. We did not finish what I had prepared. Two reasons for this: formatting is tedious and very much trial and error - some students cope very well, others need more time to grasp the ideas; and students like to talk between one another about what they are doing (I like this and do not want to stop it altogether). In tutorial 5 I plan to get them to work at their own pace as we will still be covering formatting.

We just talked about what we did in Tutorial 3 - there was too much to completely go over it again and the concepts are covered in this tutorial (eg. retrieve a file from disk, saving, printing) without specifically referring to them. I wasn't completely happy with this tutorial, it seemed too rushed. Questions 1-5 were presented, we ran out of time for the others. The content will be covered in future tutorials. I asked students to form groups of three this week, which they did.
This meant that some students needed to move their chairs. It worked reasonably well, with students discussing questions with students they had not previously sat with. Answers were good and showed some thought involved.

Andrew McDonald arrived late and could not sit next to Michael Darby, which was good as they were in different groups. Andrew is very competent with WordPerfect, Michael not so much and this showed up. With two of the questions I asked particular students who had not contributed last week for the answer. I tried to make this low key so as not to stress them. Yonneka Overduin did not handle this very well, she put her head down and said (very softly) that she did not know. I told her that was OK, and asked if anyone else wanted to answer, a number of students called out answers. I will keep an eye on Yonneka next week to see if she contributes within her group.

I know some of the students think some of the questions are easy, but by making them too hard or by not covering the topic will only stress some of the other students. A couple of the questions this week were based on the lecture content. I can't do this for any more than a couple of questions, as this would disadvantage other groups. When we move onto Database I think I might include a couple of questions related to the database search commands.

Bill Kurdi contributed to the questions this week, he was in the group with Andrew McDonald. He also came to see me after the tutorial and completed the survey and checklist. He passed the Keycoach test. He seemed more positive this week. I'm not sure whose group he was in last year.

Hanna Haddad came to see me after the tutorial. As she is a repeat student from last year and very competent, she explained that she is bored with the class work. She asked if she could do the work on her own and then go on with her own work. I agreed, and will give her the tasks to be covered at the beginning of the tutorial.

I spoke to Lysa So about her Keycoach test. She said she had been practising and will come to see me after the tutorial next week to do it. Ning Zhao is also coming to see me about Tutorial 2 which he missed due to the car accident. He is slow with WordPerfect but seemed to be coping at this point.

The class work involved three documents. The bibliography was undertaken with direction from me. This direction slows down the class for some students as others are quite slow. The letter from last week involved formatting existing text with direct instruction, this task went more smoothly - I think because the text was already typed. We made very little progress with the title page and will need to finish this next week. We were hurrying at this point as there is another class waiting to come in at 11 am. I did not like to rush and perhaps should have left the title page completely until next week.

Again this week there was a low level of noise during the tutorial and I kept the door shut. More students from this group seek assistance from me outside the tutorial time than from the 1-3 group.

**Group 1: 1-3 pm**

Tutorial time: two hours

WordPerfect review of tutorial three undertaken the same as Group 2. However, with much less involvement from the students.

The bibliography and the letter took much less time to cover than Group 2. This was with direct instruction and practically no talking. Some students were completely lost again this week and I needed to be all over the room assisting students to keep up. Particularly John Mamalioga and Alex Iozsismov who seemed a bit stressed. Stephen Crowley and Nathan Richman got lost, it does not worry them, they think it is funny. They seek assistance when this happens and help one another. Alex doesn't always ask for help, so I check his screen as I pass and stop to assist (usually every time I pass). Paul Lucas knows what he is doing and sometimes skips ahead of
what we are going. He tries to guess what we are going to do next - sometimes he is right. When he is wrong he has to undo what he has done. He is very quiet and does not seek assistance or ask questions.

I get the general idea that students in this group do not fully understand what they are doing. This is a problem with direct instruction - I have noticed this in previous semesters. It is particularly noticeable with word processing as there are so many features to cover. Even Sue Exton got a bit lost this week.

This group is not used to contributing in class, and it is like extracting teeth to get them to answer a general question like "look at the template and tell me what combination of keys are necessary to do...".

The direct instruction model is used with this group and is the same as other semesters, however I have never liked it. It is OK while I'm telling them what key to press, but I get the impression that when they are on their own they do not know what to do.

I have told students I will be available between 10 and 12 on the two Wednesdays in the break. It will be interesting to see who turns up for assistance.

**TUTORIAL 5 - WP**

**Group 2: 9-11 am Wednesday**

Tutorial time: 2 hours

Content for this tutorial not covered completely. Students did not finish the CV by the end of the tutorial. I think we would have finished if tutorial 4 had been completed. However, we needed to complete the Title Page started in tutorial 4. The same features are covered in the CV as for the Title Page, with the addition of Hanging indent, Hard Page break and Thesaurus. All students did the hanging indent and page break, no-one got to the Thesaurus. It is covered in the WordPerfect notes. This is the last of the WP tutorials. Tutorial 6 moves on the Database.

When discussing what we had covered so far in WordPerfect I asked students to tell me of any problem areas they were experiencing. They all seemed happy with what we had covered so far - or were too embarrassed to say anything. However, I don’t think this is the case as this group is quite talkative.

I advised the students I would be available on the two Wednesdays during the break for consultation. Folio 1 is due on the Thursday of the first week back (21 April).

Library sessions for all students in this subject will be organised by Jenny Wells. Involvement is not compulsory. A list was passed around for students to write their name if they wanted to attend. Hanna Haddad (not first year), Bill Kurdi (not first year) and Andrew McDonald did not put their name on the list. Twelve students did put their name on the list. Duncan Thom was absent.

Students formed groups of two or three for the questions. I asked specific students (Kamahl Abbass, Bill Kurdi, Joanna Rigas, Glen Tankard) for some of the answers this week to get involvement from those who did not usually contribute. All answered with good ideas. Other students joined in as well. Overall the discussion and answers were good. Only questions 1-4 were asked due to lack of time. Question 4 relates to one of the Activity questions for Folio 1.

The lack of time could be due to the nature of word processing - lots of features. This should become clearer when we move on to database. Also, timing of questions cannot follow the pattern of 20 minutes. With direct instruction, in some periods of 20 minutes very little is covered as some students are very slow at typing as they are not fully familiar with the keyboard. Ning Zhao and Lysa So fall into this category.
This slows down the pace of the class. Following discussion on Q2, I have advised the students (not individually) to practise typing during the break and they will need to be familiar with the keyboard when we start database. This is not necessarily true but does help how much we can get through in the time. With direct instruction, students with good keyboard skills get bored waiting for the others to catch up.

The title page was completed with direct instruction. As with previous semesters I asked the students to do the CV at their own pace as a mini review to see how they are going. I also asked them to work with the person sitting next to them. The CV was an overhead and the list of instructions on the board. The students with good keyboard skills covered about two-thirds of the task. Some others only about a quarter. Very few students consulted me with the problems - they seemed to work it out between themselves.

Hanna Haddad worked on her own and spoke to me after the tutorial regarding questions on the Activity sheets. She is not attending the lectures - this could be a problem for her in the exam. I spent some time with Ning Zhao after the tutorial going through DOS covered in tutorial 2 that he missed due to the car accident. Lysa So attempted and passed the keyboard competency test. She was very happy.

Overall this tutorial went well, even though we did not complete all work. This was not due to tutorial 5, but due to not finishing tutorial 4. The level of noise was lower this week. I'm not sure why, possibly they feel more confident with WordPerfect?

At the beginning of the class four male B&T students from Campbelltown asked if they could sit in and use spare computers to do their work. As computers were available I agreed on the understanding they did not talk or use the printer. Interestingly, they were working on Pascal programming, however, when we were discussing the questions they turned around to watch and listen. This happened on a number of occasions for the formal questions as well as the general questions. I have had other students in classes before, both at Milperra and Campbelltown, but this is the first time they have interrupted their own work to listen in. Maybe they learned something they did not previously know!!

**Group 1: 1-3 pm**

Tutorial time: 1 hour 50 minutes

WordPerfect review did not reveal any problem areas. Again hardly any involvement from students despite prompting from me. Apart from Sue Exton and occasionally David Smith, students from this group do not seek consultation. It will be interesting to see who turns up on the Wednesdays during the break.

Only three students put their name on the Library session list - Alez Izossimov, Sue Exton and John Mamalioga.

This was a very smooth running tutorial. All work was covered. Some students finished at the 1 hour 40 minute point and went on with their Folio work. Susan Chehade, Darren Chek and Stephen Crowley were absent today. As these three are very slow their absence helped keep the pace of the class together. All other students kept up with the direct instruction on the title page. They appeared to be more willing today to answer general questions. I actually got answers straight after asking them without needing to probe.

As title page was almost complete from tutorial 4, more time was available for the CV. As with previous semesters I asked students to work at their own pace as a mini review. As with previous tutorials a number of students needed assistance from me. It was evident that some students had not absorbed what we had covered so far.

Alex Izossimov needed less assistance from me today, Sue Exton was sitting next to him and she assisted on a couple of occasions. Paul Lucas and David Smith are very competent to get through the work very quickly. John Mamalioga and Ben Chamie still seem a bit lost, particularly John. John asks questions like "Why are we doing this?" He completed very little of the CV.
Based on previous semesters, overall this tutorial went extremely well.

**TUTORIAL 6 - DB**

**Group 2: 9-11 am Wednesday**

Tutorial time: 1 hour 50 minutes

This tutorial ran to schedule. Database is a lot less complex than word processing and students usually feel comfortable with DB4. The WordPerfect Review showed that this group has come to grips with the content covered. When presenting the questions I advised students not to go for the obvious answer with question 1 (ie the main purpose of a grammar program is to correct grammar). I asked Melissa Harold to answer this one, she did not want to, so Glen Tankard said that the main purpose was to check style and usage as well as grammar. This was on the right track, however the answer I was looking for was 'to improve your writing'. Michael Darby answered the second question about default settings. Kamahl Abbass answered the third about the main difference between using a word processor and using a typewriter to produce a document. All students made their own notes on the questions.

We struck a problem with the second set of questions. I learnt from the students that the Database lecture had not been presented this week. I needed to give a quick overview of what a database is, database management system, relational database and brief comments on redundancy. This wasn't enough for the students to be able to answer the questions on database. We talked in general, but they could not provide answers. I will cover this again in tutorial 7 after the lecture has been presented. I spoke to Lex later in the day about this, and he told me that he had taken the wrong set of notes to the lecture. I did not tell him this had created a problem - it wasn't a major difficulty, I just needed to work around it.

The tutorial work was completed with direct instruction and general questions. Next tutorial I will get the students to do some of the work in groups - there was not much scope to do this with tutorial 6. The database EMPFILE.DBF was created and data entered using edit mode and browse mode. Displaying specific fields was introduced and will be covered in detail in tutorial 7. Moving the record pointer, editing records, adding and deleting records, and packing the database were covered. Printing included the database and the structure.

This tutorial ran very smoothly (apart from the problem regarding the lecture) and on time. Students kept up - their typing skills have improved over the break - probably as they were working on folio 1. Hanna Hadda worked on her own on Activity 6 - she had some problems with very basic things such as defining a logical field. I think she is overestimating her competence - I will keep a eye on her over the next few weeks as I might need to suggest that she join in with the tutorial work again. Ning Zhao is still behind the group with typing, however he copes by getting the overheads from me. He also makes notes if he gets behind - I try to get to him as much as possible. Lysa So is the same, and Ning appears to be "looking after her" by passing the overheads to her when he is finished. They work together outside class.

Having two sessions for the questions fits in very well. These can be placed at convenient intervals when enough content has been covered.

This group seem like a "group" - they talk to each other and assist each other. Even Bill Kurdi is joining in - he was very much a loner at the beginning. Level of noise was about the same as last week and has decreased over recent weeks.

Folio 1 is due tomorrow (Thursday). Most students have completed their folio work. Jessica Cumin still had quite a lot to complete and asked if she could sit in on the 1-3 pm group - I told her to come along and if there was a spare computer she could stay. I will be very interested to see what marks this group gets for Folio 1. Two of the other tutors will be marking it - I will be marking Folio 2 and the final exam.

During the break I saw Lysa So, Ning Zhao, Michael Darby, Bill Kurdi, Jill Peterson, Joanna Rigas, and Lara Wong Chong.
Group 1: 1-3 pm

Tutorial time: 1 hour 30 minutes

What can I say! We finished early - no talking, everyone typing and keeping up, no questions. Do they understand? I think next week will tell.

When asking the general question of "What command do I type for this....." three or four students called out the answer. This is the first time I have got an answer the first time I asked the question and without looking directly at someone.

Joseph Giunta appeared a look happier today, not as stressed. He talked to me about his folio and about today's work.

There was an improvement in John Mamalioga today, he kept up and "appeared" to understand what we were doing. He did sit closer to the front and on the other side of the room. He did not ask his usual questions about what are we doing, just after I explain what we are doing!

Darren Chek, Susan Chehade and Stephen Crowley were absent and have been for a few weeks - they have probably dropped out. Alex Izossimov was absent today, I think he may have dropped out - he said he would come in over the break, however I did not see him.

This group are a group of individuals - very little contact with one another, except perhaps Nathan Richman and Lisa Kavanagh. Nathan is the most animated student in this group - he would fit in well in the 9-11 am group.

During the break I saw Sue Exton, Joseph Giunta, Nathan Richman and Carola Troncoso.

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TUTORIAL 7 - DB

Group 2: 9-11 am Wednesday

Tutorial time: 1 hour 45 minutes

This tutorial which is the second and last for DB ran to schedule. The students seemed to like doing DB, especially after the tedium of WP. This is the same as previous semesters. Two of the first three questions were from last week - the students handled them this week following the lecture.

Melissa Harold is a bit of a problem. When the students were discussing their answers in groups, she yawned and announced "This is boring". It appeared that other students did not share her feeling. I pretended not to hear. She tends to be a bit outspoken, which doesn't bother me, however, I will try to work on her attitude. The rest of the group work well and some students who were previously quiet (like Bill Kurdi and Ning Zhao) are putting in an effort to contribute to the discussion. One thing that did worry me, I heard Melissa say to Michael Darby, "I heard what you were saying, I was sitting outside" and then laughed. I could not gauge whether this worried Michael or not. Kathy may need to look at seating arrangements outside the interview room.

Students made notes on the questions and generally gave quite good answers - not complete but on the right track.

The syntax of the search commands was covered with direct instruction and a number of examples were explained. The second question session on the search commands worked very well. They split into five groups, some needed to move to
do this, and each group worked on one question. When they had arrived at the
correct answer (record numbers for correct answers were on the OH) one student
from each group wrote it on the board for the other students. All groups then worked
on question 6 which was harder than 1-5. Melissa Harold's group solved it first and
she wrote it on the board.

The tutorial finished 15 minutes before the next class, most students stayed in the
room, either talking to each other or to me. The scheduled finishing time is 20
minutes before the next class and we slowly seem to be getting towards this time.
Absence is very low in this group, in contrast to the 1-3 pm group (and other
semesters).

**Group 1: 1-3 pm**

Tutorial time: 1 hour 30 minutes

A number of students were absent today:
- Susan Chehade has withdrawn
- Darren Chek, Stephen Crowley and Alex Izossimov have resigned from their
course
- Lisa Kavanagh, Nathan Richman and Carola were absent.

The tutorial ran without a hitch - again, no talking and everyone keeping up. They
coped with the search commands very well which would indicate that they do
understand. Following direct instruction as for the 9-11 am group, they worked
individually on the search commands from the OH without any initial input from me.
I walked around and prompted them if they were on the wrong track.

John Mamalioga worked well again today, he asked me a couple of questions. He
accepted my answer without me needing to go to the keyboard and show him (which
I previously had to do for him to understand).

The tutorial finished early and most students left immediately. Sue Exton, Marcela
Herrera and Terry Funnell stayed to do some tutorial work. Kylie Lovell needed
some help to tidy up her disk and copy files.

This group is so quiet - you can hear a pin drop!

**TUTORIAL 8 - 123**

**Group 2: 9-11 am Wednesday**

Tutorial time: 2 hours

Folio 1 was given back to the students at the beginning of the tutorial. Eight students
had a Resubmit. I gave them feedback on the Folio from the marker's notes. There
was a lot of discussion between the students and questions like "How come we have
to re-submit, why couldn't they just take the marks off?" (Melissa Harold). Considerable grumbling from the students with Resubmits, others did not seem
concerned. Michael Darby got the highest mark in this group. This took about 15
minutes

We reviewed DB4 and there was more discussion and noise level than usual between
the students on the questions. I walked around the room to ensure they were
discussing the questions and not the folio. The answers were very good this week
with a number of students wanting to speak. It was almost as if the spirited
discussion on the folio stirred them up. This took longer than usual.

We were just starting (or should I say trying to start) Lotus 123 when error messages
on the screen indicated a problem with the Program Starter. I alerted the technical
staff who advised that the server had crashed. It took about 15 minutes to get it up
and running again. During this time I gave them tips on what to do with Folio 2, and
also skipped ahead to explain aspects of Lotus 123 which I planned to cover later, eg cell ranges.

We lost quite a bit of tutorial time and consequently ran right up to the 2 hours. We did cover most aspects of the tutorial, some were however a bit rushed. I will need to go over some of the topics again next week, particularly retrieving a file. We started with direct instruction and on some aspects that we were doing for the second time, I got the students to just do it (like, copy one cell to a range of other cells) on their own. They coped quite well, and I only needed to help Ning Zhao. Lysa So was absent today.

Lotus 123 is not a "user friendly" program by any means, there is a lot of keystrokes to learn, so most of this tutorial was direct instruction.

The second group of questions contained one from the lecture material ("What is an example of a task that you would use a spreadsheet to undertake?"). Answers to this question showed some thought (ie, not going for the most obvious answer). Students discussed answers between each other across the room without speaking directly to me - this was good. They were unable to answer the question, "What is the name of the cursor in Lotus 123?" However, they were in a very jovial mood and tried to guess, and asked for a clue. They were making statements like, "the little blue box on the screen" and "the window". In the end I told them the answer. I think I'll check this one again next week.

Students have continued to make notes, and start as soon as I put up the overhead, and then write down the answers sometimes asking for clarification of an answer. I have never asked me to do this, or even commented on it.

This tutorial had a level of noise higher than usual and I needed to remind them to pack up as the next class was waiting to come in.

**Group 1: 1-3 pm**

Tutorial time: 1 hour 40 minutes

Only three students from this group had a Resubmit, there was very little discussion, students looked through the folio and then put them away. I needed to go around the class and speak to the students as they were looking at theirfolios. This took about 5 minutes. A folio was not received from Terry Funnel - I didn't think this would be right so I asked the markers to look for it. I asked Terry in the class and he told me he did not submit it, but he would. I told me this needed to be before the end of Week 14 and that he would receive no marks. As all assessment items need to be submitted, he cannot pass without handing it in. I also told me to show me Folio 2 before he submits it to ensure that he includes as much work as possible. Sue Exton got the highest mark in this group.

Before we started Lotus 123, I gave this group the same tips on Folio 2 that I gave to the morning group.

This tutorial ran smoothly, as other weeks no talking and everyone keeping up. I have noticed that this group takes less notes than the morning group. I'm not sure of the implication of this, I guess I'll find out at the Prac. Test. The average mark for Folio 1 was higher than the morning group (13.5 and 12.5). One explanation for this could be that Sue Exton is mature age and has had study experience, whereas Michael Darby is straight from school.

With direct instruction for the whole tutorial we finished after one hour, and I went onto the first part of the next tutorial. I had planned to do this with both groups, to give more time for the review period. The review period will be Weeks 11 and 12, I did want to start it in the second hour of Week 10.
The atmosphere in this group (quiet and very little communication unless I initiate it) is very different from the morning group (everyone initiates communication, even the students who were quiet at the beginning of semester).

TUTORIAL 9 - 123

Group 2: 9-11 am Wednesday

Tutorial time: 2 hours

We started the tutorial with the review questions based on last week's Lotus 123. This week I did not tell the students to form groups for discussion, I just put up the overhead. They formed their groups and started writing down the questions. There was less noise than last week. Melissa Harold and Glenn Tankard were absent today. I saw Melissa after the tutorial as she needed to hand Folio 1 back following the Resubmit. The deadline was today and I told Yonneka to tell her that she would be penalised another 10% per day if she did not hand it back today. When I saw Melissa she was obviously sick.

All questions today were based on tutorial content. Discussion was subdued as the students seemed to know the answers. Interestingly, Yonneka Overduin spoke up and wanted to answer a number of questions in this tutorial. This is the first time she has wanted to contribute. She seemed more confident today. Was this because she wasn't overshadowed by Melissa? Kirsty Macryannis and Lara Wong Chow were also more willing to speak in the group today. Yonneka sits on one side of Melissa and Lara and Kirsty sit on the other side. I will watch to see if they continue with this next week. Jill Peterson and Joanna Rigas have gained considerable confidence in recent weeks. They are very keen to do well and are always in Lab 1 after class and seek assistance from me with the activities. Joanna has just purchased a new computer and had many questions regarding the setup and problems she had encountered at home.

The tutorial consisted of review of topics we covered in Lotus last week and some new features. We undertook this as a combination of direct instruction (for the new features - which I wrote on the board) and an instruction to carry out the task (e.g., change the label prefix on the headings, copy this to other cells, etc.) without how to do it. Some of the students knew how to do the tasks and applied it to their work and then turned to other students who needed help and advised them how to do it. There was no prompting from me to do this. I kept instructions to a minimum, and observed how they helped one another. On more than one occasion I noticed that at one stage a particular student would know how to do the task and help someone else, on other occasions this was reversed.

The whole two hours were used for the tutorial, but it was very satisfying to me to see how the students were working together and not referring to me all the time. I needed to go out of the room for a short period and when I returned they were working on their activities (in Lotus, DB or WP) very quietly.

Group 1: 1-3 pm

Tutorial time: 1 hour 50 minutes

This group covered some of the content from this week's tutorial last week, so the rest of the tutorial material was covered with direct instruction and then I asked them to do a question from the activities. I slowed the pace of the class down to try to see if they understood what we are actually doing with Lotus. I asked a few general questions and as usual I needed to extract the answers. Most students who did answer spoke very quietly (I could hardly hear them!) and had their head down. John Mamaliga got a bit lost, however he was sitting next to Paul Lucas who helped him. When completing the spreadsheet John asked me, "Couldn't we have done this in WordPerfect?" Terry Funnell was absent today. I hope he hasn't dropped out, a possibility when considering he did not hand in Folio 1. Kylie Lovell seemed more
confident today with her work. I needed to continually walk around the room to assist people, and check they were entering data correctly (eg, as values not as labels).

With direction instruction the actual tutorial work was completed in one hour. I didn't give any instructions on how to do the activity question, I just helped them individually. They waited for me to come to them to get assistance before going on. In contrast the morning group seek assistance from the other students or go ahead and when I get to them they go back to the problem.

The tutorial ran smoothly and was very quiet, as usual! I seem to be the focal point of the group, whereas in the morning group this is not the case. Quite often the students in the morning group consult me after they have consulted the other students. I feel more in the background with them than I do with the afternoon group.

**TUTORIAL 10 - GRAPHS**

**Group 2: 9-11 am Wednesday**

Tutorial time: 2 hours

Jessica Cumin and Lysa So were absent today. Jessica is very competent, but Lysa is struggling. A discussion on Folio 2 took place and I gave the students ideas on how to set out their folios. I also advised the students that if they got below 8 for Folio 1 they should let me see Folio 2 before they hand it in.

Only one set of questions for this tutorial, covering Lotus 123. Questions 1 and 3 were handled quite well, however, I needed to clarify the correct answers. Question 2 ("What is the main advantage of using a spreadsheet?") caused some confusion with some of the students answering "Why would I use a spreadsheet?" When I told them the answer they made comments like "Oh, yes" and "I should have thought of that". The question time went smoothly with most students wanting to offer answers. Yonneka Overduin was still willing to speak this week, and Melissa Harold was back, however, she was sitting about three seats away from Yonneka. Students overall seem to have a positive attitude to the discussion periods.

We moved on to Graphs which needed direct instruction as it was a new concept. Some features were covered a number of times. The first time I gave direct instruction on how to do it, and the subsequent times I just told them to do it without instruction. They referred to their notes and coped with this quite well, helping each other if necessary. I tried to say as little as possible and let them ask each other, which they did. They enjoyed doing the graphs and made comments like, "This is great" and "Graphs are fun".

We had about twenty minutes remaining in the tutorial, so I introduced how the Review would proceed and handed out the question stems. I explained to them that we would have about four groups, they would question each other using the question stems and then offer one question per group for the class to discuss. I asked them to think about questions during the week, and the groups would remain constant for the review. At this point they did not have any questions.

The remaining time was spent on starting the Lotus Review with no direction from me. The worksheet was on the overhead and the instructions on what to do was on the board to simulate the Prac. Test. In the actual Prac Test the worksheet and the instructions will be on paper.

The tutorial took the two hours and we will need to finish the Lotus Review next week. This was an enjoyable class for me with a very cooperative atmosphere. There was a low level of noise throughout. Over the last few weeks I've noticed that some of the students have private conversations in-between the tutorial work. This is fine with me as I believe it shows that they are comfortable with what we are doing.
Group 1: 1-3 pm

Tutorial time: 1 hour 50 minutes

Folio 2 covered as per the morning group. Marcela Herrera was absent today.

We covered the graphs in one hour with direct instruction. No talking in this group and only some students made notes. Most of the students coped very well while a couple said they felt a bit lost.

We moved on to the Lotus Review under the same conditions as the morning group. worksheet on the overhead, instructions on the board. This was completed and printed within the hour. I walked around the room and assisted students. They seemed to wait until I came to them before asking a question. Most questions were about the formula and function that needed to entered or formatting. Some students worked out how to do it for themselves (Joseph Giunta and Paul Lucas) while some needed hints and others I just had to tell them (John Mamiloga in particular). I needed to remind them not to waste time fiddling with the format if they had not worked out the formula and function. I felt that I needed to give instructions to this group.

The tutorial ran very smoothly as it usually does with this group and all work was completed.

### PRACTICAL TEST - WEEK 13

#### Group 2: 9-11 am Wednesday

I needed to stress with this group that they could not talk during the test - they are so used to talking in class. Jill Peterson and Hanna Haddad were very nervous and I think this impeded their ability to perform at their maximum level. Lysa So only got 6.5 out of 25. I wasn’t surprised. I think she should be removed from the analysis of the group. Ning Zhao had a major problem with DBase 4 - he only got 1 mark out of 8. At this point, he said he had a disability and produced a letter from Student Services. He asked to be able to do this part of the test again as due to his disability he was unable to concentrate. I told him to proceed with the other modules and we would discuss it at the end. Following consultation with Lex Melville (who contacted Student Services) Ning has allowed to do the DBase module again with the afternoon group. His disability is cognitive brain damage. I think he, also, should be removed from the analysis of the group.

Some very good results from the group with Lara Wong Chong getting the highest mark, 24.5 out of 25.

At the end of the test a survey from FASS Computing Department was administered covering access to facilities and useful/unsatisfactory things in the subject.

#### Group 1: 1-3 pm

Some excellent results from this group with Lisa Kavanagh getting the highest mark, 25 out of 25 and Terry Funnell 24.5. The surprise was John Mamiloga with 24. He remarked to me after the test that he had written on the survey that he would fail. I was surprised with his result, considering his difficulties in class and questions throughout the semester like, "Why are we doing this?", "What did you say this was for?" after I have just finished explaining it.

### Final reflections:

**HIGHLIGHT**: The way the students in the intervention handled the questions in the Review Period - shows they are really thinking.
DOWN SIDE: I don't think they had enough time to learn questioning using the question stems during the Review Period- there was just too much content to revise. The questions I gave them each tutorial after a suitable amount of content had been covered and at the start of the next class as a review seemed to help them in their own questioning and discussion. Maybe they should start much earlier getting the question stems or hand in something written (their own questions) to the tutor each week.

OVERALL: Cooperative Learning Group is showing self confidence and more of the students were willing to tackle problems without consulting me.
APPENDIX C: APTITUDE-TREATMENT-INTERACTION
INTERVENTION TRAINING MATERIALS

Appendix C1

Procedure Adopted in Weekly Tutorials for Intervention Group in
Aptitude-Treatment-Interaction Study 1

Instructions to Instructor

During each tutorial, after approximately 20 minutes of content presentation,
the instructor is to pause and to pose a question which requires students to engage in
their own active construction of what has been taught (1-5 minutes). In other words,
the students are to "translate" the learning into their own words. Methods might
include ideas from Table 1 in Alison King's (1993) article, "Sage on the Stage to
Guide on the Side" - "Think-Pair-Share", concept mapping, generating examples, or
pair summarising/checking, as appropriate to the content.

Note: It is important to emphasise that the focus of these short periods is on higher-
order cognitive activity, not merely recall of factual detail.

The "Think-Pair-Share" model, for example, might operate in this way:

1. Instructor poses a higher-order question adapted to computer content from Alison
   King's work in generic question stems - examples given in "A strategy for
   enhancing peer interaction and learning during teacher training sessions" (1991,
   pp.20-21), and "From Sage on the Stage to Guide on the Side" (1993, p.32).

2. Students have a partner with whom they discuss the question AFTER they have
   attempted to answer it for themselves first. This partner can be different each
tutorial.

3. The whole class comes together for brief sharing of ideas with the instructor as
   "facilitator". The aim is for the students to collectively answer the questions (or
   engage in equivalent constructivist activities) and for them to "test" their answers
   against each other, or in the "real world" by trying them out.

4. This procedure is repeated at the conclusion of the tutorial as well.
Appendix C2

Initial Training of Students in the Reciprocal Peer-Questioning Approach in Aptitude-Treatment-Interaction Study 1

1. This will take place at the conclusion of each module of content (DOS; Wordperfect 5.1; DBase 4; and Lotus 123).

2. Students are to be told: “Asking yourself questions about what you have learned can help you find out what you do and don’t understand. I am going to show you some types of questions that you can ask about the topics we will cover in tutorials. You will be asked to make up your own questions and to answer these in a group.”

3. The instructor is to give an example of the types of questions that students can ask. Note: These will have been modelled by the instructor in each of the tutorials as content-related higher-order questions displayed on overhead transparencies.

4. Students are to be asked: "What questions would you still ask about this topic? Write these questions down and form a pair to try to answer them." The whole class comes together to share questions and answers following a period of time for student independent collaboration.

5. Note: In the subject review period (Weeks 11 & 12) before the Practical Test (in Week 13), students will be asked to form larger groups (threes and fours) to create their own questions using the generic question stems and to discuss their understanding and test it out (summarise and check), test each other, and predict their performance on the test for each of the modules.

6. The case study sample will also be asked to record their predictions in their logbook - these should be both objective in terms of a numerical score, and subjective in terms of their perceptions of self-efficacy and confidence (related to anxiety).
Appendix C3

Procedure Adopted in Metacognitive Strategy Training Intervention During Practical Skills Review Period in Aptitude-Treatment-Interaction Study 1

The following procedure was adopted in the two week Prac Review period prior to the Practical Test:

1. Strategy of self-questioning introduced by the instructor:

2. "For the last few weeks I have been giving you questions dealing with the content of what we have been learning. During the Prac Review (for the next two weeks), you will be writing your own questions. To help you come up with questions I will give you a list of possible question stems. These are called ‘Generic Question Stems’ that you can use to help think of questions to ask yourself and others in your group about the work you have learned. I'll let you read through this for a couple of minutes to familiarise yourself with these."

3. Handout given out:

4. "While you are revising the work for today (Lotus 123), you might find it useful to think about some of these questions for later."

5. Instructor put up on overhead a problem for students to solve, comparable to the type of item that might be on the Prac test. Students attempted to solve it individually for a few minutes first.

6. After this exercise was completed, groups of 3 or 4 were formed. As individuals first, students generated their own (2-3) higher order questions about the area being revised. Within the group, each student, in turn, then asked their questions and had them answered (students need to have an opportunity to explain their understanding in order to facilitate their own learning). Following this, students,
as a group, selected one question that they would like to ask the whole class. The whole class (with the instructor as facilitator) then came together to discuss and to answer these questions.

7. Students were asked to generate their own questions at home on another topic that they would be revising for the Prac Test, and to bring these with them to the following week's class. This was to foster independent practice (transfer of strategy to independent application at home during private study).

8. Feedback on these questions was provided in the following week's class - students’ questions used in Pairs Summarising/Checking strategy as quick review before the next review session. Students formed pairs and took turns to summarise what they had learned while the other listened and checked for errors, correcting these as they occurred.
Appendix C4

Instructions to Instructor for Procedure to be Adopted at the Outset of the Replication of Aptitude-Treatment-Interaction Study 1 in Study 2

UNIVERSITY OF WESTERN SYDNEY MACARTHUR

MEMORANDUM

TO: Robyn Lawson
FROM: Valentina McInerney
DATE: 8th March 1995
SUBJECT: Computing research project

Robyn,

The following is an outline of the procedure that is to be adopted in the first computing tutorial for each of the groups involved in the computing research project. This is a copy for your reference and details what we have discussed in our meetings.

**Group 1: Cooperative, Self-Regulated Strategy Using Question Stems**

1. Content input by instructor for first part of session - e.g., first tutorial will begin with Keycoach.

2. Groups of three students to be formed. Students told that if there are any questions regarding tutorial exercises they should ask someone in their small group in the first instance. If neither of the other two members can help, they should ask the instructor promptly and not sit worrying about what to do. Emphasise group reliance in terms of team problem solving, as in the workforce.
3. Copies of generic question stems to be distributed to all students.

4. Explanation of the purpose of these question stems in terms of their use in facilitating problem solving and in helping students to take responsibility for some of their own learning.

5. Examples of how these questions might be written provided by the instructor - *modelling of question completion* in relation to computing content. Examples might be drawn from 1994 research project (Study 1).

6. Explanation that the use of these questions will typically follow this procedure:
   - instructor will pose content-related questions using some of the question stems several times throughout a tutorial each week.
   - students will select one question from the list towards the end of each tutorial, then write it down as well as an answer to it - this should take several minutes.
   - these question/answers should then be shared with the members of their small groups.
   - one other question should be selected and completed for "homework" in the Reflection section of the students' class folders.

7. At the end of the tutorial, in the last 10-15 minutes or so, the overhead of the four self-regulatory questions should be projected and explained in the following way:
   - these are to be copied into the Reflection section of the students' class folders.
   - they are designed as part of a problem solving strategy to assist students in focussing on what they are, and are not, learning at particular times, and in planning a course of action with regard to any difficulties.
   - each week, these questions are to be answered before the following week's tutorial and shared with members of their small group first, then shared with the rest of the class. This should form the basis of a review of content which precedes the next tutorial input.

The self-regulatory (metacognitive) questions are as follows:

a) “What did I learn this week in my computing class?” (monitoring)
b) “With what did I have difficulty this week?” (monitoring)
c) “What types of things can I do to deal with this difficulty?” (problem solving/planning)
d) “What specific action(s) am I going to take this week to solve any difficulties?” (planning)

**Group 2: Direct Instruction with Independent Practice**

1. Tutorial content input by instructor.

2. Independent practice by students. Instructions given that the students should try to solve problems *alone* wherever possible - e.g., by trying again; by referring to the text/notes; by asking the instructor as a last resort.

3. Keep it "quiet" in the classroom, that is, ensure that the students work independently, rather than wandering around asking for help. Treatment differences between the groups need to be kept strictly clear.

All the best for the research, and thanks for your valued co-operation.

Valentina