The Effect of Trainee Characteristics, Learning Styles and Organisational Factors on Effective End-User Training in Four New Zealand Organisations: A Multiple Case Study.

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DEDICATION

This thesis is dedicated to the memory of my parents

Isabel Purse Shand 1921-1972

and

Robert Bruce Shand 1928-2002

ABSTRACT

This study represents the results of a one-year thesis project into the effectiveness of End User Training (EUT) of software applications in four large organisations in New Zealand. The ubiquity and criticality to successful business of desktop computers in business organisations in the twenty-first century is unchallenged. Information Systems (IS) research over the past thirty years has consistently identified that the success of IS is heavily dependent on the skills and knowledge of the end users of those systems. Further, a large IS research effort has identified that a critical success factor of skilled and knowledgeable users is effective EUT. Governments and organisations world-wide recognise and expend considerable resources on improving the increase of knowledge and skills of workers, with particular focus and emphasis, in more recent years, on EUT.

This project has identified and emphasised the large number of factors that impact on the effectiveness of EUT. Focus has been on identifying factors that are particularly pertinent to practitioners in the New Zealand environment in order to provide a rigorous academic framework for future practical EUT. Multiple case study methodology has enabled the project to provide a rich picture of the organisational environment that surround EUT in large New Zealand organisations.

Analysis of data in the study has identified four trainee characteristics that impacted on the results of EUT. Additionally, the study found that organisational factors to support EUT and training method when optimally combined with trainee characteristics and learning styles, could provide essential information for effective EUT design and delivery in New Zealand organisations.

As this study was exploratory in nature, there is opportunity for IS researchers to explore and explain in greater detail a range of factors that both produce and predict greater effectiveness in EUT.

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Introduction

This study has been conducted in the New Zealand business environment to investigate issues that impact on effective and efficient training of employees to use business software. The goal of training is to maximise learning in order to improve end-user skills and knowledge, which ultimately improves productivity.

1.1 The Importance of End User Training (EUT)

The general adoption of end-user computing (EUC) in business over the past decade has created the need to measure and understand factors that contribute to EUC success in organisations (Goldstein, 1993). In the current technology-intensive business environment it is essential that organisations effectively support end-users in order to meet business objectives (Huang, 2002). EUC has been defined as the practice of users developing, maintaining and using their own information systems (IS)[1] (Bostrom et al, 1988). Currently, a generally accepted definition of EUC is the non-mandatory use of microcomputers by people who are not trained as IS professionals. EUC activities, such as word processing and spreadsheeting, are commonly carried out by non-IS professionals in most business organisations today (Connor et al, 1996).

A critical success factor of EUC is user satisfaction (Shayo et al, 1999), which is promoted by identifying and implementing effective end-user training (EUT) strategies (Sein et al, 1999). EUT has also been identified as a key factor in promoting the productive use of technology (Compeau et al, 1995), which is critical for organisational success in today's increasingly competitive and geographically dispersed business structures.

As early as 1963 researchers were defining the concept of user information satisfaction (Cyert and March (1963) in Ives et al, (1983)). User satisfaction was considered a perceptual or subjective measure of system success and it was suggested that information systems that meet the needs of users will reinforce user satisfaction (Ives et al, 1983). Throughout the 1980s IS researchers continued to consider user satisfaction as one of the most important measures of IS success and to develop instruments (Baroudi and Orlikowski, 1988; Doll and Torkzadeh, 1988; Raymond, 1985) to identify the components of user satisfaction.

Whilst user satisfaction continued to be considered a strong predictor of IS success, another thread of IS research examined measures for predicting and explaining the use of IS. If users do not use the technology no performance gains will be realised. Determinants of user acceptance of IS are therefore critically important for successful EUC. Davis (1989) proposed two determinants for influencing IS use – perceived usefulness and perceived ease of use.

[1] Throughout this document the term Information Systems (IS) is used synonymously with the term Management Information Systems (MIS), which is commonly used in earlier IS research.

"Use is defined as the prospective user's subjective probability that using the information system would increase their job performance ... Perceived ease of use refers to the degree to which the prospective user expects the target system to be free of effort." p. 985:(Davis et al, 1989) The Technology Acceptance Model (TAM) proposed by Davis et al, (1989) hypothesised that actual system use is dependent on a number of variables which are in turn dependent on external variables, such as training and education, and user learning based on feedback to influence perceived usefulness and perceived ease of use. (See Figure 1.1) Results of the study indicated that perceived ease of use may be an antecedent to usefulness rather than a parallel, direct determinant of usage.

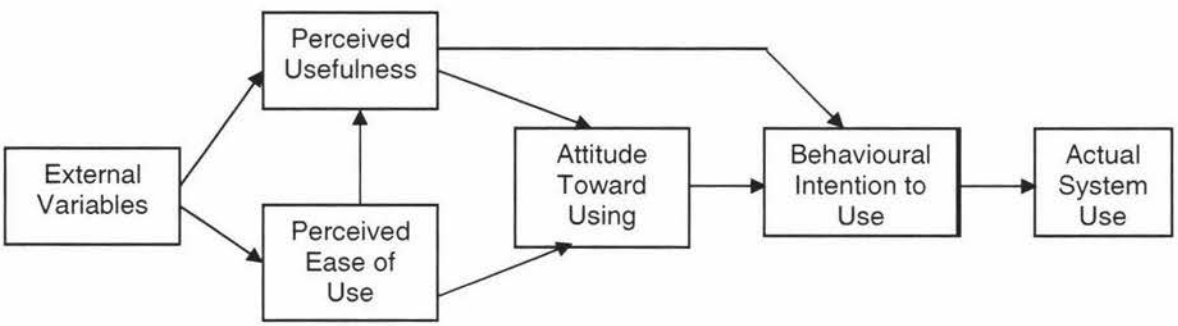

Figure 1.1 Technology Acceptance Model (TAM) (Davis et al, 1989)

According to acceptance theory described in Lehrer, (1990), the first thing to notice about acceptance is that it is goal-directed. Acceptance is an attitude defined in terms of some purpose, it involves an evaluation of whether the attitude fulfils the purpose. More recently, Morris and Dillon, (1997) have described a model based on acceptance theory that demonstrates a theoretical basis for relating software usability to usage patterns. Another study measured user satisfaction and system-affected behaviour for an indirect and a direct user group of the same information system in 39 organisations. Results indicated that a relationship does exist between satisfaction and behaviour for both user groups (Gatian, 1994).

"The success or failure of EUC within an organisation will ultimately depend on whether end-users effectively use EUC software." (Bostrom et al, 1988). Hence it is necessary to specifically identify determinants of end-user behaviour, which Bostrom et al, (1988) consider to be:

- User's task (e.g. problem to be solved, decision to make)
- User's motivation to use the system
- User's knowledge (understanding of EUC software)
- User-system interface
- User's other characteristics
- User's behaviour/performance

To provide users with a sense of control over the system in order to use it effectively, it is essential that users' understanding and motivation are maximised. This can be achieved through good EUT.

Having established the importance and necessity of EUT for effective EUC, many IS researchers have turned to considering determinants of effective EUT. Compeau and Higgins, (1995a) conducted a study to evaluate EUT performance using outcome expectations (among others) as a dependent variable. Despite the changed terminology the authors considered that outcome expectations (of using the information system) equated with Davis's (1989) defined variables of perceived usefulness and perceived ease of use. IS researchers continued investigating the external factors that affect individuals' perceptions of usefulness and ease of use (Adams et al, 1992; Dishaw and Strong, 1999). An important variable that has been identified as impacting on how individuals' expectations of their abilities in using information systems can predict their behaviour, both whether to use and when using the system, is self-efficacy – described as an individual's belief that they can perform tasks (Compeau and Higgins, 1995a, 1995b; Gist et al, 1989).

Variables that impact on the effectiveness of EUT have been identified by IS researchers. Effectiveness of EUT in turn impacts on IS usage and acceptance. The current study will directly measure the following:

- personal characteristics (Davis and Davis, 1990)
- individual differences (Egan, 1988; Harrison and Rainer, 1992)
- user attitudes and beliefs (Goodhue, 1995; Noe, 1986), specifically outcome expectations and self-efficacy (Compeau and Higgins, 1995a and 1995b; Gist et al, 1989)
- previous computer experience (Thompson et al, 1994)
- learning styles (Bohlen and Ferratt, 1993; Bostrom et al, 1990; Simon, 2000)

IS researchers have identified and demonstrated the critical role that EUT plays in the success of EUC by considering the relationships that exist between EUT-related variables and the outcome of increased ability in performing IS tasks. Increased ability is positively related to both an individual's use of and satisfaction with the information system (Yaverbaum and Nosek, 1992). Therefore, high levels of EUT are important in IS acceptance (Nelson et al, 1991). Additional to the importance of increased user abilities in positively affecting user IS acceptance and use, Lee et al, (1995) found that user IS acceptance positively affected IS satisfaction, which in turn positively affected user job satisfaction. Hence, an important consideration in the current EUT environment is to maximise user acceptance in order to maximise the effectiveness and productivity of the information system.

Commonly through the 1990s, researchers and practitioners have identified training in organisations as a problem. Some of the challenges in training identified by Allen, (1996) are: a

wide range of learner abilities, high costs of staff down time, increasing levels of worker turn-over and mobility, and inconsistent delivery and presentation of the same training courses to geographically dispersed groups. Particularly with EUT in the rapidly changing technology environment it is important that training materials are up-to-date. Training materials should include a level of active involvement and user interaction with resources (due to the fact that EUC is an interactive activity) to increase the effectiveness of learning (Kruse, 1997; Rossett and Barnett, 1996).

The cost and effectiveness of EUT have for a number of years been a concern to IS researchers and practitioners alike (Desai et al, 1999; King, 1996; Levin, 1998; McGee, 1998; Nelson et al, 1995). Large amounts are spent on training nationally and globally; in 1995 US organisations spent US$5 billion out of a total training spend of US$50 billion on EUT (Nelson et al, 1995), which was up on 1990 total training figure of US$45.5 billion (Rifkin, 1991). The increase over recent years of technology-based training has provided industry with a wide range of options to address organisational training needs effectively and with greater cost efficiency.

Statistics NZ does not collect information on cost of training and does not separate computer-related training statistics from total training statistics. However, Baker (2000) quotes Gartner Group research stating that 75% of employees without training utilise less than 10% of software's functionality but after training utilisation is up to 75%.

The mid 1990's has witnessed a huge growth in World Wide Web (WWW) based courseware and delivery for both education and training. Despite the popularity of the medium, courseware varies greatly in quality and educational effectiveness. A number of authors have identified sets of general requirements that are necessary in designing effective multimedia courseware. (Allen, 1996; Liebowitz, 1997; Rossett and Barnett, 1996; Summers, 2000; Wade and Power, 1998). The main themes from these studies are that learner needs must be addressed and the importance to the trainee and hence, the necessity of providing an on-line facilitator.

A number of researchers and practitioners have suggested that interactive multimedia in computer-based training (CBT) could provide answers to training problems (Allen, 1996; Rifkin, 1991; Rossett and Barnett, 1996). The technological advances of the late 1990's in respect of the growth, availability and reducing cost (especially of digital technology) of the Internet has opened new avenues for EUT. (Levin, 1998; Wade and Power, 1998). The increase in capabilities (such as video and audio streaming) and reduction in costs of technology to support multimedia has seen a large growth in a range of EUT techniques and strategies. (Abernathy, 2001; Gareiss, 2001; Niederman and Webster, 1998).

Leading edge educational technology research is investigating the use of Intelligent Tutor Systems (ITS) that provide interactive learning environments where the system adapts to the

learners' requirements and provides customisation of domain content and tutoring strategies (Kinshuk. et al, 2000), thereby reducing or eliminating the need for human facilitators. However, researchers have agreed that the human tutor and paper in the learning environment are not obsolete yet (Min, 1996). From information gained conducting this research it appears the practitioner situation in New Zealand at this date is not ready to embrace the humanless and paperless learning environment.

According to Angelides and Dustdar (1997), multimedia provides a unique opportunity to alleviate expected shortages of better trained workers with more effective, individual and continuous training using interactive multimedia systems.

1.2 Justification for Research

The investigation of factors that contribute to more effective EUT is an essential area of IS research. There is general agreement that the effectiveness of training can be improved by considering a number of impacting variables. Training needs analysis, training design, training methods, the pre- and post-training environments (often termed organisational factors) and trainee characteristics are all important determinants of EUT success (Goldstein, 1993; Tannebaum and Yukl, 1992). It has also been demonstrated by researchers and practitioners that a wide range of trainee characteristics impact on the effective design and delivery of training. Different training methods and environments are more or less effective depending on different trainee characteristics. Examples from research include considering the impact of trainee learning styles and training methods on learning (Bohlen and Ferratt, 1993; Bostrom et al, 1990; Simon, 2000), or personal characteristics, such as age and gender, and different training techniques on learning (Davis and Davis, 1990).

There are many trainee characteristics that have been investigated as affecting performance gains from EUT. Goldstein, (1993) points out that there is now a much broader conception of trainee characteristics and quotes Tannebaum and Yukl, (1992) by stating "... there has been a virtual explosion in the consideration of trainee characteristics including many cognitive characteristics such as self-efficacy and goal orientation ... [and] other signals such as expectations about whether training will be useful." (p. 87: Goldstein, 1993). Categorisation of trainee characteristics is varied in the training literature; a summary of trainee characteristics that are considered to impact on effective training is summarised in Table 1.1.

The other important area for organisations is the ability to predict the success of training. Often there are constraints in the general organisational environment on training. The most common constraint is time, which directly impacts cost in a business environment. The cost of downtime for training has been identified as a major constraint (Allen, 1996). Effective and efficient predictors of training success are invaluable to businesses. If a trainee can be assigned to a

training method by knowing what method best suits their characteristics (such as learning style or gender or level of self-efficacy) training cost savings can be achieved, both by reducing training time and increasing training effectiveness. A study reported in Tannebaum and Yukl (1992) (p. 417) found that training time was reduced by 50% by assigning trainees to particular training programs rather than random assignment.

TRAINEE CHARACTERISTICS THAT IMPACT ON TRAINING EFFECTIVENESS		
CATEGORY	COMPONENTS	RESEARCHER
Ability and Skills	Trainability testing, content abilities, perceptual speed ability, psychomotor	(Tannebaum and Yukl, 1992)
	Trainee readiness,	(Goldstein, 1993)
Motivation Attitudes and Expectations	Cognitive abilities, distal and proximal motivation, volition ("will do" attitude), expectations of training, self-efficacy, problem solving style, action orientation, need for achievement, goal orientation	(Tannebaum and Yukl, 1992)
	Trainees' belief in external assessment of their ability, locus of control, motivation to learn and achieve, believe outcomes of training are relevant, career planning, entry self-efficacy.	(Goldstein, 1993)
Aptitude Treatment Interactions (Interactions between training methods and aptitudes)	Aptitudes – any trainee characteristic that determines their ability to profit from instruction including ability, skills, knowledge, academic ability, achievement and previous experiences	(Tannebaum and Yukl, 1992)
	Scholastic and spatial aptitude, verbal reasoning, intelligence, cognitive style, deductive/inductive reasoning, need for autonomy and miscellaneous personal characteristics	(Goldstein, 1993)

Table 1.1 Summary of Trainee Characteristics that Impact Training. (Goldstein, 1993; Tannebaum and Yukl, 1992)

Whilst a great deal of EUT research has identified and demonstrated the importance of a number of variables in both increasing outcomes of training and predicting which trainees will benefit from what types of training, there has been very little research done in this area in the New Zealand business environment. This study uses a number of theoretical principles that have been used in EUT research to identify and investigate the importance of training needs

analysis, trainee characteristics and organisational support to effective EUT in a cross-section of NZ organisations.

1.2.1 Relevance to Practitioners

Recent research has discussed the need for IS research to play a greater role in providing relevance to practitioners (Benbasat and Zmud, 1999; Sein et al, 1999) and, related to that role, to investigate more cost effective training methods (Hlusko et al, 1998; Levin, 1998; McGee, 1998; Venkatesh, 1999).

Benbasat and Zmud (1999) identify that IS research has a credibility gap within the business community and offers explanations as to why IS research lacks relevance. Firstly, in the 1980s IS research was soundly criticised by IS researchers (Banville and Landry, 1989; Zmud et al, 1989) as not building a cumulative body of knowledge. Emphasis changed in the 1990s and was placed on academic rigour in order to build a cumulative research tradition to gain the respect of other business academic disciplines. This has relegated the practical relevance of IS research to a secondary role. Secondly, the dynamic nature of IS has produced a time lag between practical implementation and publication of academic research findings. Very often, due to delays (of up to years) in academic publication, rigorous research is reported long after it has application to practitioners. Additionally Benbasat and Zmud (1999) identify the limited extent to which academicians are exposed to business and technological environments, and institutional environmental constraints that influence freedom of action within academia as limitations on producing IS research that is relevant.

Rollier (2001) identifies the orientation of IS research as a barrier to relevance. IS research can be classified as basic or applied; basic research that develops new products, such as the Mosaic browser or World Wide Web, are produced by computer scientists, physicists or mathematicians. The role of IS research is more evaluative once a new product is announced; for example researching improvements to interface, which will be rigorously carried out and published long after the product could be past its use by date. Rollier (2001) also identifies the isolation in which many IS researchers work in a "new" discipline, following individual interests in order to build a cohesive theoretical framework, as erroneous – suggesting that IS researchers should follow other newish academic disciplines (such as computer science or nuclear physics) to collaborate with colleagues and industry to identify research questions that are vitally important to practitioners.

A critically important factor in providing relevance in IS research is to identify the topic for research (Benbasat and Zmud, 1999; Rollier, 2001). Future interests of stakeholders (e.g. journals, academicians and practitioners) must play a major role in the identification of research topics – this requires that researchers prioritise topics that serve the interests and needs of

industry over topics selected from academic literature. Dissemination of IS research knowledge should be both via academic and practitioner journals, hence requiring that research results are reported in clear concise everyday language to encourage readability for all potential readers.

Despite the widespread call for relevance in IS research there are pertinent points made by a number of academicians of the value that rigorous IS research provides. Mason (2001) considers there is not an either/or question for rigour versus relevance, and justifies the argument by quoting rigorous and relevant research conducted by Pasteur, where need-driven research was conducted in a rigorous scientific manner. It is essential that a two-dimensional focus of "quest for understanding" and "considerations of practical use" are contained in future IS research to simultaneously pursue both good science, which provides understanding, and practical solutions to problems.

1.2.2 The New Zealand Context

For the past ten years the NZ Government has recognised the importance of training and more especially technology training. Chapman (1993) reports on Government initiatives to address training needs by introducing the Industry Training Act, that encourages industries to form Industry Training Organisation (ITO) to take responsibility for training in their area. The 1991 budget noted that the best way to take full advantage of New Zealand's deregulated economy was to ensure that the country had a skilled and adaptable workforce. Political vacillation caused details of whether employers should be compelled to ensure their work force participated in appropriate training and how that training would be funded, to vary. However, over the decade that has followed training has gained a lot of attention, both from the point of view of the necessity of training for successful business gains (Moore, 2001) and questions such as how to train and who should deliver training.

Statistics New Zealand reported that of the 1,672,500 people who were employed in the September 1996 quarter, forty two percent (711,200 people) had participated in education or employment related training in the 12 months prior to September 1996. Twenty one percent of people employed participated in training provided by their employer; of this group twelve percent received computer training. Computer training is defined in the technical notes to the survey as: (p. 6: Cook, 1996).

> **COMPUTING**: Include training that provides or upgrades skills in: Word processing; basic programming; data processing Use of general software packages - e.g. spreadsheets; databases; desk-top publishing PC hardware, equipment etc.

This survey was a one-off and did not gather any data about the cost of training. Also it did not specify in the above definition if the computer training included specific application of using software to job-related tasks. However, given the above information it is clear that a large

number of people received employment-related computer training during the time covered by the survey. On the information provided it appears the training was generic to provide or upgrade computer skills, the implication being that the training was a necessity for the trainees to effectively perform work tasks.

According to Tapsell (1999), "Organisations are fighting not only to attract skilled employees for understaffed Information Technology departments, they are struggling to hold onto these people who, as research shows, are prepared to leave their jobs if they do not get an adequate amount of training.", hence illustrating the importance of training to trainees in New Zealand IT industry. Businesses are recognising the need as well, spurred by the plethora of training providers that have emerged since 1991. A training provider broker – The Training Line – has approximately 1100 training providers on their database (Sole, 1999).

From reviewing NZ industry magazines (such as NZ Business, Management, Marketing) it appears that a large amount of IS training undertaken is provided by training providers, who espouse the benefits of training broadly as "training equals efficiency equals time saving" (Baker, 2000). However, this is identified as problematic as employees are sent on training courses that are not targeted to specific skills and abilities required of the job; trainees are not informed of the programme or organisational expectations for their training. Organisations are said to be reacting to situations, rather than adopting training as part of the company culture and strategic plan (Moore, 2001). As stated by Huang (2002), if organisations do not have an effective training strategy to support end users, it will be difficult to meet business objectives. The extent to which organisations take an "organisational culture" viewpoint of EUT, encompassing continual learning for staff and offering organisation specific in-house training in New Zealand is difficult to quantify; the 1996 Statistics New Zealand survey reported above was the only information available.

Recent articles have offered opinions of the ineffectiveness of training (such as "sixty percent of training currently done in New Zealand is wasted" - consultant Barry Dow in (Moore, 2001)). A suggestion is that technology and web-based training offer solutions, such as the availability of resources 24 hours, self-paced learning, support for existing programmes, customised training and time and cost efficiencies (Baker, 2000; Moore, 2001). Another method of training that has been discussed as having benefits in increasing the effectiveness of training is coaching (Moore, 2001; Sole, 1999). Sole (1999) quotes a management and training consultant who identifies some of the issues recognised in academic literature as important to the effectiveness of training, for example, identifying goals of training, previous training of trainees, type of training preferred by trainees (e.g. on-the-job, theory, practical), measuring outcomes and what support systems are in place.

For organisations wishing to evaluate training providers Moore (2001) provides some useful practical suggestions considering organisational factors that have been identified as important in academic literature. Examples are:

- Set objectives and outcomes and communicate these to potential training providers and trainees before training.
- Identify whether the prospective trainer is prepared to customise the programme for the individual organisation.
- Query whether the programme includes pre-, during and post-training support.
- Identify the level of the trainers' experience and their record of success.
- Understand whether and how results of training are measured.
- Identify whether the trainer takes into consideration different "learning patterns" and achievement levels of individuals considered.

The importance and criticism of training and especially EUT in the NZ business environment that has been identified by practitioner literature suggests that investigation into a number of issues would be beneficial to managers, trainers, trainees and the general economy.

1.3 Research Objectives

The overall objective for this research is to investigate the influence of certain trainee characteristics and their relationship with EUT methods and organisational factors on effective end user learning. The aim of the research is to build on the current body of knowledge in the area of providing effective EUT that has relevance to practitioners, while maintaining adequately rigorous procedures, using a sample of New Zealand businesses across four industry sectors. Consideration of potential benefits to the academic community and practitioners (as recommended by Benbasat and Zmud (1999)) has assisted in the selection of the research topic for this study.

This section will define specific trainee characteristics being measured, identify how relationships between those characteristics, methods and organisational factors will be reported and how learning will be measured. Additionally, the strategy for setting up the project will be described, in terms of identifying practitioner needs and business participants for the study. Chapter three will provide the details of procedures, choice of variables, instruments to measure them and justification for their inclusion in the study.

There is ample evidence in the research literature that a number of trainee characteristics impact on trainee learning. One task for this project was to identify and justify which specific trainee characteristics would be measured. Two considerations guided the choice; firstly, characteristics that had a history of being studied by EUT research, to allow findings from previous studies to be compared to the New Zealand context. Secondly, to measure those

characteristics using instruments that have been previously validated, proven reliable and are economical in terms of time for respondents to complete.

The detailed research objective of this study is to measure the impact of:

- trainees' learning style
- self-efficacy
- outcome expectations
- entry skills in generic software applications
- previous computer use
- qualifications
- years employed
- age
- gender
- individual learning and problem solving abilities

on learning from an EUT intervention. Learning is measured using pre- and post-training instruments that ask trainees to grade themselves on a number of specific skills in the applications that are the subject of the training.

Qualitative data was gathered from each organisation regarding details of training methods used and organisational factors that have been identified in EUT research as impacting on EUT effectiveness. Pattern-matching analysis which compares an empirically based pattern with a predicted one (Yin, 1994), will be used to analyse the impact of trainee characteristics with training methods used and organisational factors.

Benbasat and Zmud (1999) state that there are many ways to identify what is of interest to practitioners and suggests attending practitioner conferences, reading practitioner journals and magazines, talking to and teaching practitioners. The way that the topic of investigating factors that contribute to effective EUT for this project was identified was using all the above means.

1.4 Limitations of Study

A number of practical limitations impacted on the design and implementation of this study. The initial proposal for this research had the following research objective statement:

> This proposal is for research to investigate the influence of trainees' learning styles and abilities on the relationship of End-User Training (EUT) techniques, methods and context to effective, efficient end user learning, especially in transfer tasks (applying skills learnt in training to the workplace).

The proposed methodology was a longitudinal field experiment due to the fact that IS research is a behavioural science that should be cognisant of social systems, and that information systems interact with the organisational environment. The natural, realistic environment that field experimentation provides lends added weight to the suitability of the methodology for testing theory and developing causal models as well as the possibility of real-life organisational problem solving.

Limitations that changed this plan were firstly, the unavailability of organisations to participate. Lack of organisational resources (e.g. time and physical resources) required to commit to such an extensive research project rendered field experiment research methodology impractical. Secondly, the time frame for the research did not allow for a longitudinal study, hence excluding the measure of transfer skills.

Having secured organisations to participate in the research further limitations were recognised; once more the time available in a business organisation for "non-producing" activity is at a premium. The impact of the time constraint was that the researcher had no input into training method to be employed and therefore had to report only on the effects of input variables to training methods and techniques. "Context" of training was clarified and explained further as organisational support for the training process, including training needs analysis.

Sample sizes of the training groups were small (ranging from 7 to 15), which impacted when considering trainees as the unit of analysis, as must be done when measuring trainee characteristics, and how those characteristics impact on the training intervention. Quantitative analysis alone would produce statistically insignificant results, hence, to provide rigorous, relevant information, additional data gathering and analysing methods had to be used.

Multiple case study methodology was chosen as it is a preferred method when examining contemporary events in a natural setting where relevant behaviours cannot be manipulated and it is open to all forms of data gathering (Yin, 1994). Full details of research method and design are provided in chapter three.

Using self-reported measurements has been criticised in IS literature; however "self-reported scales are the instruments of choice by researchers." (p. 32: Sein et al, 1999) when measuring end user satisfaction. Self-reported measurements were used due to the limited time available to test trainees in any other manner and due to the environment in which the research was conducted. The training managers and supervisors who participated in this study generally had the opinion that their trainees would be reluctant to take pre-training and post-training "tests" and would perceive them as threatening. The trainees were however, happy to identify their own abilities honestly on self-assessment forms as the pre-training assessment was perceived

as a personal training needs analysis and the post-training assessment clearly identified their (anticipated) increase in skills.

1.5 Research Questions

The overarching research question is to answer: How do trainee characteristics (including learning styles) and work environment factors affect the learning for trainees of end-user software applications? As outlined in the previous sections, the answers need to have relevance to practitioners and the project therefore needed to be cognisant of pragmatic issues surrounding training.

Trainee characteristic variables that met the criteria for the study were chosen. These criteria include: having a strong theoretical base, a history of EUT research, valid and reliable instruments available and are economical in terms of time to administer. Research questions can have the general formula:
How does {identified trainee characteristic} impact on training effectiveness?

Training effectiveness must also be defined and measured, considering constraints and limitations on the study. To give training effectiveness the narrow definition of "increase in levels of skills between pre- and post-training assessments" allows measurement to be represented as a single number. Two possibilities emerge for reporting change; firstly, the absolute post training number - the higher the number the better the score. Using this figure a number of research questions can be posed as:
How does {identified trainee characteristic} impact on trainees' exit level score?

Secondly and more accurately, a calculated variable can be used to represent the outcome of training - increase in skill levels, calculated by subtracting the pre-training score from the post-training score; the research questions then become more measurable and specific in the form:
How does {identified trainee characteristic} impact on trainees' increase in skills?

Combinations of variables could also be important predictors of increase in skill levels, which raises a number of other research questions in the form:
How do {trainee characteristic_1 AND trainee characteristic_2} impact on trainees' increase in skills?
Additionally, the impact of one trainee characteristic on a second trainee characteristic that has been shown individually to have a positive relationship with increase in skills, is a potentially useful predictor of effectiveness of EUT. For example, if self-efficacy has a positive correlation with increase in skills, asking the the following question is pertinent:
What relationship does {trainee characteristic} have with self –efficacy?

The above research questions are suitable when the variable to be measured can be represented by a single numerical variable, hence allowing statistical analysis. However, learning styles is a variable that is represented by one of four categories and therefore, the research questions need to be more in the form of propositions, such as:
Trainees with {learning style A (or B or C or D)} will have the greatest increase in skills after training.

As explained in section 1.4 the researcher did not control the training methods used by the different organisations that participated in this study; the training methods employed could be described as:

1. Individualised small group instruction
2. Paper-based self-directed learning
3. Individual "key user" instruction
4. On-line self directed learning
5. Classroom structured group instruction

Given this situation a further set of research questions can be stated in the form:
How does {training method 1 or 2 or 3 etc.} impact on trainees' increase in skills?
And further propositions can be formulated, such as:
Trainees with {(a value of) trainee characteristic} will have the greatest increase in skills after training using {training method 1 or 2 or 3 etc.}.

Trainees with {learning style A (or B or C or D)} will have the greatest increase in skills after training using {training method 1 or 2 or 3 etc.}.
This research question could be modified by the fact that trainees in the study may display only one or two dominant learning styles.

The questions posed above lend themselves to statistical analysis; however as identified, problems of small sample numbers in the individual organisations and relatively small sample size (approximately forty trainees) to the population of interest for the whole study, indicate that statistical analysis alone would not make statistically reliable predictions. Therefore, statistical data results will be modulated with qualitative analysis, both of the trainee characteristics variables and the training methods variables using the analytical strategy of pattern-matching. Yin, (1994) considers pattern-matching can be used to strengthen the internal validity of a case study if an empirically based pattern coincides with a predicted pattern. Predictions of patterns are derived from propositions and EUT literature. Pattern matching can be useful to draw solid conclusions when dependent variables are different. For example, in the above proposition regarding learning styles and training methods the following patterns could be predicted from previous EUT research on learning styles studies:

1. *Trainees with {learning style A} will have the greatest increase in skills after training using {training method 1}*
2. *Trainees with {learning style A} will have the smallest increase in skills after training using {training method 3}*
3. *Trainees with {learning style D} will have the greatest increase in skills after training using {training method 3}*
4. *Trainees with {learning style D} will have the smallest increase in skills after training using {training method 1}*

If all the results are as predicted solid conclusions can be drawn about the effects of trainees' learning styles combined with training methods on the increase in skill levels after training (Yin, 1994).

Pattern-matching will also be used to analyse the impact of organisational factors on the effectiveness of training. The general research question to be answered is:
How do {organisational factors} impact on training effectiveness?
The complexity in this question is that for the case study the unit of analysis is the organisation and (due to limitations of the study in measuring training effectiveness for the organisation – initially considered to be operationalised by improved transfer of skills to the job or transfer tasks) the unit of analysis for measuring training effectiveness is the trainee. The variable to describe training effectiveness for the organisation will be 1) the sum of all post-training scores for trainees in that organisation, and 2) the sum of the increase in scores for trainees in that organisation.

Descriptive qualitative analysis will report on the following organisational factors that have been identified by EUT research to impact on training effectiveness: Training needs analysis (Nelson et al, 1995), user support pre- and post-training (Tannebaum and Yukl, 1992), opportunity to use skills acquired (Ford et al, 1992), supportive work environment and feedback (Noe and Schmitt, 1986), top management support (Phillips, 1983) and an "organisational learning culture" (Wolf, 1998). Therefore, research questions to be answered are formulated as follows:
How did {organisational factor 1 or 2 or 3 etc.} impact on the {total increase or decrease} in skill levels of all trainees in {organisation A or B or C or D}?
Propositions from this question can then be analysed by pattern-matching.

A general research question that does not have a background of EUT research findings is:
Do organisations that are aware of and apply theories, frameworks and findings that have been developed by EUT researchers have more effective training outcomes?
This is a complex question that requires qualitative data gathering in terms of examining written organisational policies and procedures as well as personal interviews of key staff to determine the extent of organisational knowledge of the topic.

To facilitate analysis of the question, it can be re-stated more specifically in the form:
Do organisations that are aware of and apply theories, frameworks and findings that have been developed by EUT researchers practice {organisational factor 1 or 2 or 3 etc}?

The above discussion illustrates the large number of research questions and propositions that can be posed in this study. Development of hypotheses and identification and rationale of which specific questions will be addressed in this study is described in chapter four.

1.6 Organisation of Thesis

This chapter has introduced the topic of training with particular emphasis on EUT both from an academic and practitioner's perspective. The importance (and potential trade-off with rigour) of relevance has been identified and introduced in the current New Zealand context. Objectives, limitations of the study, and research questions for the study have been identified.

Chapter two will provide a review of literature of EUT from both academic and practitioner viewpoints. The importance of evaluating training and identification of factors that impact effective EUT will be illustrated and discussed under the broad categories of trainee characteristics, training methods and organisational factors. The trend toward computer-based training (CBT), the variations available under that title and the potential advantages and disadvantages of using CBT for EUT are identified. The chapter will conclude with discussion of the theoretical bases that underpin the study.

Chapter three explains the research strategy used in the study, introduces case study methodology and justifies the reasons for using multiple case study design. Details of data collection methods used will be explained by discussing what instruments were used, justification for their use in this study to gather quantitative data and the methods and need for gathering qualitative data. Explanation and rationale of data analysis of both types of data will precede discussion of the ethical considerations of the study.

Chapter four provides details of the study by describing each case followed by research design and objectives for each case. Commonalties and differences between the cases will be discussed with reference to the research questions culminating in a set of hypotheses to be tested by analysing the data.

Chapter five presents the results of the study and provides both statistical and qualitative analysis. Descriptions and interpretations of statistical analysis methods used, including any limitations pertinent to the data sets, as well as summarisation of qualitative data assists in analysing tables and graphs provided in this chapter.

Chapter six discusses the results and draws some conclusions. Discussion includes how the results of the research could provide relevant information for practitioners and provides suggestions for further research for academics. A conclusion of the study including its limitations is included.

Appendices to this study include all documentation used to contact and engage participants – both organisations and individuals. Instruments used for gathering quantitative data from trainees and interview sheets used for gathering qualitative data from the organisations and trainees are included. All data gathered from organisations is summarised and complete data used for analysis is presented.

Literature Review of End User Training

2.1 Introduction

The growth and subsequent ubiquity of powerful desktop personal computers and distributed client/server architectures in business organisations from the late 1980's (Panko, 1987) through to the present time has raised a number of important questions in the area of effective training for information systems (IS) users. This chapter reviews the literature pertaining to the effectiveness of EUT in business organisations. Firstly, discussion will focus on training and learning effectiveness in organisations, with a specific review of literature that identifies predictors of training effectiveness in EUT. Effectiveness in EUT will consider the impact of trainee characteristics, organisational factors and the relationships of EUT techniques, methods and context to effective and efficient end user learning. Secondly, computer-based training (CBT) methods that have emerged as a result of the growth, availability and reduction in cost of digital technology and the Internet in the late 1990's will be reviewed. Finally, the chapter will conclude with a review of the theoretical bases that underpin EUT, highlighting those that are used in this study.

2.2 Training and Learning Effectiveness

The ultimate goal of training is learning. "The goal of training is to produce a motivated user who has the basic skills needed to apply what has been learned and then continue to learn on the job." (p. 24: Compeau et al, 1995). It is important that the variety of ways that learning takes place is recognised when both designing and reviewing training materials and courses to achieve the goal of learning in trainees. A number of models and methods of measuring and evaluating learning in EUT have been developed and a number of IS researchers have identified the importance of investigating and delivering cost effective training methods (Hlusko et al, 1998; Levin, 1998; Venkatesh, 1999; McGee, 1998). Recent research has discussed the need for IS research to play a greater role in providing relevance to practitioners (Benbasat and Zmud, 1999; Sein et al, 1999). Hence, evaluation (as well as delivery) of training programmes must be cognisant of the restrictions that are imposed by constraints of cost and time balanced against benefits to the organisation.

2.2.1 Description of Training Evaluation Models

A training evaluation model that has been widely used in industry since it was first developed in 1959 by Donald Kirkpatrick is the four level model (Kirkpatrick, 1998). The four levels of evaluation are termed (from level one to level four) reaction, learning, behaviour and results. According to Kirkpatrick's model, evaluation begins with level one, and then moves sequentially through levels two, three, and four. Information from each prior level serves as a base for the

next level's evaluation. Therefore, each successive level represents a more precise measure of the effectiveness of the training program, but at the same time requires a more rigorous analysis. The reaction level measures how learners react to the training intervention and is most commonly administered via questionnaire. Reaction questionnaires gather information on such issues as: learners' reactions to instructor, course, and learning environment; they communicate to trainees that their feedback is valued and can provide quantitative information about customer (trainee) satisfaction. Level one evaluation then feeds into the level two-four evaluations by indicating whether trainees will use new skill(s) or information (level two), plan to change behaviour (level three) and whether to expect improvements in results (level four) .

Learning at level two is evaluated by measuring the increased skills, improved knowledge or change in attitude that occurs as a result of the training. Learning is measured by interviews, surveys, tests (pre-training and post-training), observations or a combination of the above. Behaviour (or sometimes called transfer) at level three is an evaluation of the amount of what was learned as a result of training that is applied in the work environment. Evaluating at this level attempts to answer the question - Are the newly acquired skills, knowledge, or attitudes being used in the everyday environment of the learner? Measuring at this level is difficult as it is often impossible to predict when the change in behaviour will occur. Hence, important decisions in terms of when to evaluate, how often to evaluate, and how to evaluate must be made by employers and trainers. Most often evaluation is made by observation (by supervisors and peers), checklists, questionnaires and interviews, or combinations of the above. Other issues that impact at this level are the amount of organisational support for behaviour change, for example, how to make changes; reward schemes that encourage or discourage change; and the desire of the trainee to change.

Level four evaluation of results is a business or organisational focused measure. It is frequently thought of as the "bottom line" that measures the success of training in terms of for example, increased productivity, improved quality, decreased costs, reduced frequency of accidents, increased sales, and even higher profits or return on investment. In industry, the effectiveness of training is not often assessed on level four results due to the difficulty of firstly, determining results in financial terms and secondly, the linkage between results and training (Kirkpatrick, 1998).

Another model of training evaluation suggested by Phillips, (1983) is a results-oriented approach. By categorising the orientation of the training programme in three areas of activity, individual- or organisational-oriented, desired results can be identified prior to training and measured after training. Activity-oriented programmes are when all employees in a group or department attend training, for example, to learn about an organisation's IS infrastructure. The evaluation of the training is measured by the result of the trainees' ability in the activity after training. The evaluation of individual-oriented training is the amount of improvement the

individual demonstrates after training and the organisational -oriented training is measured by bottom line savings. Phillips (1983) suggests that essential elements for effective training are top and line management support and cost/benefit evaluation, which can be achieved by using the results-oriented approach to training evaluation.

Another early model of training evaluation that has similarities to Kirkpatrick's four levels is suggested by Warr et al, (1970). The evaluation of training considers four areas – context evaluation, input evaluation, reaction evaluation and outcome evaluation (CIRO). Context evaluation considers three levels of objectives to be achieved by the training:

1. Ultimate objectives – organisational difficulties to be overcome
2. Intermediate objectives – changes in trainee behaviour necessary to achieve ultimate objectives
3. Immediate objectives – new knowledge, skills and attitudes necessary to achieve intermediate objectives

Results of training can then be measured against these levels of objectives.

Input evaluation considers training resources and the options available, reaction evaluation is the same as Kirkpatrick's reaction level, that is, a measure of trainee satisfaction. It is suggested that outcome evaluation is prepared before training commences to achieve maximum effectiveness from the programme. Guidelines for preparing the outcome evaluation include defining objectives, how and when those objectives will be measured, and how results will be assessed. The model also identifies the need for trainees to fully understand expectations of the training and how it will be put into practice.

2.3 Factors that Impact EUT Effectiveness

Niederman and Webster, (1998) consider that the level of success of training in organisations has a high dependence on three broad areas: the individual characteristics that the trainee brings to the training, the method used to deliver training, and organisational factors.

The first area of individual characteristics, provides many examples of IS research projects that have investigated factors that influence the effectiveness of EUT. These can be broadly classified as investigating social and human factors, with consideration of both what is brought to the training and what is provided by the training. Bostrom et al, (1988) proposed a framework for EUT that considered trainee motivation to learn and use technology. The framework was built on by Bostrom et al, (1990) to consider trainees' individual differences and learning styles. Egan, (1988) provided early work on considering individual differences in human computer interaction and, due to the large effect individual differences have on effective EUT, suggested approaches mixing interface design and user training for accommodating user differences. Davis and Davis, (1990) considered the effects of training techniques and personal

characteristics, such as age and gender, in EUT. Other social or human factors that have been researched are the effects of positive and negative word of mouth by peers during training (Galletta et al, 1995); levels of "computer playfulness" (Martocchio and Webster, 1992); trainee's locus of control (Noe, 1986); the interaction between personal and situational factors in EUT (Lee et al, 1995) and the influence of the cognitive variables of visual ability and learning mode in learning software (Sein and Bostrom, 1989).

The second broad area of research into effective EUT considers methods, techniques and content of training; for example, Gist et al, (1989) and Simon and Werner, (1996) investigated training methods of tutorial and behaviour modelling. Olfman and Bostrom, (1991) compared two training methods termed applications-based and construct-based training which were designed to have different levels of personal relevance to the trainee. Alternative training methods designed to produce increased effectiveness of EUT were researched by Venkatesh, (1999) where the aim was to enhance intrinsic motivation (equated with enjoyment of the process) in trainees by using a game based training method. Bielenberg and Carpenter-Smith, (1996) investigated using stories to enhance learning as an EUT method.

The increase in capabilities (such as video and audio streaming) and reduction in costs of technology to support multimedia has seen a large growth in a range of EUT techniques and strategies. (Abernathy, 2001; Gareiss, 2001; Niederman and Webster, 1998) Interactive multimedia is seen by many researchers and practitioners to provide answers to the "training problem". (Allen, 1996; Kruse, 1997; Rifkin, 1991; Rossett and Barnett, 1996) Multimedia provides a unique opportunity to alleviate expected shortages of better trained workers with more effective, individual and continuous training using interactive multimedia systems (Angelides and Dustdar, 1997).

A number of studies have used a combination of individual characteristic variables and training methods in their research design. Some examples are: considering covariates of the subject's cognitive ability when examining the effects of training techniques (Simon et al, 1996); motivation to use, when examining training methods (Olfman and Bostrom, 1991); prior knowledge of software when examining effects of content of materials (Olfman and Mandiviwalla, 1994). Trainees' learning styles have been identified as an important individual characteristic that, in combination with a variety of methods, techniques and content of training can be a powerful predictor of effective EUT (Bohlen and Ferratt, 1993; Bostrom et al, 1990; Sein and Robey, 1991; Simon, 2000).

Organisational factors impacting on effective EUT have attracted less research attention; however, some issues such as cost effective training strategies (Fitzgerald and Cater-Steel, 1995; Mahapatra and Lai, 1999), training needs analysis (Nelson et al, 1995; Goldstein, 1993;

Ostroff and Ford, 1989; Tannebaum and Yukl, 1992) and management support for training (Ford, 1997) are gaining importance in the IS research community.

Electronic performance support systems (EPSS) which are defined as electronic systems that provide information, advice, tutorials and tools to assist individuals in performing work tasks with minimal support from other people (Bill, 1997b), are increasingly being used in organisations to create an environment whereby the individual could become an autonomous, self-directed learner cost-effectively (Desmarais et al, 1997).

2.3.1 Trainee Characteristics

A critical success factor of EUC is user satisfaction; use of IS and productivity are considered equally important (Shayo et al, 1999). The importance and significance of training in promoting user satisfaction has been highlighted by a number of authors, cited in Bostrom et al, (1990) who point out that adequate understanding of and motivation to use EUC tools will enhance the successful outcomes of EUC. In a more recent paper, Sein et al, (1999) discuss directions for EUT research that are necessary for developing effective training strategies. The authors use a framework first developed by Bostrom et al, (1988) and identify trainee motivation to learn and use the system, which results in increased performance, as an important training outcome. Bostrom et al, (1990) identify attitudes and learning performance as desired training outcomes (See Figure 2.1), which are dependent on the combination of individual differences, the target system of the training and training methods. Successful EUC can be promoted by providing successful EUT, which a number of IS researchers have argued is dependent on trainee characteristics.

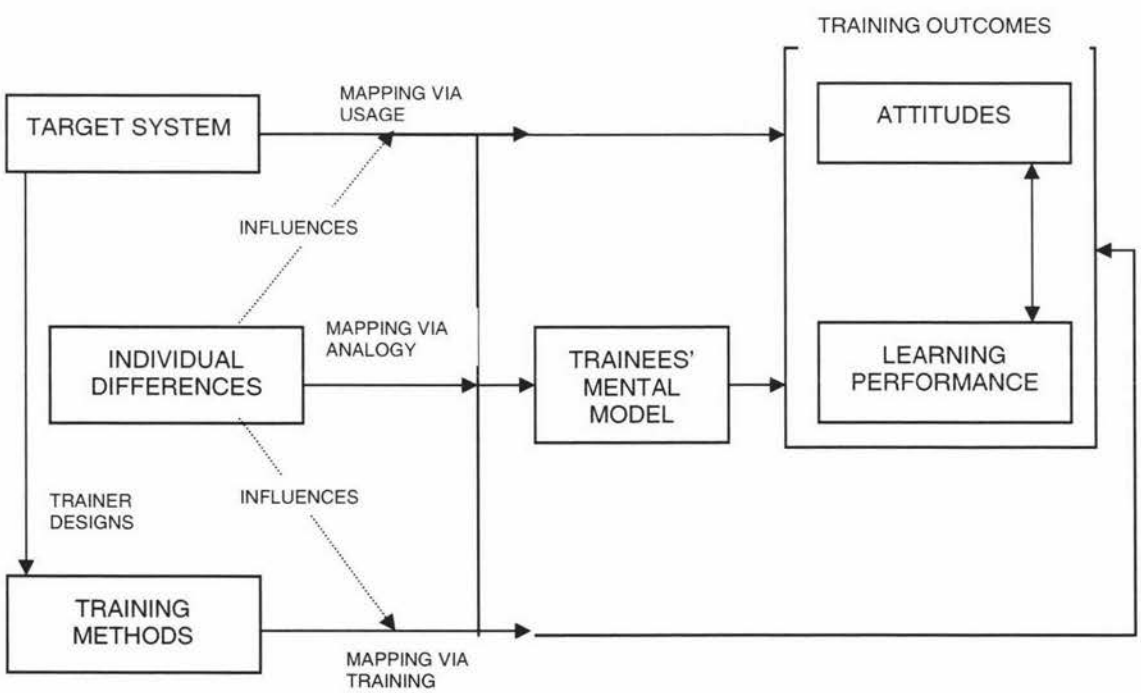

Figure 2.1 The Research Model for EUT (Bostrom et al, 1990)

2.3.1.1 Learning Styles

Individual differences or characteristics, such as cognitive and motivational traits, ability and experience have been shown to influence outcomes of effective EUT (Bostrom et al, 1988; Harrison and Rainer, 1992). An individual difference that has received much attention from IS researchers as a predictor of EUT success is learning style (Bohlen and Ferratt, 1993; Bostrom et al, 1990; Bostrom et al, 1993; Chou and Wang, 2000; Sein and Robey, 1991; Simon, 2000).

Bostrom et al's, 1988 study investigated the training/learning process by proposing a research framework that was firmly based on theories of learner motivation and the current information processing paradigm in cognitive educational psychology. The framework was to address the shortcomings of previous research in the training process which the authors state "...fail to address adequately its cognitive aspects and almost totally ignore its motivational outcomes." (Bostrom et al, 1988: p 245). The study is now considered a seminal work in the area of the impact of trainees' mental and conceptual models, motivation to learn and use IS and motivational and cognitive traits, on the effectiveness of EUT.

Bostrom et al. in their 1990 study extended their 1988 study by presenting a taxonomy of mental information processing operations that they used to organise previous EUT research. In this paper they considered that the lack of a consistent predictor of learning outcomes from the cognitive traits in the taxonomy was attributed to the relative lack of a theoretical basis for expecting effects. The authors' considered that learning style had a theoretical basis to explain how an individual's learning style influences his/her learning.

A number of learning style theories exist. Bostrom et al. (1990) identify four and others have been used in IS research, for example Felder's learning styles (Carver et al, 1996) and Bloom's Taxonomy (Howard et al, 1996).

Riding and Rayner, (1998) describe "learning style" as referring to an individual's set of differences covering stated personal preferences for instruction and learning activities as well as intellectual psychological differences (as opposed to cognitive traits). Another description of learning style is provided by Keefe (1979) in Bohlen and Ferratt, (1993) as "characteristic, cognitive, affective and physiological behaviours that serve as relatively stable indicators of how learners perceive, interact with and respond to the learning environment". Bohlen and Ferratt (1993) continue on to state that cognitive style and learning style should not be confused – learning style is a broad term that includes cognitive as well as affective and physiological styles.

Riding and Rayner, (1998) report that educationalists became frustrated with using constructs of intelligence and ability to predict effective outcomes for training and education and moved

toward the 'learning-centred approach' which was considered to provide a more reliable predictor of effective outcomes. The learning-centred approach focuses on the learners' interactions with the learning context, for example, an individual learner's preference for method of delivery and the learning environment . Hence, to achieve effective outcomes from a learning intervention the process of learning is different for each individual depending on their learning preferences (styles), rather than their inbuilt individual traits (Bostrom et al, 1990).

A large number of learning style models have been developed and used by educational researchers. Riding and Rayner, (1998) classify learning style models in the following way:

- the learning process – based on experiential learning
- the learning process – based on orientation to study
- instructional preferences
- cognitive skills and learning strategy development.

Emphasis, especially in the first three groups is on the 'process' of learning rather than inbuilt individual traits of the learner.

A learning style model that has been used extensively in EUT research is the learning style model developed by Kolb - Kolb's Learning Style Inventory (KLSI) (Kolb et al, 1995), which is discussed in detail in *Section 2.5.1.*

2.3.1.2 Self-Efficacy

One of the first theories that gained widespread acceptance in IS research to explain the behavioural factors that influence adoption of information technology was the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, (1975) in Compeau and Higgins, (1995b)). TRA states that individuals would use computers if they could see positive outcomes of using them. An extension of this theory, as it relates to individual behaviours explaining outcome expectancies of using information technology, is Social Cognitive Theory (SCT) (Bandura, 1986; Bandura, 1977; 1978; 1982 in Compeau and Higgins, (1995b)). According to SCT, watching others perform a task influences the observers' perceptions of their own ability to perform. A user's perception of his/her ability to perform is termed self-efficacy, which is a key concept of social learning theory.

The most often quoted definition of self-efficacy in the IS literature is that provided by Bandura (1986) as:

> People's judgements of their capabilities to organise and execute courses of action required to attain designated types of performance. It is concerned not with the skills one has but with the judgements of what one can do with whatever skills one possesses. (p. 391)

Research has shown that self-efficacy is positively related to individuals' performance in a number of organisational roles and settings (Tannenbaum et al, 1991), such as enhanced problem solving, increased work attendance, and productivity in a manufacturing setting (Martocchio and Webster, 1992). Self-efficacy is also related to an individual's openness to experiment and to the likelihood they will use new technology, suggesting that improving post-training self-efficacy should facilitate transfer of training to the work place. Motivation and commitment also impact on performance – trainees who enter training with higher levels of motivation learn more and perform better. Training motivation can be considered both an important antecedent of training effectiveness and an outcome of training. (Tannenbaum et al, 1991).

A number of studies have provided initial work on computer self-efficacy by extrapolating self-efficacy from social psychology and investigating it as an explanatory variable in computer training. (Compeau and Higgins, 1995a, 1995b; Gist et al, 1989; Martocchio and Webster, 1992; Simon et al, 1996; Webster and Martocchio, 1992). Individuals with high self-efficacy tend to outperform individuals with low self-efficacy, hence indicating that self-efficacy is an antecedent of training effectiveness (Gist et al, 1989).

Further applications of SCT as it relates to individual characteristics in EUT is provided by Webster and Martocchio, (1992) and Martocchio and Webster, (1992). The purpose of Webster and Martocchio's, 1992 study was to develop a valid microcomputer playfulness measure and demonstrate its implications for IS researchers and practitioners. The authors discussed the need to design training programs for employees based on their differing motivational orientations toward training. The relationships between microcomputer playfulness and computer attitudes, computer anxiety, computer competence and computer efficacy were examined with respect to outcome measures of involvement, positive mood, satisfaction and learning. The Computer Playfulness Scale (CPS) instrument that was developed had a high degree of internal consistency and reliability; concurrent, discriminant and predictive validity; predictive efficacy, as well as test-retest reliability. Results of three survey studies and two training studies indicated that generally microcomputer playfulness relates positively with computer attitudes, computer competence, computer efficacy and with outcomes of involvement, positive mood, satisfaction and learning. The authors identify implications of the study for pre-training assessment; employers could measure microcomputer playfulness and adopt different training strategies for those with high and low levels. There is an implication that individuals who display high levels of microcomputer playfulness require less formal training as they find it easier to learn software on their own. If, however, an individual's level of microcomputer playfulness can be increased through training, the authors propose that training programs should incorporate material that positively enhances trainees' attitudes, lessens computer anxiety and provides more hands-on computer experiences. Due to the variety of

participants in their studies (undergraduate and postgraduate students and employees), there is support for external validity.

A further study conducted by Martocchio and Webster, (1992) investigated the effects of positive and negative feedback during software training. Trainees' pre-training levels of cognitive playfulness were measured using the Webster and Martocchio, (1992) CPS. In each treatment in the experiment trainees received hand-written feedback randomly assigned as either positive or negative, yet both types of feedback were constructive. After receiving the feedback trainees answered a set of questions designed to assess satisfaction with feedback and software efficacy. Results indicated that positive feedback resulted in higher test performance and increased software efficacy beliefs than negative feedback. Trainees with higher cognitive playfulness also exhibited higher learning, positive mood and satisfaction with feedback than those with lower cognitive playfulness. Trainees with lower cognitive playfulness benefited more from positive feedback than those with higher cognitive playfulness. The findings of the study supported those of Webster and Martocchio, (1992). The implications of the findings for practitioners are that positive feedback is an important resource for building employees' self-efficacy and systematically influencing training outcomes.

Galletta et al, (1995) covered similar ground using positive and negative word-of-mouth (WOM) by peers during software training. The major findings were that word-of-mouth communications can be a significant and important determinant of the training outcomes of attitudes, behaviour and performance. Specifically, negative statements caused trainees to adopt unfavourable attitudes, while positive statements and no statements (control group) had similar outcomes. This supports findings in marketing literature that negative WOM has more impact than positive WOM.

Gist, (1989) suggests that self-efficacy is an important motivational variable that influences individuals' effort, persistence and motivation. Baldwin and Ford, (1988) and Noe, (1986) used an expectancy framework for studying motivation in EUT. Noe's 1986 model used locus of control as a predictor of self-efficacy expectancies that impact on training effectiveness. Locus of control is a stable personality trait that affects individual motivation and ability to learn. Individuals are either internals, who believe job performance and events occurring in the work place are contingent on their own behaviour and therefore under personal control, or externals, who believe work outcomes are attributable to luck or the actions of others and are therefore outside their personal control. Also identified as having relevance to training situations are Vroom's (1964) effort-performance and performance-outcome perceptions. Trainees have expectancies that the training will provide outcomes (e.g. promotion) relating to their level of effort (e.g. answering questions during training sessions), which affect their behaviour and performance. Empirical evidence for the positive relationship between trainee motivation and training outcomes has been provided by Baldwin et al, (1991) and Tannenbaum et al, (1991).

From the above research it can be concluded that individuals' levels of self-efficacy can be not only a reliable predictor of effective training, but also a process variable during training (Gist et al, 1989) and a desirable outcome of training (Tannebaum and Yukl, 1992).

There is evidence from a number of studies that a positive relationship exists between training and the acceptance of technology within the end-user environment (Davis, 1989). There is also a positive relationship between the amount of computer-related training an individual has received and his/her ability to perform several IT related tasks. Ability also impacts on use and satisfaction with IT (Nelson et al, 1991).

In a study that considered trainees' outcome expectations Compeau and Higgins, (1995a) discussed the difference between measuring self efficacy as component skills of behaviour (as they assert the Gist et al, (1989) study did), rather than as the assessment of one's own ability to carry out a task. According to social cognitive theory, outcomes and self-efficacy are the other primary determinants of individual behaviour; outcomes are an important pre-cursor to usage behaviour. Similar to perceived usefulness defined by Davis (1989), individuals are more likely to undertake behaviours that they believe will result in valued outcomes than those that they believe will result in unfavourable outcomes. Contrary to expectations, the Compeau and Higgins, (1995a) study found a negative relationship between outcome expectations and performance. The authors offer a possible explanation in that, as outcome expectations are generally realised over a longer time frame than the time frame used to measure performance, the relationship could have been artificially reduced by using short-term performance measures. This finding has implications for further research especially in considering longitudinal methodologies to assess factors of trainees' abilities to transfer their learning of tasks sometime after training, hence, enhancing transfer of training to the workplace.

2.3.1.3 Traits

Traits are generally defined as distinguishing features or characteristics of a person (Pearsall, 1999) and are static aspects of information processing affecting a broad range of variables – they can be categorised as cognitive traits and descriptive traits (Bostrom et al, 1990). Variables used to describe descriptive traits in EUT research prior to 1990 were age, educational background, experience with specific software, grade point average, overall computer experience, gender, typing speed, work experience and years of education (Bostrom et al, 1990).

Harrison and Rainer, (1992) conducted a study investigating what they termed "individual differences" as independent variables to the dependent variable of computer-related knowledge and skills. They categorised the traits in three areas as:

1. Demographics, which included age, gender, education level and experience

2. Personality, which included computer anxiety, computer attitudes and math anxiety
3. Cognitive Style, which included Weberian – the cognitive style of precise, reliable, disciplined individual; Mertonian – the cognitive style of the bureaucratic individual and Originality – the cognitive style of the creative individual

The study found that personal characteristics of individual EUC personnel accounted for 56 percent of the variation in computer skill. The important finding of the study was the relationship between attitudes and computer skill – overcoming negative attitudes by education and training (Davis and Davis, 1990) "may remove one barrier preventing individuals from increasing their computer skill." (p 106: Harrison and Rainer, 1992). Harrison and Rainer's (1992) study concluded that knowledge of individual characteristics will help organisations tailor education and training techniques for employees most effectively.

Davis and Davis, (1990) posed a number of questions as to the effects of age, gender, educational level, human information processing (HIP) style, prior experience and previous training using two training methods (lecture-based and self-directed). The study concluded that age, education and gender should not be a factor when considering EUT, HIP style will affect efficient learning using different methods of delivery, and previous training or experience does not affect the choice of training method.

The discussion above has provided an introduction to some of the individual characteristics of trainees that impact on learning; however, research has indicated that trainee characteristics alone are rarely reliable predictors of effective training, learning and transfer of learning to the work environment. Many researchers have illustrated that combinations of independent variables in EUT research are more effective predictors of training outcomes (Bill, 2000; Bohlen and Ferratt, 1993; Chou and Wang, 2000; Davis and Davis, 1990; Nelson et al, 1991; Simon et al, 1996; Simon, 2000; Tannebaum and Yukl, 1992).

2.3.2 Training Methods

A large focus of EUT research has been investigating the efficacy of training methods. As previously stated, more recent research has focused on considering training methods in combination with other input variables. Some of the methods of delivery that have been researched in EUT include: lecture-based (instruction), exploration, behaviour modelling, conceptual models, procedural, construct-based, applications-based, and computer-based instruction. A synopsis of studies considering training methods follows.

Simon, (2000) conducted a field experiment using a large number of subjects to investigate the relationship of learning style and training method to computer satisfaction and use. Three training methods were used – instruction (where the content is presented to the trainee in its

final form), exploration (involves freedom for individuals to impose their own structures on learning) and behaviour modelling (a combination of the other methods and learning by watching others perform tasks). The study contained over twenty hypotheses regarding the performance of trainees with different learning styles receiving different training treatments. The author states that the hypotheses regarding learning styles were "for the most part upheld". Results showed that reflective observation learners performed best when an instructional training method was used and active experimentation learners excelled in the exploration technique. Also hypothesised, learning style did not significantly influence trainees who were trained using the behaviour modelling technique. Implications for managers and organisations identified by the author are summarised as:

- Learning styles are important for understanding users' abilities and predicting effectiveness of training
- The type of information to be taught has a link to learning style and training technique
- A technique such as behaviour modelling can lead to successful training outcomes regardless of learning style or information type
- The correct match of learning style, information type and training/learning technique can lead to higher levels of EUC satisfaction, which leads to higher computer use (discussed below)

The research has implications for business, industry and training designers as it expands the knowledge of predictors of effective training.

Sein and Robey, (1991) identified that EUT research had proceeded in two directions – one examining individual characteristics and the other examining training methods. Their study was designed to examine the interaction between the two. Learning styles were measured using KLSI, and training methods used two types of conceptual models – analogical, depicting the computer system in terms of another system with which the learner is familiar, and abstract, depicting the computer system in terms of a flow chart or schematic diagram. The results indicated that performance in using application software may be affected by learning style independent of training method and that the effectiveness of a training model depends on the learning style of the trainee. This finding has important implications for training designers, as tailoring instructional methods to accommodate individual differences in learning style can enhance trainee performance. However, they also found that no one learning style is inherently better than another; rather, training method can be used to overcome shortcomings of learning styles.

Bohlen and Ferratt, (1993) conducted research to test the effects of teaching method and learning style on outcomes of achievement, efficiency and satisfaction. The training methods used were lecture-based and computer-based and learning style was evaluated using KLSI-1985. The findings of the study were not strongly conclusive, especially as far as learning style affecting outcomes was concerned.

Davis and Davis', (1990) study, considering the effects of training techniques and personal characteristics on effective training, showed clear results that lecture-based training was superior to self-study method.

The technique of behaviour modelling (learning by watching others perform a task or behaviour) is another dimension of social cognitive theory, and has been very effective in teaching new behaviours and skills. According to the theory, one of the principle ways through which behaviour modelling operates is self-efficacy (Compeau and Higgins, 1995a) .

Gist et al. (1989) considered that the behaviour modelling technique may indirectly enhance successful computer training performance by increasing self-efficacy perceptions of the training tasks. Gist et al. (1989) compared behaviour modelling with tutorial training, which was a type of computer aided instruction that presented information with illustrative examples, programmed instruction and structured drills. There were three objectives of the study, first to examine the relative effectiveness of behaviour modelling and tutorial approaches for improving training performance; second, to examine the relationship between self-efficacy and training performance; and third, to examine alternative training approaches from a social learning perspective. Results of their study found that behaviour modelling training yielded better performance, more positive work styles, greater satisfaction and less frustration; it also proved more effective than tutorial training for trainees at all levels of computer self-efficacy. However, the study did not specifically examine transfer of learning to the work place.

Compeau and Higgins, (1995a) also compared behaviour modelling and lecture training techniques in a study of self-efficacy, outcome expectations and performance using two software packages. Several conclusions are drawn from the study. First, self-efficacy influences computing performance; therefore, assisting trainees to form positive perceptions will assist in skill development in IS. Second, behaviour modelling can alter self-efficacy and performance in some cases; hence, with certain types of software, learning by observation (behaviour modelling) can promote self-efficacy. Their findings highlighted some interesting differences across the four research models used in the study that provide questions for further research in the area of behaviour modelling and self-efficacy in EUT.

Simon et al, (1996) extended the two studies discussed above by combining three training treatments (behaviour modelling, lecture and exploration) plus a control group in a field experiment with a sample size of 200. Outcome measures were training effectiveness, computer tasks, near transfer tasks, far transfer tasks, comprehension tests and end-user satisfaction. Covariates of cognitive ability and computer use were also measured. Results showed that the use of hands-on training methods (especially behaviour modelling) resulted in superior retention of knowledge, transfer of learning, and end-user satisfaction. The authors did

not specifically measure or account for self-efficacy; rather, they concentrated on the outcomes of the teaching methods or techniques. However, in the discussion section of the paper their explanation for the high performance results of the behaviour modelling teaching method discussed the "style" of the technique with respect to merging structured instruction with experimentation for the learner with continuous feedback. The method created a synergy that encouraged trainees to excel. The authors also noted that trainees in the behaviour modelling group became more excited about working with the system, and as a result they sought to use the system with fewer inhibitions than their counterparts in the other training treatments in the study. This would suggest an increased level of self-efficacy and motivation to use in the group of trainees that received behaviour modelling instruction.

A cumulative body of knowledge has emerged regarding the impact of trainee characteristics on the outcomes of training. IS researchers agree that trainee characteristics are not the only explanatory variable of effective training; however, when considered in combination with a range of training methods, knowledge of trainee characteristics can be powerful predictors of effective training.

2.3.3 Organisational Factors

The context and environment that surrounds training in organisations has been researched extensively in educational and organisational literature (Goldstein, 1980; Goldstein, 1993; McMahon and Carter, 1990); Tannebaum and Yukl, 1992). Organisational factors that impact on effective EUT have been identified by researchers as organisation-wide training needs analysis (Nelson et al, 1995), support for users pre and post training (Tannebaum and Yukl, 1992), providing resources to give trainees opportunity to use newly acquired skills and knowledge (Ford et al, 1992) and change management (Hendry, 1996). Phillips (1983) suggests that essential elements for effective training are top and line management support and cost/benefit evaluation.

2.3.3.1 Needs Analysis

An area of EUT that has had some attention from researchers but has very often been ignored by practitioners is needs analysis. Research has focused on two areas: learner needs analysis and organisational/task needs analysis. As stated by McLoughlin, (1999), in many institutional contexts the pressure of student numbers and scarce resources limits the scope of learner needs analysis. Time is usually the limiting factor for needs analysis in organisations (Nelson et al, 1995).

In order for instructional design of learning resources to be tailored to the needs of the learners, McLoughlin (1999) suggests that knowledge of learning styles and strategies can be factored

into instructional design to gain benefits in learning and performance outcomes, especially when designing self-instructional learning and materials for distance learners. Sein et al, (1999) agree with this point and propose a training strategy framework that identifies classifications of user type, IT tools, training methods and required knowledge levels in order to develop validated training strategies to deliver optimum training given the input variables. (See Figure 2.2)

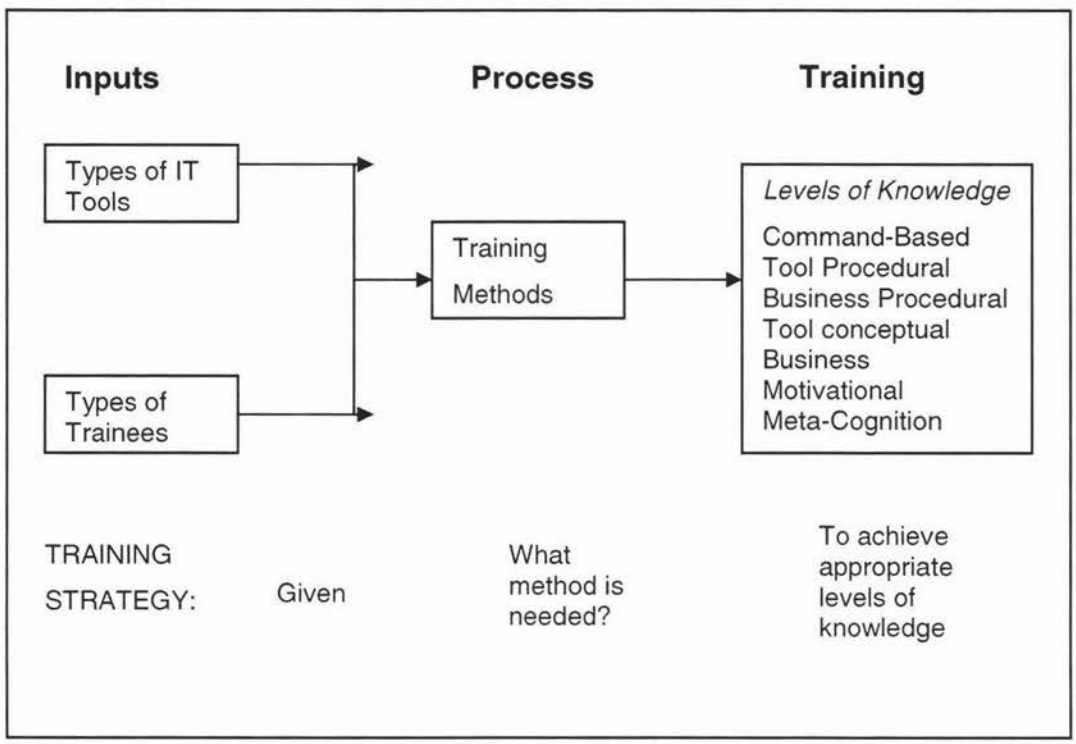

Figure 2.2 Training Strategy Framework (Sein et al, 1999)

There is an implication that needs analysis is necessary to identify the required inputs (user type) and outputs (knowledge levels) of the training process. The basic premise is to tailor training approach and contents to the trainees' characteristics rather than matching trainees to training approaches. Interestingly, this approach has popularity in current organisational psychology; in a recent BBC documentary (A Century of Psychology, 2000. NZ National Radio, May 19 2001), (BBC, 2000) the psychologist interviewed stated that often now employers matched jobs to people rather than using psychometrics to match people to jobs.

Nelson et al, (1995) state that studies in the US have shown that often (more than 50% of the time) inputs to the training process are not systematically identified and outputs are not systematically evaluated, hence wasting a great deal of money and effort. "Needs assessment, therefore, clearly sets the stage for effective training." (p. 27). Most needs assessment in EUT has focused on the individual component and ignored the organisational and task components. Nelson et al. (1995) tested a framework developed by McGehee and Thayer in 1961 and expanded by Ostroff and Ford, (1989) using qualitative case research in a large organisation

(US Internal Revenue Service). The Content-Levels framework is a three by three matrix considering content, with cell headings of person, task and organisational on one axis and level with cell headings of individual, subunit and organisational on the other. Each cell in the matrix can then very specifically identify requirements for each intersection. For example, in the task/subunit cell issues and questions that should be addressed in assessing needs of training could be: what activities, technologies and behaviours are needed for effective task performance within a given sub-unit? (See Figure 2.3). The authors state that this framework enables needs assessment across an entire organisation to reflect all goals, objectives and values as it takes account of the individual, the department and the organisation. Results of the case study suggested that training was more effective when needs assessment considered issues identified in the framework. The potential benefits of a systematic needs analysis in large organisations is the saving of duplication of needs assessment, hence facilitating development of standardised core training where appropriate and increasing efficiency of EUT. Additional benefits identified by the authors are from the linkages between the cells in the framework, for example, a more organisation-wide coherent training strategy can be embraced when goals at each level of the framework are considered congruently rather than as discrete units.

C O N T E N T				
L E V E L		**Person**	**Task**	**Organisational**
	Individual			
	Subunit		e.g. what activities, technologies and behaviours are needed for effective task performance within a given sub-unit?	
	Organisational			

Figure 2.3 Example of Contents-Levels Framework for Needs Assessment (Nelson et. al, 1995)

Organisational needs assessment could be effectively used to develop training programs where there needs to be differentiation between types of IT based tools and applications. For example the difference between "infrastructure technologies" (e.g. operating systems) and "line technologies" (e.g. software application) training could be co-ordinated across the organisation (Niederman and Webster, 1998)

Needs assessment of learners takes on greater complexity and skill requirements of the designer when designing multimedia-based instruction. Rossett and Barnett, (1996) emphasise the importance of needs assessment for trainee, organisation and the environment. Needs assessment should establish current and desired skills and knowledge levels, and for multimedia must emphasise users' attitudes toward the topic and technology-based learning. This is due to the fact that multimedia training material is pre-designed; that is, there is no room

for human intervention during training where instructors are absent, to compensate or take account of trainees' individual needs (or characteristics if known). A quote from one of the leading authors on training is an apt summary of the needs analysis section: "The effective design of instructional programs necessitates the simultaneous consideration of organisation, task and person analysis..." (Goldstein, 1980: p. 233)

2.3.3.2 Task-Technology Fit

For information technology to have positive effects on individual performance the technology must be used and the technology must fit well with the tasks it supports (Goodhue, 1995). As indicated by Compeau and Higgins, (1995b) in discussing self-efficacy, and Davis, (1989), use of the technology can be predicted, to an extent, by trainee attitudes of perceived ease of use and perceived usefulness. Goodhue and Thompson (1995) developed a model called Technology-to-Performance Chain (TPC) to assess the impacts of both utilisation (of the technology) and user attitudes about the technology, on individual performance. The Goodhue, (1995) study specifically highlights the importance of task-technology fit (TTF) to explain how technology impacts on performance. The rationale for considering both utilisation and technology fit is that neither alone is a strong predictor of performance; utilisation is not always voluntary and greater utilisation of a system with low TTF will not lead to increased performance. An excellent system must be used before any performance benefits will be realised. The antecedents of TTF are task characteristics and technology characteristics. Although support for the predictability of TTF for performance outcomes was mixed, strong evidence for the necessity for the inclusion of both TTF and utilisation in predicting performance was found.

The implications for the findings from the TTF research for EUT is the need for designers of training material to consider organisational specific, detailed constructs (such as data quality, locatability and systems reliability) that will be available to trainees in the organisation, post training. Where possible this material should be incorporated into training material in order to maximise skill transfer and productivity improvements. These organisational constructs can be measured using the Measure of Task-System Fit instrument which has been validated and tested (Goodhue, 1995). The fit between the target system and the task to be accomplished could well be an important facet of learning that occurs on the job after training, as use is reinforcing and leads to increased skills and competence (Bostrom et al, 1990).

2.3.3.3 User Support

User support for trainees after training has taken place has been advocated as an important variable in producing effective transfer of skills to the workplace (Garavan and McCracken, 1993a). Lack of user support can occur in a variety of ways namely, lack of specific on-the-job

tasks to perform, few opportunities to practise skills and lack of immediate and relevant feedback (Ford et al, 1992). Training is often treated as a one time discrete activity rather than a flow of activities, and course notes and materials are not used as functional tools for applying new skills and concepts, after the training has taken place. A systematic approach to training could include such considerations as training being demand rather than supply driven, for example, by making use of a clearly defined needs analysis system as suggested by Nelson et. al (1995). Other essential considerations in supporting users are formal evaluation and feedback obtained from trainees and formal training provided for support staff which would facilitate learning in the organisation, rather than an ad hoc fire-fighting approach that is often taken (Garavan and McCracken, 1993b). "A supportive work climate in which reinforcement and feedback from co-workers are obtained is more likely to result in transfer of skills from the training environment to the work environment" (p. 737: Noe, 1986). The climate of the organisation in terms of supervisors and co-workers providing reinforcement as well as availability of equipment and financial resources is important in influencing positive attitudes to learning. (Lee et al, 1995) in their field survey study of eleven large companies in Nebraska USA, found the most critical success factor in implementing EUT was top management support.

A study with surprising and interesting findings of user support was conducted by Compeau and Higgins, (1995b), where support had a negative influence on self-efficacy and outcome expectations. It would be expected that the support of the organisation for computer users would influence users' self-efficacy and their outcome expectations positively as more resources would be available to users and the support would indicate organisational norms of use of the computer system. The authors offer possible explanations, such as high support may hinder self-efficacy - if help is always available it will discourage users from solving their own problems thereby lowering their perceptions of their ability to do so. Further research is necessary to investigate this finding.

These issues highlight the arguments for using TTF and needs analysis especially in the design of training materials. If training is demand driven and fits with the technology, it would also be efficacious to have user support in order to maximise the effectiveness of training.

Organisational trainers need to be cognisant of the way learning is taking place and be prepared to review a variety of ways of conducting training, considering the specific organisational environment, organisational goals and required results and the cost/benefit return on investment.

In a survey of employees conducted to examine the different ways people learn software, over thirty different learning activities were ranked. Interestingly, the activity "attending formal training" ranked 23 on the list, also ranking near the bottom were "referring to training materials from class" and "watching videotaped lectures or demonstrations". The top three ranking

activities were experimenting with the software, relying on consistent features of the software and asking co-workers for help (Harp et al, 1997). The results of this survey could contradict other findings, for example the work on behaviour modelling, but the survey has limitations; it is not rigorous in its methodology, does not specify the sample size and respondents were employed by only one employer. However, there is other practitioner literature that illustrates alternative approaches to formal training and learning. For example, Blumfield, (1997) identifies "accidental trainers" as savvy users who assist their peers in learning on the job, and urges employers to make use of the accidental trainers in their workplace, as no one approach to learning works best for everyone (many adult learners prefer to learn from a peer than from formal training, according to Harp et al, (1997)).

A study that evaluated the efficiency and effectiveness of an organisation's EUT and support strategy analysed an Australian Local Government setting where competent user-employees (key-users) of software packages provided both training and support for their peers (Fitzgerald and Cater-Steel, 1995). In this study all trainees and trainers who were involved in the in-house courses during 1992 and 1993 were surveyed. Results indicated that respondents valued highly the ability to ask work-specific questions of the trainers during courses and strongly supported improved confidence in using computers, job satisfaction, job performance and motivation to use applications. The course-ware was designed to focus on broad outcomes (tasks) rather than emphasising features, the goal being to satisfy business requirements rather than teach commands. The conclusions of the study were that instructor-led in-house training can be an efficient (by examining costs) and effective (from survey results) way of meeting the training need for packaged software. "The key-users who serve as the trainers in this context ... became an important "just-in-time" source of continuing support for their fellow workers in the day-to-day use of these packages." (p. 59: Fitzgerald and Cater-Steel, 1995)

Practitioners in a number of areas are advocating a focus on learning and developing learning organisations. A paper from the insurance industry gives guidelines on how to emphasise learning as opposed to training and advocates "place an emphasis on how learning is occurring rather than focusing on the delivery of information" (p. 11: Wolf, 1998)

A measurable outcome of learning can be the amount of learning that is transferred to the work place. "transfer of skills across domains is not easy, as any learned skills are closely associated with the context in which they are learned" (p. 7: Garavan and McCracken, 1993a). This suggests that context is an important aspect for optimising the effectiveness of training and should be included in training design considering also examples of work tasks, technology fit, material to increase perceptions of usefulness and self-efficacy to maximise transfer. "Learning settings ... need to be as close to the work setting as possible, in time, place and spirit". (p. 3: Sherry and Wilson, 1996)

A comprehensive framework that uses an early model of EUT and learning combined with recent (1995) field research, was presented by Compeau et al, (1995). (See Figure 2.4). This model incorporates the training issues that have been addressed in sections two and three of this review.

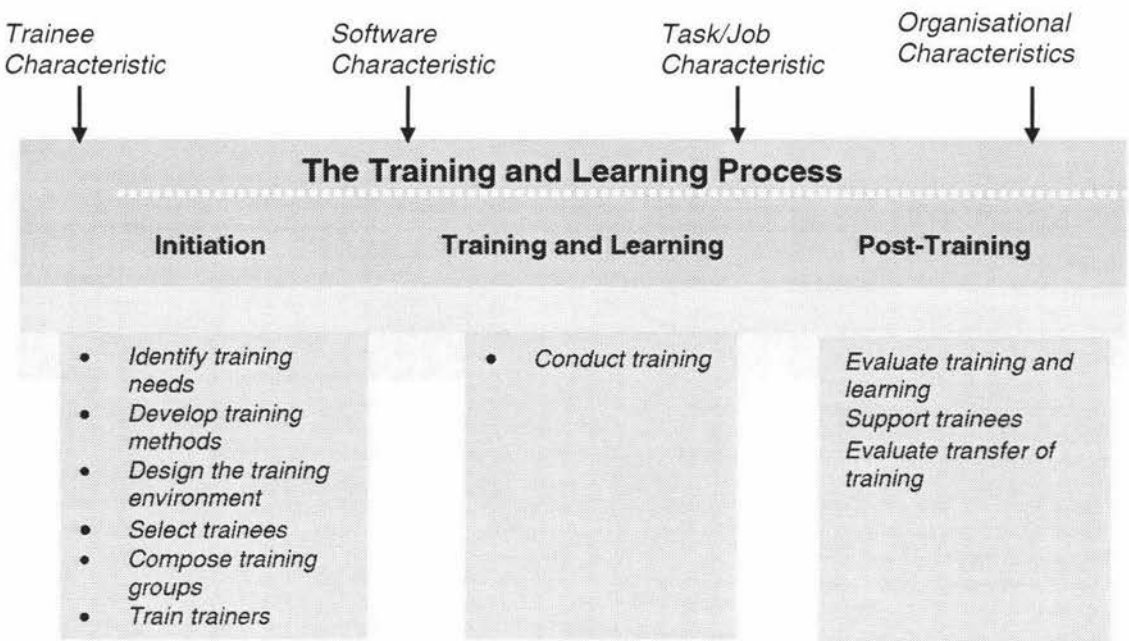

Figure 2.4 A Framework for the Training and Learning Process (Compeau et al, 1995)

2.4 Computer Based Training Methods

Computer-based training (CBT) can be defined as training that is delivered via computer (Bill, 1997b). Training compact disks (CDs) have gained a measure of popularity as a training medium, mainly due to cost effectiveness. Savings on travel, workers salaries, maintaining training suites and trainer costs have impacted on decisions to use CBT. However, the lack of a human face to training has caused problems and impacted on the effectiveness of learning for certain content and contexts (for example, teaching interpersonal skills or skills that need hands-on activity). Computer-aided instruction (CAI) or learning (CAL) is where trainer-led instruction is complemented with computer resources. These terms are often used interchangeably with each other and with multimedia training, on-line training (OLT), internet-based training (IBT) and e-learning; however the last three terms imply a networked system for storage and distribution of training materials. Multimedia is the combination of text, animated graphics, video and sound, (Flynn and Tetzlaff, 1998) and therefore refers to the content of training material rather than the delivery method.

Niederman and Webster, (1998) consider that emerging training methods such as internet-based training (IBT), performance support systems (PSS) and distance videoconferencing have

the potential for improving the delivery of EUT. Their paper reviews EUT literature and considers the emerging training methods in the context of trainee characteristics, software categories and the organisational context. A number of research questions and methodologies are proposed to evaluate training methods in the organisational context and the scalability and cost-effectiveness of delivering training in large real-world settings. E-learning is seen as one way to address the issue of delivering global training in large organisations (Gareiss, 2001). The main selling point of e-learning is flexible, round the clock online access to any number of courses; however, the challenges of global e-learning are language, localisation and technological issues (such as available bandwidth).

The mid 1990's have witnessed a huge growth in World Wide Web (WWW) based courseware and delivery for both education and training. Despite the popularity of the medium, courseware varies greatly in quality and educational effectiveness. A number of authors have identified sets of general requirements that are necessary in designing effective multimedia courseware (Allen, 1996; Liebowitz, 1997; Rossett and Barnett, 1996; Summers, 2000; Wade and Power, 1998). The main themes from these studies are that learner needs must be addressed and the importance/necessity of providing an on-line facilitator.

2.4.1 Advantages and Disadvantages of Online Training

Three key areas of end-user acceptance, trainer acceptance and realistic management expectations need to be addressed before implementing and realising the gains from new CBT training applications. (McGregor, 1996).

Due to the high cost of traditional instructor-led training many organisations are pioneering new computer-based learning systems in the process of integrating training into the organisation's culture. (Levin, 1998). Many intranet-based training systems can take advantage of streaming multimedia to deliver to thousands of employees in hundreds of different locations. One big advantage of OLT is that it personalises the learning experience, allowing trainees to move at their own pace and in their own way through the courseware. Predictions for the future are that corporate networks will be a growing repository of knowledge that can continuously deliver to employees what they need to know when they need to know it.

"Online training (OLT) communicates training information through computer networks such as the Internet or a company's own intranet" (p. 35: Huang, 1997) OLT provides all the advantages of CBT and also retains the advantages of instructor led training. OLT is flexible, cost effective and also provides individual attention and support to trainees via e-mail, group decision support systems and electronic meeting systems. Cost savings can be made through larger trainee to instructor ratios, sharing of data between organisations or outsourcing training or other resource needs (e.g. cost of on-line library). Huang, (1997) concludes his article by

stating that productivity, safety and quality in the workplace should all be improved by adopting OLT. The advantages and opportunities of networked computer-based instruction are numerous. It can support a range of educational modes of learning; provide increased learner control, feedback and interactivity; as well as merge distance teaching techniques, videoconferencing and computer presentations (Wade and Power, 1998).

Kruse, (1997) identifies five levels of IBT that can provide benefits to organisations ranging from general communication through on-line referencing, testing assessment and surveying, distribution of CBT, to delivery of multimedia. The fact that a universal language is used (HTML) on the WWW allows for training programs to be written once to run on many platforms. Training material resides on a server and can be distributed to an unlimited number of trainees world-wide, saving time and expense of duplicating and packaging training material. Trainees can have instant access to material for just-in-time learning, and the material can be quickly and inexpensively updated. Another advantage is the low cost of the technology as web pages can be accessed using inexpensive browser software (Kruse, 1997).

Multimedia not only saves time and money in distributing the training material, but also makes gains through "learning compression" rates of up to 70%; that is, trainees learn material taking up to 70% less time than with traditional training methods, with no loss of training effectiveness (Allen, 1996; Frankhauser and Lopaczuk, 1996). Allen (1996) states that high quality multimedia courseware is faster, cheaper (over two to three years) and better than classroom training, due to significant increases in transfer of learning, retention and ability to remember and practice what is learned. In reporting on studies on a number of large US companies and the military, Allen (1996) asserts and illustrates that the Return on Investment (ROI) of multimedia courseware is significant, considering both quantitative and qualitative data.

Trainee interaction using multimedia courseware facilitates learning through exploration which research has shown to be more conducive to retention and learning than instructional techniques based on passive presentation methods (Frankhauser and Lopaczuk, 1996). Other benefits identified by Frankhauser and Lopaczuk, (1996) are consistent presentation, privacy for trainees to ask questions, and improved management of learning (e.g. keeping test scores and details of trainee performance) (Ehrmann, 1996). Using OLT allows for communication not only between the instructor and the learner but also amongst learners, which can also improve learning effectiveness.

Huang, (2000) considers that web browsers provide an ideal interface for educational technology applications. They assist in increasing perceptions of usefulness and ease of use for users, which are the antecedents to acceptance of the technology according to TAM. Huang, (2000) distinguishes between trainees and instructors in discussing users of educational technology, and points out that usefulness and ease of use are important from the instructors'

point of view also. In considering the cognitive fit theory to view learning as a problem solving process, two recommendations are made when designing and implementing educational technology applications. First, presentation formats should match learners' learning styles, learners should be able to choose their preferred format or the application should have the facility to automatically configure the site based on learners' cognitive characteristics. Second, learning tools should match the learning tasks, e.g. an analytical course should provide analytical tools to learners, such as spreadsheets (Huang, 2000).

A criticism of custom-developed multimedia courseware is that it frequently needs changing and updating, due to changing software and differing organisational needs. A solution is to be able to recycle the learning content and repackage it as needed. This is being considered by a group of learning technology developers and hardware manufacturers in an attempt to set standards for defining learning content that allows content to be used by competing learning architectures. The goal is to provide learning that can be tailored to individual needs and delivered anytime anyplace. To accomplish that goal the content has to be "granularised" and defined in a way that will allow it to be disassembled and reassembled into various multimedia, if this can be achieved an industry-wide framework for re-usable learning objects will be available (Abernathy et al, 1999).

In a review of methodology rather than content of training CD's, it was concluded that they vary widely in quality, ranging from "lightweight" and "annoying" to "attention grabbing" interactive training (Schindler, 1997).

Liebowitz, (1997) discussed critical success factors for developing multimedia courseware, and placed particular importance on content, design and the needs of users. "Substance and style go hand in hand", (p. 17: Liebowitz 1997) developers of multimedia can get carried away with the 'glitz' of the system and not pay enough attention to content. For multimedia training to maximise return on investment and provide the maximum benefits to an organisation, the design of the multimedia training must be high quality. Allen, (1996) suggests that "the best multimedia training applications are fanatically audience centred" (p. 3), that is, the designers of the programmes need to have an in-depth knowledge of learners, content, methods of learning, instructional strategies and implementation tactics.

Christoph et al, (1998) carried out a study to measure the effects of two types of self-efficacy (existing and developed) on multimedia-based training, in order to identify barriers to effective use of the technology. A survey instrument was developed and administered to four hundred students in five classes. Results showed that students with prior multimedia experience had significantly higher levels of both types of self-efficacy and higher self-efficacy levels increased trainee perceptions that multimedia-based instruction is more effective than traditional presentations. The importance for practitioners is that trainee multimedia self-efficacy levels

need to be considered before investing in multimedia training presentations, or conversely multimedia self-efficacy levels need to be increased before expecting gains from multimedia training.

A problem that has been identified in using CBT to train for soft-skills (e.g. selling or interpersonal communication) is lack of technological capabilities to deliver material that provides a convincing experiential learning medium (Barron, 1998). In this article the author estimated that 18 months will make a significant difference in the degree of interactivity in off-the-shelf courseware, due to improvements in the technology infrastructure.

The internet (IBT) has proven to be a popular means of delivering EUT, however, it is best suited for intellectual and cognitive domains, where the training can be conveyed through text and graphics with on-line interaction, and especially for situations where there are a large number of geographically dispersed learners (McManus, 1995). However, reasons that cause off-the-shelf multimedia courseware to work well in one situation/organisation and to fail in others include the degree of users' knowledge about computer technologies, users' preferences for types of technology-based training and the type of business. Users want to feel the training is tailor-made for them and can be put off by the smallest details (such as clothes worn by actors on the cover of a training CD) (Barron, 1998).

2.4.2 Performance Support Systems (PSS)

Traditional support systems are no longer meeting the needs of modern business workers. Change is occurring not only at the task and tool level, but also in the nature of work with organisational paradigms shifting, such as flexible project teams, working from home and increased job mobility. Traditional training methods are not responsive to individual needs and have typically been fragmented across functional lines in the organisation, which has led to inconsistencies in the support material. Therefore, a new paradigm in user support can be investigated – Performance Support (PS) that aims to enhance user performance through a user interface that anticipates user needs and supports them conveniently and effectively (Bezanson, 1995). PSS extend the functions of computer based training and online documentation to integration into a host application that addresses all aspects of user performance. These aspects include training, online reference, interactive task advice, help, coaching, feedback and other forms of assistance. The PSS allows workers to control their own learning and provides them with the ability to access information in the workplace at the time they need it.

PSS are particularly suited to skills-based operational situations where the worker needs access to some knowledge or procedure at infrequent intervals. They are very effective when the job they are supporting allows incremental learning on the job, where the PSS supplies

information "just-in-time" for the worker to learn while doing. PSS increase users' self-efficacy as the learning provides immediate results and knowledge can be built up in small steps, increasing workers' sense of empowerment and ultimately improving productivity for the organisation. PSS are not good for rapidly changing jobs or jobs that require a high level of analysis. A number of critical success factors for implementing a PSS are important, for example, management commitment, a multidisciplinary team for development, thorough planning and using an iterative prototyping development methodology (Bezanson, 1995).

One of the large realisable advantages of PSS is when they are electronically embedded in computer applications (EPSS) they can provide support that allows individuals to enter jobs without prior training and continually gain higher skills on the job. A study to provide a framework to evaluate EPSS as far as cost/benefit in terms of reduced training and increased employee performance against the cost of the EPSS, concluded that break-even point is likely to occur after about four years, and the project would provide an internal rate of return of 9% over five years. On financial data from the training perspective only this is not excellent; however, gains such as increased productivity, quality and knowledge in the organisation and worker empowerment all provide additional financial benefits to the bottom line of the organisation (Desmarais et al, 1997).

Shepherd, (2001) identifies the key to EPSS as a system that delivers information "just-in-time" not "just-in-case", as with typical training situations. The distinctions between information, knowledge, understanding and skill are also made. EPSS deliver information online that is specific to the user's immediate need to their desk-top. A range of EPSS designs exist and have been classified as minimal, mid-level and optimal EPSS by Sleight, (1993).

It is possible that traditional EUT will be subsumed by EPSS, and the relationship has been described as "training and EPSS are integrated into one seamless service environment" (p. 5: Sherry and Wilson, 1996) or the re-representation of knowledge within the organisation (Bill, 1997a)

Yellen, (1999) states that trainers have made the transition from traditional training mechanisms to on-line-only mechanisms much more smoothly than trainees, who need a human presence in the training environment. Their study indicated that those trained without a human present wanted to receive human assistance, however, when a trainer was present trainees did not use the trainer very much but wanted them available. Implications for training software designers is the need to demonstrate to trainees that their needs will be met without human assistance.

The use of well designed interactive micro-worlds using multimedia technology for training courses leads to learner cognitive engagement which promotes greater degrees of concentration for longer periods of time. This in turn drives learners to higher orders of thinking.

Multimedia allows course material to be interesting, realistic and relevant, thereby allowing students to link theory to practice. In order to reduce lower order thinking, applications can provide reduced levels of mechanical tasks and ready access to information (Stoney and Oliver, 1999).

Interestingly, a study of continuing professional development considering the learning preferences of business management students found that they preferred dependent methods (e.g. lectures) over autonomous learning (e.g. self-directed and computer based) (Sadler-Smith et al, 2000).

In a study to test six principles of instructional design from cognitive theory of multimedia learning Moreno and Mayer, (2000) found the following results that impact on learning using multimedia applications. Students learn better when the instructional material does not require them to split their attention between multiple sources of information; for example, students who received visual and voice information performed better than students who received the same information visually and with text. Redundant information and extraneous material reduced learning, for example, students learned better from animation and narration than from animation, narration and text. Greater learning was demonstrated when on-screen text and visual materials were physically integrated rather than separated.

The introduction of EPSS has changed the focus of training for users from acquiring job-related skills by being taught to learn by doing (on the job). EPSS can be thought of as a revolution as it allows users to realise performance gains without learning (Sherry and Wilson, 1996). Much more emphasis will be placed on "learning organisations" in the future, where EPSS will be used to support organisational learning (Bill, 1997a).

The adoption and use of new media for delivering training should not distract from the fact that, to be effective, training must focus on specific teaching-learning methods (Ehrmann, 1996). EUT is particularly suited to the new techniques of presenting and delivering training, due to the fact that more sophisticated users who are comfortable with using the technology benefit more from self-paced CBT (McGee, 1998). A framework of EUT suggested by Olfman et al, (1986) considers EUT as an ongoing process, where after initial training the trainee becomes a user who applies software on the job and continues to learn. This model fits very well with the PSS model.

2.5 Theoretical Bases for EUT Research

EUT has been criticised by IS researchers as not having a strong theoretical base (Bostrom et al, 1990), therefore it is important to have a theoretical grounding when designing research in order for the findings to be able to be generalised.

2.5.1 Kolb's Learning Style Inventory

As discussed in *Section 2.3.1.1*, learning styles have received much attention from IS researchers as a predictor of EUT success. The theory of experiential learning, which is based on five characteristics of the adult learning environment, underpins KLSI. By studying how adults learn from experience to generate rules and concepts that guide future behaviour, Kolb has identified a learning process that he builds into a four-stage cycle. (See Figure 2.5). The process is both active and passive; concrete and abstract and is continuously recurring. Concepts are tested as a result of experience and observation and then modified. The direction of learning is governed by individuals' needs and goals and hence the learning process becomes individualised in direction and process. For example, a manager may be concerned with the active application of concepts, whereas a naturalist may have exceptional observational skills; a mathematician may value abstract concepts whereas a poet may place greater value on concrete experience.

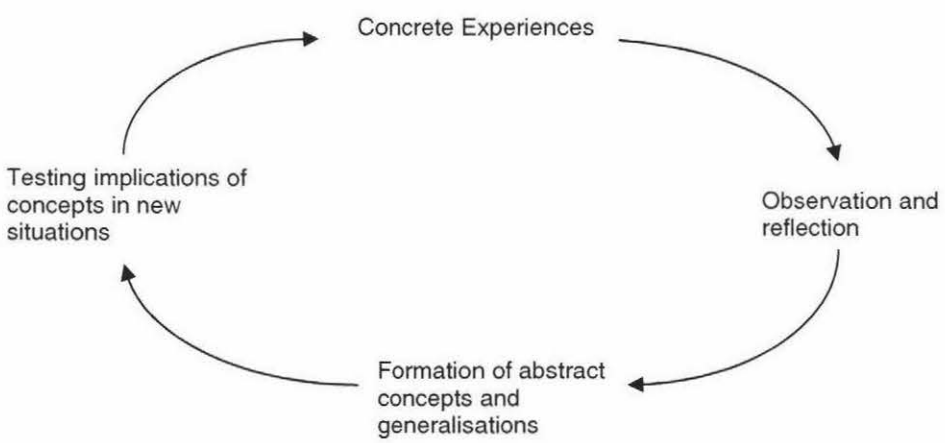

Figure 2.5 Kolb's Model of Experiential Learning (Kolb et al, 1995)

Kolb theorised that the learning process involves moving through stages of human growth that are shaped by social, educational and organisational factors that develop an individual's competence to master tasks to meet the individual's goals and needs. With this in mind it is possible to accept that an individual has the ability to learn to use each learning style in the correct combination to maximise learning of the task at hand. The model reflects individual differences that can change over time, that is, it is possible for an individual to adapt and change their learning style.

By categorising learning modes as concrete experience (CE), reflective observation (RO), abstract conceptualisation (AC) and active experimentation (AE), the KLSI can be used to identify an individual's relative emphasis on the four learning modes. Originally, KLSI-1976 used nine groupings of four words and asked respondents to order the four words as to what best describes the individual as 4 through 3 and 2 down to what least describes them at 1. Due

to criticisms of the instrument for having low reliability, lack of validity, poor factor structure, conflating learning process and style and having little correlation with other indicators or models (Riding and Rayner, 1998), a revised edition (KLSI-1985) was developed to improve the reliability and construct validity of the instrument. Twelve items were used and a phrase (rather than a single word) used for ranking. Instructions to respondents on KLSI (Kolb, 1993) state that "The LSI describes the way you learn and how you deal with ideas and day-to-day situations in your life. Below are 12 sentences with a choice of endings. Rank the endings for each sentence according to how well you think each one fits with how you would go about learning something new ....." . As with the earlier version of KLSI the rankings are 1 through 4 with 1 being least preferred and 4 being most preferred.

Resulting scores are then calculated for the sentence endings that represent the learning modes to give a raw score for each of CE, RO, AC and AE. Two points are found on the two scales to identify the individual's emphasis on abstractness over concreteness (AC minus CE) and the extent that active experimentation is emphasised over reflection (AE minus RO). (Figure 2.6)

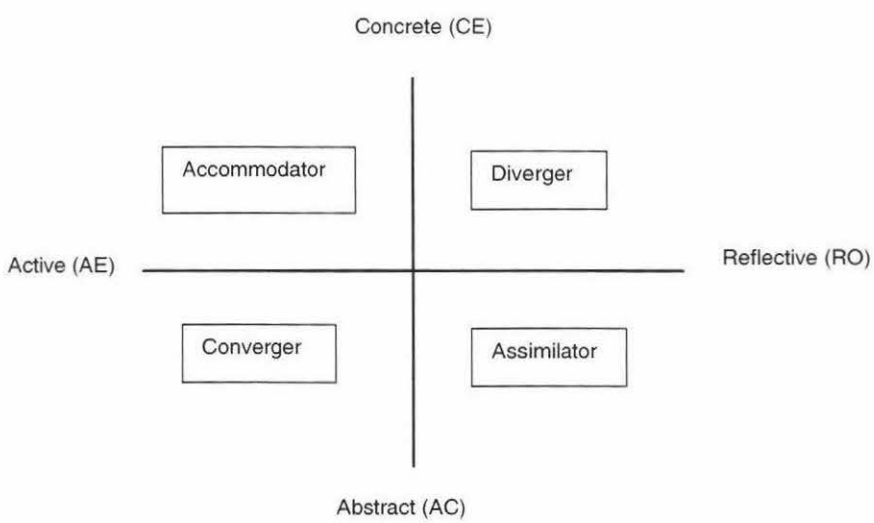

Figure 2.6 Diagrammatic representation of Kolb's Learning Style Grid (Bostrom et. al 1990)

KLSI uses a four-point grid with opposing learning modes of Active and Reflective at either end of a continuum scale and Concrete and Abstract on the other. (See Figure 2.5) The quadrants on the grid form the four learning styles of Accommodator, Diverger, Assimilator and Converger, which measures the individual's preferred method of learning, considering both individual traits and a situational dimension.

Kolb (Kolb et al, 1995) describes characteristics of the four basic learning styles, which are summarised below.

Learning Style	Predominant learning mode	Strengths	Career suitability
Diverger	Concrete experience and reflective observation	Imaginative ability, awareness of meaning and values, generating alternative ideas, imaginative, feeling oriented	Liberal arts, humanities, counsellors, personnel managers
Assimilator	Abstract conceptualisation and reflective observation	Inductive reasoning, ability to create theoretical models, judges ideas by logic and precision	Basic sciences, maths, research and planning
Converger	Abstract conceptualisation and active experimentation	Problem solving, decision making, practical application of ideas	Physical sciences, engineering, technical experts
Accommo-dator	Concrete experience and active experimentation	Doing things, carrying out plans and tasks, getting involved in new experiences,	Business "action-oriented roles" – marketing, sales, management

Table 2.1 Characteristics of Kolb's learning styles

There has been criticism of KLSI in EUT research. Bostrom et al, (1990) used KLSI-1976 to measure subjects' learning style in four experimental training sessions. The study concluded that learning style is important in learning EUC software and that one training method will not suit all new users; therefore training methods should be tailored to individual learning modes (based on the trainees learning style). The study was criticised by Ruble and Stout, (1993) on the grounds that the findings were not consistent and the KLSI-1976 had psychometric limitations. Bostrom et al, (1993) defended their study pointing out Ruble's identified reliability limitations of KLSI-1976, are not relevant in one-time organisational training sessions (as opposed to classroom learning that continues over a time period, where trainees' learning styles can change), and acknowledged limitations of KLSI-1976, but state that "important research cannot wait for the perfect measure" (Bostrom et al, 1993).

Not-withstanding the criticism of KLSI's psychometric properties, it has been widely used in IS research since the mid-1970's, (Bostrom et al, 1990; Chou and Wang, 2000; McLoughlin, 1999; Sein and Robey, 1991; Simon, 2000). It has also been found to provide a useful pedagogical framework and has influenced the development of replicative theories, for example Honey and Mumford's 1992 model. (In Riding and Rayner, 1998).

2.5.2 Self-Efficacy

EUC success has been evaluated by measuring performance gains, which are often obstructed by users' unwillingness to accept and use the available systems (Davis, 1989). Hence user acceptance of technology is an important IS issue, particularly so when EUT has taken place. Acceptance of technology can be measured by the amount of use of technology, which is influenced by users' attitudes and beliefs. Stemming from the Theory of Reasoned Action to

explain the behavioural factors that influence adoption of information technology, two variables that have been identified by research as important determinants of end-user behaviour to use IS are perceived usefulness and perceived ease of use. The definition of perceived ease of use as "the degree to which a person believes that using a system would be free of effort" provided by Davis, (1989) has similarities with Bandura's (1986) definition of self-efficacy, in that they are both concerned with peoples' judgements (beliefs) of their skills (effort required) in using a system. Perceived usefulness is defined by Davis (1989) as "the degree to which a person believes that using a system would enhance his or her job performance". Davis's, 1989 study undertook to provide valid reliable measures in order to gain greater understanding and depth into perceived usefulness and perceived ease of use, which were hypothesised to be determinants of behavioural intention to use computer technology. The paper concluded that three types of validity (convergent, discriminant and factorial) and reliability were strongly supported in the developed scales, which confirmed their excellent psychometric strength.

The model, known as the Technology Acceptance Model (TAM), has been shown to be a robust model that has been compared and extended as well as replicated showing confirmation of validity and reliability of the measurement scales in a large number of research studies. (Adams et al, 1992; Davis, 1993; Dishaw and Strong, 1999; Nelson et al, 1991; Taylor and Todd, 1995; Venkatesh, 1999). Findings have indicated that perceived usefulness of a system is fifty per cent more influential than ease of use in determining usage (Davis, 1993). This finding should provide direction, for both training designers and deliverers of EUT, to include specific applications to the work environment in the training material.

However, notwithstanding the usefulness of TAM to IS research in predicting computer usage, it has focused on perceived usefulness and perceived ease of use as determinants of usage, rather than the external factors that affect the perceived usefulness and ease of use determinants in individuals (Igbaria and Iivari, 1995). Social Cognitive Theory (SCT) can be used to explain how individuals' expectations of their abilities in using IS can predict their behaviour (outcome expectancies). Bandura (1977) considers that if individuals do not also have the belief that they have the capabilities to perform activities, their outcome expectancies will not be realised. Hence SCT incorporates two expectations of individuals - firstly, outcome expectations and secondly, self-efficacy expectations. There is a perception that while outcome expectancy has received attention from IS researchers (Adams et al., 1992; Davis 1989), more research is needed to explore the role of self-efficacy in EUC behaviour (Igbaria and Iivari, 1995).

The Bandura, (1977) theoretical framework for self-efficacy suggested four determinants of self-efficacy:

1. Enactive mastery
2. Vicarious experience

3. Verbal persuasion
4. Emotional arousal

They are ordered by Bandura according to magnitude of effect from 1(highest) – 4 (lowest). Igbaria and Iivari, (1995) suggest that from a review of IS literature enactive mastery is operationalised as prior experience and verbal persuasion as organisational support. They then propose a research model (Figure 2.7) to test hypotheses of the (positive) impact of these variables on CSE which in turn impacts on computer anxiety; the variables when combined act as determinants for TAM's perceived ease of use and perceived usefulness, culminating in determination of system usage. The study used structural equation modelling to analyse results for twenty hypothesised relationships in the model. Findings supported SCT in that computer experience and support affect self-efficacy, with computer experience being the most influential determinant of self-efficacy; also experience had a strong direct effect on usage. The findings generally supported TAM and also highlighted that outcome expectancies may not be sufficient to affect behaviours if individuals doubt their abilities to use computer systems.

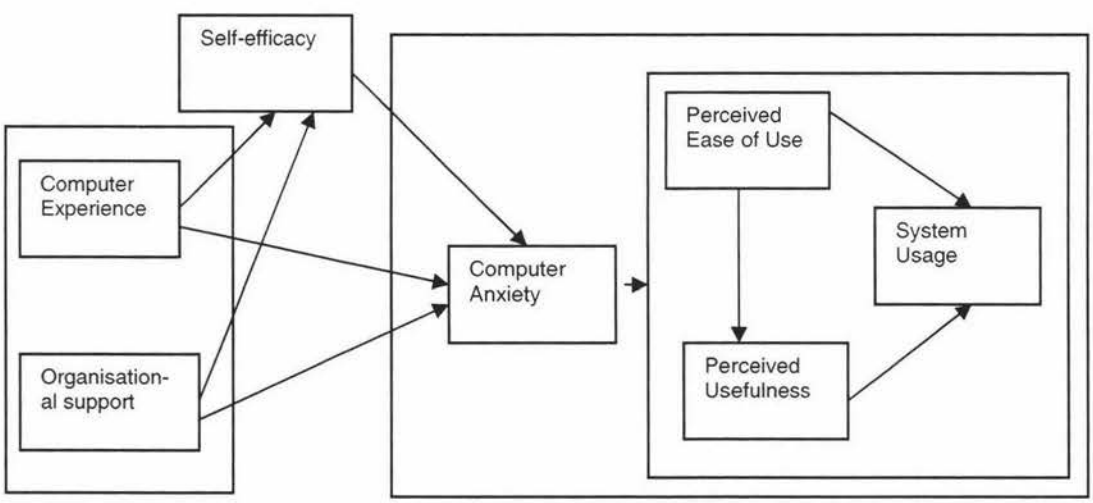

Figure 2.7 The determinants and consequences of self-efficacy: a computer usage model (Igbaria and Iivari, 1995)

Marakas et al, (1998) however have constructed a model of CSE derived from empirical studies with a large number of operationalised antecedent and outcome variables that are associated with CSE perceptions. (Figure 2.8). They also provide a table summarising their review of forty CSE studies from 1985 to 1996.

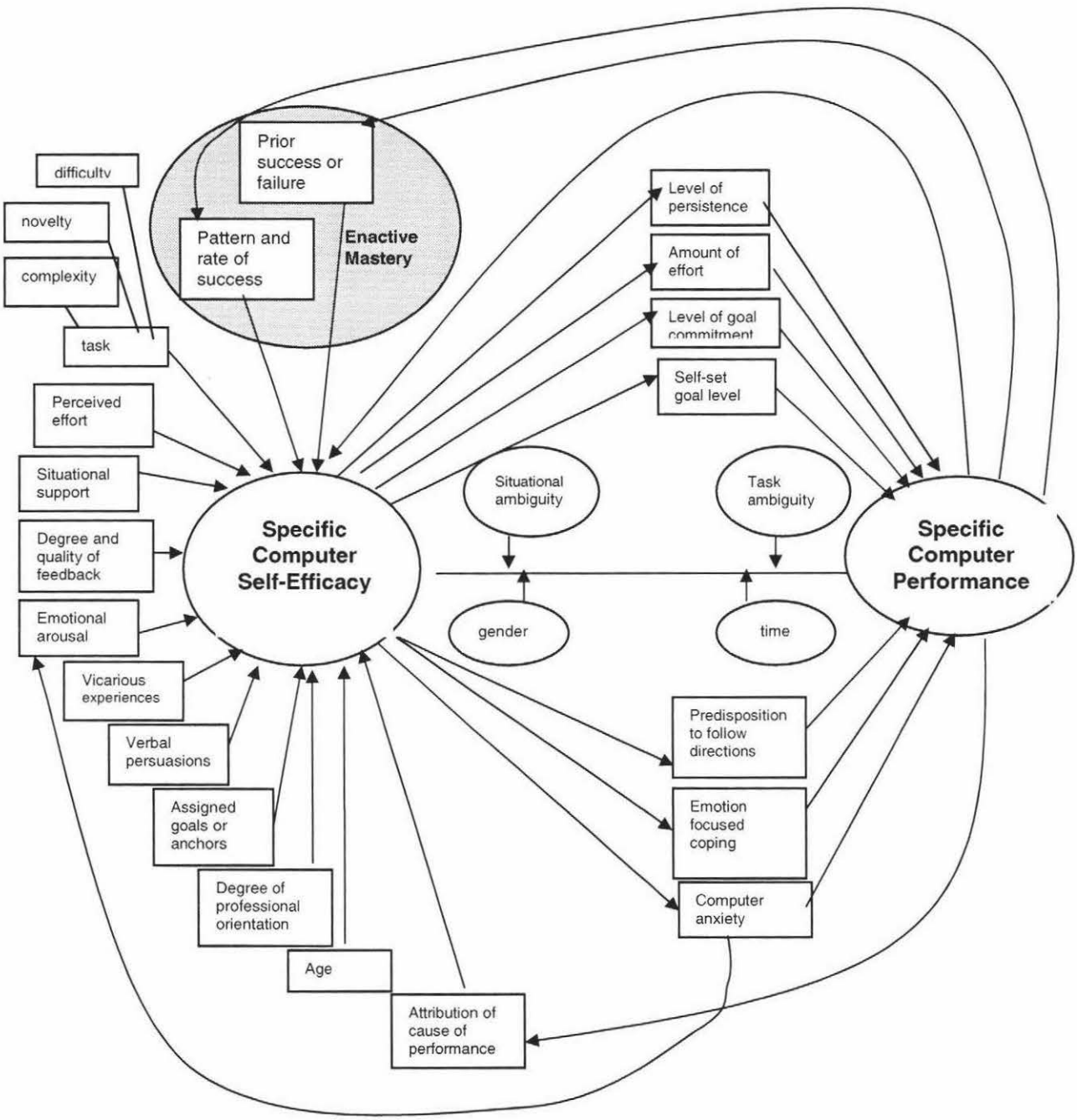

Figure 2.8 Multifaceted Model of Specific Computer Self-Efficacy (Marakas et al, 1998).

Marakas et al, (1998) consider that IS researchers need to focus efforts on improving measurement of the CSE and refining its definition. They propose that CSE can be operationalised at the task specific computer application level comprising the application environment ([A/E] i.e. operating systems environment - Windows NT, Unix) or at the application specific environment ([A/S] i.e. wordprocessor, spreadsheet). CSE in this situation refers to an individual's perception of efficacy in performing specific computer tasks within the domain of general computing. This facilitates the measurement of an individual's perception of their ability

to use the tool without confounding the perception of the task being performed with the use of the tool. An example would be using a spreadsheet (the tool) to provide a financial forecast (the task). General CSE (GCSE) refers to the individual's SE in relation to the general computing environment, i.e. across multiple application domains. GCSE is a product of many computer experiences and "can be thought of as a collection of all CSE's accumulated over time" (Marakas et al, 1998). Due to this fact combined with the fact that CSE and performance have a reciprocal relationship that degrades over time due to the individuals' compounded successes at the task level CSE, they consider that GCSE may become more salient in predicting future performance levels. It is important to consider carefully the task level CSE when designing CSE manipulations as a predictor of performance. The presence of prior task relevant experience needs to be ascertained and used as a control variable before measuring any change in CSE due to the manipulation (Marakas et al, 1998).

2.6 Conclusion

This chapter has discussed some of the many variables that impact on efficiency and effectiveness of EUT. Some conclusions which can be drawn to guide research, and for practitioners and managers, in the area of training design and delivery should include considerations of how the training is going to be useful in the workplace. Consideration of required organisational results and goals, and formal evaluation of training using a well-structured framework, for example the Kirkpatrick model, assists measuring the effectiveness of training.

Training antecedents of task characteristics and technology characteristics and the fit between the two also impact on training effectiveness. An awareness that the level of trainees' self-efficacy perceptions and expectations of their abilities in using IS, can predict their behaviour in using IS post training, must always be considered as well as the different means for encouraging development of self-efficacy through training.

The impact of trainees' learning style on outcomes of training needs to be considered. Encouraging trainers to deliver training using a variety of styles and methods to meet the needs of trainees with differing styles is one option, another is to incorporate a range of materials that are designed to meet the needs of trainees with differing styles into the training program. Other motivational factors must also be factored into training materials.

Knowledge of the effectiveness of different training methods is important, especially when combined with context and content of training. For example, behaviour modelling has proven to be a very effective method of delivering training across a number of contexts and is independent of other variables, such as learning styles.

Needs analysis is an important and often neglected variable in EUT that should be considered with special consideration of organisational issues. User support should be paramount in developing a learning organisational culture that will take advantage of emerging trends in training, such as EPSS, to realise gains both financial and qualitative in all sectors of business.

Research Methodology and Design

3.1 Research Strategy

This section examines the purpose of research, particularly IS research in an organisational setting. It then goes on to introduce and briefly discuss the background of IS research in designing IS research projects. To provide clarification in reading this chapter, the following meanings are attached to words and phrases:

'Research paradigm' is used to mean the theoretical underpinning of how the research is carried out – similar to "the world view underlying the theories and methodology of a scientific subject" (Pearsall, 1999), (the scientific subject in this study being EUT). Many researchers have used 'research approach' to mean the research paradigm, however other researchers have used research approach to mean the particular methodology of a study being undertaken.

'Research methodology' describes the collection methods used in a research project. For example the research methodology for a study is case study, methods used within that study are surveys and interviews.

'Research approaches' is not used by the author, however when describing work from other researchers, the definition provided by the cited author is provided.

'Research strategy', used as the title for this section and throughout the chapter, is used to mean the strategic plan for the whole study, which includes consideration of IS research paradigms, methodologies and methods; it also includes details of design of the research in order to meet the research objectives for this study.

The following two definitions of the word research provide an understanding of the strategic intent of any research endeavour, the first is the Concise Oxford Dictionary definition and the second is from a business research textbook.

1. The systematic investigation into and study of materials and sources in order to establish facts and reach new conclusions > use research to discover or verify information presented in (a book, programme etc.) (Pearsall, 1999)
2. Research is the process of systematically gathering and analysing information in order to gain knowledge and understanding. (p. 9: Kervin, 1992).

The purpose of research is to provide sufficient valid evidence to reach credible conclusions; to ensure this result, arguments in the research report must be valid, data must measure what it reports to measure and interpretations of the link between arguments and data must be logical (Sapsford and Jupp, 1996). Business research is a systematic method for obtaining information in order to make sound decisions and solve problems; business research frequently focuses on peoples' behaviours and attitudes (Kervin, 1992).

All research can be considered on a continuum considering the general objectives and audience of the study. At one end of the continuum is basic research; at the other end is

applied research. (See Figure 3.1) Kervin, (1992) considers basic business research produces results that add to general laws and theories; within applied research there is specific applied research which results in solutions to immediate problems, and between basic research and specific applied research is general applied research that has features of both. General applied research is suited to academic subfields that address practical issues, such as organisational behaviour or organisational sociology; it also combines both theory building and theory testing focusing on issues of general interest to Governments and organisations (Kervin, 1992).

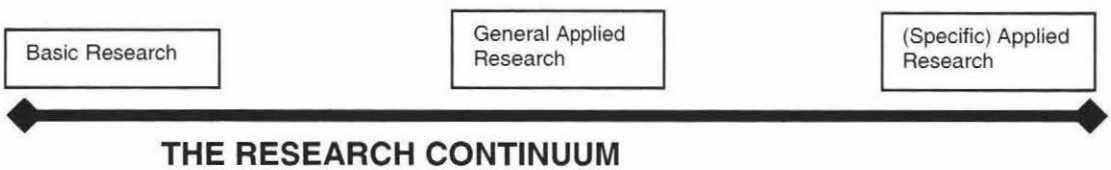

Figure 3.1 The Research Continuum (Kervin, 1992).

Research paradigms have been variously categorised, most commonly identifying the difference between the "hard" (natural) sciences and social sciences. The natural science paradigm of positivism is where strictly controlled variables are manipulated in a strictly controlled (often experimental) setting and analysed quantitatively, emphasising the neutrality and separateness of the researcher. A fundamental point of the natural science paradigm is the repeatability of the experiment. A number of other research paradigms have been identified and explained, such as an interactionist perspective that considers that the meaning of situations and actions for people are changing. This leads to a naturalistic approach where the reactive effect of the research procedures on what is being studied is reduced or eliminated, allowing observation by and participation of the researcher in the situation as a whole (Sapsford and Jupp, 1996).

IS research has predominantly followed the natural science paradigm of positivism, assuming that the elements of language correspond to an objective reality. Orlikowski and Baroudi, (1991) reported that 96.8% of all published Management Information Systems (MIS)[1] articles in their study's sample were positivist in their approach. At this period a number of criticisms that were levelled at IS research by IS researchers focused around the lack of consideration of the human behavioural aspect of IS, suggesting that IS research should give more consideration to social systems (Hirschheim, 1985; Lyytinen, 1987). IS researchers suggested that greater focus should be placed on studying the design, delivery, use and impact of IS on organisations and society and, as a vehicle to facilitate that direction for IS research, to do away with the scientific positivist approach; hence as stated by Hirschheim (1985), entering an era of "post-positivism". Other IS researchers were of the opinion that the solution to what research strategy was most appropriate for IS research was to have a pluralistic approach, meaning more than

[1] Throughout this document the term Information Systems (IS) is used synonymously with the term Management Information Systems (MIS), which was commonly used in earlier IS research.

one research paradigm should be used – positivist and interpretivist approaches in the one study, for example the work discussed in Lee, (1999).

Increasingly, since 1991, IS researchers have used interpretativism, where researchers consider themselves as the instrument of observation: Lee, (1999) considers three other elements of interpretativism; firstly, the subjects involve the "life world", including humanly created meanings, secondly interpretation is iterative – i.e. constantly in process, and thirdly, the validity of the interpretation can be assessed in many different ways.

Galliers (1992) identifies the terminology used in arguments put forward for using different research paradigms; he states "I have used the word approaches as opposed to methods ... to differentiate between the two terms ... methods are ... ways to systemise observations ... approaches are a way of going about one's research ... and are a more generic concept than methods." (p. 147: Galliers, 1992). Hence "research approaches" used by Galliers in the following discussion equates with "research methodology" used in this study. Galliers splits IS research approaches into the context of two research philosophies (paradigms). Firstly, scientific - under which is listed experiments, surveys, case studies, theorem proof, forecasting and simulation; and secondly, interpretivist - which lists subjective/argumentative, reviews, action research, descriptive/interpretive, futures research and role/game playing as approaches. However, although each approach is described in the Galliers' paper, no explanation of the method of categorisation was presented. The taxonomy of approaches developed was used illustratively to make the point that IS researchers need to be aware of the research strategies available and not limit IS research by blindly following an approach that may not be the most suitable to the topic or research objective.

IS researchers have identified a number of factors that are important in selecting the best research strategy for a study, for example, recognising the available strategies and understanding their strengths, weaknesses and the context of the study's object or focus (Galliers, 1992; Jenkins, 1985). Using a clear unambiguous statement of the research objective facilitates the selection of the appropriate research strategy (Jenkins, 1985). In choosing a methodology to employ for a research study it is essential to identify the goals of the researcher and the nature of the research topic (Benbasat et al, 1987); also to be considered is how each methodology impacts on building, testing and extending theory (Galliers, 1992). Galliers (1992) states that it is useful to review previous research in a field of study from the perspective of research methodologies and, if a predominance of one or two methodologies have been used, it could be useful to employ another methodology to provide a different light on the topic.

Often there is not one single best research strategy to employ and usually the choice is a trade-off, for example the requirement for a natural setting involves loss of control over independent

variables. However, it is critically important in ensuring validity of the research not to choose an inappropriate research methodology.

3.2 Case Study Research

This section will consider where IS case study research fits as a methodology in the paradigmatic framework discussed above. It will also define and explain case study research, examine the strengths and weaknesses of case study research methodology and discuss contexts within IS research that are most suitable to be investigated using case studies.

According to Yin (1992), case study research is based within the framework of scientific method and is termed logical positivism, involving the collection and analysis of empirical data on which findings and conclusions are based. Lee (1989) also considers that the methodological basis (paradigm) for IS case studies is scientific, and offers descriptions of how to overcome problems that could jeopardise standards of the natural science model when using case study methodology in IS research. Scientific standards that could cause problems in single case study research were identified as difficulty in making controlled observations and deductions, and allowing for replicability and generalisability. Lee provides guidelines and examples of MIS case study research that have addressed requirements to comply with the scientific model to rigorously test theories.

However, Walsham (1995) argues that increasingly IS researchers have used interpretive case studies and cites authors who have researched interpretive case studies in IS as using four underpinning philosophies of phenomenology, ethnomethodology, the philosophy of language and hermeneutics. Discussion of these philosophies is outside the scope of this research project. However, it is interesting to note the opinion given by Galliers (1992) that the survey (under the scientific paradigm), descriptive/interpretive and action research (under the interpretive paradigm) appear to have the widest applicability in IS research.

Although there is no standard definition for case study research, it has been defined as "an empirical enquiry that investigates a contemporary phenomenon within its real life context especially when the boundaries between phenomenon and context are not clearly evident" (p. 13: Yin, 1994). Benbasat et al, (1987) have drawn upon that definition and others to suggest further, "A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups or organisations). The boundaries of the phenomenon are not clearly evident at the outset of the research and no experimental control or manipulation is used." (p. 370). The purpose of research projects can be described as exploratory, descriptive or explanatory and case studies can be used for each of the investigative purposes (Yin, 1994). Although this opinion could be seen as contradicting the placement of case study methodology within the framework of logical

positivism, Yin further explains that research strategies should not be arranged hierarchically as had been considered in the past. This hierarchical arrangement placed case study methodology as "... appropriate for the exploratory phase, surveys and histories were appropriate for the descriptive phase and experiments were the only way of doing explanatory or causal inquiries. ... A more appropriate view is a pluralistic one where each strategy can be used for all three purposes" (p. 3: Yin, 1994).

A useful summary table of terminology of phases of knowledge as they are investigated by case study is provided by Benbasat et al, (1987) (See Table 3.1).

Traditional phases of knowledge accrual	**(Yin, 1984) framework**	**Bonoma's (in (Benbasat et al, 1987) framework)**	**Number of cases**
Exploration	Description	Drift	Single or multiple
Hypothesis generation	Exploration	Design	Multiple
Hypothesis testing Confirmation Disconfirmation	 Explanation Explanation	 Prediction Disconfirmation	 Multiple Single critical case

Table 3.1 Terminologies for stages of case research programmes (Benbasat et al, 1987)

Yin (1994) considers case study research is particularly suited to answering "how" and "why" research questions that focus on contemporary as opposed to historical events. As such, case studies provide an excellent means to increase the relevance of academic research to IS practitioners. Case studies allow IS researchers to study IS in a natural setting to investigate state of the art technologies in order to generate theories from practice. Additionally, as IS moves away from a strictly technical perspective toward organisational and people focused issues, case study allows a deeper and richer picture to be extracted from the research. Due to the rapid changes that occur in IS, case study provides a means to identify pertinent new issues that warrant investigation (Zinatelli and Cavaye, 1992). Case studies facilitate the study of complex phenomena to provide in-depth understanding and qualitative analysis, which can prove to be an effective means for communicating research findings to practice (Benbasat and Zmud, 1999).

Galliers (1992) states that the strength of case study is that it enables the capture of reality in greater detail and the analysis of a greater number of variables than laboratory experiments, field experiments, field studies or surveys. Due to the fact that case study research has a distinct advantage when the researcher has little control over behavioural events being studied (Yin, 1994), researchers can investigate IS issues in organisations without the necessity for un-natural interventions that could distort the reported results. For example, using laboratory experiments to investigate factors affecting EUT introduces an artificial environment that could

impact on reported results and efficient organisational management. The necessity for random assignment of subjects to treatments means employees would receive different (not necessarily the most effective) training. Contrarily, using case study allows the researcher to observe, measure and report on EUT that is consistent with organisational policies and procedures in an organisation.

Yin (1994) identifies areas where case study as a research methodology has been variously criticised, the main concern being lack of rigour due particularly to the difficulty in controlling variables, observations and deductions. Other criticisms are concerns over generalisabilty and replication of research that has been restricted to a single event or organisation. Additionally, due to the (usually) qualitative nature of data gathered, concerns have been expressed that different interpretations of events could be made by individual researchers. The amount of detail required and the resulting length of the research report, along with the time necessary to conduct case studies has also been identified as a negative factor in using case study methodology for research (Yin, 1994).

Advocates for case study research have put forward arguments and illustrated a variety of means to overcome identified shortcomings of the case study methodology. Firstly, given that traditional mathematical methods of statistical control of variables, relationships of variables on each other and the resulting deductions are precluded when studying IS in a real-world setting, Lee, (1989) provides some guidelines for controlling observations and deductions in case study research, using natural controls. Secondly, scientific facts are not based on a single experiment. They are based on a multiple set of experiments replicating the same phenomenon under different conditions; hence the same principle can be applied to case study methodology by using multiple case studies. Case studies are generalisable to theoretical propositions and not to populations or universes (Yin, 1994). Although the observations of a particular case study are very difficult to replicate, the findings of a case study (the confirmation or disconfirmation of a theory) is replicable (Lee, 1989).

Concerns over different interpretations of events made by individual researchers analysing qualitative facts can be addressed in a number of ways. Firstly, two versions written by two authors of a case study may be produced, for example to address different aspects of the case to different audiences. Secondly, multiple case studies can report results from each case in separate sections or chapters with another section of the report providing cross-case analysis and results. Alternatively, the report can consist of questions and reported answers, allowing the reader to make cross-case comparisons by examining the answers to the same questions across cases. Additionally, the case can be described repeatedly from differing points of view or with different descriptive models to provide a comparative structure. The format of case reports should be geared to the audience and need not be lengthy documents; clear concise writing is essential. As case studies do not depend on ethnographic or participant-observer

data they need not require a long period of time to complete. Despite the fact that criticisms of case study research can be mitigated by good design, case studies can be difficult to do (Yin, 1994), and rely heavily on the skills of the researcher who "must actively apply his or her ingenuity in order to derive predictions that take advantage of natural controls and treatments that are already in place or likely to occur." (p. 39: Lee, 1989).

Analytical rigour can be achieved using case study methodology by addressing four requirements of the scientific model's theory testing characterisation in both natural science and social science. For theories to be considered scientific they require the characteristics of falsifiability, logical consistency, predictability and must survive attempts made at falsification. Checking for each of these requirements in case study research can be achieved by considering the following in the research design:

1. Falsifiability can be checked by ensuring the study considers any predictions that could prove the theory wrong.
2. Logical consistency can be rigorously satisfied by increasing the number of predictions that are derived from the theory and ensuring predictions are consistent with one another.
3. Predictability can be satisfied by increasing the number of rival theories (to the theory of interest) against which the predictive performance is compared and empirical tested.
4. Increasing the number of predictions derived from the theory of interest, through which the theory could be proven wrong, will increase the theory's degree of falsifiability.

(Lee, 1989)

SUMMARY OF CASE STUDY ATTRIBUTES

- Investigations can follow traditional rules of scientific enquiry
- Interpretive techniques can be used
- Phenomena are studied in a natural setting
- Context is considered an essential part of the phenomena being studied
- Focus is on contemporary events
- One or many entities may be examined (e.g. person, group or organisation)
- Complexity of units can be studied intensively
- Allows theory building and testing
- Particularly suited to exploration but may also be used for description and explanation
- Useful to study "how" and "why" questions that are not concerned with frequency or incidence
- Favours multiple data collection techniques
- Both or either quantitative and qualitative data may be gathered and analysed
- No experimental controls or manipulations are involved
- Independent and dependent variables need not be specified in advance
- Changes in site selection and data collection methods can occur throughout the study if new hypotheses are developed

Table 3.2 Summary of Case Study Attributes

3.3 Research Design

This section will discuss and explain the design of the research project under five headings. Firstly, the requirement of theoretical underpinnings in designing a research project and details for this project are discussed. Secondly, the units of analysis that are included in the project and their impact on the design of the research are presented. Thirdly, description of reliability and validity issues in the research design are addressed. Fourthly, the rationale for data collection and a description of the data that was collected is presented. The section will conclude with how the data was analysed in the study.

With cognisance of the issues discussed in *Section 3.2*, the research methodology chosen for this project is a multiple case study. Yin (1994) considers multiple-case research designs are in the same methodological framework as single-case study, and states that the distinct advantage of multiple-case designs is that the evidence gathered from multiple cases is considered more compelling, hence rendering the overall study more robust.

3.3.1 IS Theoretical Issues

The role of theory in organisational research has been identified as having three distinct uses: "as an initial guide to design and data collection; as part of an iterative process of data collection and analysis; and as a final product of research." (p. 76: Walsham, 1995). Yin, (1992) identifies three important choices to be made in research designs for case studies of MIS, namely data collection, units of analysis and the role of theory. Yin (1992) states that specific theoretical propositions that relate to the topic of study need to be constructed, as they are an important step in creating the research design. Identification of the aim of the research in relation to theory is important. An initial design question must be to identify whether the project will test theory or build theory.

Building theory uses an inductive approach – a general law or principle is inferred from observed particular instances. Testing theory however involves employing a deductive approach, whereby a theory is identified, hypotheses are generated, a research methodology is chosen to enable evidence to be gathered which will either support or refute the hypotheses and hence the theory. If the theory is not supported the researcher needs to identify to what extent the original theory can be modified or extended.

This research uses a deductive approach and will show how a number of variables that have been identified in IS literature as having a theoretical base (see *Section 2.5* and *Table 3.3)*, affect the effectiveness of EUT in four New Zealand businesses in different industry sectors. This study can be considered descriptive, explanatory and hypothesis testing (Sekaran, 2000). Firstly, it will describe the EUT environment in the four New Zealand businesses. Secondly, it

will examine relationships that affect the effectiveness of EUT in the units of analysis (for example, considering correlations of organisational and individual variables) on the outcomes of learning.

Case study research is considered an appropriate methodology when there is little *a priori* specification of the dependent variable (Benbasat et al., 1987; Zinatelli and Cavaye, 1992) or little *a priori* knowledge of what the variables of interest will be and how they will be measured; however, it is also appropriate to identify critical variables and conceptual frameworks before conducting case studies. Bekesi (1999) states that a conceptual framework is a guiding structure that identifies, either in narrative form or graphically, the key factors, constructs or variables and the relationships between them as a base for the research design. The conceptual framework for this study is presented in Figure 3.2. Zinatelli and Cavaye, (1992) state that very few case studies involving New Zealand firms appear in IS literature and urge researchers to use the methodology to realise that "theory developed from case studies is likely to have important strengths including innovation, testability and empirical validity, primarily due to the fact that theory emerges from the data" (p. 21: Zinatelli and Cavaye, 1992).

Descriptive case studies are a useful methodology when a goal of the research is to provide relevance to practitioners. It is necessary to apply theories to IS phenomena to be used as a basis for developing practical frameworks that can "... be used by practitioners to legitimate, rationalise and justify courses of action taken." (p. 9: Benbasat and Zmud, 1999).

Identification of variables of interest and development of a conceptual framework for this study were made after reviewing IS literature, which identified that trainee characteristics impact on trainee learning. Choice of trainee characteristic variables for this study was made by identifying those that have a theoretical basis and have been previously measured using instruments that are valid and reliable and are economical to administer to respondents. Therefore, this case study will show that, by knowing how trainee characteristics and organisational factors impact on EUT, trainers and training providers can make predictions to maximise the learning that trainees gain from an EUT intervention. Reference to New Zealand IS literature in the area of needs assessment (Connor et al, 1996) and using case study methodology (Bekesi, 1999) provided some confidence that these findings will prove valid in New Zealand organisations.

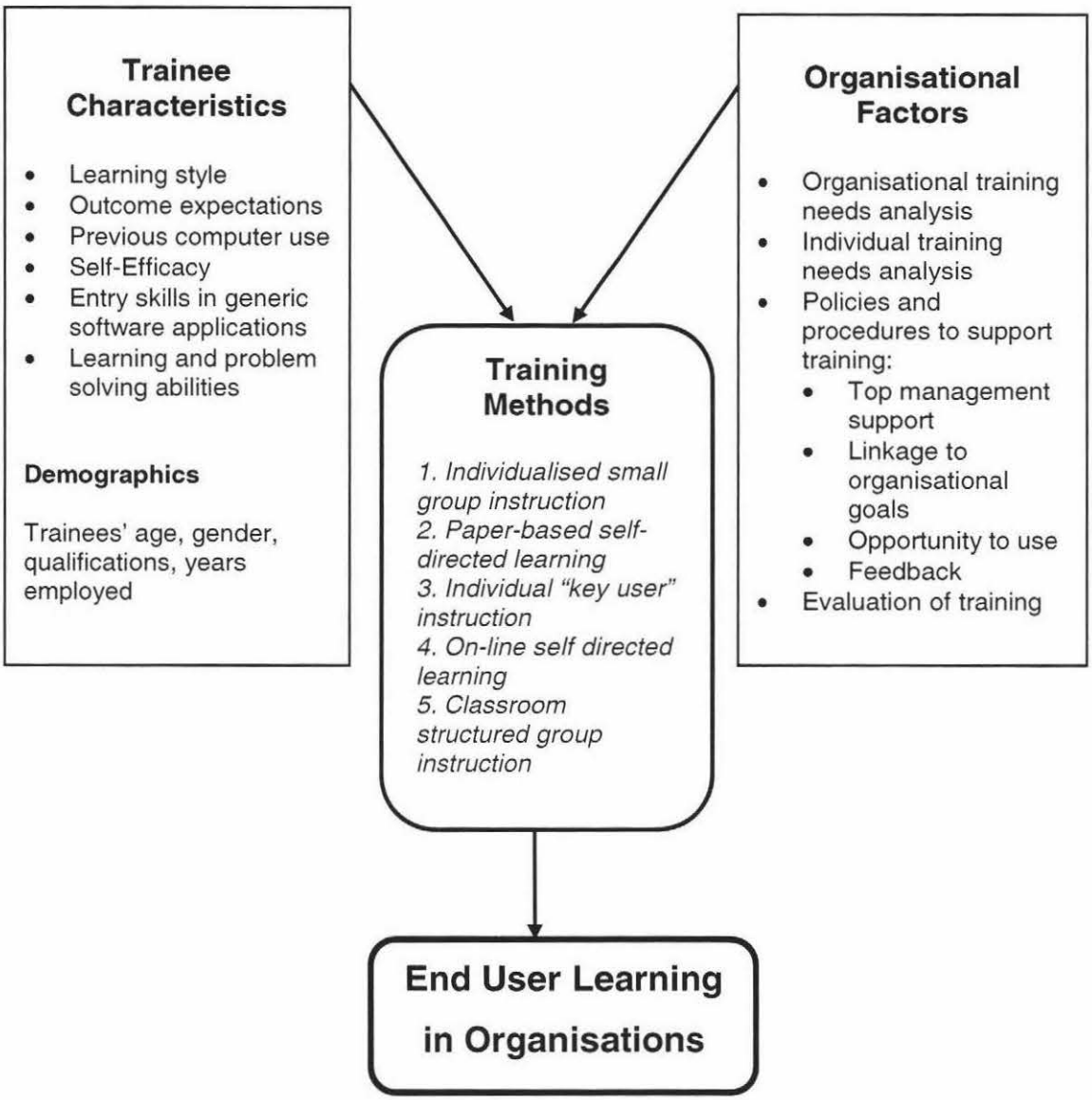

Figure 3.2 Conceptual Framework of End User Training (Shand, 2002).

3.3.2 Units of Analysis

The unit of analysis in research is defining what the "case" is. Kervin (1992) identifies six common units of analysis in business research as:

- An individual person
- An event
- An object
- A body of individuals (includes groups and organisations)
- A relationship
- An aggregate (of individuals or bodies)

It is essential to be clear in defining the units of analysis for the case study to ensure the correct identification of data collection and analysis. It is also important that each case study and unit of analysis should be similar to those studied by previous research in order to compare findings (Yin, 1994). Kervin, (1992) suggests building a matrix of research design with the units of analysis as rows and the variables represented in the columns; the data sources can then be clearly identified to fill the body of the data matrix. The matrix for the current project is presented in Appendix 3.

Another method of identifying the units of analysis is to work from the research questions to identify the variables of interest, which then point to the unit of analysis. For example, to answer the research question: *How does {identified trainee characteristic} impact on trainees' increase in skills?* The variables of interest are the individual's trainee characteristic and the individual's increase in skills, and the unit of analysis is the individual trainee. In order to answer the research question: *How do {organisational factors} impact on training effectiveness?* The variables of interest are organisational factors indicating the unit of analysis is the organisation; and training effectiveness (by implication for the organisation), which indicates the unit of analysis is an aggregation of the increase of skills in individual trainees that are employed by the organisation.

Lack of clear research objectives have been identified as impacting on the lack of identification of the units of analysis and consequently the rationale for site selection in IS case study research (Benbasat et al, 1987). The research objective and aim of this study stated in Section 1.3 "... to investigate the influence of previously identified trainee characteristics and their relationship with EUT methods and organisational factors on effective end user learning. The aim of the research is to build on the current body of knowledge in the area of providing effective EUT that has relevance to practitioners, while maintaining adequately rigorous procedures, using a sample of New Zealand businesses across four industry sectors." Also stated in Section 3.3.1, this study fits into the knowledge building process by testing theory through description and hypothesis testing, without precluding the possibility of exploration through theory modification due to the fact that, as Zinatelli and Cavaye (1992) state, theory can emerge from the data collected in case studies.

Benbasat et al, (1987) considers it is important to identify site selection objectives; for this study the criteria for choosing sites was:

- Organisations that had planned EUT in the next 12 months
- Organisations that had more than 50 employees (to enable reasonable sample sizes of trainees)
- Representation of different industry sectors in New Zealand (to provide for a measure of comparison and generalisability)
- Availability and willingness of organisations to participate in the project

Hence, this study has as its primary unit of analysis a number of New Zealand organisations across industry sectors. Identification of potential participants was made using NZ Company web site addresses and the phone book. Initially the approach was made by phone to arrange personal meetings where organisations were provided with an information sheet containing information about the proposed research including an invitation for their organisation to participate in the research (Appendix 1).

From this approach, three organisations agreed to participate in the study. A fourth organisation approached the researcher, as their organisation had identified a need for training staff on specific software packages. They were particularly interested in raising skill levels for all trainees and in developing a training model to provide structure for future training.

The four organisations that are participating in the research can be described as:

- a multi-national consulting and accounting firm (Organisation A)
- a national distribution company for an international vehicle manufacturer (Organisation B)
- a Government department (Organisation C)
- a fast moving consumer goods retail and distribution company (Organisation D)

The sites chosen represent four sectors in the New Zealand business environment. As they are large organisations that have direct competitors, they can be considered to fairly represent the above sectors. They also provide opportunities for "literal" replications - where similar results are predicted and "theoretical" replications - where contradictory results are predicted (Benbasat et al., 1987), that can be categorised as follows:

- Three organisations are providing training for the same software applications using different methods.
- Two organisations are providing training for existing employees.
- Two organisations are training new recruits.

Yin (1994) differentiates between holistic and embedded case study design and describes the embedded design as having more than one unit of analysis. As the object of interest in this study is the impact of trainee characteristics on EUT for the organisation (already identified as the case), individual trainees are an embedded unit of analysis. Further consideration of the aims of the research, and the practicalities of uncontrolled variables (the training method) identifies the need to aggregate data and hence identify another subunit of analysis as the training group or department within the organisation.

3.3.3 Validity and Reliability

The quality of social empirical research is commonly judged using the four criteria of construct validity, internal validity, external validity and reliability (Yin, 1994). Reliability is the extent to

which a measure, procedure or instrument yields the same result on repeated trials. Validity is concerned with the degree to which a study accurately reflects or assesses the specific concept that the researcher is attempting to measure. A method can be reliable, consistently measuring the same thing, but not valid.

3.3.3.1 Construct Validity

Construct validity seeks an agreement between a theoretical concept and a specific measuring device, such as observation or instrument. Yin (1994) provides tactics to use in case study design to ensure the four criteria are met. For construct validity, case study tactics are to use multiple sources of evidence, establish a chain of evidence and have key informants review draft reports of the study. When using instruments to measure variables, a number of validity tests are performed; the validity of specific instruments used in this study will be discussed in *Section 3.3.4.1.*

3.3.3.2 Internal Validity

Internal validity is the rigour with which the study was conducted (e.g., the study's design, the care taken to conduct measurements, and decisions concerning what was and wasn't measured) and in explanatory or causal studies the extent to which the designers of a study have taken into account alternative explanations for any causal relationships that are explored. There are a number of tactics that can be used to ensure that a case study adheres to the internal validity principle; for example, pattern-matching whereby a number of predicted patterns, derived from propositions of the study, are compared with empirically based patterns. If all the predictions coincide with empirical evidence from the case, reliable conclusions can be drawn about the proposition. The quality of a research study from an internal validity perspective relies on the assurance that the observed effects are caused by the hypothesised and measured variables (Straub and Carlson, 1989). Hence, by using a theoretical foundation to identify theories and propositions in the design of a study and to rule out rival theories of causality, confidence can be placed in the internal validity of the study.

3.3.3.3 External Validity

External validity is the extent to which the results of a study are generalisable or transferable to another situation. External validity in case study requires the identification of the boundaries to which the findings of the study can be generalised. Commonly case studies are criticised for lack of generalisability, due to the unique nature of each case being studied. Case study findings should be generalised to theory by using the technique of replication (Yin, 1994). Replication can be used in three ways; firstly by applying the same theories from one case to the same set of initial conditions in another case to deduce the same predictions. Secondly, the

theories from the original case study could be applied to a case with different initial conditions resulting in different predictions. Although the predictions are different the same theory is being tested (Lee, 1989). Thirdly, applying replication logic to multiple case studies that are selected to either predict similar results (literal replication) or produce contrasting results for predictable reasons (theoretical replication) increases external validity. It is essential when using replication in multiple case studies to have a strong theoretical framework that states the conditions under which literal or theoretical replications will be found; the theoretical framework can then be used to generalise findings to new cases (Yin, 1994).

Scientific generalisability does not rely on the result of a single test, whether it be a laboratory experiment or an IS case study; generalisability is achieved by successive testing across a range of settings, not a single test in a single setting (Lee, 1989).

3.3.3.4 Reliability

Reliability requires that the same result be achieved if the case study were repeated (not replicated); therefore, a case researcher needs to carefully document all procedures in conducting the study. Yin (1994) suggests that using a case study protocol and case study database is a method of increasing reliability of case study research. The protocol details the procedures and general rules to be followed in using the case study instruments and the database is a formal assembly of the evidence gathered and is separate from the case study report. Instrument reliability is discussed in *Section 3.3.4.1*.

3.3.4 Data collection

The IS case study research approach (methodology) can be characterised as defining specific questions of the study, using logical positivism to develop rival hypotheses and collecting relevant evidence relating to these questions (Yin, 1992). The collection of relevant evidence is of paramount importance in ensuring the case study is rigorous and also to address validity and reliability issues. Gathering data from multiple sources is the recommended tactic to use for high quality case studies; however, care needs to be taken in considering the required result of gathering the evidence. The rationale for using multiple sources of evidence is to achieve triangulation – the situation when data is gathered from multiple sources to corroborate the same fact or phenomenon. Case study findings are more convincing and accurate if they are based on different sources of evidence following a corroboratory mode (Yin, 1994).

One of the reasons for using case study methodology for this study was that it provided a rigorous methodology for gathering and analysing different types of data from a variety of sources. Practical limitations in conducting this study (See *Section 1.4*), especially in the area of getting large enough numbers of trainees to adhere to rigorous experimental design features, forced the researcher to choose a research methodology that encompassed using both

quantitative and qualitative data. Two categories of independent variables have been identified for this study – trainee characteristics and organisational factors. Generally, trainee characteristics are measured using questionnaires that provided quantitative data and organisational factors are measured using qualitative techniques of interviews and examining documentation. However, qualitative data is also used to describe training methods used, as the training methods were chosen by each of the organisations. The next sub-sections will discuss and identify data collection for this study under those two headings.

3.3.4.1 Quantitative data

This subsection will identify variables where data was gathered with the intention of performing quantitative analysis. The instruments used and the justification for their inclusion in this study will be described, with reference to the IS literature.

The following trainee characteristic variables were measured using a questionnaire that produced quantitative results: age, gender, qualifications, years employed, previous computer use, entry skills in generic software applications, self-efficacy and trainee outcome expectations. All variables were measured on one questionnaire administered to trainees prior to training commencing (Appendix 4). Additionally, three other questionnaires were filled out prior to training commencing, in order to measure trainees' problem solving abilities using Wonderlic Personnel Test (WPT), learning styles using Kolb's Learning Style Inventory (KLSI) and self-reported skill levels in specific tasks across each of three software applications (Appendix 5).

IS researchers in the 1980's criticised IS research for not building a cumulative body of knowledge, (Banville and Landry, 1989; Zmud et al, 1989) especially in construct measurement (Sethi and King, 1991; Farhoomand, 1987; Jarvenpaa et al, 1985) and instrument validation (Straub and Carlson, 1989). Benbasat, (1999) states that until recently, IS scholars have not valued a well-defined collection of research constructs and instruments. The situation is improving; currently, there is available a range of previously used and reliable instruments for construct measurement in IS research, which facilitates rigour and promotes co-operative research efforts (Straub and Carlson, 1989). This research project used previously developed instruments to measure trainee learning styles, trainee self-efficacy, trainee outcome expectations and trainee learning abilities.

See *Section 2.5.1* for a discussion of the theoretical basis, details of application and characteristics of KLSI. The advantages of using KLSI to capture individuals' learning modes are that it is simple and short. In an industry training environment, where time is important, the advantage of having a 12-question instrument is important. The instrument is also non-threatening in as much as there are no right or wrong answers – hence respondents can be made to feel at ease by completing KLSI before a more taxing test. It is considered to be a

relative measure of differences between individuals, and hence is useful in evaluating individual differences in an EUT setting. This study used KLSI-1993.

Outcome expectations and self-efficacy were measured using Compeau and Higgins, (1995a) instruments prior to training. The rationale for using the computer self-efficacy (CSE) instrument adapted from Compeau and Higgins, (1995a) was identified by reviewing forty CSE studies provided by Marakas et al, (1998). Compeau and Higgins, (1995a) used an instrument that measured both the strength and magnitude of CSE, Marakas et al, state "a measure of CSE must account for both the strength and magnitude of the estimation if it is to be valid" (p. 153: Marakas et al, 1998). Lee and Bobko (1994) compared five methods of measuring self-efficacy and concluded that measures with multiple performance levels (CSE strength and CSE magnitude) and the two composite measures displayed higher convergent and predictive validities than the one item measures. "We thus recommend that researchers refrain from using single item measures of confidence as indices of self-efficacy" (p. 368: Lee and Bobko, 1994). The Compeau and Higgins, (1995a and 1995b) studies used samples of professional knowledge workers and managers; this population fits more closely with the population of the current research than with other populations identified in the review (mainly students). Additionally, the instrument had been used by other researchers, and was formally validated and relatively brief.

Measures of trainees (learning) abilities (also termed cognitive abilities) have been identified as the best predictor of training success (Ree and Earles (1991) in Simon (1996)). The Wonderlic Personnel Test (WPT) has been widely used in industry since 1937 to measure peoples' aptitude for learning as well as capacity to apply what has been learned to new situations in order to solve problems. WPT was found to predict training and hiring success in 80% of cases studied by Hunter (1989) (quoted in Simon (1996)).

A number of researchers have tested the validity and reliability of WPT in psychological trials, getting results that showed that WPT produced IQ scores that correlated very closely (.91 to .93) with the standard, but much longer Wechsler Adult Intelligence Scale (WAIS) (Dodrill, 1991). Additionally, Edinger et al, (1985) p. 937 states "the impressive validity of the Wonderlic was not compromised by differences in sex, age, years of education, level of intelligence, or emotional adjustment." McKelvie, (1989) conducted validity and reliability tests on WPT with undergraduate students over a three year period. The study's findings concurred with those in the WPT manual; namely, that WPT is internally consistent showing that the test is acceptable in both academic and non-academic settings. Suggestions for using WPT in an academic setting were the possible use as a general screening device for student admissions and more usefully, for students to use as a research instrument to provide a quick estimate of general intelligence. The WPT was used in this study as it has not only proven to be valid and reliable,

but it also is a 12 minute test, hence fitting with the need for time economy of administering questionnaires.

The study also measured prior experience (hours/week over the previous year spent using specific applications), self-assessed current ability (on a scale of 1-4) in four application specific areas, gender, age, years spent in employment and highest educational qualification using a questionnaire developed by the researcher (Appendix 4).

A single self-report instrument was used to measure training needs and specific skills in Microsoft (MS) Word, Excel and PowerPoint prior to training (Appendix 5). Trainees rated their skill levels in specific tasks in the three applications on a scale of 1-5, 1 being "no knowledge" of the skill and 5 being "know it very well". A single absolute number could then be computed to represent a skill level for each application and a total skill level for each trainee. Aggregation could be used to represent skill levels in applications for departments and organisations as well as total skill levels for the study. The same instrument was used to measure post-training skills in order to calculate the difference between pre- and post-training skills.

A number of potential problems with using self-reports (or ratings) has been identified, such as the bias that individuals may display when asked to enumerate their deficiencies in work related tasks (Connor et al, 1996). For this study however, it was considered that this problem would be mitigated when asking trainees to use the same form to identify their skill levels as a means of identifying training needs. "Specifically, when individuals perceive that enhancement of their skills is needed and that training will assist in the development of those skills, they are more likely to accurately report their training needs." (p. 8: Connor et al, 1996). Consideration of the trainees' perception of the need for the specific EUT for which they were identifying their skill levels was gained via interviews with training managers in the organisations.

Whilst self-reports as a means of gathering data have been criticised in academic literature (more especially the influence of individual and contextual issues on self-assessed training needs (Guthrie and Schwoerer, 1994)), there is a body of opinion that self-reports stack up well when analysed for validity issues especially construct validity (Howard, 1994). Howard concludes his discussion of the use of self-reports by stating "When employed with a sensible design, self-reports often represent a valuable and valid measurement strategy." (p. 403: Howard, 1994)

The rationale for using the one instrument to measure trainee skills in this study was twofold; firstly, from the discussion above it would be a valid measure and secondly, it filled the requirement to take up as little time as possible for trainees to complete. Additionally, a participating organisation's training manager initially developed it; hence, it was relevant to a practical situation.

3.3.4.2 Qualitative data

Benbasat (1987) states that the goal in data collection in case study research is to "obtain a rich set of data surrounding the research issue, as well as capturing the contextual complexity" (p 374). Additional to qualitative data gathered in order to provide a richer picture of the contexts of gathering quantitative data, data was gathered from interviews, both of trainees and training supervisors, and examination of organisational data. Each organisation in the study had different qualitative data gathered, due to differing requirements and circumstances. However, common themes and situations were identified and explored in order to produce overall hypotheses for which data is needed to support or refute. Additionally, external data from such sources as NZ business journals and periodicals was examined in order to gain insights into EUT in different industry/sector groups.

For clarification in the reporting of this research, the researcher's contacts in each organisation will be termed training manager, as that was the role they fulfilled, although different titles were used in each organisation. The person who conducted the training (where applicable) will be termed the trainer and the people receiving the training are termed trainees.

The research strategy for each organisation was designed by conducting initial semi-structured interviews with training managers using the Summary of Training Project form (Appendix 2) as a guideline. Due to differences between the organisations, preliminary data needed to be gathered to ensure the feasibility of the project for that organisation, in terms of time frames, availablitiy of staff to work with the researcher and required organisational outcomes. Additionally, in order to be able to provide opportunities for both theoretical and literal replications, to improve the quality of the case research (Benbasat et al, 1987), preliminary data was examined to find required replications between the organisations.

Organisational training needs analysis with all the organisations was conducted by the organisations prior to the research commencing. The fact that organisations had training planned was an essential criterion for participation in the research, and hence identification of organisational training needs was not directly addressed. However, qualitative data was gathered from training managers and other employees to identify the general organisational criteria followed for identifying organisational training needs. Individual training needs analysis (identified by trainees' self-reported skill levels) was augmented with interviews with trainees in Organisation B using Appendix 7 as a guideline. This served the purposes of providing a richer picture of individual training needs both for the organisation and the research; it also provided triangulation by gathering data from different sources and by different methods.

An organisational factor that has been identified as impacting on EUT effectiveness is organisational support for users after training has taken place (Ford et al, 1992; Garavan and McCracken, 1993b; Noe, 1986). A number of factors that have been identified as improving user support post-training include:

- providing specific on-the-job tasks to perform (Ford et al, 1992)
- opportunities to practice skills (Ford et al, 1992)
- immediate and relevant feedback (Ford et al, 1992),
- supervisor and co-worker reinforcement (Noe, 1986)
- availability of resources (Noe, 1986)
- top management support (Lee et al, 1995)
- formal evaluation and feedback to facilitate learning in the organisation as a whole (Garavan and McCracken, 1993a).

The above data was gathered via interviews with training managers. Additional information gathered at these interviews included questions about the organisations' general goals and objectives for training, whether "training success" and "training transfer" were measured and organisational demographics. (See Appendix 6).

A summarisation of issues discussed in *Section 3.3* is provided in Table 3.3.

SUMMARY OF RESEARCH DESIGN COMPONENTS

Independent Variables	Unit of Analysis	Instrument	Type of data	Examples of previous EUT Research	Theory
Demographics - (age, gender, qualifications, years employed)	Trainee	Self-evaluation questionnaire (Appendix 4)	Qualitative Quantitative	(Davis and Davis, 1990)	Learning Theory
Previous computer use, entry skills in generic software applications	Trainee	Self-evaluation questionnaire (Appendix 4)	Quantitative	(Davis and Davis, 1990)	Learning Theory
Self-efficacy and trainee outcome expectations	Trainee	Self-evaluation questionnaire (Appendix 4)	Quantitative	(Compeau and Higgins, 1995b) (Compeau and Higgins, 1995a)	Social Cognitive Theory
Learning Styles	Trainee	Kolb's Learning Style Inventory	Qualitative	(Bostrom et al, 1990) (Simon, 2000)	Experiential Learning Theory
Learning and problem solving abilities	Trainee	Wonderlic Personnel Test	Quantitative	(Simon et al, 1996) (Noe and Schmitt, 1986)	Aptitude for learning. Trainability
Training needs analysis	Trainee Organisat-ion	Application Skills Outline (pre-training) (Appendix 5)	Quantitative	(Nelson et al, 1995)	General Systems Theory
Organisational support	Organisat-ion		Qualitative	(Fitzgerald and Cater-Steel, 1995) (Noe and Schmitt, 1986)	Diffusion of innovation in organisations Effort-performance-outcome expectancies
Training Method[2]	Trainee		Qualitative		
Dependent Variables					
Learning	Trainee	Application Skills Outline (post-training) (Appendix 5)	Quantitative	(Bostrom et al, 1988)	Motivation to learn and use
Increased Skill levels	Trainee Organis ation	Application Skills Outline (pre minus post scores) (Appendix 5)	Quantitative	(Noe and Schmitt, 1986)	Effort-performance-outcome expectancies

Table 3.3 Summary of Research Design Components.

3.3.5 Data analysis

Identification of the levels of measurement (or measurement scales) used in a study provide a framework for how the data is analysed. Pervan and Klass, (1992) consider that all scales possess the properties of at least one of four major levels of measurement being:

1. Nominal – measured variables are partitioned in mutually exclusive categories, using numbers as labels only with no quantitative value
2. Ordinal – measured variables are categorised as for nominal but also a ranking is applied
3. Interval – measured variables are categorised and ranked additionally, the difference between two successive numbers on the scale is constant
4. Ratio – the same as interval scales but a natural zero point indicates the total absence of a characteristic

This study used all four levels of measurement and is summarised in Table 3.3

Descriptive and univariate analysis of data provide answers to what the typical unit of analysis looks like, how typical the typical unit is and what is the overall picture of the dependent variable of the research. Statistical techniques are used to measure the central tendency and variability of the variables; central tendency measures of mode, mean and median and variability measures of range, quartile deviation and standard deviation are used depending on the measurement levels (Kervin, 1992).

As this research is descriptive, breakdowns of the key variables of pre- and post-training skills and increase in skills by demographic variables of each case study provides sample descriptions. Inferential statistics are used to draw conclusions about the target population from the study's samples.

The population for the study is defined as North Island New Zealand employees who receive work-related EUT and who work for organisations with more than 50 employees. Each case is considered to be a random sample of this population due to the random choice of organisation participants and the random choice within those organisations of trainees. Estimations about the population drawn from sample results must consider sampling errors and the appropriate level of confidence (statistical significance) required. To test hypotheses about a characteristic of the population of interest involves testing whether the population characteristic is equal to, greater than or less than a specified value. Hypotheses testing use a sample mean and standard deviation from a random sample as well as the sample distribution to enable the calculation of the probability that the true population characteristic falls within a range of values.

[2] The organisations chose the training methods to be employed.

Hypothesis testing involves three steps:

1. Specifying the research hypothesis – either some difference between a desired standard and the true value or a relationship between variables; from the hypothesis (H) the null hypothesis (H_0) is the opposite, stating no difference or relationship.
2. An alpha level is chosen for the probability of a type 1 error, which is when the null hypothesis, which is true, is mistakenly rejected. Type 2 error, which is when a null hypothesis, which is false, is accepted, is inversely related to type 1 error.
3. Calculation of the critical region for rejecting the null hypotheses (using normal distribution assumption or when samples are small using t-distribution), and determine if the null hypothesis is rejected (Kervin, 1992).

Specific research questions guide bivariate analysis to identify the strength of relationships between identified variables. Specific techniques to use depend again on the measurement level of each variable to be compared. Table 3.4 identifies bivariate techniques that can be used when comparing the independent variables with the dependent variables.

Multivariate analysis is used to discover how one or more dependent variables is affected by two or more independent variables or to examine interdependence relationships among variables without specifying any dependent variable. Multivariate analysis allows statistical control of certain variables while examining the effects of other variables, which is particularly important when control through research design is not possible, for example, when random assignment to samples is not possible or when sample sizes are small.

When using statistical analysis it is essential that all statistical assumptions be identified and where there is an option of techniques to use the rationale for using one technique is explained. Additionally, if different results are found using two techniques on the same data, explanations are necessary to explain the more likely interpretation (McClave et al, 1998). Misuse of significance tests result in type 1 or type 2 errors, which is particularly likely to occur when small samples are used, as is the case in many IS studies. The important consideration when using significance to test hypotheses is to understand what the test does and does not provide; the correct interpretation of statistical significance testing provides the p value, or probability of obtaining coefficients of certain sizes under the null hypothesis, and hence is used to make a decision accepting or rejecting that chance caused the results. Misinterpretation of the p value occurs when researchers consider the p value is the probability that research results were due to chance; or statistical significance is the probability of obtaining the same results when replicating an experiment with different data, in other words as justification for reliability. A further misinterpretation occurs if researchers believe statistical significance reflects the probability that the research hypothesis is true. The p value has nothing directly to do with inferences about research hypotheses (Pervan and Klass, 1992).

DATA ANALYSIS TECHNIQUES AVAILABLE FOR STATISTICAL ANALYSIS

Variables	Measurement Level	Descriptive Analysis (Univariate)	Association tests		Significance tests
			Relationships Analysis (Bivariate)	Group Differences Analysis (Multivariate)	
Demographics –age, gender, qualifications,	Nominal or ratio	Mode, median, mean. Range. Frequency.	Scatterplots, Cross-tabulations	Analysis of Variance	Chi-square
Years employed, previous computer use (hrs/week)	Interval	Mean. Range, Standard deviation.	Standardised regression co-efficient, correlation co-efficient	Multiple regression	t-test or F test
Entry skills in generic software applications	Manipulated Ordinal	Median, mean. Range, Standard deviation	Scatterplots	Multiple regression	t-test or F test
Self-efficacy, trainee outcome expectations	Manipulated Ordinal	Median, mean. Range, Standard deviation	Standardised regression co-efficient, correlation co-efficient	Multiple regression	t-test or F test
Learning Styles	Nominal	Mode Scatterplots. Frequency.	Scatterplots, boxplots	Analysis of variance	Chi-square
Learning and problem solving abilities	Ordinal	Median, Mean. Range, Standard deviation	Standardised regression co-efficient, correlation co-efficient	Multiple regression	t-test or F test
Training needs analysis, specific entry skills	Ratio	Mode, Mean. Range, Standard deviation	Standardised regression co-efficient, correlation co-efficient	Multiple regression	t-test or F test
Organisational support	Descriptive	Frequency			
Training Method	Descriptive				
Dependent Variables					
Learning – post training skill level	Ratio	Mean. Standard deviation.	SECOND VARIABLE		
Increased Skill levels	Ratio	Mean. Standard deviation.	SECOND VARIABLE		

Table 3.4 Data Analysis Techniques Available for Study Variables

Important to the correct interpretation of the results of statistical inference tests is the concept of statistical power, which as reported by Baroudi and Orlikowski, (1989) was low in numerous MIS studies surveyed. The statistical power of a null hypothesis has three parameters:

1. The significance criterion, alpha, the chosen risk of a type 1 error occurring, and whether the test is one or two tailed. Power is increased with larger alpha and one-tailed tests.
2. The precision of the sample estimates, influenced by sample size n. The larger the n the greater the precision, increasing the probability of rejecting the false null hypothesis
3. The effect size represents the magnitude or strength of the relationships among variables. If other factors are controlled, the larger the effect size the greater the probability that it will be detected and the null hypothesis rejected.

The effect size is critical in determining statistical power and is fundamental to adequate interpretation and application of research results; MIS research has not paid enough attention to the effect size which measures the effectiveness of a theory to explain or predict empirical observations (Baroudi and Orlikowski, 1989).

Pervan and Klass (1992) suggest that too many "researchers using various statistical techniques place too much emphasis on tests of significance and neglect to get a better feel for the data and its decision-making implications." (p. 219: Pervan and Klass, 1992). IS research should place importance on gathering information using informal examinations of summary statistics rather than over-relying on formal tests of statistical significance, partly due to unreliable results that can be produced when sample sizes are small and when non-significant results are interpreted as providing no support for the research hypothesis. IS research should be guided by principles and concepts of exploratory data analysis, rather than being totally reliant on statistical significance tests (Pervan and Klass, 1992).

Deciding which tests to apply in which circumstances requires consideration of hundreds of options; factors to be considered include type of measurement scale, the number of variables, distribution of the variables, size of the sample and types of relationships between variables. Once these factors have been identified, a large decision tree can be used as a framework (Pervan and Klass, 1992). Additionally cautions of misuse of statistical tests, what they do and do not indicate and the researchers "feel" for the data and subject area assist in providing meaningful interpretation and application of research findings.

3.4 Ethical Considerations

As the activities necessary to carry out this research involved human subjects, it is appropriate to consult The Code of Ethical Conduct for Teaching and Research Involving Human Subjects produced by Massey University, (2000) which provides five ethical principles:

1. Informed consent of the participants
2. Confidentiality of the data and individuals providing it

3. Minimising of harm to participants, researchers, technicians etc.
4. Truthfulness – the avoidance of unnecessary deception
5. Social sensitivity to age, gender, culture, religion, social class of the subjects

This research project used strategies to adhere to the above principles. As organisations were approached as the primary participants, they were fully informed of the purpose, data requirements and time frame for the research project. They were also informed of the potential benefits to their organisation and assured of anonymity of the organisation in any published documents. Consent was obtained from each organisation to verbally identify their organisations with other organisations participating in the study for the duration of the study. (See Appendix 1).

The individual participants were employees of the organisations participating in the research. The researcher met with all potential participants and provided information that assured trainees that their participation in the research project was entirely voluntary and had no effect on their participation in the organisational training programme. Their rights regarding participation in the research, the right not to answer questions and their rights to withdraw from the study at any time were clearly explained, as was the aim of the research. Full confidentiality of their identities and the data they provided was ensured by coding all responses, only using those codes in reports to the organisations and ensuring the physical safety of the data by using locked filing cabinets. This information was also provided in writing to each participant and informed consent of participants was achieved via the Information and Consent Forms (Appendix 8). The assured anonymity of individual responses was important in minimising harm to participants, for example, if an individual's unfavourable test scores could be used to impact on their career opportunities. Anonymity also mitigated feelings of participant's social sensitivity in disclosing personal details such as age or qualifications.

When conducting experiments a threat to their external validity is the reactive effects of the subjects to an experiment being conducted, therefore it is an important ethical issue to maintain truth by avoiding unnecessary deception. However, as this research used a case study methodology, participants were fully informed of the aims and research questions as well as procedures for gathering the data.

Other issues that have been identified as unethical research practice for which full consideration to eliminate or at least mitigate in this study include:

1. Control of measurement error – the desire of the researcher to control measurement error requires that the measurement situation is controlled (Kervin, 1992). Respondents' consent must be obtained before controlling the situation, which can be important in interview situations. All interviews in this research were conducted in the

situation chosen by the interviewee with prior consent obtained, which included an outline of the issues to be discussed in the interview. (See Appendices 2, 6 and 7)

2. Unethical statistical practice, for example intentionally biased samples, using inappropriate statistical tests, representing relationships to be more significant than they are without warning of possible erroneous conclusions and presenting conclusions that are not fully supported by the data (McClave et al, 1998).
3. Withholding treatments from groups of participants. This issue did not impact this study due to the fact that assignment of trainees to training groups and the methods employed to train were decided by individual's employers.
4. The failure to carry out multivariate analysis can produce misleading roles of certain variables, for example a variable that appears vital at the bi-variate level can turn out to be spurious at the multivariate level, hence leading to misleading conclusions and potentially harmful recommendations. It is an ethical responsibility of researchers to carry out appropriate multivariate analysis in keeping with the data and discuss any limitations imposed by the study (Kervin, 1992).

3.5 Summary

Design of research plays a large role in the effectiveness of the study. This chapter has identified important issues in designing research. Firstly, an appropriate methodology has been chosen followed by consideration of the theoretical underpinning of the research. Objectives of the research guide issues to ensure a rigorous and relevant study is carried out. Consideration of units to be analysed, the aggregation of those units, data required and techniques to provide valid and reliable measurements of the variables of interest, with understanding of the impact of analysis of relationships among the variables, must be clearly stated. Ethical issues must be addressed, and any ethical concerns must be mitigated to contribute to the future of the research endeavour when studying human subjects.

The Present Study

4.1 Description of each case

Four New Zealand organisations participated in this multiple case study to investigate factors that impact on effective EUT. With the requirement to answer the research questions in the most effective and efficacious manner, research strategies for each organisation were tailored to the individual organisation's circumstances. The first meeting with each participating organisation used the Summary of Training Project form (Appendix 2) as a structure for setting up the research strategy in each organisation. Data gathered via interviews with training managers included:

- Identification of trainees
- Identification of content of training (applications)
- Identification of training method/s
- Structure of training needs analysis (TNA)
- Applicability and feasibility of using pre, post and transfer tests
- Time frames and timetable for project

Subsequent interviews with training managers identified organisational demographics, training goals, support for training, measures of success for training and transfer of skills to the job after training. (See Appendix 6). The responses from these interviews were used to identify issues that this project could investigate as research objectives for each organisation, which, combined with organisational constraints and practicalities, then formed a framework for the research design for the organisation.

Firstly, this chapter will give a general description, including mission statements, goals and organisational culture of each organisation involved in the study; followed by identification of research objectives and description of the research design particular to each organisation. The next section will identify commonalities and differences between the organisations as related to the study in order to identify replications. Specific research questions will be set out in the next section, followed by the hypotheses to be tested for the study.

4.1.1 Organisation A

Organisation A is a multi-national consulting and accounting firm with branches throughout New Zealand. Internationally it is one of the Big 5 firms and has over 95,000 people working in over 140 offices around the globe. It is the largest consulting practice in New Zealand, employing over 900 people with revenues of $120 million. The mission of the organisation is to help their clients and their staff excel. Exceeding the expectations of clients is an integral part of the culture. Their unique service proposition is about facilitating and encouraging in-depth relationships between staff and clients. The partners are considered to be an integral part of this

relationship, overseeing clients' needs and ensuring that the expertise of their many specialists is employed, tailored and delivered to meet requirements. Local, regional and global resources can be readily accessed to provide a full range of professional services to clients.

The mission expresses the vision for the firm and shared values are fundamental beliefs that provide the firm with its unique and distinctive character. The shared values provide guidance and common principles that influence the way the daily work is approached. They provide flexibility and adaptability, which are necessary to succeed in the current fast-paced, ever-changing business and professional environment. These values are:

- Dedication to Client Service
- Recognition of the Importance of People
- Commitment to Quality
- Sense of Partnership and Teamwork
- Financial Success.

The culture of the organisation can be summarised by the following philosophies that the organisation uses as signals to guide the way they work and interact:

- Recruit and Retain the Best
- Continuously Grow and Improve
- Empower and Trust
- Talk Straight
- Play to Win - Think Globally
- Aim to be the Best
- Praise and Recognition

The organisation combines its expertise in providing accounting, auditing, taxation and management advisory services with an in depth understanding of business sectors that include: utilities, healthcare, retailing, agribusiness, manufacturing, distribution, education, telecommunications and local government. This combination of expertise and business sector understanding enables it to target its responses to meet client needs.

Organisation A has a dedicated learning and development department that has the following mission and vision statements:
Our vision – "To be recognised as a national learning organisation by 2005 which demands and supports self-directed learning to meet client needs and achieve business objectives."
Our mission – "To use learning as a tool to forge growth and improvement in the 2000's."

4.1.1.1 Research Objectives

Organisation A has a well developed strategy embedded in the organisational framework and culture for supporting, facilitating and maximising the results of staff training. Organisational

procedures for training, with comprehensive documentation, support the training function. Training is considered to follow two strands; firstly, technical knowledge to do the job, for example, computer skills, and secondly, shared competencies, for example, national marketing and management. Needs analysis is carried out at national level to identify priorities for training, which is then mapped to competencies' framework. Individual training needs analysis (TNA) is identified by unit managers as part of the process of six-monthly career reviews with individuals; where development needs for the individual's short and long-term career plans are translated into action plans, often resulting in training. Once training has been identified, individuals complete a learning agreement, the purpose of which is "to ensure that the module meets your development needs. It also helps your manager to consider the business requirement for the learning and alerts them to the requirement to support you in the transfer of skills back into the workforce." In consultation with the unit manager individuals set learning objectives and identify expected measurable outcomes of achieving these objectives in the workplace.

Organisation A bases evaluation of training on (Kirkpatrick, 1998) four levels of evaluating training framework. (See Table 4.1). Currently, levels three and four are not formally evaluated; however, conditions necessary for level three and four change to occur are present.
(Kirkpatrick, 1998) identifies the following four conditions:

1. The person must have the desire to change
2. The person must know what to do and how to do it
3. The person must work in the right climate
4. The person must be rewarded for changing

The first two conditions can be accomplished by the training programme. The third and fourth conditions are dependent on the organisation. Organisation A creates a climate that encourages changes in behaviour after training by:

- Ensuring trainees have on the job tasks to perform after training by designing modularised training directly from the TNA.
- Providing informal feedback – individual managers use coaching and reinforcing techniques with trainees
- Providing formal feedback every two months via performance review by the person who delegates to the staff member
- Reviewing achievement of objectives with managers (set out in the learning agreement)
- Providing incentives to support good performance and having zero tolerance for poor performance

In consultation with the training manager and the IT department manager, research objectives for Organisation A were to investigate:

- The impact of trainees' individual characteristics (such as learning styles, attitudes and previous experience) on the level of increased skills after training.

- Whether the method of delivery (small groups and one on one 'at desk' training) impacts the effectiveness of training, considering trainees' characteristics.

KIRKPATRICK'S FOUR LEVELS OF EVALUATION OF TRAINING			
Level	*Name*	*Description*	*Measurement*
One	Reaction	How training participants react to the training	Satisfaction sheet
Two	Learning	Level of participants' changed attitudes, improved knowledge and/or increase in skills as a result of training	Pre and post training learning tests
Three	Behaviour	Extent to which behaviour has changed as a result of training – applying learning to the job	Survey/interview trainees, supervisors, subordinates
Four	Results	The final results that occurred as a result of training	Increased production, sales, quality, profits etc.

Table 4.1 Four Level Evaluation of Training (Kirkpatrick, 1998)

4.1.1.2 Research Design

Organisation A had well-developed TNA processes in place. As outlined by (Nelson et al, 1995), the organisation carries out TNA at the organisational, departmental and individual levels, and training is co-ordinated on this basis.

Using organisational and departmental TNA, the training manager chose the group of trainees to participate in this study and the applications for which they received training. Having identified the trainees to participate in the research project, the content of training and the time available for trainees to spend participating in the research, it was necessary to address the individual TNA for the group which, considering other constraints, led to the training method for the group. A detailed individual TNA was developed by the training manager (Appendix 5), which was subsequently amended slightly and used as TNA, pre and post-training assessment for three of the cases in this research project. The group of trainees consisted of thirteen secretaries from across departments in one office of the organisation. They would receive training on MS Word specifically targeted to meet identified skill gaps. The researcher made a short presentation to the trainees, explaining the research; the trainees' optional involvement, including assurances of their anonymity, and the factors that the research was investigating in order to improve future training.

The researcher and the training manager analysed the results of the TNAs to identify training groups; topics where self-identified skill levels where below level 3 were collated. Where individual needs were not part of a group, they were identified and recorded on an individual profile for training.

The training manager was interested in considering different training approaches and from analysis of previous level one and level two evaluations (as labelled by (Kirkpatrick, 1998)) of training sessions decided that different methods were appropriate in different circumstances. From analysis of the TNAs, the training manager wanted to assign some trainees to small groups to train and others to be trained using a one on one 'at desk' approach. The training manager, in fact promoted the 'at desk' approach as it was considered to be more effective, which is corroborated by findings of (Shayo and Olfman, 1993), who identified using job related examples and giving individualised hands on training in the place of work as important factors in increasing the effectiveness of formal EUT. The training manager for Organisation A proposed the research question:

Do trainees who receive one on one at desk training have higher increase in skill levels than those trained in small groups?

4.1.2 Organisation B

Organisation B has three sites located in three North Island towns and is a national distribution company for an international vehicle manufacturer. The international company was first established in 1937 in Japan and began production outside Japan in 1959, continuing to build a growing network of overseas plants, with the first site opening in New Zealand in 1978. The company has a strong culture of localising its operations to provide customers with the products they need where they need them; this philosophy builds mutually beneficial long-term relationships with local suppliers and helps the company fulfil its commitments to local labour. The company strives to be a responsible corporate citizen building close relationships with people and organisations in the local community and across the world, participating enthusiastically in community activities ranging from the sponsorship of educational and cultural programmes to international exchange and research.

The corporate philosophy of mutual trust and dependence between labour and management is a firm principle, which continues to guide the growth of the company world-wide. Underpinning all operations across the world are production systems based on the principles of Jidoka, Just-in-time and Kaizen, which is considered to be a major factor in the reduction of inventories and defects in the plants of the company and its suppliers. Over and above manufacturing, the company also has a global network of design and 'Research and Development' facilities, embracing the three major car markets of Japan, North America and Europe. The company is one of the world's largest manufacturer of automobiles in unit sales and in net sales, producing more than 4.5 million vehicles per year, equivalent to one every six seconds.

Organisation B imports and wholesales new vehicles sourced from Japan and Australia as well as used vehicles purchased in Japan and certifies them to specific standards at its Vehicle

Operation Centre. Ex-lease vehicles originally sold new in New Zealand are refurbished at the Vehicle Operation Centre and sold on. Car parts and accessories are supplied from Organisation B's distribution centre. In 2001, Organisation B sold 19,579 new and used cars. 168 permanent staff are employed in New Zealand. Ninety-two staff are in administration and seventy-six in production across the sites. Additionally there are a number of contractors with varying degrees of permanence.

Organisation B has the following business objectives to "Meet the motoring needs of New Zealanders with company products and services":

- To assert leadership in Customer Satisfaction to ensure "Customers for Life"
- To provide products and services of superior quality and best overall value
- To play a leading role in New Zealand's vehicle market
- To generate prosperity for the Company's shareholder, staff and dealers
- Foster a corporate culture that values people and honours individuality while promoting teamwork
- Meet the needs of customers in partnership with the company's financial services' section and an independently owned dealer network
- Focus on putting the customer at the centre of the business
- Conduct operations with innovation, efficiency and integrity
- Be a leading contributor to the New Zealand community through different initiatives

4.1.2.1 Research Objectives

Organisation B does not have a dedicated training section or formally identified procedures for EUT. The organisation's IT manager, through informal TNA, identified a need for training in MS Office for administration staff in two sites of the organisation. The researcher was approached to put forward a proposal (the full proposal is in Appendix 9) to the organisation to investigate TNA and effective EUT in order to set up a training framework for the organisation. The perception was that staff currently had a range of competencies, therefore, an individualised program was to be considered. The objective was that skill levels for all staff could be raised by EUT, and, as a result of measuring factors that impact on the effectiveness of that training, a model developed to provide some structure for future training at Organisation B.

The following summarises the proposal and identifies research objectives:

> "The first step is to conduct a training needs analysis. Formal training needs analysis will be conducted on three levels; first organisational, second departmental and thirdly at the individual level. Organisational and departmental analysis will require interviews with appropriate staff (management/supervisory) and possibly some gathering of secondary data (for example, mission statement, goals, departmental targets etc.) Individual training needs analysis will be

conducted on two levels, firstly by trainees identifying their own training needs via a questionnaire that also identifies trainees' perception of their level of skill. Secondly, individual needs analysis can be identified by interviews with trainees, which gathers additional data, from the individual perspective, to the departmental/task analysis (Appendix 7 is the questionnaire template used for trainee interviews).

Results of the training needs analysis will guide the training design. Some areas for consideration are using "key users" as training mentors. This would involve identifying power users in a department, providing them with out-sourced training and supporting them to provide solutions for MSOffice users in their everyday work environment. Another area is using a coaching style training approach with a trainer working one to one with a trainee. Yet another approach could be using web-based training packages with or without an on-line (via e-mail) support person. (Appendix 9)

4.1.2.2 Research Design

The training manager undertook the organisational and departmental TNA and from that identified the trainees and the applications for this project. The first task for the researcher for Organisation B was to conduct an in depth individual TNA of the trainees in order to guide choice of training methods. Organisation B had two groups of trainees at two sites (labelled as Organisation B1 and Organisation B2). Both groups filled in the training assessment form (Appendix 5), adapted from the original developed by Organisation A; additionally, individual interviews were conducted with each trainee to give a deeper understanding of:

- Skills and tasks necessary to carry out their jobs
- Trainees' perceptions of their jobs
- Trainees' preferred method of training

(Appendix 7)

Results of the TNA and interviews were collated, summarised and analysed to identify specific areas of training needs. The interviews provided information additional to that gained from the numerical self-evaluation of skill level alone; for example, certain skills that were not required to perform individual's jobs and how trainees currently received assistance in carrying out tasks were identified.

The training group at organisation B1 consisted of eleven administration workers employed in two departments. For organisation B1, 'key power users' were identified through trainees naming them as assistance givers when the trainee did not know how to perform a necessary job-task. As reported by (Fitzgerald and Cater-Steel, 1995) in a study conducted in an

Australian local Governement, the key users were then directed to out-sourced training sessions to take their skills to a higher level and they were subsequently used to train small groups on skills identified by the individual TNAs.

The training group at organisation B2 consisted of seven managers and supervisors from the Vehicle Operation Centre. For organisation B2, an initial flexible training session, with the idea of getting all trainees to a minimum standard level, was facilitated by the training manager and the researcher. This was proposed to further refine the needs analysis and provide requirements for individuals' training programmes. From this session, it was identified that provision of self-directed training manuals made available to the trainees on the job would facilitate learning and greater productivity in carrying out job-tasks.

4.1.3 Organisation C

Organisation C is a retail and distribution foodstuffs company; a fully owned subsidiary of an international retailing and wholesaling organisation focused on the Asia-Pacific region. At June 1999 the group and its associates operated over 1900 outlets, employed 72,500 people in nine countries and had sales totalling US$6.6 billion in 1998. The group operates supermarkets, convenience stores and drugstores in Hong Kong, Taiwan, Singapore, New Zealand, Indonesia, Malaysia and India.

Organisation C has been in New Zealand for over 70 years. It employs over 9,500 people nation-wide within 96 supermarkets, two meat-processing plants, three warehouse operations and one support office. The focus of the organisation is on delivering the best quality and biggest range of goods in a friendly local store atmosphere. The mission is to make shopping as easy, pleasant and rewarding as possible. Organisation C considers that recognising a need in the market and acting upon that need is what makes the organisation the most innovative and versatile supermarket chain. Key partnerships with other innovators enable them to deliver ahead of the market and they have entered into a number of partnerships with a petrol company, a pharmacy chain and a coffee outlet.

The organisation has an internal mission statement focusing on business goals, the human resource department mission is committed to building organisational capability by supporting a performance driven culture by upgrading talent, supporting growth and reducing costs. The organisation operates a profit sharing scheme, whereby managers receive performance bonuses and profit sharing is allocated to teams of employees. Currently the organisation is trialling individual performance-based profit sharing based on gaining knowledge and skills.

With the growth of and need for employees to have computer skills, organisation C has used and trained employees using their intranet. In March 2000, having upgraded the WAN the year before, organisation C rolled out its corporate intranet. In addition to the challenges faced by

every organisation intent on deploying an intranet, Organisation C faced some very particular issues, specifically:

- How to roll out cost effective training to employees distributed across all stores and other remote locations.
- How to ensure strong take up by a team where close to one third had never used a mouse before.
- How to overcome the constraints of hardware that meant that in the first instance there would be access to the intranet via one terminal only in each store.

The prime question the organisation faced was how to encourage strong take up of its corporate intranet amongst users that cannot use a mouse? The solution was provided by deploying simple online learning applications that run in the intranet browser, one to take the team through the use of the mouse; another for the web browser. In this way the rollout of the intranet could occur simultaneously around the country and ensure that the learning would always be available whenever new team members required it, or as a refresher for those who had already taken the training.

4.1.3.1 Research Objectives

Organisation C's human resource department carry out organisation wide TNA as part of employee development and evaluation. The management information system measures every function broken down into tasks against standards and produces condition reports to identify any gaps in meeting those standards. If gaps are identified staff are immediately directed to using the tools and processes available to meet the required standards. Specific competencies that have levels of indicators are identified for the learning needs analysis process. Team leaders and employees complete a form that produces a development plan, which includes learning needs, goals and time frames for achievement of the goals. An annual learning curriculum is produced for the organisation by collating the data from the individual person implementation plan.

Computer skills are part of the overall TNA. Organisation C has identified a difficulty in providing EUT as often there are only small numbers in the organisation who identify the need for EUT. If numbers requiring EUT are less than five, it is not cost effective to provide classroom based EUT.

The training and leadership program is run twice yearly to train future mangers. Although the program has a requirement for future managers to have computer skills, the intensity of the course and the work-based, hands-on nature of the training has made it difficult to provide effective classroom EUT. The course has the requirement that trainees receive EUT on MS Office products. The training manager has trialed using CD-ROMs and classroom training with a facilitator in the past and had decided to trial a new medium by using web-based self-directed

learning for the 2001 training and leadership group. Justification and advantages of using this medium were:

- computer skills are transferable and can be thought of as personal development, hence using personal time for EUT is justified
- trainees get the benefit of free registration to a web-based training course
- trainees get to choose when they want to study – 24/7 availability
- the training group are geographically dispersed for most of their training time
- it is cost effective for organisation C

The training manager was therefore, very interested in assessing the effectiveness of using this medium. The initial research objectives for organisation C were:

1. Assessing the importance of individuals' learning styles in the effectiveness of on-line learning
2. Assessing the value of self-paced learning versus classroom learning for the leadership and development training group
3. Developing processes to monitor and evaluate the application of learning gained back into the workplace
4. Gaining an understanding of the perceived value for individuals involved
5. Developing appropriate evaluation models that could be used ongoing

4.1.3.2 Research Design

The group of ten trainees at organisation C that participated in this research was on a one-year leadership and development course. This research investigates EUT for the group in MS Office applications. The group was a mixture of new employees and current employees who had been identified through the human resource process and internal recommendation for management training. The training was based at the New Zealand head office of organisation C, which had a training suite that had seminar, class and computer rooms. A lot of training was based in the field and trainees were assigned to branches of organisation C throughout New Zealand as well as attending out-sourced modules and classroom training at the training suite.

The research objectives were narrowed down to fit with time constraints and using instruments common to the other cases in this study. Hence, objective one was expanded to consider the effects of not only learning style but also all the trainee characteristics being measured in this study. Due to lack of measurement of previous classroom EUT, the second objective is outside the scope of this research, however the training manager would have a model to use if training method changed in the future. It was proposed initially that objective three could be measured using (Davis, 1989) Technology Acceptance Model (TAM), however as other cases were not measuring trainees' perceived value, this objective was also outside the scope of this project. As with other cases in this study, the timeframe for this project precluded longitudinal analysis of

transfer of skills from training into the work environment. Despite the constraints, the training manager decided it was appropriate and useful for organisation C to achieve objectives one and five from the original proposed list.

In the first week of training trainees completed all questionnaires and the training assessment form (Appendix 5). The researcher provided trainees with feedback and information about the study via the training manager's e-mail distribution list. Trainees were provided with stamped addressed envelopes to complete the training assessment form again at the end of their training program in order to measure any change in self-assessed skill levels.

4.1.4 Organisation D

Organisation D is a Government department, which is the single largest government department in New Zealand. It administers over $13 billion of transfer payments on behalf of the Crown. It operates within the parameters of a wide range of legislation, related regulations and agreements.

The primary purpose of Organisation D is to assist the greatest number of people (who are eligible) to participate effectively in their services. It offers a complex range of services, which have direct or indirect impact on the lives of about one in three adults and their families in New Zealand.

Organisation D is organised into 13 regions, each managed by a Regional Commissioner, which allows maximum flexibility and local responsiveness to address regional need in a timely and appropriate manner. This regional flexibility is balanced by a national framework for consistency. National strategy is managed from the national office in Wellington. Within each region services are delivered through a network of service centre offices where clients meet face-to-face with staff. Clients are also assisted over the telephone by Customer Service Representatives who are available via the Department's 0800 numbers. Some specialised centres look after particular client groups.

The national office supports regional service delivery through the following national service areas:

- Service Delivery - headed by the National Commissioner who has overall responsibility for services delivered
- Specialist Services - national management for the frontline services
- With the overall goal of enhancing and developing existing organisational capability, the work of Business Development, Communications and Government Relations includes managing relationships with Government, public and other key stakeholders.

- Human Resources provides consultancy on human resources policy, activity and processes, organisational development, training and development and payroll.
- The Finance Group provide financial management services including strategic advice. Property Management sits within this group and is responsible for providing cost-effective accommodation for clients and staff.
- Information Technology is responsible for managing the design, development and maintenance of the information systems which process Organisation D's data. The group ensures information needed to support services is provided in a timely and efficient way.
- Risk, Strategy and Capability provide a risk management framework to assist Organisation D in minimising its risks. This includes an internal audit role to ensure appropriate management and control systems are in place.

Organisation D has a research and evaluation unit, which undertakes work in three main areas:

1. Evaluation and assessment of the Government's policy
2. Monitoring and evaluation of Organisation D's operations and regional activities
3. Provision of research and evaluation advice, training and expertise to Organisation D's regional and local offices

As a part of this work the unit has produced a number of publicly available reports. Strategic policy evaluation work helps the Government and the department decide whether to expand, change or discontinue a policy, initiative or project. Often this evaluation work is in collaboration with other Government agencies. The on-going monitoring of daily operations involves researching the needs and concerns of clients regarding services. The unit also examines the impact and cost effectiveness of programmes and services delivered. This information enables both the Government and Organisation D to determine more effective policies and programmes to adopt. Part of the unit's operational role is also to provide research and evaluation and advice to both Organisation D's national office and regions. This entails some funding of regional evaluations, providing evaluation training, networking with other evaluation agencies and giving guidance on evaluation methods to those conducting their own regionally based projects.

4.1.4.1 Research Objectives

Regional offices of organisation D are made up of 6 - 20 workers under the guidance of a regional team co-ordinator and a team coach, who are responsible to the centre manager. TNA is carried out regionally by the team coach and co-ordinator working together to identify needs for the region.

Organisation D conducts their induction training in a dedicated training environment utilising training centres in central localities. This research project was conducted at one of the training centres. The centres are well equipped with resources and the environment is user friendly.

The mission of the training centres is to increase the competencies of new recruits both in application use (which comprises 70-80% of training content) and standards of best practice within the organisation. Trainees are well informed of the content and expectations of their training and encouraged to fully participate in activities.

Expectations and procedures post-training are clearly communicated to trainees and support is provided for each trainee to practice and improve on skills learnt in the training sessions. Team coaches complete competency matrices for all trainees on their processing and standards of best practice skills that were taught in training sessions.

Employees are supported in identifying career paths via the performance appraisal process and are further encouraged in high performance by achieving targets, that are clearly stated at the beginning of six month periods, in order to receive performance bonus pay. On-going training needs for employees are identified by team coaches to target gaps in skills and the training is tailored to the individual's training need, for example, the training could be one-on-one or in groups at the training centre. Team coaches also can identify high performers and put forward names for leadership.

This research project was conducted at one of the regional training centres to provide information for the training manager to assist in analysing and improving the training operation. The centre trains approximately ninety new recruits to the organisation each year. The training manager considered that any information that would assist in identifying factors that contribute to effective, efficient EUT of software applications would be useful. Hence, the research objective was to investigate if individual trainee characteristics, traits and previous software application experience affect the amount of learning of trainees in the induction training, as measured by the trainee induction record.

4.1.4.2 Research Design

The training that was to be the subject of this research project at organisation D was training fifteen new recruits on a specific in-house application that was essential to their ability to perform their new jobs. The training manager was interested to investigate any factors that could predict the success of the training operation. Trainees from one intake completed questionnaires for this study prior to the two week training commencing. The training assessment form used by Organisation A, B and D (Appendix 5) was not used, as this form was to measure specific MS Office skills. Measure of entry skills was from the computer skills self-evaluation form (Appendix 4), questions 1-5.

Organisation D used a self-assessed skill rating (Induction Training Record) to measure exit skills in seventy tasks that were taught during induction training. The training manager

considered that 95% of new recruits would have no knowledge of the in-house application before training commenced. The questionnaires to measure entry and exit skill levels measured different skills and abilities of the trainees in the use of different software applications (generic categories and the in-house application). These two scales were compared and a new scale computed from the two variables by normalising the scales and subtracting the entry skill assessment from the exit skill assessment. The new figure was represented as a percentage of change compared with the entry score. This was not considered an absolute measure of the learning that occurred due to the training, it was an indicator of change in the trainees' self-assessed skills and provided a measure with which to compare other variables.

Due to the different questionnaires used to measure entry and exit skill levels it was necessary to choose a factor by which to normalise the entry skills level variable. A number of factoring options were considered and justification for the choice of using the actual numbers that were represented by the data was made on the basis that entry skills had a range of 5 – 20 and exit skills had the range 25 – 100, hence multiplying the entry skills by 5 normalised the scales for comparison.

4.2 Intra-organisation comparisons

An advantage of using multiple case study research design is the potential to use replication logic. Replication logic is entirely different to past ideas of multiple case-studies that were considered analogous to multiple respondents in a survey or multiple subjects within an experiment, which is more correctly termed "sampling logic" (Yin, 1994). Replication logic considers that each case is more akin to an experiment, and hence if similar results are obtained from each case, replication has taken place. It is important to select cases that will either provide literal replications (where similar results are predicted), or theoretical replications (where contrasting results are predicted for predictable reasons). The cases in this study were chosen to provide for replications.

4.2.1 Identification of Commonalities and Differences

Organisation A, B and C are all part of multi-national organisations with a presence in New Zealand. All three organisations have as part of their corporate culture a strong emphasis on local involvement in the countries in which they operate. Additionally, organisations A and C have a strong emphasis on the organisation as a learning environment and a commitment to maximising the potential of employees. Although not formally stated as part of the organisation-wide culture, organisation B, due in part to the direction from the training manager, also had a strong commitment to maximising the potential of employees. Organisation D has national policies and procedures in place to monitor and review training effectiveness and efficiency in the organisation.

Organisation A and C conducted formal organisational and departmental TNA as part of the organisation's employee performance analysis. These TNA were not within the scope of this project; however, individual's TNA for organisation A, B and C were included in the project. (Appendix 5). Organisations A, B and C used the same questionnaires to identify training needs, measure skills pre-training and measure skills post-training.

Organisation C and D's participation in this project involved measuring effectiveness of EUT on new recruits, whereas organisation A and B's participation involved upskilling existing employees in identified areas.

Organisation A, B and D were training the Microsoft (MS) Office suite of applications. Due to time constraints organisation A trained only MS Word, organisation B trained mostly (except **two** trainees) MS Excel and organisation D trained MS Word, MS Excel and MS Powerpoint.

Organisations A and B2 consisted of groups of trainees of the same gender. Organisations B1, C and D had training groups of mixed gender.

Organisation A trained existing employees using the in-house trainer in small groups. They all had small group training - groups of anywhere from two to five people usually - one session had seven. Each session was an hour at a time and in each, the focus was on a specific functionality i.e. one whole hour on Word tables, one on mail merging, one on styles, one on graphics etc. The training manager considered this style worked well for the particular group, as it was the best approach for concepts to sink in without being confused with too many other functions.

Organisation B1 used a 'key-user' as a trainer. This person was identified from the individual TNAs as the person most likely to be able to help users when they needed it at work. The person was sent to external training and then trained other users individually and in small groups. Organisation B2 had an initial training session (group of five) and then provided paper-based materials for self-directed learning.

Organisation C had classroom-based learning with the whole group (15 trainees) using an in-house trainer. The EUT was structured into lessons and lasted for 2 weeks.

Organisation D provided registration to an on-line learning programme. The trainees in this training group were free to use the application in their own time for approximately one year. The learning application provided lessons and tests so the trainees could assess their progress through the course. No human facilitator was available.

4.2.2 Replication Propositions

With reference to IS research literature and the above analysis of this study the following propositions are tested. Proposition one provides that organisations with a stronger emphasis on organisational learning and maximising the potential of employees, both in policy statements and in fact, will realise greater efficacy from EUT (Nelson et al, 1995). Organisations A, C and D have formal organisation-wide TNA linked to performance evaluation and rewards for employees. Given that other factors are held constant it is proposed that organisations that have high levels of organisational support will have the greatest increase in skill levels.

The second proposition is that trainees who received training using self-directed learning (organisation B1 and C) will realise greater increases in skill levels. Wade and Power, (1998) consider that on-line training can support a range of educational modes of learning; provide increased learner control, feedback and interactivity; as well as merging distance teaching techniques, videoconferencing and computer presentations. (Allen, 1996) states that high quality multimedia courseware is faster, cheaper (over two to three years) and better than classroom training, due to significant increases in transfer of learning, retention and ability to remember and practice what is learned.

Simon, (2000) conducted a study to determine the effect of learning styles on methods of training and concluded that reflective observation learners (categorised as divergers and assimilators) perform best when the training method was instruction-based classroom training and active experimentation (categorised as accommodators and convergers) performed best using an exploration technique. Hence, the third and fourth propositions are that trainees with diverging and assimilating learning styles will perform best using training method 5 - Classroom structured group instruction and trainees with accommodating and converging learning styles will perform best using training methods 2 - Paper-based self-directed learning and 4 - On-line self directed learning.

Specific research questions that can be tested as hypotheses for this study were identified by conducting a preliminary analysis of data to identify variables that indicate some correlation with the dependent variable and using *Section 1.5* as an overall guide.

4.3 Hypotheses for the Study

The dependent variable of trainee performance is measured as a percentage increase or decrease in performance from the pre-training self-assessment.

The following hypotheses for this study are stated as null hypotheses:

H1 There will be no significant difference in performance due to trainees' age
H2 There will be no significant difference in performance due to trainees' gender

H3 There will be no significant difference in performance due to trainees' qualifications
H4 There will be no significant difference in performance due to time that trainees' have been employed
H5 There will be no significant difference in performance due to trainees' score on the Wonderlic Personnel Test
H6 There will be no significant difference in performance due to trainees' learning style.
H7 There will be no significant difference in performance due to trainees' generic computer skill level pre-training
H8 There will be no significant difference in performance due to trainees' level of computer use pre-training
H9 There will be no significant difference in performance due to trainees' level of self-efficacy
H10 There will be no significant difference in performance due to trainees' expectations of using computers

4.4 Summary

	Org. A	Org. B1	Org. B2	Org. C	Org. D
Trainee Numbers: entry	13	7	11	10	15
Completed data	11	5	5	6	15[1]
Training Group occupations	Secretaries	Managers and supervisors	Administration workers	Trainee managers	Customer service workers
Trainee status	Current employees	Current employees	Current employees	New recruits	New recruits
Applications trained	MS Word	MS Word, Excel, Powerpoint	MS Excel	MS Word, Excel, Powerpoint	In-house
Training Methods	Small groups	Paper-based self directed	Key user	On-line self directed	Classroom
Formal Organisational TNA for group	Yes	No	No	N/A[1]	N/A
Formal Individual TNA for group	Yes	Yes	Yes	No	No
Time available for research questionnaires	1 hour	8 hours	4 hours	Completed in trainees' own time	Administered by trainer

Table 4.2 Summary Data for Cases in the Study

[1] Two Learning Styles questionnaires were invalid but the rest of the data was included in analysis
[1] Planning of courses for new recruits has not been included as formal organisational training needs analysis for this study

Analysis and Results

5.1 Introduction

The first section of this chapter analyses the complete data for the study; results of hypotheses testing using parametric and nonparametric statistical tests is reported. Correlation between variables is statistically examined and analysis of trainees' learning styles is described. Summary of the study analysis considers the hypotheses of the study. The next section provides descriptive analysis of each case, comparisons for each organisation to results for the whole study and with each of the other organisations are made. Propositions of the study are considered in the summary of the case analyses.

The raw data gathered in this project is provided in Appendix 10. Average and standard deviation for each variable by organisation and the increase in skills and percentage increase in skills is calculated and provided in Appendix 11. Count and percentage for the nominal variables is also provided. When formulae have been used to calculate figures (as, for example the increase or decrease in skill levels using the scores from pre- and post-training tests) and when, due to missing data, the result is zero the figures have been removed. The rationale for this is to provide a more robust and valid average and standard deviation for each of the variables for each organisation. Where logical anomalies occur the data has not been removed. For example, where a trainee completed a post-training skill level form and not a pre-training form or vice versa, the actual figure for increase in skills is included in the data, but the percentage increase or decrease has been removed. This has the effect of skewing the average and standard deviation of the actual figures for increase in skills post-training, but not the percentage increase figures of post-training score divided by pre-training score. (For example, see Organisation A, participant reference 770).

A summary of the statistical analyses performed is provided in Table 5.1. Due to the different measurement scales used to gather data, a number of different statistical techniques have been used with reference to statistical textbooks (Sapsford and Jupp, 1996; Siegel, 1956; McClave et al, 1998). Analysis has been performed using both nonparametric and parametric tests using MS Excel and Statistical Package for Social Sciences (SPSS) software. The dependent variable for the study is percent increase in learning, which is an interval measurement.

SUMMARY OF STATISTICAL TESTS USED FOR DATA ANALYSIS			
Independent Variables	**Measurement Scale**	**Statistical Tests**	
		Hypothesis Test	**Correlation**
Gender, qualifications, learning styles	Ordinal	Chi-squared test	Contingency co-efficient C
WPT, Generic entry skills, User expectations, Self-efficacy	Nominal	Kruskal-Wallis H test	Spearman Rank correlation co-efficient
Age, years employed, previous computer use	Interval/Ratio	F test ANOVA	Multiple Regression

Table 5.1 Statistical Tests Used for Data Analysis

5.2 Study Analysis

A total of fifty-six trainees from the four organisations participated in the study. Participants that did not complete post-training self-evaluation forms were removed from the data set that was statistically analysed. Two participants from organisation D did not complete the KLSI correctly but were included to leave forty-two complete data sets in the study. Descriptive statistics of average and standard deviation for each organisation for all variables (except gender and learning style code) are presented in Appendix 12. Average, standard deviation and median are calculated for the full data set; additionally, the coefficient of correlation, the covariance between each variable and the percentage increase in skills is calculated. The count and percentage of the ordinal variables of gender, qualifications and learning styles for all data gathered and the complete data analysed is presented in Table 5.2. All data has been included to illustrate any differences between all data gathered and the data used for analysis.

		All data		***Complete data***	
Code	*Description*	*Count*	*Percentage*	*Count*	Percentage
Gender					
1	Female	31	55%	26	62%
2	Male	25	45%	16	38%
	Total	*56*	*100%*	*42*	*100%*
Qualifications					
1	None	3	5%	2	5%
2	School	18	32%	14	33%
3	Diploma/Certificate	25	45%	19	45%
4	Undergraduate degree	8	14%	5	12%
5	Postgraduate degree	2	4%	2	5%
	Total	*56*	*100%*	*42*	*100%*
Learning Style					
1	Accommodating	14	27%	9	22%
2	Diverging	10	19%	7	18%
3	Assimilating	18	35%	15	38%
4	Converging	10	19%	9	22%
	Total	*52*	*100%*	*40*	*100%*

Table 5.2 Count and Percentage of Gender, Qualifications and Learning Styles.

5.2.1 Hypotheses Testing

The following hypotheses, expressed in the null format, will be statistically tested with the α level is set at .10:

H1 There will be no significant difference in performance due to trainee's age

H2 There will be no significant difference in performance due to trainee's gender

H3 There will be no significant difference in performance due to trainee's qualifications

H4 There will be no significant difference in performance due to time that trainees have been employed

H5 There will be no significant difference in performance due to trainee's score on the Wonderlic Personnel Test

H6 There will be no significant difference in performance due to trainee's learning style.

H7 There will be no significant difference in performance due to trainee's generic computer skill level pre-training

H8 There will be no significant difference in performance due to trainee's level of computer use pre-training

H9 There will be no significant difference in performance due to trainee's level of self-efficacy

H10 There will be no significant difference in performance due to trainee's expectations of using computers

The initial analysis consisted of categorising all variables and building a frequency table in order to calculate expected values and run the chi-squared test (χ^2 test). Table 5.3 shows frequency data for demographic variables and learning styles as categorised in the original questionnaires. Categories for age and percentage increase in skills have been arbitrarily set to illustrate the data range. Five categories of percent increase in skills have also been arbitrarily set considering the range from reported decrease in skills of 13% to increase of 200% to show as much detail as possible.

FREQUENCY TABLE OF DEMOGRAPHIC VARIABLES AND LEARNING STYLES TO INCREASE IN SKILLS

	% Increase skills post-training						
	< 0	*1-20*	*21-50*	*51-100*	*100+*	*%*	*Totals*
Percent	*10%*	*36%*	*36%*	*10%*	*10%*		
Gender							
F	2	11	9	2	2	*62%*	*26*
M	2	4	6	2	2	*38%*	*16*
Total	*4*	*15*	*15*	*4*	*4*		*42*
Age							
20-30	3	8	6	0	2	*45%*	*19*
31-40	0	3	4	2	2	*26%*	*11*
41+	1	4	5	2	0	*29%*	*12*
Total	*4*	*15*	*15*	*4*	*4*		*42*
Qualifications							
None	0	1	0	0	1	*5%*	*2*
School	1	4	6	2	1	*33%*	*14*
Diploma/Cert	2	7	6	2	2	*45%*	*19*
Undgrad degree	1	3	1	0	0	*12%*	*5*
Postgrad degree	0	0	2	0	0	*5%*	*2*
Total	*4*	*15*	*15*	*4*	*4*		*42*
Learning Styles							
Accommodating	1	5	2	1	0	*23%*	*9*
Diverging	1	1	3	1	1	*18%*	*7*
Assimilating	1	6	4	1	3	*38%*	*15*
Converging	1	2	5	1	0	*23%*	*9*
Total	*4*	*14*	*14*	*4*	*4*		*40*

Note: 2 invalid learning style questionnaires

Table 5.3 Frequency Data for Demographic Variables

5.2.1.1 Chi-Squared Test

The chi-squared test is an appropriate non-parametric test for the significance of difference between two independent samples when the data is at least in nominal scales (Siegel, 1956). It establishes whether two variables in a contingency table are independent of each other, by comparing the actual observed frequencies and the frequencies that would be expected if the null hypotheses were true (Sapsford and Jupp, 1996). The χ^2 value is calculated by summing for each cell in the table:

$$\frac{(\text{Observed value} - \text{Expected value})^2}{\text{Expected value}}$$

The resulting value of χ^2 is analysed for significance by determining the sampling distribution using degrees of freedom (*df*) for the table by calculating: (number of rows – 1) (number of columns – 1). If the calculated χ^2 value is equal to or greater than the value set in an χ^2 table for the calculated *df* at a pre-set level of significance (p value), then the null hypothesis may be rejected, that is there is a level of dependence among the variables.

Cautions about the inferences to be drawn from using contingency table χ^2 values include:

- the χ^2 test will not be meaningful when *df* >1 if more than 20% of cells in the table have expected frequencies of less than 5 and no cell may have an expected frequency of less than 1(Siegel, 1956).
- An expected count of at least five means that the χ^2 probability distribution can be used to determine an approximate critical value (McClave et al, 1998).
- Avoid inferring causality between classifications even if the χ^2 value does exceed the critical value of χ^2 for the *df*, as statistical dependence does not imply causality (McClave et al, 1998).

In order to meet the criteria of expected values in each cell to be at least 5 and with consideration of the data presented in Table 5.3, categories for increase in skills were arbitrarily chosen considering the range of data from decrease in skills of 13% to increase in skills of 200%. Increased skill categories were combined down to two categories of less than 25% increase in skills and greater than 25% increase.

Independent variable categories (initially with the exception of learning styles) were combined to create binary variables. Where variables did not fall naturally into one of two categories; for example, age, years employed, Wonderlic Personnel Test score etc. the average of the variable was used as the criteria to create two categories of greater or lesser than the average. Highest qualification was combined to secondary and tertiary qualifications.

By keeping the four categories of learning styles as identified by (Kolb, 1993) of accommodating, diverging, assimilating and converging in the frequency table built in order to perform the χ^2 test, expected frequencies do not meet the criteria as set down by Siegel, (1956). Additionally, it can be seen from Figure 5.1 that the spread of respondents in this study regarding learning styles is not strongly directional i.e. there is a preponderance of results clustered around the axes of the graph. Hence, the categories were further summarised to diverging or assimilating (representing a more theoretical perspective in the learner) and converging or accommodating (representing a more active learning style). According to (DeGeus, 1988), the diverging style has the opposite strengths to the converging style and the accommodating style has the opposite strengths to the assimilating learning style. However, although combining the styles created expected values that did not violate the less than 5 rule the p value calculation showed a greater level of independence. (See Table 5.4 and 5.5).

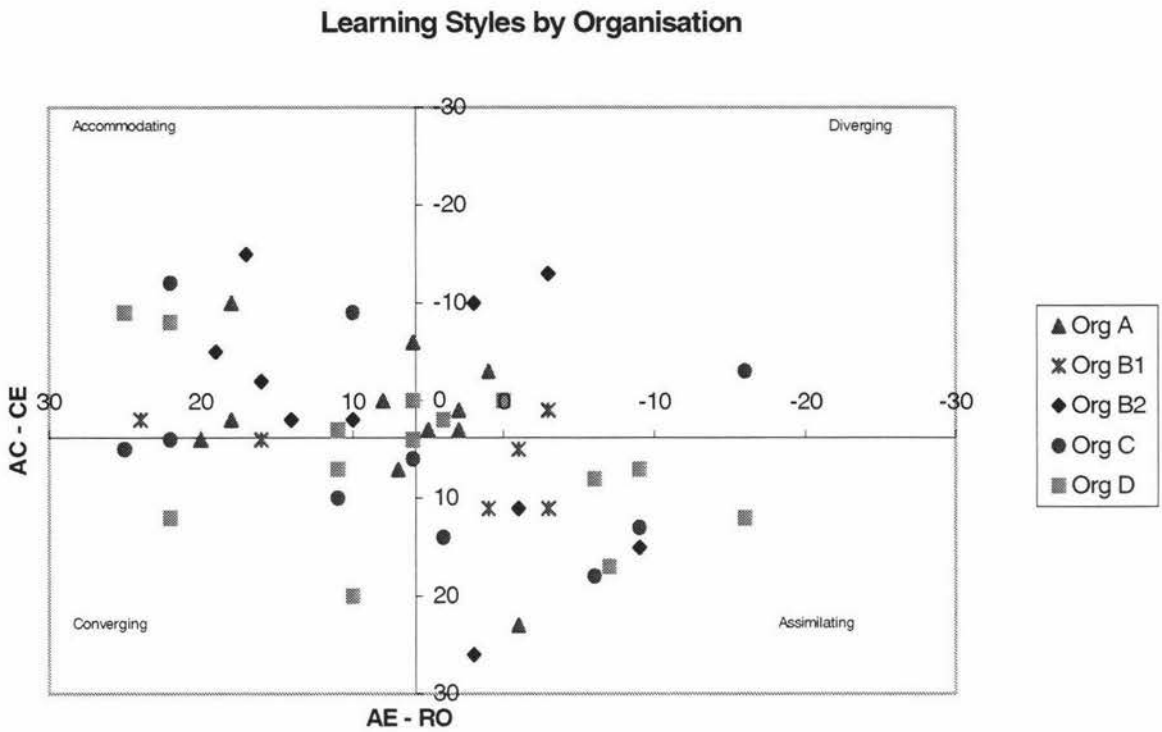

Figure 5.1 Learning Style Categories by Organisation

Due to the fact that gender, qualifications and learning styles are nominal variables, the most appropriate test for the hypotheses H2, H3 and H6 is the chi-square:

Although the chi-square test may be used to test ordinal variables for independence, information about the data can be lost because χ^2 only identifies that an association exists and does not identify the type or strength of the association (Sapsford and Jupp, 1996). To provide as many indicators as possible and comparisons of analysis between the variables, all variables were included in the chi-squared test.

Table 5.4 shows the results of performing the Chi-square test on all the quantitative variables using the MS Excel chi square function, which calculates the probability under the null hypothesis that the calculated χ^2 value for that variable is greater than the chi square with 2 *df* at the set level of significance (.10). These values are reported for each of the categories in the shaded squares labelled "Chi square Test" in the table. With the α level set at .10 the only variables that show a probability under the null hypotheses that the calculated χ^2 value for that variable is greater than the chi square with 2 *df* (labelled as p beside each variable reported) are generic computer skills (p = .05), previous computer use (p = .07) and self-efficacy (p = .01). This indicates that these three variables are not independent of increase in skills, and hence the

null hypotheses H7, H8 and H9 could be rejected. The large values of age (p = .76), gender (p = .63), years employed (p = .55) and Wonderlic personnel test (WPT) scores (p = .98) indicate that those four variables are completely independent of increase in skills causing the acceptance of the null hypotheses H1, H2 and H5. Qualifications (p = .26), learning styles (p = .32 from Table 5.5), and user expectations (p = .32) are less extreme; however, by only using chi-square to test the null hypotheses for H3, H4, H6 and H10 would be accepted when p < = .10.

Therefore, the chi-squared test for the nominal variables of gender, qualifications and learning styles would result in acceptance of the null hypotheses that these variables have no significant effect on increase in learning post-training.

CONTINGENCY TABLE OF VARIABLES TO INCREASE IN SKILLS

		Percent	***<25%*** *Expected*	***>=25%*** *Expected*	***<25%*** *55% Observed*	***>=25%*** *45% Observed*	*Totals*	*%*
H1	**Age**							
	<35		11.5	9.5	12	9	*21*	*50%*
	>=35		11.5	9.5	11	10	*21*	*50%*
	Total		*23*	*19*	*23*	*19*	*42*	
	Chi-square Test	*0.76*						
H2	**Gender**							
	F		14.24	11.76	15	11	*26*	*62%*
	M		8.76	7.24	8	8	*16*	*38%*
	Total		*23*	*19*	*23*	*19*	*42*	
	Chi-square Test	*0.63*						
H3	**Qualifications**							
	Secondary		8.76	7.24	7	9	*16*	*38%*
	Tertiary		14.24	11.76	16	10	*26*	*62%*
	Total		*23*	*19*	*23*	*19*	*42*	
	Chi-square Test	*0.26*						
H4	**Years Employed**							
	<=15		12.05	9.95	13	9	*22*	*52%*
	>15		10.95	9.05	10	10	*20*	*48%*
	Total		*23*	*19*	*23*	*19*	*42*	
	Chi-square Test	*0.55*						
H5	**Wonderlic Test**							
	<=22		10.95	9.05	11	9	*20*	*48%*
	>22		12.05	9.95	12	10	*22*	*52%*
	Total		*23*	*19*	*23*	*19*	*42*	
	Chi-square Test	*0.98*						

H6	**Learning Styles**						
	Accommodating	4.73	4.28	7	2	*9*	*23%*
	Diverging	3.68	3.33	2	5	*7*	*18%*
	Assimilating	7.88	7.13	8	7	*15*	*38%*
	Converging	4.73	4.28	4	5	*9*	*23%*
	Total	*21*	*19*	*21*	*19*	*40*	
	Chi-square Test *0.25*						
H7	**Gen. Comp skills**						
	<=14	13.14	10.86	10	14	*24*	*57%*
	>14	9.86	8.14	13	5	*18*	*43%*
	Total	*23*	*19*	*23*	*19*	*42*	
	Chi-square Test *0.05*						
H8	**Computer Use**						
	<=25 hrs/week	10.95	9.05	8	12	*20*	*48%*
	>25 hrs/week	12.05	9.95	15	7	*22*	*52%*
	Total	*23*	*19*	*23*	*19*	*42*	
	Chi-square Test *0.07*						
H9	**Self-efficacy**						
	<=26	12.05	9.95	8	14	*22*	*52%*
	>26	10.95	9.05	15	5	*20*	*48%*
	Total	*23*	*19*	*23*	*19*	*42*	
	Chi-square Test *0.01*						
H10	**User Expectations**						
	<=38	12.60	10.40	11	12	*23*	*55%*
	>38	10.40	8.60	12	7	*19*	*45%*
	Total	*23*	*19*	*23*	*19*	*42*	
	Chi-square Test *0.32*						

Table 5.4 Contingency Table and Chi-square Probabilities of Variables to Increased Skills

CONTINGENCY TABLE FOR COMBINED CATEGORIES OF LEARNING STYLES

	<25	***>=25***	***<25***	***>=25***		
	Expected	*Expected*	*Observed*	*Observed*	*Totals*	*%*
Accommodating and Converging	9.45	8.55	11	7	*18*	*45%*
Diverging and Assimilating	11.55	10.45	10	12	*22*	*55%*
Total	*21*	*19*	*21*	*19*	*40*	
Chi-square Test *0.32*						

Table 5.5 Chi-square probabilities for Combined Categories of Learning Styles

5.2.1.2 Kruskal-Wallis H-Test

The Kruskal-Wallis H-Test is a nonparametric test to test the null hypothesis that the samples come from the same population, or identical populations with respect to averages, when the variables are at least ordinal. "The Kruskal-Wallis test has asymptotic efficiency of 95.5 percent when the assumptions associated with the statistical model of the F test are met." (p. 193: Siegel, 1956). The assumptions associated with the F test are:

- The observations must be independent and drawn from a normally distributed population
- The observations must have the same variance
- The variables must be measured on at least a linear scale
- The means of the populations must be additive

These assumptions are elements of the parametric statistical model, however when using the nonparametric model, it is important to use the most powerful test that is appropriate for the measurement level (Pervan and Klass, 1992; Siegel, 1956).

The implication of power efficiency of a test, is that when there are fewer or weaker assumptions under a statistical model the conclusions are more general but the null hypothesis test is weaker, hence risking a type 1 or 2 error. When comparing two statistical tests the percentage power efficiency of the weaker test states the amount of increase in sample size (N) needed to equate the power of the two tests. Hence, using the Kruskal-Wallis H-Test would require an N = 9.5 for N = 10 using the F test.

SPSS was used to apply the Kruskal-Wallis test to the ordinal, interval and ratio variables to test hypotheses 1,4,5,7,8,9 and 10. Table 5.6 shows the output of this analysis. With α = .10, as with the chi-test generic computer skills (p = .07) and previous computer use (p = .08) results would reject the null hypotheses. Additionally, the result would indicate that the null hypothesis should be rejected for user expectations (p = .03). Contrary to the chi-square test results, self-efficacy (p = .30) is above the set α level and the null hypothesis would be accepted. The WPT (p = .38) significance level is high as with the chi-test results. Age (p = .13) and years employed (p = .13) fall just outside the significance level.

Comparison with the chi-test is illustrative only due to the fact that categories for increase in skills set by SPSS when performing the Kruskal-Wallis differ from the categories used for the chi-square test. (Chi-square used under and over 25% increase in skills and Kruskal-Wallis used <0, 1-99, 100-199 and >200).

Therefore, the null hypotheses 7 and 8, stating that generic computer skills and previous computer use have no significant effect on increase in skills, can be rejected with confidence at the α = .10 level. Less confidence can be placed in rejecting H9 and H10 stating that self-

efficacy and user expectations have no significant effect on increase in skills, although there is an indication.

KRUSKAL-WALLIS 1-WAY ANOVA

Variables by % Change in Skills						
AGE	**Mean Rank**	**Cases**		**Chi-Square**	**D.F**	**Significance**
	8.83	3	PERC_CHG = -1	5.5021	3	.1385
	23.20	35	PERC_CHG = 0			
	12.83	3	PERC_CHG = 1			
	26.00	1	PERC_CHG = 2			
	Total	42		Corrected for ties		
				5.5186	3	.1375
YRS_EMP						
	12.00	3	PERC_CHG = -1	5.5412	3	.1362
	23.34	35	PERC_CHG = 0			
	9.33	3	PERC_CHG = 1			
	22.00	1	PERC_CHG = 2			
	Total	42		Corrected for ties		
				5.5695	3	.1345
WPT_SCO						
	24.00	3	PERC_CHG = -1	3.0199	3	.3886
	22.00	35	PERC_CHG = 0			
	20.00	3	PERC_CHG = 1			
	1.00	1	PERC_CHG = 2			
	Total	42		Corrected for ties		
				3.0481	3	.3843
COMP_SKL						
	27.67	3	PERC_CHG = -1	6.8198	3	.0779
	22.64	35	PERC_CHG = 0			
	7.83	3	PERC_CHG = 1			
	4	1	PERC_CHG = 2			
	Total	42		Corrected for ties		
				6.9009	3	.0751
COMP_USE						
	34.83	3	PERC_CHG = -1	6.5301	3	.0885
	21.56	35	PERC_CHG = 0			
	10.17	3	PERC_CHG = 1			
	13.50	1	PERC_CHG = 2			
	Total	42		Corrected for ties		
				6.594	3	.0860
SELF_EFF						
	25.17	3	PERC_CHG = -1	3.5716	3	.3116
	22.29	35	PERC_CHG = 0			
	14.83	3	PERC_CHG = 1			
	3.00	1	PERC_CHG = 2			
	Total	42		Corrected for ties		
				3.5917	3	.3091
US_EXPEC						
	7.83	3	PERC_CHG = -1	8.6170	3	.0348
	23.83	35	PERC_CHG = 0			
	8.00	3	PERC_CHG = 1			
	21.50	1	PERC_CHG = 2			
	Total	42		Corrected for ties		
				8.6832	3	.0338

Table 5.6 The Kruskal-Wallis Test of at Least Ordinal Variables

5.2.1.3 One Way ANOVA and F-Test

When measurement levels are at least interval parametric tests should be used, as non-parametric tests usually do not take advantage of all the information contained in the data (Siegel, 1956). Z and t tests are useful for examining single significance differences; however, when a whole set of differences are to be examined for hypothesis testing, the F test is more appropriate. The F statistic represents the total variance of the data by calculating the ratio of the variances between the samples and the variances within the samples.

Variables in this study identified as ordinal in Table 5.1, are not truly interval in the fact that the intervals between the numbers do not necessarily have the same significance. For example, on the WPT or self-efficacy scales: the difference between total scores of 10 and 20 (being 10) is not the same as the difference between scores of 20 and 30 (also being 10) Additionally, the scores are manipulated in that a number of questions with numbers assigned to them are added for each respondent to make up the total score for the trainee. However, it can be argued that these variables can be treated as interval for analysis due to the fact that they are numeric and can have arithmetical operations performed on them. Hence, they have been included in the one way ANOVA and F test, to provide additional information.

Table 5.7 shows the output from SPSS, the column F Prob. indicates the probability of obtaining an F value at least as large as the value calculated for that variable just by chance. The calculated F values show the probability of the null hypothesis, i.e. that there is no difference in the means of the populations from which the samples are drawn, is due to chance.

F probability values larger than the set $\alpha = .10$ would suggest that the null hypotheses should be accepted for all hypotheses except H7 - previous computer skills with an F probability of .03. However, considering the previous analysis in this study H4, H5, H8, H9 and H10 are between .22 and .10 and do not clearly indicate that the null hypotheses should be accepted. On the other hand H1, H2, H3 and H6 show probabilities over .45 and probably indicate that the null hypotheses for these variables should be accepted.

ONE WAY ANALYSIS OF VARIANCE

ALL By Variable PERC_CHG

Variable AGE

Source	D.F.	Sum of Squares (SS)	Mean Squares (MS)	F Ratio	F Prob.
Between Groups	2	142.4048	71.2024	.6904	.5074
Within Groups	39	4022.0000	103.1282		
Total	41	4164.4048			

Variable COMP_SKL

Source	D.F.	SS	MS	F Ratio	F Prob
Between Groups	2	59.6078	29.8039	3.5113	.0396
Within Groups	39	331.0351	8.4881		
Total	41	390.6429			

Variable COMP_USE

Source	D.F.	SS	MS	F Ratio	F Prob
Between Groups	2	774.2679	387.1339	1.6549	.2043
Within Groups	39	9123.3750	233.9327		
Total	41	9897.6429			

Variable EDUCATIO

Source	D.F.	SS	MS	F Ratio	F Prob
Between Groups	2	.6942	.3471	.4181	.6612
Within Groups	39	32.3772	.8302		
Total	41	33.0714			

Variable GENDER

Source	D.F.	SS	MS	F Ratio	F Prob
Between Groups	2	.3960	.1980	.8121	.4513
Within Groups	39	9.5088	.2438		
Total	41	9.9048			

Variable LE_STYLE

Source	D.F.	SS	MS	F Ratio	F Prob
Between Groups	2	.1833	.0917	.0747	.9282
Within Groups	37	45.4167	1.2275		
Total	39	45.6000			

Variable SELF_EFF

Source	D.F.	SS	MS	F Ratio	F Prob
Between Groups	2	188.7306	94.3653	2.2014	.1242
Within Groups	39	1671.7456	42.8653		
Total	41	1860.4762			

Variable US_EXPEC

Source	D.F.	SS	MS	F Ratio	F Prob
Between Groups	2	129.9236	64.9618	1.5739	.2201
Within Groups	39	1609.7193	41.2749		
Total	41	1739.6429			

Variable WPT_SCO

Source	D.F.	SS	MS	F Ratio	F Prob
Between Groups	2	82.3083	41.1541	2.0557	.1416
Within Groups	39	780.7632	20.0196		
Total	41	863.0714			

Variable YRS_EMP

Source	D.F.	SS	MS	F Ratio	F Prob
Between Groups	2	354.9674	177.4837	1.5509	.2248
Within Groups	39	4463.0088	114.4361		
Total	41	4817.9762			

Table 5.7 One Way ANOVA and F values of all variables

5.2.2 Correlation Testing

Despite being unable to clearly reject the null hypotheses for a number of variables from the statistical methods used in the previous section, it is interesting to analyse any relationships that may appear between the variables and increased skills after training. As stated, this study is not a true experiment and statistical methods are used as indicators of situations, as opposed to statistically rigorous predictors.

5.2.2.1 Contingency Coefficient C

The contingency co-efficient is a measure of the extent of the association between two sets of attributes. It is uniquely useful when data is nominal, as it does not require either sets of data to be continuous or ordered in any way. It is calculated by finding the square root of (χ^2 divided by $N + \chi^2$). When χ^2 has shown that there is a level of association in the data, C measures the significance of the association. Although when there is a complete lack of association between variables, the C value will equal zero, the limitation of using C as a correlation coefficient is that C is dependent for its upper limit on the number of categories in the table. Hence, two contingency coefficients can not be compared unless they come from contingency tables of the same size. Additionally, C is not directly comparable to other measures of correlation. Because of these limitations, C is not very powerful in detecting a relation in a population. However, C is a useful measure of association due to its wide applicability – it makes no assumptions about the shape of the population of scores, it requires only nominal measurement levels and does not require continuity in the variables to be analysed (Siegel, 1956). The calculated values of C for each variable are presented in Table 5.8.

C COEFFICIENTS FOR EACH VARIABLE

	Variable	*Chi-test*	χ^2	*C coefficient*
H1	Age	0.76	0.10	0.05
H2	Gender	0.63	0.24	0.07
H3	Qualifications	0.26	1.27	0.17
H4	Years Employed	0.55	0.35	0.09
H5	Wonderlic Test	0.98	0.00	0.00
H6	Learning Styles (4 categories)	0.25	4.15	0.31
H6	Learning Styles (2 categories)	0.32	0.97	0.15
H7	Gen. comp skills	0.05	3.88	0.29
H8	Computer Use	0.07	3.36	0.27
H9	Self-efficacy	0.01	6.31	0.36
H10	User Expectations	0.32	0.99	0.15

Table 5.8 Calculated C Coefficients for Variables

The C value for each variable can be compared, when using the two-category value for learning styles as all the tables are of the same size (they are 2 X 2 tables). The upper limit of C values of a 2 X 2 table is .707. For the variables of generic computer skills, computer use and self-efficacy where the Chi test indicated that the null hypotheses should be rejected the C value indicates the amount of association (.29, .27 and .36 respectively). The nominal variables of gender, qualifications and learning styles indicate a relatively low level of correlation at .07, .17 and .15 respectively.

5.2.2.2 Spearman's Rank Correlation Coefficient

Spearman's Rank coefficient (r_s) requires all variables to be measured on at least ordinal scale. The range of values of r_s is from –1 to +1, with the values representing perfect negative and positive correlation respectively; a zero value indicates no correlation, therefore, the closer the r_s value is to 0 the weaker the correlation. SPSS was used to produce Table 5.9, where each variable of at least ordinal measurement is correlated with each other variable. Focus is on the correlation of each of the variables with percent change in skills (shaded in the table). From this analysis, only age has a small positive correlation, suggesting that for all other variables a higher independent variable score relates to lower increase in skills. For the variables of generic computer skills, previous computer use and self-efficacy, where previous analysis has indicated that the null hypothesis should be rejected, the direction of the variables is provided. Conclusions can then be that lower levels of those three variables are associated with higher increase in skills. User expectations, as with previous tests shows some level of negative correlation (-.12), however the p value is larger than .10.

SPEARMAN'S RANK COEFFICIENT - 2-TAILED TEST

	AGE N=42	COMP_SK N=42	COMP_USE N=42	PERC_CH N=42	SELF_EFF N=42	US_EXPEC N=42	WPT_SCO N=42	YRS_EMP N=42
AGE	1.0000 P=.	-0.2103 P=.181	-0.0873 P=.583	0.0358 P=.822	-0.1076 P=.497	0.1821 P=.248	-0.0797 P=.616	0.8909 P=.000
COMP_SK	-.2103 P=.181	1.0000 P=.	0.4967 P=.001	-0.4636 P=.002	0.5646 P=.000	0.2703 P=.083	0.0236 P=.882	-0.2279 P=.147
COMP_US	-.0873 P=.583	0.4967 P=.001	1.0000 P=.	-0.3873 P=.011	0.0957 P=.546	0.0934 P=.557	-0.0812 P=.609	0.0554 P=.727
PERC_CH	.0358 P=.822	-0.4636 P=.002	-0.3873 P=.011	1.0000 P=.	-0.4133 P=.007	-1214 P=.444	-0.0444 P=.780	-0.0489 P=.758
SELF_EFF	-.1076 P=.497	0.5646 P=.000	0.0957 P=.546	-0.4133 P=.007	1.0000 P=.	0.1935 P=.219	0.1399 P=.377	-0.1725 P=.275
US_EXPEC	0.1821 P=.248	0.2703 P=.083	0.0934 P=.557	-1214 P=.444	0.1935 P=.219	1.0000 P=.	0.0831 P=.601	0.2439 P=.120
WPT_SCO	-.0797 P=.616	0.0236 P=.882	-0.0812 P=.609	-0.0444 P=.780	0.1399 P=.377	0.0831 P=.601	1.0000 P=.	-0.1102 P=.487
YRS_EMP	0.8909 P=.000	-0.2279 P=.147	0.0554 P=.727	-0.0489 P=.758	-0.1725 P=.275	0.2439 P=.120	-0.1102 P=.487	1.0000 P=.

P=. When the coefficient can not be calculated

Table 5.9 Spearman Rank Correlation Coefficients

The usefulness of this analysis is that it also shows the correlation among variables, which for the purposes of this study introduces a number of issues as to what impacts indirectly on increase in skills after EUT. For example, considering the variables that have an association with computer skills, computer use and self-efficacy, it can been seen that apart from those

three variables being associated with each other, user expectations is significantly positively associated with computer skills. Some other interesting observations are:

- Years employed are negatively associated with computer skills (p=.14)
- Years employed are positively associated with user expectations (p=.12)
- Age is negatively associated with computer skills (p=.18)
- Age is strongly positively associated with years employed (p= .00) as would be expected

5.2.2.3 Multiple Regression and ANOVA

Multiple analysis of variance and multiple regression are parametric statistical tests that allow the exploration of interaction effects of independent variables on the dependent variable. Generally regression and correlation techniques are for ratio measurement levels, but may be used for interval and sometimes ordinal data. Additionally, a dichotomous variable at the nominal level can also be included; for example, gender may be coded 1 for female and 2 for male. This variable will then act like a ratio variable; if the group has a mean score of 1.67, it is then two-thirds male and one-third female. Multiple regression provides a tool to allow prediction of one variable from a combination of other variables. The variance effect of each variable, ignoring the effects of the other variables, is given by the correlation coefficient r. Multiple regression assesses the total proportion of variance explained by all the variables included in the multiple regression calculation. A set of summary statistics explains the relationship as follows:

- The coefficient of determination (R^2) identifies the proportion of variance explained overall
- The significance of R^2 is tested using the F statistic
- The independent contribution of each variable is estimated by standardising regression coefficients (converting to z scores). The larger the value, the larger the effect of that variable on the dependent variable
- The estimated value is tested for significance using the t-test. If t is not significant the prediction would be as accurate with the variable left out of the equation

(Sapsford and Jupp, 1996)

For example, as identified in Section 5.2.2.2 where variables affect other variables, additional hypotheses can be postulated and stated in the null form:
There will be no significant difference in performance due to the interaction between user expectations and computer skills.

Running a multiple regression analysis in Excel on all variables in the study at least at ordinal level of measurement (including gender as explained above) is presented in Table 5.10.

MULTIPLE REGRESSION – DEPENDENT VARIABLE PERCENT CHANGE IN SKILLS

Regression Statistics	
Multiple R	0.6179605
R Square	0.3818752
Adjusted R Square	0.2320268
Standard Error	0.3645604
Observations	42

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	8	2.70955637	0.33869	2.54841	0.02782846
Residual	33	4.38584087	0.1329		
Total	41	7.09539724			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 90.0%*	**Upper 90.0%**
Intercept	1.7137	0.7044	2.4330	0.0206	0.5217	2.9057
Age	0.0124	0.0134	0.9266	0.3609	-0.0103	0.0352
WPT score	-0.0043	0.0127	-0.3368	0.7384	-0.0258	0.0172
Years employed	-0.0169	0.0132	-1.2774	0.2104	-0.0392	0.0055
Computer skills	-0.0498	0.0307	-1.6219	0.1143	-0.1017	0.0022
User expectations	0.0035	0.0099	0.3532	0.7262	-0.0133	0.0203
Computer use	-0.0050	0.0048	-1.0559	0.2987	-0.0131	0.0030
Self-efficacy	-0.0194	0.0107	-1.8095	0.0795	-0.0375	-0.0013
Gender	-0.1958	0.1397	-1.4013	0.1705	-0.4322	0.0407

Table 5.10 Multiple Regression Analysis to Percent Change in Skills

From this analysis it can be seen that all variables explain 23% (after adjusting for errors) of the variance in the model which is significant at .02 level. Further interpretation identifies the significance of the estimate for the contribution each independent variable makes to the prediction. Only self-efficacy is significant at the α = .10 level, although computer skills is significant to .11.

By removing the two variables with the highest t statistic probabilities (WPT (p = .73) and user expectations (p = .73)) and running the multiple regression again an adjusted R^2 value of 27%, significant at .007 is obtained. Repeating the exercise and removing age (p = .37) and computer use (p = .26) results in an adjusted R^2 value of 25% significant at .005. Removing years employed (p = .20) from this model reduces the R^2 to 24% with a significance of .005, hence leaving generic computer skills, self-efficacy and gender in the model. While only predicting under 30% of the variance is not a strong indicator of the value of the variables as predictors for the dependent variable of increase in skills, it is useful to identify which variables are relevant and which are not.

5.2.3 Learning Styles

Due to the fact that learning styles are a nominal variable and the restrictions that imposes on performing statistical analysis for hypothesis and correlation testing, this section will use descriptive statistics to consider the impact of learning styles on increase in skill levels post-training. The chi-square test did not reject the null hypothesis that learning styles have no significant effect on increase in skills; however, it is useful to consider descriptive analysis. Table 5.11 shows the relative position for each learning style by variables (excluding age and years employed) and Table 5.12 summarises the data by learning styles, using Excel calculations.

	Accommodating	Diverging	Assimilating	Converging
Variable				
Highest qualification	1	3	4	2
WPT Score	3	1	4	2
Generic Skills	1	3	4	2
Computer use	2	1	3	4
User expectations	2	3	4	1
Self-efficacy	2	4	3	1
% Inc in skills	4	2	1	3

1 = highest average value for the variable
5 = lowest average value for the variable

Table 5.11 Position of each Learning Style for Magnitude of Variables' Averages

Accommodating learning style (22.5% of the group) emphasises concrete experience and active experimentation. Problem solving in this style tends to be intuitive trial and error, relying on other people for information rather than analysis. The style is suited to action oriented jobs such as marketing sales or management (DeGeus, 1988). The trainees in this study with accommodating learning style had the most significant (-.63) negative correlation of self-efficacy with increase in skills, indicating that accommodating learning style trainees with low self-efficacy have the greatest increase in skills after EUT. They also had the highest and only positive correlation of age (.39), user expectations (.27) and years employed (.48) with increase in skills.

Diverging learning style (17.5% of the group) emphasises concrete experience and reflective observation. The emphasis of this style is on adaptation by observation rather than action with an imaginative ability and awareness of meaning and values. People with diverging learning style tend to be feeling oriented and to specialise in liberal arts and humanities (DeGeus, 1988). The only significant correlation with increase in skills from the diverging group was WPT score (.55); additionally this group had the highest average WPT score. This suggests that for

trainees with diverging learning style higher WPT scores correlate with higher increase in skills. Correlations of all other variables were negative.

The largest learning style group was assimilating (37.5%), which emphasises abstract conceptualisation and reflective observation. Assimilating learning style is characterised by inductive reasoning, the ability to create theoretical models and in assimilating disparate observations into an integrated explanation. People with assimilating learning style are suited to basic sciences and mathematics and in organisations tend to work in research (DeGeus, 1988). The assimilating group had negative correlation between generic computer skills (-.50) and computer use (-.51) with increase in skills. This suggests that trainees with assimilating learning styles would gain greater benefit from EUT if they have previous computer skills and use.

Converging learning style (22.5% of the group) relies primarily on abstract conceptualisation and active experimentation. Problem solving, decision making and practical application of ideas are the strengths of this style. People in this category tend to do better in conventional intelligence tests where there is a single correct answer, as knowledge is organised through hypothetical-deductive reasoning to focus on specific problems. People with converging learning styles prefer technical tasks and are suited to jobs in physical sciences and engineering (DeGeus, 1988). Trainees with converging styles had four variables with significant correlation to increase in skills. WPT (.60) score was positively correlated and generic skills (-.50), computer use (-.89) and self-efficacy (-.51) were negatively correlated. This suggests that trainees with converging learning styles would, like the assimilating learning style, gain greater benefit from EUT if they have previous computer skills and use. Additionally, as for the diverging style, higher WPT scores correlate with higher increase in skills. Similar to the accommodating style (although less significant), trainees with low self-efficacy have the greatest increase in skills after EUT.

COMPARISON OF DESCRIPTIVE STATISTICS BETWEEN LEARNING STYLES

	Accommodating					Diverging				
Variables	*Ave*	*Stddev*	*Median*	*Range*	*Correlation to % inc*	*Ave*	*Stddev*	*Median*	*Range*	*Correlation to % inc*
Age	36	12.66	35	36	0.39	33.57	8.73	32	23	-0.09
High qual	3.11	0.60	3	2	-0.06	2.71	1.11	2	3	-0.25
Yrs empld	14.89	12.95	10	37	0.48	13.79	7.98	17	19	-0.27
WPT score	22.44	4.56	23	12	0.37	25.00	4.73	27	13	0.55
Generic skills	14.83	3.26	14.5	11	-0.34	13.57	3.91	15	12	-0.37
Computer use	28.83	16.16	35	49.5	-0.04	29.00	16.84	30	45	-0.34
User expectns	38.22	4.63	38	17	0.27	36.86	1.77	37	5	-0.13
Self-efficacy	26.33	6.18	25	22	-0.63	21.00	8.25	24	21	-0.29
% inc/dec	0.20	0.27	0.14	0.98		0.40	0.43	0	1	

	Converging					Assimilating				
	Ave	*Std. Dev*	*Median*	*Range*	*Correlation to % inc*	*Ave*	*Std. Dev*	*Median*	*Range*	*Correlation to % inc*
Age	34.00	9.37	34	29	-0.32	36.20	9.68	37	28	-0.05
High qual	3.00	1.00	3	3	0.38	2.53	0.92	3	3	0.00
Yrs empld	14.61	11.65	17	37	-0.24	16.87	10.96	15	32	-0.23
WPT score	23.11	3.44	23	11	0.60	21.87	5.13	20	17	-0.39
Generic skills	14.72	1.20	14	4	-0.50	12.53	3.09	11	10	-0.50
Computer use	19.67	11.49	20	37	-0.89	24.17	17.62	30	49	-0.51
User expectns	42.78	4.58	42	14	-0.27	36.13	8.25	36	29	-0.05
Self-efficacy	29.78	5.45	30	17	-0.51	25.00	6.20	25	20	-0.41
% inc/dec	0.27	0.20	0	1		0.48	0.57	0	2	

Table 5.12 Descriptive Statistics of Learning Styles

5.2.4 Summary of Study Analysis

Statistical support to reject the null hypotheses with $\alpha = .10$ for the study can only be shown for the following variables:

H7 There will be no significant difference in performance due to trainees' generic computer skill level pre-training (Chi test, Kruskal-Wallis H test, F test)

H8 There will be no significant difference in performance due to trainees' level of computer use pre-training (Chi test, Kruskal-Wallis H test)

H9 There will be no significant difference in performance due to trainees' level of self-efficacy (Chi test)

H10 There will be no significant difference in performance due to trainees' expectations of using computers (Kruskal-Wallis H test)

If a higher level of probability of a type 1 error can be accepted and the level is set $\alpha = .20$ the following null hypotheses could additionally be rejected:

H1 There will be no significant difference in performance due to trainees' age (Kruskal-Wallis)

H4 There will be no significant difference in performance due to time that trainees' have been employed (Kruskal-Wallis)

H5 There will be no significant difference in performance due to trainees' score on the Wonderlic Personnel Test (F test)

Hence, the following null hypotheses would be accepted:

H2 There will be no significant difference in performance due to trainees' gender

H3 There will be no significant difference in performance due to trainees' qualifications

Results of statistical correlation analysis of the independent variables was provided using the C coefficient for at least nominal data, Spearman's rank coefficient for at least ordinal data and multiple regression of analysis for data that could be expressed on at least interval scales.

Considering the upper limit of the C coefficient in a 2 x 2 table is .707, significant correlation can be considered above .35. The C coefficient indicates that self-efficacy is significantly related to increase in skills (.36). Less significant relationships are generic computer skills and computer use.

The Spearman rank coefficient test provided that all variables, apart from age, are negatively related to percent increase in skills, suggesting that a higher variable score relates to lower increase in skills. Multiple regression analysis showed that age, years employed, computer skills, computer use, self-efficacy and gender explained 27% of the variance in the model to predict increase in skills.

Analysis of percent increase in skills showed that assimilating learning styles had the highest average percent increase in skills, followed by diverging, converging and accommodating having the lowest percent increase in skills. Summary of analysis of the significant correlations of variables to percent increase in skills by learning styles is provided in Table 5.12.

Significant level of correlation with % inc skills Learning Style	WPT	Generic skill	Comp use	Self-efficacy
Accommodating				-.63
Diverging	.55			
Assimilating	.60	-.50	-.89	-.51
Converging		-.50	-.51	

Table 5.13 Significant Correlations of Variables to Percent Increase in Skills by Learning Styles

5.3 Case Analyses

Breakdowns of the total amount of complete data returned from each organisation is provided in Table 4.2 (p. 95). Due to the small sample sizes (N), the analysis for each organisation will provide descriptive and comparative information. Comparisons will be made between organisations and to the study as the unit of analysis. Excel was used to provide descriptive statistics of average, standard deviation, median, range and correlation of each variable to both the actual increase in scores and percent increase (See Table 5.14). This section will firstly discuss the quantitative and qualitative variables measured and then discuss each organisation in more detail. The format for individual organisational analysis will follow the form of:

- Discussion of level of training needs analysis (TNA)
- Description of training method
- Comparison of relative position for that organisation on averages of variables for all organisations individually (from Tables 5.14 and 5.15)
- Analysis of correlations of variables for that organisation to the dependent variable of % increase in skills (Table 5.14)
- Description and analysis of the organisation's results (percent increase in skills), categorised by learning style on the independent variables of generic skill levels, computer use, user expectation and self-efficacy

The section will conclude with a summary of the data from each case with reference to the propositions of the study described in Section 4.2.2. as:

P1 Organisations that have high levels of organisational factors present will have greater increase in skill levels than organisations that have low levels of organisational factors.

P2 Organisations that used self-directed training will have greater increase in skill levels than organisations that use small group or classroom instruction training

P3 Trainees with diverging and assimilating learning styles will perform best using classroom structured group instruction

P4 Trainees with accommodating and converging learning styles will perform best using self-directed training methods

COMPARISON OF DESCRIPTIVE STATISTICS BETWEEN ORGANISATIONS

Org A

Vars	Ave	Stddev	Media	Range	Correlati to Inc Sk	Corellati to % inc
1	39.09	11.46	36	33	0.56	0.57
2	2.73	0.65	3	2	-0.48	-0.51
3	20.86	11.38	20	32	0.66	0.67
4	22.36	2.91	23	10	-0.63	-0.69
5	15.73	1.47	16	5	-0.32	-0.41
6	31.73	9.43	30	30	-0.10	-0.07
7	41.36	4.80	42	15	0.26	0.24
8	27.18	6.29	28	22	-0.39	-0.51
9	370.09	64.65	354	157	-0.68	-0.77
10	416.73	47.68	401	138	-0.07	-0.21
11	46.64	40.56	42	148		
12	0.14	0.12	0.12	0.43		
Count of Learning Styles			Acc 3	Div 3	Ass 1	Con 4

Org B1

	Ave	Std. Dev	Media	Range	Corellati to Inc Sk	Corellati To % inc
1	44.60	2.61	43	6	3.11	0.08
2	1.60	0.55	2	1	-0.17	0.28
3	27.00	4.64	26	11	0.50	0.21
4	20.60	4.04	20	11	0.39	0.72
5	10.60	3.05	11	7	-0.72	-0.88
6	22.00	14.98	27	35	-0.43	-0.75
7	39.80	5.59	38	15	-0.18	-0.31
8	24.00	11.98	22	29	-0.80	-0.87
9	571.20	293.48	538	738	-0.95	-0.94
10	648.00	248.46	618	612	-0.92	-0.93
11	76.80	48.10	92	126		
12	0.19	0.15	0.15	0.41		
Count of Learning Styles			Acc 0	Div 1	Ass 3	Con 1

Org B2

	Ave	Std. Dev	Media	Range	Corellati to Inc Skls	Corellati to % inc
1	33.40	10.36	28	25	0.63	0.76
2	3.40	1.34	4	3	-0.29	-0.39
3	13.20	11.37	6	26	0.61	0.72
4	25.60	4.10	27	11	0.10	0.22
5	12.80	1.92	13	5	-0.18	-0.01
6	40.80	1.10	40	2	-0.25	-0.07
7	34.80	8.29	35	23	0.82	0.90
8	25.40	3.91	24	9	-0.16	0.02
9	312.40	45.50	311	121	-0.81	-0.91
10	394.80	39.66	376	95	0.74	0.59
11	82.40	66.24	111	148		
12	0.29	0.24	0.36	0.58		
Count of Learning Styles			Acc 1	Div 1	Ass 3	Con 0

Org C

	Ave	Std. Dev	Media	Range	Corellati to Inc Skls	Corellati To % inc
1	34.00	9.19	33	24	-0.30	-0.35
2	2.50	0.55	3	1	-0.61	-0.64
3	14.50	6.41	16	16	-0.59	-0.63
4	23.50	6.41	21	15	0.10	0.12
5	11.67	2.50	11	7	0.30	0.22
6	5.67	5.17	5	15	-0.29	-0.30
7	33.50	7.87	36	23	-0.02	0.06
8	25.33	3.44	25	10	0.89	0.90
9	453.50	97.66	428	281	-0.13	-0.23
10	669.00	201.61	673	549	0.88	0.83
11	215.50	189.81	139	499		
12	0.49	0.47	0.27	1.19		
Count of Learning Styles			Acc 1	Div 1	Ass 4	Con 0

Org D

	Ave	Std. Dev	Media	Range	Corellati to Inc Skls	Corellati to % inc
1	28.47	6.96	25	18	0.56	0.56
2	3.13	0.74	3	3	-0.04	-0.15
3	8.04	6.58	5	21	0.51	0.43
4	22.60	5.15	25	15	0.06	-0.19
5	14.80	3.23	14	10	-0.79	-0.87
6	23.13	16.66	20	47	-0.47	-0.40
7	39.60	5.77	38	22	-0.13	-0.31
8	25.73	7.23	25	23	-0.68	-0.75
9	49.00	16.17	45	50	-0.79	-0.87
10	66.47	9.93	65	38	0.06	-0.22
11	17.47	13.35	17	49		
12	0.51	0.56	0.31	2.13		
Count of Learning Styles			Acc 4	Div 1	Ass 4	Con 4

Variables Key

1	Age
2	Highest Qualification
3	Yrs employed
4	WPT score
5	Generic computer skills
6	Computer use
7	User expectations
8	Self-efficacy
9	Skill Before
10	Skill After
11	Inc/dec
12	% inc/dec

Table 5.14 Descriptive Statistics of Quantitative Variables for Organisations

Table 5.15 shows the relative position of each organisation for the average of each quantitative variable and provides useful information to facilitate comparisons between the organisations.

POSITION OF EACH ORGANISATION FOR MAGNITUDE OF VARIABLES

	Org A	Org B1	Org B2	Org C	Org D
Variable					
Age	2	1	4	3	5
Highest qualification	3	5	1	4	2
Yrs employed	2	1	4	3	5
WPT Score	4	5	1	2	3
Generic Skills	1	5	3	4	2
Computer use	2	4	1	5	3
User expectations	1	2	4	5	3
Self-efficacy	1	5	3	4	2
% Inc in skills	5	4	3	2	1

1 = highest average value for the variable
5 = lowest average value for the variable

Table 5.15 Position of each Organisation for Magnitude of Variables

The qualitative variable of training method is described for each organisation as identified in the conceptual framework for this study (Figure 3.2, p. 62) and summary Table 4.2 (p. 95).

- Organisation A Individualised small group instruction
- Organisation B1 Paper-based self directed learning
- Organisation B2 Individual "key user" instruction
- Organisation C On-line self directed learning
- Organisation D Classroom structured group instruction

The second qualitative variable of organisational factors from the conceptual framework (Figure 3.2, p. 62) is broken down into the following parts:

1. Organisational training needs analysis
2. Individual training needs analysis
3. Policies and procedures to support training:
    i. Top management support
    ii. Linkage to organisational goals
    iii. Opportunity to use
    iv. Feedback
4. Evaluation of training

Each part is reported for each organisation as formally present in the organisation or not, by checking Yes or No in Table 5.16. In situations where some informal organisational factors were present, this will be reported in discussion of each organisation's results.

ORGANISATIONAL SUPPORT FACTORS FOR EUT BY ORGANISATION

Organisational Factors	**Org A**	**Org B**	**Org C**	**Org D**
Organisational training needs analysis	Yes	No	Yes	Yes
Individual training needs analysis	Yes	Yes	Yes	No
Policies and procedures to support training:				
Top management support	Yes	Yes	Yes	Yes
Linkage to organisational goals	Yes	No	Yes	Yes
Opportunity to use	Yes	No	No	Yes
Feedback	Yes	No	No	Yes
Evaluation of training	Yes	No	No	No

Table 5.16 Organisational Support Factors Present in each Organisation

5.3.1 Organisation A

Organisation A utilises a training needs analysis (TNA) on the three level matrix as identified by (Nelson et al, 1995), and was the only organisation that practises organisational support for training on all factors identified in Table 5.16. Due to organisational constraints the proposed "one-on-one at desk" training for some of the group was not carried out. However, all trainees had small group training - groups of anywhere from 2 to 5 people. Training was to be on MS Word. Each session was an hour long and focused on a specific functionality for the whole hour, for example, one on tables, one on mail merging, one on styles, one on graphics etc. The training manager considered that "this format worked well for the group as it was the best approach for concepts to sink in without the trainees getting confused with too many other functions". The training was carried out on site in a room that was set up especially for the sessions.

Comparing averages of variables for organisation A with the other organisations (Table 5.14 and 5.15), it can be seen that they had the lowest percentage increase in skills of all the organisations. Interestingly, they had the highest generic skill levels, self-efficacy and user-expectations. Organisation A was an older group than the average for the study (by 5 years) and closely related to that is that they had a greater average years employed than the whole study by 6 years. As would be expected by their position in Table 5.15, organisation A had a higher average for generic skills, computer use, user expectations and self-efficacy than the average for the whole study. These results would indicate that organisational factors (as identified in Table 5.16) that are present; older trainees and high levels of generic skills, computer use, user expectations and self-efficacy produce a lower percentage increases in skills after EUT in this study.

The above indicators are not entirely borne out by the correlation to percentage increase in skills for the quantitative variables reported in Table 5.14, which indicates that there are positive

significant[1] correlations between age, years employed and increase in skills. There is a weaker positive correlation with user expectations (.24) and significant negative correlations between highest qualifications, WPT score, self-efficacy and skills before training[2].

AVERAGE OF VARIABLES BY LEARNING STYLES – ORGANISATION A

Learning Style	Count	% inc skills	Generic sk	Comp use	U expectations	Self-efficacy
Accommodating	3	0.20	14.83	29.67	41.67	26.33
Diverging	3	0.06	16.67	40.00	37.00	23.33
Assimilating	1	0.10	17.00	30.00	42.00	32.00
Converging	4	0.17	15.38	27.50	44.25	29.00
Approx. Total Ave for Group		*0.14*	*15*	*31*	*41*	*27*

Table 5.17 Average of Variables for Learning Styles Categories for Organisation A

Examination of Table 5.17 shows the spread of learning styles in organisation A, and the comparison in averages for the dependent variable and the four independent variables that relate most strongly to the dependent variable (from results of the study analysis). Although the group is too small to draw any strong conclusions from the data, it is interesting to note where different learning styles have larger or smaller averages than for the group as a whole. For example, diverging learning styles have higher generic skills and computer use and lower increase in skills, user expectations and self-efficacy than the group average.

Considering the training method and organisational factors, the analysis from Table 5.17 would suggest that accommodating learning styles benefit most, and diverging learning styles benefit least from small group training where all organisational factors are present.

5.3.2 Organisation B

Due to the fact that the two groups that participated in the research from organisation B were so diverse in location, occupation, training method employed and applications that were the subject of EUT, they have been treated as separate organisations. Additionally, although organisation B was graded "No" on five of the seven organisational factors, informal organisational support is much stronger for the group B2. This is due mainly to B2's location as the main site for the organisation and the much larger number of administration workers and managers at site B2. Site B1 only had seven administration workers out of the sixty-four workers at the site

[1] Positive significant correlation is defined as greater than .50, negative significant correlation is defined as less than -.50.

5.3.2.1 Organisation B1

Organisation B1 had an in depth individual TNA for this study, consisting of completion of the training assessment form (Appendix 5), individual interviews with trainees and a group session where the training manager and the researcher physically examined the levels of skills. The training method was self-directed paper based, where user-friendly training manuals were provided for trainees to use at anytime when they had problems completing work tasks or as a method of up-skilling in identified areas. The concept of key user was not used as formally as in organisation B2, however, one trainee had a high level of skills prior to training and the other workers often referred to him when they had problems with work tasks. Trainees were learning MS Word, Excel and Powerpoint.

Comparisons with other organisations from Table 5.14 and 5.15 shows that organisation B1 had the second lowest average increase in skills after EUT (5% higher than organisation A). They were the oldest group with the highest years employed. They had the lowest qualifications, WPT score, generic skills and self-efficacy; the second lowest computer use and the second highest user expectations. Averages for user expectations, age and years employed in organisation B1 were the only ones that were higher than the averages for the whole study.

These results would indicate that when most of the identified organisational factors are not present; older trainees, and lower levels of generic skills, computer use and self-efficacy; combined with high user expectations produce lower increases in skills after EUT in this study. This indication contradicts that from organisation A in levels of generic skills, computer use and self-efficacy, yet corroborates the indication that older trainees and high user expectations produce lower levels of increase in skills.

The correlation to percentage increase in skills from Table 5.14 indicates a positive significant correlation (.72) of WPT scores. However, there are significant negative correlations of generic skills, computer use, self-efficacy and skills before training, which is consistent with analysis of the relative position of organisation B1 with the other organisations.

[2] Skills before training are results of the training needs analysis completed by trainees prior to training (Appendix 5)

AVERAGE OF VARIABLES BY LEARNING STYLES – ORGANISATION B1

Learning Style	Count	% inc skills	Generic sk	Comp use	U expectations	Self-efficacy
Accommodating	0					
Diverging	1	0.27	7.00	8.00	38.00	11.00
Assimilating	3	0.23	10.67	25.00	39.67	23.00
Converging	1	0.00	14.00	27.00	42.00	40.00
Approx. Total Ave for Group		*0.19*	*10*	*20*	*39*	*24*

Table 5.18 Average of Variables for Learning Styles Categories for Organisation B1

Comparison of Table 5.18 with Table 5.17 is difficult due to missing values and the small numbers, however for organisation B1, the single converging learning style, the same as with organisation A had higher average than for the group of the independent variables, but had lower increase in skills.

Consideration of training method and organisational factors for organisation B1 would indicate that diverging and assimilating learning styles benefit most from self-directed paper based learning with low levels of organisational support.

5.3.2.2 Organisation B2

Organisation B2 had similar individual training needs analysis to organisation B1, in that the training assessment form (Appendix 5) and individual interviews were carried out with each trainee to ascertain training needs. However, there was no physical analysis (by watching trainees working on their computers) conducted. Training was carried out on site by an identified "key user" who had prior to training attended outsourced training courses in Excel.

From Tables 5.14 and 5.15, organisation B2 was in third position for percent increase in skills, with 6% lower increase in skills than the average for the whole study. They had the highest averages for qualifications, WPT score and computer use and second lowest averages for age, years employed and user expectations.

These results would indicate that when most of the identified organisational factors are not present; younger trainees with lower levels of user expectations, combined with high qualifications, WPT score and computer use have a medium level of increase in skills.

Consideration of correlations of variables to increase in skills for organisation B2, significant positive correlations are shown for age, years employed and user expectations. Skills before training, as with the other organisations, show a significant negative correlation. Generic skills, computer use and self-efficacy show little correlation in this group. Qualifications show a weaker negative correlation (-.39) and WPT a weaker positive correlation (.22)

AVERAGE OF VARIABLES BY LEARNING STYLES – ORGANISATION B2

Learning Style	Count	% inc skills	Generic sk	Comp use	U expectations	Self-efficacy
Accommodating	1	0.09	14.00	40.00	32.00	23.00
Diverging	1	0.46	12.00	40.00	35.00	24.00
Assimilating	3	0.34	12.50	41.00	35.50	26.00
Converging	0					
Approx. Total Ave for Group		*.29*	*12*	*40*	*34*	*25*

Table 5.19 Average of Variables for Learning Styles Categories for Organisation B2

All learning styles for this group had averages for the dependent variables closely clustered around the averages for the group; however, the diverging style had significantly higher percentage increase in skills after EUT and the accommodating style had significantly lower increase.

For organisation B2, with consideration of training method and organisational factors (a score of 2 out of 7), the diverging learning style benefited most, and the accommodating style least from training using a key user in the workplace with low levels of organisational support.

5.3.3 Organisation C

Organisation C utilises TNA on a three level matrix as identified by Nelson et al, (1995). Although Table 5.16 rates organisation C with "no" for three of the factors, these factors would be present in general organisational training for existing employees. The trainees in this group used self-directed on-line training in their own time and although the training application provided tests with results for the trainees, it has not been classed as formal feedback. The trainees, when out on work experience through their one year course, may well have been given opportunities to use the skills they learned from EUT on the job, but it was also not considered formal organisational support. Formal organisational evaluation of training for this group is under development in organisation C – their participation in this research study was a preliminary exploration for the training manager. On-line training was provided for MS Word, Excel and Powerpoint.

Comparison of averages of variables for organisation C from Tables 5.14 and 5.15 shows that they had the lowest levels of computer use and user expectations, and the second lowest for qualifications, generic skill levels and self-efficacy. Other dependent variables of age, years employed and WPT score were in the middle of the group. However, of the organisations that were training staff to use MS Office applications, they had the highest percentage increase in skills after EUT at 49% (See explanation of organisation D's percent increase in skills in Section 5.3.4). These results would indicate that a highish level of organisation factors (4 out of 7) with

low levels of generic skills, user expectations, computer use and self-efficacy produce the highest percent increase in skills after EUT.

Considerations of correlations for organisation C from table 5.14 shows a significant positive correlation between self-efficacy and percent increase in skills, significant negative correlation between qualifications, years employed and percent increase in skills. Negative correlations of age and computer use were weaker and WPT score and user expectations had little correlation. Organisation C had a much lower negative correlation than the other organisations between skills before and percent increase (-.23 for organisation C compared to -.77 for organisation A, which was the next lowest).

AVERAGE OF VARIABLES BY LEARNING STYLES – ORGANISATION C

Learning Style	Count	% inc skills	Generic sk	Comp use	U expectations	Self-efficacy
Accommodating	1	0.14	8.00	0.50	37.00	25.00
Diverging	1	0.77	15.00	5.00	37.00	27.00
Assimilating	4	0.52	11.75	7.13	31.75	25.00
Converging	0					
Approx. Total Ave for Group		*.49*	*11*	*4.21*	*33*	*25*

Table 5.20 Average of Variables for Learning Styles Categories for Organisation C

The assimilating learning style in organisation C had average values close to averages for the group, due to the fact they made up most of the group. The diverging learning style in organisation C had a significantly higher percent increase in skills than the average for the group and the accommodating style had significantly lower percent increase in skills.

Considering training method and organisational factors, the analysis of table 5.20 would indicate that diverging learning style benefits most, and accommodating style least from self-directed on-line learning where most organisational factors are present.

5.3.4 Organisation D

Organisation D carries out organisational-wide TNA, but does not specifically measure skills or training needs for the group of new recruits that participated in this research study. Organisational policies and procedures are in place to support training in all the categories in Table 5.16, however, although the trainees completed a self assessment of skills post-training there was no other evaluation of training conducted by the organisation. Trainees in this group were trained to use an in-house application in a classroom group of fifteen trainees, using dedicated in-house trainers.

The results of increase in skills for organisation D have constraints and differences from the other organisations in this research study because an in-house application was taught as opposed to off-the-shelf MS packages that were taught by the other organisations. The variable of "skills before" [EUT] with organisations A, B and C measured specific levels of skills on specific tasks using the applications that were the subject of EUT in the MS Office package. All trainees had used the application/s before participating in this research. None of the trainees in organisation D in this study had used the application that was the subject of training. Hence, the specific skills before for organisation D were nil. In order to perform analysis and to use the data from this organisation in the study, a decision had to be made of how to calculate values for skills before.

The decision was made to normalise the generic skill level variable in order to match it with the self-assessed in-house exit skill level that trainees completed after training. Whilst this is not an absolute measure of the learning that has occurred due to the training, it is an indicator of change in the trainees' self-assessed skills and provides a measure with which to compare other variables.

A number of options were available in deciding how to normalise the generic skills scores to match the in-house exit skill level evaluation. At the simplest level the generic skills (maximum score 20) could be factored by 5 to equate with the exit skill level (maximum score 100). However, this produced an unusual result of negative increase in scores for all but two trainees in the group, and a non-optimal average result of negative increase in skills for the group. Consideration was given to the syntactical differences in the questionnaires, for example equating "introductory skills" (value of 2) in the entry questionnaire with "limited skills" (value of 1) in the exit questionnaire would require using a factor value of 6.67. The decision was made by considering that a total score of 5 on the entry skill questionnaire would equate to nil skills prior to training, i.e. if trainees rated themselves as having no generic skills using computer software, they would have an entry score of 5. Hence, 5 was subtracted from the entry skill score prior to factorising by 5.

The choice of method of factorising organisation D's skills before EUT has a large impact on the percent increase in skills after EUT. The reported figures can not be compared to the other organisations' absolute percent increase. The comparatively larger percent increase scores for organisation D can not be given any weight. Additionally, the standard deviation and range of percent increase scores indicate that these figures have been calculated using an arbitrarily decided scale. However, the scale chosen and applied allows for a percentage increase on entry skills to be calculated and for analysis of organisation D's data.

Organisation D consisted of the youngest group of trainees and had the least years in employment; for all other variables they were the middle of the range between the organisations

(See Table 5.15). The above cautions regarding the calculation of percent increase in skills need to be heeded for comparisons with other organisations. However some correlations within organisation D can be examined and compared. The only significant positive correlation to percent increase in skills was age; all other correlations were negative. As generic skills and skills before were in fact the same numbers (factorised for the latter) the correlations are the same at -.87, and no conclusions can be drawn from those figures. Self-efficacy showed a significant negative correlation with percent increase in skills.

AVERAGE OF VARIABLES BY LEARNING STYLES – ORGANISATION D

Learning Style	Count	% inc skills	Generic sk	Comp use	U expectations	Self-efficacy
Accommodating	4	0.25	16.75	32.50	37.50	27.50
Diverging	1	1.13	11.00	30.00	37.00	15.00
Assimilating	4	0.85	13.50	26.25	36.75	23.00
Converging	4	0.44	14.25	10.00	41.50	28.00
Approx. Total Ave for Group[3]		.67	13.88	24.69	38.19	23.38

Table 5.21 Average of Variables for Learning Styles Categories for Organisation D

The diverging learning style has the greatest increase in skill level, followed by the group of four in the assimilating learning style. The converging learning style has the highest scores for user expectations and self-efficacy. Considering training method and organisational factors, analysis from Table 5.21 would suggest that diverging and assimilating learning styles benefit most, and accommodating learning styles benefit least from classroom group training where most organisational factors are present.

5.3.5 Summary of Case Analyses

The case analyses have focused on the qualitative data gathered for training methods employed, organisational factors and learning styles in each organisation. Propositions for the study can not be clearly upheld, due mainly to the small sample size, which in some matrix analyses creates categories with only one data item or in some cases no data items. However, by stating the propositions for this study it focuses attention toward the issues that have been identified by IS research to impact on EUT.
Summary of each proposition is presented below:

P1 Organisations that have high levels of organisational factors present will have greater increase in skill levels than organisations that have low levels of organisational factors.

[3] Averages for Table 5.21 are different to averages in Table 5.14 due to two missing values for learning style data

This proposition was not upheld as organisation A had the highest level of organisational factors and the lowest level of increase in skills.

P2 Organisations that used self-directed training will have greater increase in skill levels than organisations that use small group or classroom instruction training.

This proposition was upheld to some extent – organisation C had the highest level of increase of the organisations that trained MS Office and used self-directed on line training method. Organisation B1 also used self-directed training (paper-based) and had the second lowest increase in skills

P3 Trainees with diverging and assimilating learning styles will perform best using classroom structured group instruction

This proposition is upheld by organisation D as the two styles had clearly higher increase in skills within this group than the other learning styles

P4 Trainees with accommodating and converging learning styles will perform best using self-directed training methods

This proposition was difficult to clearly analyse as organisation B1 had a complete absence of accommodators and organisation C had a complete absence of convergers. In both organisations, the other style had the lowest increase in skills, suggesting that the proposition would not be upheld.

Table 5.22 summarises the findings

Learning Style	Accommod	Diverging	Assimilating	Converging	Org	Org Factor
Training Method						
Individualised small group instruction	19.9	6.4	9.6	16.7	A	7
Paper-based self-directed learning		27.4	23.4	-.5	B1	2
Individual "key user" instruction	9.4	45.6	29.9		B2	2
On-line self directed learning	13.7	76.7	51.5		C	4
Classroom structured group instruction	25.1	113.3	84.8	43.8	D	5

Table 5.22 Matrix of Training Methods by Learning Styles

5.4 Summary of Data Analyses

This chapter has used a variety of parametric, nonparametric and qualitative data analysis statistics to analyse the data gathered in the project. Summary of the hypotheses and correlation testing on the quantitative variables is provided in Section 5.2.4 and summary of the proposition findings is provided in Section 5.3.5. Chapter 6 will discuss these findings and their implications for practitioners and academics.

Discussion and Conclusions

6.1 Introduction

This project has encompassed a wide scope in the area of EUT in New Zealand organisations. It was an ambitious project attempting to draw the attention of IS researchers and practitioners to the importance and large number of factors that contribute to efficient and effective EUT. It can be considered as an initial exploratory analysis of the possible factors that impact on effective EUT in the light of prior investigations by international IS researchers.

Results of the study do not show strong statistical relationships; however there is clear evidence that certain variables that have been identified and measured in this study have greater or lesser impact on the increase in skills after EUT. Results will be discussed with reference to IS literature, identifying where similarities and differences with other research have been observed. Limitations and their impact on this research project will be identified. The value of this project to practitioners and suggestions for further research in this area of EUT will be made. The chapter will conclude with a summary of the conclusions of the project.

6.2 Limitations of the Research

As identified in Section 1.4, a number of practical limitations impacted on the design and implementation of the study. Further, statistical limitations of small sample sizes, especially when considering the individual cases, were identified in Chapter 5. The limitation of small sample sizes impacts directly on the ability of the study to state with any statistical confidence predictors of effective EUT. However, this study has identified indicators that can provide a basis for further research on EUT in New Zealand.

Section 5.3.4 specified constraints on the data gathered and analysed for organisation D regarding the need to use manipulated and normalised scales to measure skills before and after training in order to compute increase in skills. It was considered that the limitations regarding organisation D's measurement of the dependent variable was justified when making an overall consideration of the value to the project of the data gathered from that organisation. Firstly, organisation D represented a Government department in New Zealand, which provided information from outside the private sector. Secondly, organisation D had the largest numbers of participants for whom data was returned to the researcher; and thirdly, it was the only group that used classroom based training.

Due to differing scales used between organisations in the self-evaluation of skills before and after training it was not possible to use the actual figure for increase in skills when comparing the cases. This was due, in organisation A, B and C, to trainees receiving training on one or more of the applications in the MS Office package. In organisation D it was due to the fact that

the "skills before" measures were normalised scales derived from the separate variable of self-assessed generic computer skills. Therefore, when comparing cases and analysing results for the whole data set this was overcome by using the percentage increase in skills as the dependent variable.

As can be seen from the raw data gathered (Appendix 10), a problem in the study was receiving data from trainees with missing values. Fifty-six trainees signed up for the study but only forty-two (forty for learning styles) sets of complete data were available for analysis.

6.3 Discussion of Statistical Analysis

As identified and summarised in Table 3.3 (p. 71), variables that were measured and analysed in this project were identified by referencing IS literature to consider variables that impacted EUT in overseas studies and that had a theoretical base. This study has provided an exploratory analysis, with some indicators as to how the New Zealand EUT environment may differ from overseas environments. Results of analysis of quantitative data regarding hypothesis testing and correlations of the independent variables to increase in skills after EUT is compared to findings from overseas studies. Qualitative data regarding training methods, learning styles and organisational factors is also comparatively described and discussed.

6.3.1 The Study's Hypotheses

Setting the α level at .10, the null hypotheses of no significant difference in increase in skills after EUT for the following variables were rejected:

- Generic computer skills
- Level of computer use
- Level of self-efficacy
- User expectations

The results of correlation testing indicate that these variables are negatively related to increase in skills for the whole study, thereby showing that trainees with low levels of the variables gain a greater percent increase in skills after EUT. All four variables above are positively related to each other, indicating that a higher level in one of the variables is related to higher levels in the all the other variables. Computer skills and self-efficacy have the most significant relationship with a correlation coefficient of .56. Multiple regression analysis of these variables indicates that they explain 23% (after adjusting for errors) of the variance in the model to predict percent increase in skills.

Davis and Davis, (1990) investigated whether subjects' performance (measured after EUT) differed between two training techniques due to prior experience and prior IS training. Their

study concluded that neither variable had any significant effect on performance. It is intuitive to accept that generic computer skills are positively related to computer use, as generally more practise equates with higher skills, statistical analysis supports this supposition (the correlation between computer skills and computer use is .50). However, explanation of why higher skills and use relate to lower increase in skills after EUT is not entirely clear. It could be that trainees with higher skill levels have less to learn, which would be particularly relevant when large group classroom training methods are used. However, considering the nature of the training methods employed in this study (predominantly small group, individualised) and the detailed level of individual TNA carried out, it would be expected that the effect would not be so important. Self-assessment of skill levels may provide an explanation, as self-assessment could be linked to a number of personality variables. Further research into this area, using tests to measure skill levels would clarify the result.

A number of studies have examined the effect of trainees' levels of self-efficacy and outcome expectations (user expectations) on performance outcomes after EUT using different training methods. Compeau and Higgins, (1995a) found that self-efficacy positively influenced both outcome expectations and performance after training on two different software applications; however, as with this study, they found there was a negative relationship between outcome expectations and performance. Compeau and Higgins', (1995a) study also measured immediate prior performance (performance on the previous day of training) and found prior performance had a significant impact on self-efficacy and performance after EUT. The current study shows that computer skills and computer use (which could be considered similar to prior performance) are positively related to self-efficacy; they are also positively related to user expectations which was different to the finding in the Compeau and Higgins' study . The negative relationship between prior performance and outcome expectations was not expected by the authors, however, they considered that an explanation for negative relationships of outcome expectations to both prior performance and performance after EUT could be explained by the time horizon for outcome expectations. The authors considered that outcome expectations were not specifically short-term while performance measures were.

Contrary to the current study, Gist et al, (1989) in a study of alternative EUT methods found that pre-training self-efficacy was positively related to higher performance after EUT. The Gist et al study also measured intercorrelations among self-efficacy, years of education and computer experience using two different training methods. All correlations were positive, as were the findings in this study when considering correlations of self-efficacy with qualifications and computer use.

In order not to eliminate any possible relationships in the data and to allow for the maximum level of discussion of variables that were measured in this study, the following hypotheses were further analysed for relationships to the dependent variable of increase in skills. If a higher level

of probability of a type 1 error can be accepted and the level is set α = .20 the following null hypotheses could additionally be rejected:

H1 There will be no significant difference in performance due to trainees' age (Kruskal-Wallis)

H4 There will be no significant difference in performance due to time that trainees' have been employed (Kruskal-Wallis)

H5 There will be no significant difference in performance due to trainees' score on the Wonderlic Personnel Test (F test)

As would be expected, age and years employed are significantly positively correlated with each other. Age is slightly positively correlated and years employed is slightly negatively correlated with percent increase in skills as is WPT score. None of the correlations with percent increase in scores after EUT is significant. These results are contrary to findings of Davis and Davis, (1990) and Harrison and Rainer, (1992), however, those two finding were contradictory. Harrison and Rainer's results found that age was significantly negatively correlated with EUC skills indicating younger people had higher EUC skills and Davis and Davis found that age was significantly positively correlated with performance after EUT indicating older people benefited more from EUT.

Simon et al, (1996) quoted a number of IS research studies that had found that WPT had been shown to be a strong predictor of training success. Contrary to those findings Simon et al, found that cognitive ability as measured by WPT was not a significant predictor of evaluation scores in their EUT study. Similarly, the current study showed an insignificant negative correlation of WPT score and percent increase in skills. The average and standard deviation of the WPT score reported in Simon et al study were 18.20 and 5.15. The average and standard deviation in this study were 22.79 and 4.59. Simon et al offered a possible explanation of the lack of the predictive value of WPT in their study by saying that many training interventions are "classroom" oriented using abstract concepts and materials. However, when as in the Simon et al study and the current study, training is computer related with hands-on tasks, experimentation of abstract concepts compensates for the cognitive ability factor.

The following two null hypotheses have been accepted in this study:

H2 There will be no significant difference in performance due to trainees' gender

H3 There will be no significant difference in performance due to trainees' qualifications

Davis and Davis, (1990) identified questions that organisations may have regarding end user learning; specifically related to these variables was the question:
"Should the ... level of formal education, gender ... affect the choice of appropriate training technique ... for that employee?" (p. 95: Davis and Davis, 1990).

Results of Davis and Davis' study categorised formal education by years spent in education and concluded that educational level did not affect overall learning performance but when learning performance was broken down into categories of programming language learning performance and concepts learning performance lower levels of education had higher performance. A study conducted by Harrison and Rainer, (1992) found that education level was not significantly related to EUC skills. Qualifications in the current study were treated as a nominal variable and consequently tested using the chi square test on two categories of qualifications – secondary and tertiary. Examination of averages of qualifications to averages of percent increase in skills from Table 5.14 (p. 117) provides more information to support the null hypothesis H3. Further research using larger sample sizes in order to keep the original categories of qualifications as identified in this study's questionnaire would provide useful information.

Gender in relationship to EUC skills and its effect on outcomes of EUT received much attention from IS researchers prior to the 1990s (Harrison and Rainer, 1992). Findings were that computer use was perceived to be a male-oriented activity. The growth in computer use for every activity in the business environment and the increasing number of females in employment in the past ten years suggests that this finding has changed over time. Harrison and Rainer, (1992) found that females had significantly lower levels of EUC skills than males, but Davis and Davis, (1990) found that gender had a very small insignificant effect on learning performance. Gender, treated as a nominal variable in the current study had a chi squared test result of .63, hence causing the null hypothesis to be accepted. Gender was included in multiple regression analysis as a quasi interval variable and after successive removal of variables with the highest t-statistic p values, gender was included among the variables that could explain 27% of the variance (the highest level obtained) in the model. Whilst it is not useful to consider gender on its own as a predictor of efficient EUT, it could be important in considering performance using different training methods, which could be the subject of further research.

6.3.2 The Study's Propositions

Contrary to studies reported by Nelson et al, (1995) in the United States that more than 50% of the time inputs and outputs of training are not systematically identified and evaluated, this study found that formal training needs analysis (TNA) was mostly carried out by the organisations in the study. The organisations were all aware of the three levels of TNA (trainee, department and organisation) that have been identified in IS literature.

The data in this study did not support the proposition that organisations with higher levels of organisational factors to support EUT would have greater increase in skill levels after EUT. This could be partly explained by the fact that for organisation C, which had the highest level of increase in skills, the three organisational factors that were not present in this study, were

normally part of organisation C's support for training. The factors were only not present for the participants in this study, due to the fact that trainees were self-directed on-line learners and trainees were not formally given "opportunity to use, feedback and evaluation of training" as part of the overall management training programme. Organisation C does in fact provide opportunity to use, feedback and evaluation of training in its mainstream organisational training. Hence the organisational culture is one of supporting training generally. Another possible explanation is that in organisation A, which had the highest level of organisational support and the lowest level of increase in skills, other factors could have contributed to the low level of increase in skills. A possible factor is that organisation A had a high level of generic skills and skills before training. Hence, it is reasonable to assume that less increase in skills would be realised compared to cases where skill levels were low prior to training, as is borne out by organisation C's results.

Compeau and Higgins, (1995b) considered the effects of organisational support for users on levels of self-efficacy and outcome expectations. The authors were surprised by the result that organisational support had a negative effect on self-efficacy and user expectations. Possible explanations of this finding were that high user support may hinder self-efficacy in that if help is always available, users will be discouraged from solving problems themselves, which impacts on their perception of their ability to do so. However, Compeau and Higgins', (1995b) findings are contradicted in this study. Organisation A, having the highest level of organisational support also had the highest levels of both self-efficacy and user expectations. Organisation D, which had the second highest level of organisational support had the second highest level of self-efficacy and user expectations.

The second proposition that organisations that used self-directed training will have greater increase in skill levels than organisations that use small group or classroom instruction training is currently an important issue in EUT. Very often self-directed learning is computer based due to the benefits of twenty-four seven availability. Section 2.4 discusses computer-based training in some detail. In this study the proposition was upheld to some extent as it was stated – organisation C used self-directed on-line training and had the highest level of increase of the organisations that trained MS Office. However, organisation B1 also used self-directed training (paper-based) and had the second lowest increase in skills. Possible explanations for the low percent increase in skills for organisation B1 include extraneous factors that were impacting on the organisation during the training period. Firstly, there was a change of management and secondly, a large project was being carried out at the time, which took time available for training away from the trainees.

The third and fourth propositions relate to learning styles, and were proposed to replicate findings of Simon's, (2000) study. The first part of the proposition is upheld in this study as trainees in the classroom instruction group with diverging and assimilating learning styles had clearly higher increase in skills than trainees with accommodating or converging learning styles.

The second part of the proposition was difficult to analyse as there was a lack of both accommodating and converging learning styles in each of the two organisations that used self-directed training methods. Those trainees with accommodating and converging learning styles that were present had the lowest increase in skills suggesting that Simon's, (2000) findings regarding trainees with accommodating and converging learning styles having the greatest increase in skills using self-directed training methods was contradicted.

6.4 Value of the Research

This research has provided a framework for analysis of EUT in New Zealand organisations. Due to the multiple case study methodology employed, it has been able to provide details of issues that impact on EUT across four organisations, which could also be extended and examined to apply to other organisations. The scope of the project has been wide, both in the types of organisations studied and the number of variables that have been investigated as to their impact on effective EUT. The value of this is that it provides an overall picture of the New Zealand EUT environment and a basis for a large number of detailed studies in many areas identified in this project.

6.4.1 Practitioner

As stated by Benbasat and Zmud, (1999), the IS research community is now more welcoming of qualitative, case-oriented descriptive studies which are valuable in conveying the outcomes of rigorous IS research to practitioners. This study has attempted to follow not only the above guideline but all recommendations made by Benbasat and Zmud, (1999) in their paper urging IS researchers to provide work that has relevance to practitioners. A frame of reference developed by academics to reorganise phenomena to reduce complexity can provide an effective means of communicating academic findings to practitioners (Benbasat and Zmud, 1999). This study has provided such a framework summarised in Figure 6.1.

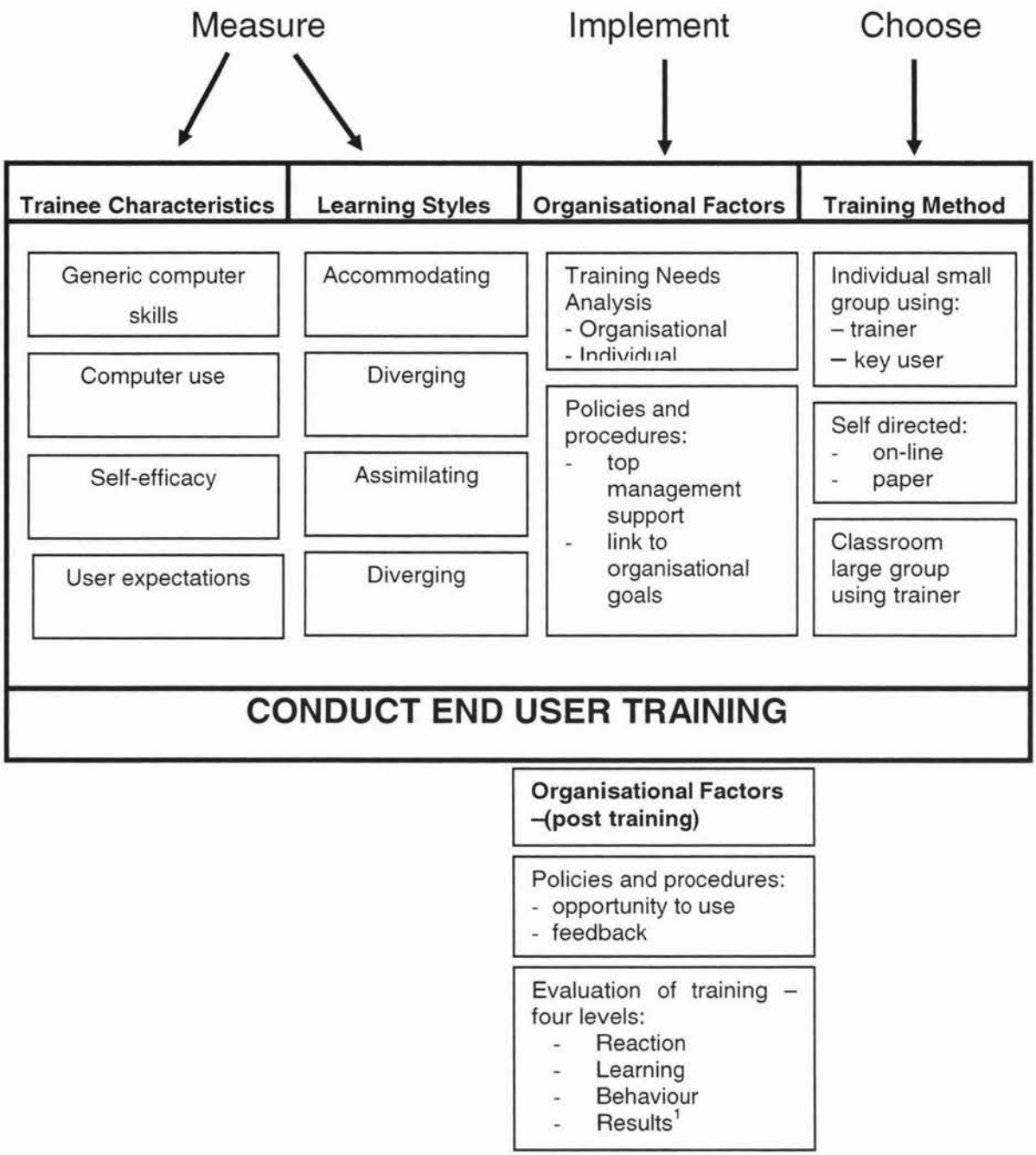

Figure 6.1 Framework for Conducting EUT

Each box containing the variable name in the Figure 6.1 can be considered as a unit and when designing EUT, the optimum mix can be developed. For example, if in the group to be trained, there were predominantly assimilating and diverging styles with high levels of self-efficacy, low generic skills and computer use, the training method most effective for that type of group can be chosen and the organisational factors that support that type of learner can be implemented. Additionally, the framework can be used to assign trainees to different training groups using different methods and emphasising specific levels of organisational support.

This framework is economical to administer, as measuring the four variables and learning styles would take trainees approximately ten minutes. Analysis of learning styles can be automated using software. The data that an organisation builds up, especially evaluation of training, will facilitate further refinements to conducting effective EUT for that organisation.

For the participating organisations in this study, a large amount of information is available for analysis of their organisation. Table 5.14 (p. 117) provides details that show where and how the individual organisation differs from results of the whole study. The four independent variables that the study has identified as having a relationship with increase in skills after training are negatively correlated for the whole study. Individual organisations can analyse the breakdown for their organisation and identify the specific correlation for each variable. For example, organisation B2 has a strong positive correlation of user expectations to percent increase in skills and organisation C has a strong positive correlation of self-efficacy to percent increase in skills. Therefore, organisation B2 could look at techniques for increasing user expectations and organisation C could look at ways of increasing self-efficacy to improve future EUT outcomes. For each organisation the information provided is invaluable for designing future training.

6.4.2 Academic

The prime value of this study for IS researchers is that it has elucidated and synthesised issues surrounding EUT in the New Zealand business environment. Because of full and rich information that can be gained from multiple case study research it is possible to refine and modify factors from previous studies (Zinatelli and Cavaye, 1992). The purpose of this study was mainly exploratory, without ruling out the possibility of identifying pertinent new issues. Multiple case study methodology had the additional advantage in this study of facilitating the analysis of a large number of variables. The exploration of the effect of those variables on effective EUT in organisations has provided a sound basis for academics to conduct further research.

6.5 Suggestions for further research

Due to the importance placed by businesses on the value to their organisations of effective EUT, research that provides pertinent usable information to facilitate improvements in EUT performance is important. Further research that is suggested by this study can be categorised into two broad areas; firstly, using the whole of this study as a basis for replication, and secondly, using sections of this study to investigate issues in greater detail and with more depth. New areas of investigation into transfer of skills from EUT to the workplace in a longitudinal study would also be valuable to the New Zealand business sector.

A replicative study, using the framework and instruments that this study has employed but using different organisations, would be useful to confirm or disconfirm the generalisability of the findings of this study. A number of alternatives could be employed; the framework for organisations (Figure 6.1) developed in this study could be used by the organisations in future studies and compared with organisations who did not use an EUT framework, or who used an organisation-specific framework. The framework from this study could be modified to test other theories developed from IS literature, or to focus more closely on a specific area of the framework. For example, an area that has received little attention in New Zealand is organisational factors that are particularly important in maximising the results of EUT with consideration of levels of trainee characteristics.

Confirmation or disconfirmation of the findings from this study could be provided by replicating the study using an experimental research methodology for the quantitative variables and controlling the training method. Using tests (as opposed to self-assessments) to measure change in skills after EUT would also clarify some of the confounding issues in this study's findings.

The second area of future research from this study is large. By taking some of the quantitative variables that have been used in the study and increasing the sample sizes, much more rigorous statistical analysis could be performed. Discriminant factor analysis, which is a multivariate statistical technique to determine a combination of variables that predict a dependent variable, could be applied to the data. This information would be extremely useful, not only for giving more depth to understanding the combination of variables that impact increase in skills after EUT, but also to analyse the impact of relevant variables on each other. As has been illustrated by reference to previous IS research, important findings emerge when relationships between variables are examined. For example, for organisation C where high self-efficacy is positively related to increase in skills after EUT, and examination of the relationship among variables for the study as a whole shows computer use has a significant positive correlation with self-efficacy, it would indicate that providing trainees with extra time to use computers should impact positively on results of EUT. Due to the number of variables measured in this study there are a large number of possible explanatory variables of the independent variables that could be investigated by future research.

The impact of learning styles on effective EUT has attracted much attention in overseas IS literature. This study has not provided an in-depth analysis of their impact in the New Zealand environment, but it has provided an indicator that different learning styles impact on the effectiveness of EUT depending on different training methods. Learning styles were treated as categorical variables in this research, however by considering the details provided in Kolb' Learning Style Inventory (KLSI), it is possible to analyse trainees learning style on the degree to which learners emphasise abstractness over concreteness and action over reflection in a

learning situation. By using the detail in the measurements provided in KLSI, statistical analysis would be appropriate and provide more robust information. Further research considering learning styles in greater detail would provide useful information for New Zealand practitioners due to the fact that measuring learning styles is economical in terms of time and is non-threatening to trainees in an organisational training environment.

Further research is essential to investigating in greater depth the overall negative relationship that was found in this study of the independent variables of computer skills, computer use, self-efficacy and user expectations to increase in skills. Additionally, further research into the qualitative variables of organisational support would provide depth and details that would be invaluable to academics and practitioners. Of especial interest would be the impact that organisational support has on the variables of self-efficacy and user expectations.

6.6 Conclusions

This study has found that the trainee self-reported variables of generic skills in computer applications, the amount of time spent using computers in the year prior to EUT and the constructs of user outcome expectations and self-efficacy as developed by Compeau and Higgins, (1995a), impacted the increase in skill levels of trainees after EUT. The somewhat surprising and contrary to findings from other IS literature, was that there was a negative relationship. Hence trainees with lower values of these variables can be expected to gain higher increase in skills from EUT. Although this was the result for the whole study, examination of the relationships in each case provides greater detail, indicating that organisations with the higher increase in skills had more positive and less significant negative correlations of these variables with increase in skills.

Gender and educational qualifications clearly had no significant relationship with increase in skills and less clearly, but still significant age, years spent in employment and cognitive abilities (as measured by WPT) also did not affect increase in skills.

The level of organisational support was shown not to directly affect the level of increase in skills after EUT. However, analysis of the cases in this study found that high levels of organisational support are positively related to high levels of self-efficacy and user expectations in trainees.

The training methods used by the organisations that participated in this study were broadly categorised as individualised small group instruction, self-directed and classroom large group instruction. Self-directed on-line training proved to be more effective than using both self-directed training using paper-based materials and small group individualised training, in realising high increase in skills.

Learning styles in this study were treated as categorical variables and hence their impact on outcomes of EUT lacked detail that is potentially available using the KLSI instrument. However findings partially supported findings from previous IS research in that the trainees in the classroom instruction group with diverging and assimilating learning styles had higher increase in skills than trainees with accommodating or converging learning styles. However, partly due to small data sets, and therefore absence of data in some categories the findings to support the proposition that accommodating and converging learning styles would realise higher increase in skills using self-directed training methods was not upheld.

This study has synthesised a large number of factors that have been theorised in IS literature to impact on the effectiveness of EUT into a practical framework. It has provided current information both from and for the practitioner environment in New Zealand to facilitate the improvement of the effectiveness of EUT. It is an exploratory descriptive analysis that has provided a rich picture of the current situation with reference to a large body of IS literature in order to provide stimulus for academics to further investigate a wide range of issues on the very important topic of effective EUT in organisations in the twenty first century.

APPENDICES:

INVITATION TO PARTICIPATE IN END USER TRAINING RESEARCH

Dear
As part of completing a Master of Information Science degree at Massey University I am looking for organisations to participate in research studies into effective, efficient end user training (EUT) of software applications.

Some of the advantages to your organisation of participating in this research project may be as follows:

1. Identifying potential productivity gains as a result of increased efficiency in end-user training
2. Identifying crucial training issues that affect your organisation's productivity
3. Findings from the research studies will be made available to your organisation to use in your planning processes.

The focus of my research is to evaluate cost-effective learning, with particular reference to the productivity increases that can be realised by employees gaining skills and knowledge of software applications that can be used in their everyday work environment. The specifics of these applications are not important; i.e. they can be anything from an in-house POS application to a commercial word-processing or e-mail package.

As I am particularly concerned with research that has practical application in industry, the specific design of research that would be carried out in your organisation is negotiable. The benefit of this is that, through initial interviews with staff, crucial training issues that affect your organisation and its productivity will be identified. Through the interview process I will design research questions, and gather data to answer questions that will provide benefits to your organisation as well as providing data for my thesis.

Some areas/questions that could be covered in this project and may have application to your organisation are:

- The importance of trainees' individual characteristics (such as learning styles, motivation, attitudes and previous experience) in the effectiveness of transferring skills learnt in training to your organisational environment.
- What methods of delivery (such as lecture-based, self-paced, computer-based) are most effective, for your organisation, considering trainees' characteristics?
- What are the effects of training over time? Can a "just-in-time" approach to training be adopted? For example, providing training to staff, as they need to perform tasks rather than training classes that teach skills in large blocks.
- What are the benefits to your organisation of performing an organisation-wide training needs analysis and co-ordinating training on this basis? That is, the training is demand driven rather than supply driven.

I would be interested in working with your organisation, whether you contract out your training or whether you perform in-house training. In the former case, the research would involve asking your staff to answer questionnaires and possibly participate in interviews. If you have a training suite in your organisation, I have the qualifications and skills to design training experiments to provide data that will answer questions that have been identified during the research design process. (In consultation between your organisation and myself)

All data gathered in your organisation will be strictly confidential, and if used as part of a thesis will not identify your organisation. However, the data will be readily available to you in an appropriate fromat. Any other work produced by myself on this topic may also be made available to you. (e.g. thesis and/or published papers)

Please indicate your willingness to participate in this research by completing the enclosed form and posting in the freepost envelope or by contacting me by e-mail or phone.

Jane Shand
Department of Information Systems

QUESTIONAIRE RE: TRAINING RESEARCH

1. I would be interested in participating in EUT research. ☐

2. I am particularly interested in investigating: (Please tick as many as applicable)
   - the importance of trainees' individual characteristics ☐
   - methods of delivery ☐
   - effects of training over time ☐
   - organisation-wide training needs analysis ☐
   - other (please list)

3. My preferred method of contact is:

   Name: _____

   Position: _____

   ☐ Mail. Address: _____

   ☐ E-mail. Address _____

   ☐ Phone. Number _____

Jane Shand
Department of Information Systems
Massey University
PB 11-222
Palmerston North
E-mail: J.I.Shand@massey.ac.nz
Phone: (06) 3505799 extn 7550

SUMMARY OF TRAINING PROJECT			
	MAJOR TASKS	*TIME*	**WHO**
1	Inform departments of project		
2	Gather data for organisational departmental and task analysis		
3	Identify trainees		
4	Meeting with trainees		
5	Administer self-identified training needs and skill level questionnaire		
6	Conduct pre training test using data from step 2		
7	Consider training design: 1. Using key users 2. Using coaching 3. Using web-based materials (or a combination of the above)		
8	Design training materials		
9	Plan delivery of training: - time, location, trainers etc.		
10	Administer additional questionnaires (e.g. learning style and ability)		
11	Training and post training assessment		
12	Transfer of training assessment		

OTHER ITEMS			

Notes:

1. Will there be a control group of trainees? This could be organised as trainees who receive training at different times and measurements taken of the group that is yet to receive training. Will all trainees receive training?
2. The "skill level questionnaire" is self-identified (by the trainees)
3. The "pre-training test" is administered to the trainees to test required skills that have been identified in the analysis (i.e. this is an experimental pre-test).

DATA MATRIX1 SHOWING UNITS OF ANALYSIS, VARIABLES AND DATA SOURCES

Independent Variables											**Dependent Variables**	
Units of analysis	*Demographics (age, gender, qualifications, years employed*	*Previous computer use,*	*Entry skills in generic software applications*	*Learning Styles*	*Learning and problem solving abilities*	*Self-efficacy and trainee outcome expectations*	*Organisational support*	*Training needs analysis*		*Training Method2*	*Learning*	*Increased Skill levels*
								Individual	*Organisational3*			
Trainees	*Self-evaluation Questionnaire*	*Self-evaluation Questionnaire*	*Self-evaluation Questionnaire*	*KLSI4*	*WPT5*	*Self-evaluation Questionnaire*		*Application Skills Outline (pre-training)*	*Organisiation specific*	*Organisiation specific*	*Application Skills Outline (post-training)*	*Pre minus Post Skills outline score*
Department (where applicable)	*Aggregated Self-evaluation Questionnaire*	*Aggregated Self-evaluation Questionnaire*	*Aggregated Self-evaluation Questionnaire*	*Aggregated KLSI*	*Aggregated WPT*	*Aggregated Self-evaluation Questionnaire*		*Aggregated Application Skills Outline (pre-training)*	*Organisiation specfic*	*Organisiation specific*	*Aggregated skills outline data*	*Aggregated Pre minus Post Skills outline score*
Organisation6	*Aggregated Self-evaluation Questionnaire*	*Aggregated Self-evaluation Questionnaire*	*Aggregated Self-evaluation Questionnaire*	*Aggregated KLSI*	*Aggregated WPT*	*Aggregated Self-evaluation Questionnaire*	*Structured and unstructured interviews*	*Aggregated Application Skills Outline (pre-training)*	*Organisiation specific*	*Organisiation specific*	*Aggregated skills outline data*	*Aggregated Pre minus Post Skills outline score*

1 [Kervin, 1992 #141]
2 The organisations chose the training method to be employed.
3 Organisational training needs were identified by the organisations prior to research commencing. The fact that the organisiation was planning to undertake EUT in the research time frame was a factor in including the organisation in the study.
4 Kolb's Learning Style Inventory
5 Wonderlic Personnel Test
6 Training groups were initialy included as a unit of analysis, however there were no training groups in the study that could not be aggregated into departments and some organisations only included new recruits or trainees from one department.

COMPUTER SKILLS SELF EVALUATION FORM FOR TRAINEES

This questionnaire is to gather demographic data about you, your computer use, your perceptions of using computers and self-assessed skill level.

The purpose of the questionnaire is to assess your current levels of skill in order to measure the learning that occurs after you received training.

Section One – Self-assessed generic computer skill level

For questions 1-5 use the numbers below to rate your skill level on the following scale:

1. = Nil	2. = Introductory
3. = Intermediate	4. = Advanced

1. My general computer skills are: _____
2. My wordprocessing skills are: _____
3. My spreadsheeting skills are: _____
4. My e-mailing skills are: _____
5. My electronic Personal Information Management (e.g. MS Outlook calendar) skills are: _____

Section Two: Users expectations

The following statements describe some outcomes from using a computer. For each statement please indicate how likely you would be to experience that outcome from computer use.

If I use a computer.....	Very Unlikely		Neutral		Very Likely
1. I will be better organised	1	2	3	4	5
2. My co-workers will perceive me as competent	1	2	3	4	5
3. I will increase my sense of accomplishment	1	2	3	4	5
4. I will increase my chances of getting promoted	1	2	3	4	5
5. I will increase my effectiveness on the job	1	2	3	4	5
6. I will been seen as higher status by my peers	1	2	3	4	5
7. I will spend less time on routine job tasks	1	2	3	4	5
8. I will increase the quality of output of my job	1	2	3	4	5
9. I will increase the quantity of output for the same amount of effort	1	2	3	4	5
10. I will be less reliant on computer support staff	1	2	3	4	5

Self-efficacy

The next set of questions is about your ability to use an *unfamiliar* piece of software. Imagine you have been given a new software package to assist with some aspect of your work, you have never used the package before but it is intended to make your job easier. The questions ask if you could use the software package under a variety of conditions, for each condition please answer "YES" or "NO" as to whether you could complete the job using the software package. If you answer "YES" please rate your feelings of confidence from 1-5 where 1 indicates "not at all confident", 3 is "moderately confident" and 5 is "totally confident"

I would be able to use the new unfamiliar software if		Not at all confident		Moderately confident		Totally confident
1. there was no one around to tell me what to do as I go	YES / NO	1	2	3	4	5
2. I had only the software manuals for reference	YES / NO	1	2	3	4	5
3. I had seen someone else using it before trying it myself	YES / NO	1	2	3	4	5
4. I could call someone for help if I got stuck	YES / NO	1	2	3	4	5
5. someone else helped me get started	YES / NO	1	2	3	4	5
6. I had a lot of time to complete the job for which the software was provided	YES / NO	1	2	3	4	5
7. I had just the built-in help facility for assistance	YES / NO	1	2	3	4	5
8. someone showed me how to do it first	YES / NO	1	2	3	4	5

Section Three - Demographic data and computer usage

In a typical week, how many hours, including work and leisure use, would you spend at a computer?

_____

Now please detail how many <u>hours per week</u> on average over the last year you have used the following types of software, by circling the appropriate number.

Word Processing	0	1	2	3	4	5 or more
Spreadsheet	0	1	2	3	4	5 or more
Email/	0	1	2	3	4	5 or more

Section Three - Demographic data and computer usage (cont.)

Personal Management	0	1	2	3	4	5 or more

1. Gender (circle one): Female / Male

2. Age: _____

3. Number of years spent employed (any full-time equivalent employment) _____

4. Circle your highest qualification:

   a. no qualifications

   b. any school qualification

   c. a Polytech (or equivalent) Diploma or Certificate

   d. an undergraduate degree

   e. a postgraduate degree

Please feel free to make any comments:

END OF QUESTIONNAIRE

Level

Essential Excel techniques

Entering data
- Enter text, values and dates
- Edit cell contents

Excel's Auto features
- AutoCalculate
- AutoComplete
- AutoFill

Selecting ranges
- Select columns & rows
- Select non-adjacent ranges
- Keyboard selection techniques
- Select multiple sheets

Managing worksheet structure
- Change column widths and row heights
- Insert rows / columns
- Insert/Delete cells
- Delete rows / columns
- Hide rows / columns
- Manage multiple worksheets

Formatting
- Common number formats
- Text formatting
- Cell formatting

Manipulating data
- Drag and drop
- Cut, copy and paste
- Paste Special
- Use the Clipboard toolbar

Managing large worksheets
- Freeze titles for scrolling
- Split the screen
- Sort list data

Page formatting and printing
- Defining a print area
- Insert pagebreaks
- Print Preview
- Margins & page layout
- Headers and footers
- Page numbering and page order
- Printing column and row headings on each
- Fitting your data to the printed page

Level

Formatting for Clarity & Emphasis with
- Add borders and shading
- Create custom number formats
- Horizontal & vertical alignment
- Merge cells
- Rotate and align text
- Wrap text
- Copy formatting using Format Painter
- Conditional formats
- Use styles

Number crunching with Excel

Basic formulae
- Autosum
- Basic calculations
- Copy formulae
- Use dates in calculations
- Relative and absolute cell references
- Join text and numbers
- Create linked formulae

Introduction to functions
- Syntax of functions
- Use Paste Function
- Statistical functions - Average, Max, Min
- Text functions
- IF statements
- Count functions
- Sum functions
- Database functions
- Vlookup, Hlookup
- Nest formulas and functions
- Use AND, OR and NOT functions

Range Names
- Defining range names
- Creating range names based on labels
- Using range names in formulas

Using the Auditing toolbar
- Trace precedent and dependant cell refs
- Trace errors

What if analysis with Excel

Analysis tools
- Goal Seek
- Solver
- Scenarios
- Sensitivity analysis
- Data tables
- Custom views and reports

Level

Selecting and manipulating data with Excel

Working with Data Lists
- Rules for setting up data lists
- Navigate using the keyboard
- Save time entering columns of data
- Use data validation
- Extended formats and formulas
- Use a data form
- Quick sort
- Sort options
- Automatic subtotals
- Create an outline
- Convert text to columns

Filtering a list
- Basic AutoFilter
- Custom AutoFilter
- Use the Advanced filter to extract information

Pivot table reports
- Use an existing pivot table
- Create a pivot table
- Format a pivot table
- Create a Pivot chart

Creating and Formatting Charts with Excel
- Using the Chart Wizard
- Chart navigation & selecting chart elements
- Update the source data
- Add & remove data
- Change the look of a chart
- Using pictures in fill effects
- Number formatting
- Combination charts
- Plot data on more than one axis
- Change the scale of the value axis
- Use dates in charts
- Time-scale axis
- Change the base unit
- Auto scale chart fonts
- Control 3D charts
- Annotate charts
- Custom chart types
- Print charts
- Print an embedded chart
- Print a chart sheet
- Troubleshoot charts

Name:

Department

Date:

Training Skill levels:

Please indicate your current skill level in the L

1. No knowledge
2. A little knowledge
3. Can do with assistance
4. Know how to do
5. Know it very well

Level

Customising Excel to suit your way of wo

Customising toolbars and menus
- Creating a new toolbar
- Adding a button to a toolbar
- Setting Excel preferences and defaults

Styles and templates
- Create a style by example
- Apply styles
- Merge styles
- Creating a workbook template

Working with Macros
- Record a macro
- Record using relative references
- Assign a macro to a toolbar button
- Create macro buttons on the spreadsheet
- Basic editing of VBA macro code

Other Useful Excel Tools and Features
- Protecting a workbook
- Inserting, Editing and Printing Comments
- Creating, editing and removing hyperlinks
- Using form controls on a worksheet

Level	Word Essentials
	Start a new document
	Use Company templates
	Change the document view
	Getting around in Word
	Use the Browse button
	Keyboard navigation
	Editing text
	Quick text selection techniques
	Undo and Redo
	Automatic spell and grammar check
	Find and Replace
	Moving and Copying
	Copy and Paste
	Drag 'n drop move and copy
	Use the Clipboard toolbar
	Fast formatting
	Use the formatting toolbar
	Use the Format Painter
	Character formatting shortcut keys
	Paragraph formatting shortcut keys
	Change case

	Page layout
	Insert Page breaks
	Control the page layout
	Print your documents
	Work in Print Preview
	Work with the Print dialog box

	Making the most of Word's automatic feature
	Use AutoCorrect
	Use AutoText entries
	Use the AutoText toolbar
	Bullets and numbering
	Numbers & bullets by example
	Automatic borders
	Use multilevel numbering

Level	Special formatting and illustrating with W
	Borders and Shading
	Apply borders to text and paragraphs
	Apply a page border
	Working with pictures
	Insert Clip art
	Insert pictures
	Format pictures
	Control the position of graphics
	Structuring documents with Word
	Create and format tables
	Insert a table
	Draw a table
	Type and navigate in a table
	Select in a table
	Insert and delete rows and columns
	Change column width and cell height
	Merge and split table cells
	Apply borders and shading
	Align and rotate text
	Change table properties
	Table AutoFormat
	Control the position and size of the table
	Print heading rows on every page
	Sort in a table
	Use Autosum in a table
	Tabulation
	Align text using tab stops
	Clear and move tab stops
	Change default tab stop spacing
	Columns
	Set up Newspaper columns
	Insert a column break
	Resize and format newspaper columns
	Balancing newspaper columns
	Creating newspaper columns on part of a page

Level	Working with long documents with Word
	Working with styles
	Use Predefined Styles
	Shortcuts for applying styles
	Modify heading styles by example
	Modify the Normal style
	Change the normal style for all documents
	Create styles by example
	Use the style dialog box
	Use the Document Map to navigate
	Headers, footers and page numbering
	Insert Headers and Footers
	Set up different first page, odd & even pages
	Working with sections
	Insert Section Breaks
	Use different Headers/Footers in a docum
	Page numbering different sections
	Table of contents
	Insert a table of contents
	Modify and update a TOC
	Formatting a TOC
	An overview of fields
	What are fields?
	Update fields
	Insert fields
	Quick Keys to use with fields
	Some useful fields

	Change-Tracking and Reviewing
	Tracking Changes
	Reviewing tracked changes
	Comparing documents with untracked change
	Saving multiple versions of a document
	Preventing loss of data
	Understanding Auto-recover
	Creating automatic back-up copies

Name:

Department

Date:

Training Skill levels:

Please indicate your current skill level in the *Level* c

1. No knowledge
2. A little knowledge
3. Can do with assistance
4. Know how to do
5. Know it very well

Level	Designing a Word template
	Save a document as a template
	Create Form templates using fields
	Insert a form field
	Text placeholders
	CreateDate
	FileName
	Insert form fields
	Text fields
	Check Box fields
	Drop-down fields
	Protect the form
	Protect sections of a form
	Use the form

	Create merged documents in Word
	Mail merge to:
	Form letters
	Envelopes
	Labels
	Customising the merge
	Selecting which records to use
	Customise the letter for different records

Essential PowerPoint 2000 techniques

Create a New Presentation
- ☐ Use Company template
- ☐ Insert new slides

Working with Text
- ☐ Use bullets and numbering
- ☐ Adjust line spacing
- ☐ Modify indents
- ☐ Use tabs
- ☐ Spell check & AutoCorrect
- ☐ Convert a word document to PowerPoint

Powerpoint Views
- ☐ Normal view, Outline view, Slide Sorter, Slide Show
- ☐ Work in Slide Master view
- ☐ Format slide background

Headers/Footers
- ☐ Add headers and footers
- ☐ Hide header/footer text or background objects

Graphics and Drawing tools
- ☐ Insert clip art
- ☐ Insert a picture from a file
- ☐ Modify and format a picture
- ☐ Use the drawing toolbar
- ☐ Select and resize objects
- ☐ Format drawing objects
- ☐ Add text boxes
- ☐ Draw a flowchart with connector lines
- ☐ Group objects

Dynamic presentations with PowerPoint 2000

Using Masters
- ☐ Reapply the default master format to a sl
- ☐ Create a title master
- ☐ Create a handout master
- ☐ Use Notes master

Advanced Drawing Skills
- ☐ Change the position of text in a text box
- ☐ Adjust margins in a text box
- ☐ Save an object style as the default
- ☐ Rotate and flip objects
- ☐ Align and distribute drawing objects
- ☐ Use guides to position objects

Charts
- ☐ Insert a chart
- ☐ Format charts
- ☐ Custom chart types
- ☐ Copy and paste data from Excel

Set up a slide show
- ☐ Run a slide show
- ☐ Animate a presentation
- ☐ Start a show from your desktop
- ☐ Save a presentation as a slide show

Other useful features
- ☐ Effective printing in black & white
- ☐ Create a Summary slide
- ☐ Hyperlinks and action buttons

Name:

Department

Date:

Training Skill levels:

Please indicate your current skill level in th

1. No knowledge
2. A little knowledge
3. Can do with assistance
4. Know how to do
5. Know it very well

DATA COLLECTION REQUIREMENTS:

Company	Contact Name	Meeting Date	Time

Data requirement	Data Source	Comment
Goals and objectives for training in the organisation	• Mission statement • Goals • Objectives Relating to training for staff	Maybe these are departmental eg TDU documents rather than organisational
Who identifies goals for training: • For the organisation • For the sub-unit • For the individual	• Interview with training manager	Maybe I need to talk to someone else here, if so can you identify and assist
To what extent does the organisation support training for end users of software applications NOTE: This is with particular reference to the training studied in the research project, but may include general organisational support for all staff (eg help desk facility)	Answers to specific questions, such as: • How does the organisation support transfer of training • How do supervisors/team leaders support transfer of training • Is there a procedure for staff to identify individualised career paths (organisation or department wide?) And maybe documented evidence (feedback forms, performance appraisals, career goals/paths etc.)	As above. These questions are very open to encourage a range of answers. However I can ask specific questions if whoever is responding needs some cues There also may be some informal support procedures within units that I would be interested in learning about
Is there currently any measurement of "training success" in the organisation	• Performance measures post training (i.e. test data proving learning has improved) • Learning needs analysis completed at a later time by a group that has received training in that area	If there is any past data for the group we are studying I would be interested in analysing it. If not it is the data that will be gathered for the research in this study. We could use the self-assessed skill level form
Is there currently any measurement of "training transfer" in the organisation	• Performance on the job some time after training • Evidence of increased productivity	This is an area that probably needs development and collaboration to identify skills/areas that can be measured to prove increased job performance. I have some material and ideas in this area.

ORGANISATIONAL DEMOGRAPHICS -	
Name	
Industry sector	
Ownership Structure	
Geographic Location	
Parent Company Address	
Subsidiaries	
Number of employees	
Department/s in Study	
No. individuals in study	

Some of the specific questions that may help in identifying the level of existing (or potential) organisational support for training:

- on the job tasks to perform (that reinforce skills from training)
- opportunity to practice skills
- immediate, relevant feedback (from supervisors)
- reinforcement (from supervisors and co-workers)
- availability of equipment and tools
- are career paths linked to training
- is there any goal-setting and self-management instruction for trainees
- Is work specified and measured in terms of timeliness, quality and cost
- Are there clearly defined work measurements standards and goals
- Does the work process generate the right quality and quantity of output on time
- Are workers made precisely aware of 1 and 2 above
- Do workers have the knowledge and skills to accomplish 1 & 2
- Feedback to adjust performance
- Incentives support good performance and not poor

Observational Training Needs Analysis

Name:		
Job title:		
Job Description: Facts of requirements of training:		
Semi-structured interviews with trainees: (aprox time 20 mins)		
1	Briefly describe your job	
2	Any problems with the job	
3	What improvements do you think could be made	
4	What are your goals	
5	What are your training needs	
Comments Trainee:		
Analyst:		
Type of training preferences:		
Scores: Word Excel PowerPoint		

Information Sheet for Research into Computer Application Training Skills Effectiveness

Researcher:
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Peter Blakey
E-mail: P.Blakey@massey.ac.nz
Voice: 06 350 5799 ext. 2682

I am a student at Massey University completing a Master of Information Science degree. I am studying effective, efficient end user training (EUT) of software applications, particularly the transfer of skills from the training environment to the workplace, and would appreciate if you could assist me with my research.

The purpose of this research project is to identify areas that affect the transfer of training to the workplace in order to improve future training programmes.

Areas that will be investigated in the research:

1. Measuring the effects of training by testing before, immediately after and some weeks after training (to measure skills transfer).
2. Comparing trainee characteristics (such as a person's learning style and ability to apply learnt knowledge to new situations) with the level of training transfer.

Therefore, your participation would involve:

1. Completing three training tests – one before training, one immediately after training and one some weeks after training. (The number of weeks after training is still to be decided) (approximately 15 minutes each)

Filling in two trainee characteristics questionnaires as follows:

2. Kolb's Learning Style Inventory – to measure learning styles (approximately 15 minutes)
3. Wonderlic Personnel Test – to measure learning abilities (maximum 12 minutes)

And

4. A self-evaluation of computer and applications skills (approximately 10 minutes).

As a participant in your organisation's training programmes, I would appreciate your participation in my research. If you agree to participate in the research, you will be asked to sign a consent form (attached, see next page) prior to training commencing. Having agreed to take part in the research project does not preclude you from withdrawing from the entire project at any time or from refusing to answer a particular question. You have the right to ask questions about the study at any time during participation.

The information in your individual responses will be strictly confidential to the researcher. Anonymity will be assured by using a coding system for all questionnaires; no material that could identify you personally will be used in any verbal or written report. Participating in this research will not affect your job position, future prospects or any work relationships or work related issues. All response material will be destroyed at the conclusion of the study.

If you agree to take part in this study could you mail your consent form and questionnaires directly to the researcher in the self-addressed freepost envelope supplied with the forms. If you have any questions please contact the researcher or supervisor above. The researcher will collate the information; all identification of individuals will be removed. Statistical analysis will be performed and results and conclusions will be drawn from the data supplied.

A copy of the results and findings of this research project will be available from the Department of Information Systems at Massey University, at the conclusion of the project.

Jane Shand 2002

COMPUTER APPLICATION TRAINING SKILLS EVALUATION

CONSENT FORM

If you are willing to participate in this research please sign the consent form and mail it with the questionnaires in the self-addressed freepost envelope provided.

I have read the information sheet for the training project and understand the details of the study.

I understand I may contact the researcher or supervisor to ask questions at any time during the study.

I understand that I have the right to withdraw from the study at any time without question.

I understand that I have the right to decline to answer any particular questions in the study.

I agree to provide information to the researcher on the understanding that my name will not be used.

I understand that no material that could identify me personally will be used in any verbal or written report produced by the researcher.

I _____ (full name)

Agree to participate in this study under the conditions set out in the information sheet.

Signed: _____

Date: _____

Company: _____

PROPOSAL FOR TRAINING RESEARCH AT ORGANISATION B,

Organisation B has identified a need for training staff in the use of Microsoft Office products. The perception is that staff currently have a range of competencies, therefore, an individualised program is to be considered. It is envisaged that skill levels for all staff can be raised, and a model can be developed to provide some structure for training at Organisation B.

As part of the fulfilment of a Master's thesis in Information Systems I have agreed to work with Organisation B. This initial proposal gives an outline of how we see the project developing and desired outcomes for Organisation B and the research. The fundamental research question for the project is: What trainee characteristics, training methods and work environment affect the learning and transfer of learning for trainees of end-user software applications?

The first step is to conduct a training needs analysis. The training manager will contact the areas where training is to occur and discuss the project. After identifying trainees either an information sheet can be given to trainees and/or a meeting between trainees, the training manager and Jane can be held to explain the training project, the research and ethical issues (such as anonymity of test results). An element of informal needs analysis can be gathered through this process (most probably verbal).

Formal training needs analysis will be conducted on three levels; first organisational, second departmental and thirdly at the individual level. Organisational and departmental analysis will require interviews with appropriate staff (management/supervisory) and possibly some gathering of secondary data (for example, mission statement, goals, departmental targets etc.) Individual training needs analysis will be conducted on two levels, firstly by trainees identifying their own training needs via a questionnaire that also identifies trainees' perception of their level of skill. Secondly individual needs analysis can be identified by administering a pre-test that has been developed during the departmental/task analysis phase.

Results of the training needs analysis will guide the training design. Some areas for consideration are using "key users" as training mentors. This would involve identifying power users in a department, providing them with out-sourced training and supporting them to provide solutions for MSOffice users in their everyday work environment. Another area is using a coaching style training approach with a trainer working one to one with a trainee. Yet another approach could be using web-based training packages with or without an on-line (via e-mail) support person.

Once training commences trainees will be asked to fill in additional questionnaires to measure for example learning styles, demographics and learning ability. Post training tests will be carried out to measure task skills.

Jane Shand 2002

RAW DATA GATHERED FROM ORGANISATIONS

							Learning Styles												
Organisa	ref	age	Gencgh	qual	Yrs emp	WPT scc	CE scor	AC scor	RO scor	AE scor	Gen. Skil	Comp u	AC - CE	E - RO	U expe	Self-effic	Skill Before	Skill After
Org A	731	45	1	3	30	24	15	38	34	33	17	30	23	-1	42	34	438	480
Org A	732	37	1	3	20	21	19	22	38	41	19	50	3	3	40	32	454	465
Org A	733	35	1	2	20	25	28	32	20	40	16	25	4	20	42	28	375	455
Org A	762	36	1	3	17	23	22	26	33	39	15	25	4	6	43	32	313	351
Org A	763	26	1	3	6.5	27	25	22	36	37	15	30	-3	1	36	26	445	401
Org A	764	52	1	3	37	17	24	24	32	40	14.5	40	0	8	38	25	315	419
Org A	765	51	1	3	34	24	27	28	31	34	17	20	1	3	42	23		
Org A	766	27	1	4	5	21	23	30	30	37	16.5	40	7	7	42	32	354	383
Org A	767	59	1	2	30	23	27	21	33	39	14	27	-6	6	49	23	324	382
Org A	768	53	1	2	37	21	37	27	19	37	14	20	-10	18	50	24	306	383
Org A	769	32	1	2	17	19	23	26	33	38	16	40	3	5	35	12	297	376
Org A	770	28	1	3	9	22					13	35			35	18		303
Org A	771	28	1	3	10	25	27	29	23	41	16	22	2	18	38	31	450	489
Org B1	717	43	2	1	26	16	17	39	35	29	11	40	22	-6	33	22	538	618
Org B1	718	45	2	2	29	27	23	34	31	32	8	5	11	1	38	15	297	418
Org B1	719	43	2	2	23	20	25	29	25	41	14	27	4	16	42	40	1035	1030
Org B1	720	45	2	2	28	21	19	30	37	34	12	20	11	-3	40	30	437	
Org B1	721	49	2	1	34	19	24	29	34	33	13	30	5	-1	48	32	636	728
Org B1	722	43	2	2	23	21	20	21	41	38	7	8	1	-3	38	11	350	446
Org B1	723	59	2	3	45	26	32	34	15	39	13	20	2	24	46	28	809	
Org B2	751	42	2	2	25	24	24	26	28	42	10	12	2	14	47	9	138	
Org B2	752	44	2	3	28	22					7	4			42	6	129	
Org B2	753	25	2	4	4	25	19	45	27	29	13	42	26	2	24	29	362	355
Org B2	754	28	2	5	6	27	34	21	34	31	12	40	-13	-3	35	24	309	450
Org B2	755	37	1	2	20	19	21	32	34	33	10	40	11	-1	36	21	311	422
Org B2	756	27	1	4	6	27	23	21	30	46	14	40	-2	16	32	23	339	371
Org B2	757	50	1	2	30	30	19	34	38	29	15	42	15	-9	47	30	241	376
Org B2	758	33	1	2	12	20	34	19	25	42	13	30	-15	17	37	24	264	
Org B2	759	33	2	3	14	27	25	27	29	39	12	50	2	10	44	31	294	
Org B2	760	47	2	3	28	16	29	24	24	43	14	30	-5	19	39	26	308	
Org B2	761	33	2	2	15	22	27	17	37	39	12	40	-10	2	33	23	413	

Organis:	ref	age	Gencgh	qual	Yrs em	WPT sc	CE sco	AC scor	RO sco	AE scor	Gen. Skil	Comp u	AC - CE	E - RO	U expe	Self-effic	Skill Before	Skill After
Org C	701	26	2	4	6	25	29	42	17	32	19	2	13	15				
Org C	702	22	1	2	4	20	35	39	25	21	11	1.5	4	-4	32	31	414	963
Org C	703	43	2	3	20	17	22	32	38	28	14	5	10	-10	19	23	645	779
Org C	704	38	1	1	9	22	31	19	33	37	7	1	-12	4				
Org C	705	35	2	3	19	22	25	22	31	42	8	0.5	-3	11	37	25	364	414
Org C	706	46	1	2	20	32	36	27	31	26	15	5	-9	-5	37	27	430	760
Org C	707	26	1	4	6	28	27	32	35	26	10	5	5	-9	40	13	88	
Org C	708	28	2	3	11	31	19	37	36	28	11	15	18	-8	42	25	442	585
Org C	709	27	2	4	8	28	24	38	36	22	12	5	14	-14				
Org C	710	30	2	2	13	19	34	40	31	15	11	7	6	-16	34	21	426	513
Org D	736	28	1	4	10	25	28	35	33	24	18	50	7	-9	36	32	65	75
Org D	737	25	1	3		18	19	31	24	46	16	10	12	22	50	30	55	73
Org D	738	34	2	3	17	26	19	26	32	43	13	3	7	11	40	25	40	65
Org D	739	38	2	3	23	27	34	26	19	41	13	35	-8	22	40	15	40	74
Org D	740	37	1	3	15	14	18	30	44	28	9	12	12	-16	38	14	20	60
Org D	741	24	1	5	2.5	29	19	39	26	36	14	7	20	10	36	34	45	67
Org D	742	23	1	3	4	15	30	21	22	47	17	37	-9	25	38	30	60	64
Org D	743	22	1	3	2	24	27	35	32	26	17	40	8	-6	45	25	60	67
Org D	744	23	2	2	4	28	32	34	25	29	11	30	2	4	37	15	30	64
Org D	745	29	1	3	10	25	27	31	28	34	14	20	4	6	40	23	45	59
Org D	746	39	2	3	5	18	28	45	27	20	10	3	17	-7	28	21	25	53
Org D	747	22	1	2	4	27					14	12			44	33	45	49
Org D	748	39	1	4		27	29	29	28	34	18	8	0	6	37	37	65	79
Org D	749	21	2	3	3	17					19	30			50	24	70	87
Org D	750	23	1	3	5	19	20	23	33	44	19	50	3	11	35	28	70	61

Organis:	excel bef	word bef	ppnt bef	exce aft	word aft	pp aft
Org A		438			480	
Org A		454			465	
Org A		375			455	
Org A		313			351	
Org A		445			401	
Org A		315			419	
Org A						
Org A		354			383	
Org A		324			382	
Org A		306			383	
Org A		297			376	
Org A					303	
Org A		450			489	
Org B1	236	195	107	234	267	117
Org B1	109	125	63	193	141	84
Org B1	395	409	231	422	373	235
Org B1	160	189	88			
Org B1	287	229	120	325	257	146
Org B1	178	110	62	240	143	63
Org B1	374	272	163			
Org B2	138					
Org B2	129					
Org B2	362			355		
Org B2	309			450		
Org B2	311			422		
Org B2	339			371		
Org B2	241			376		
Org B2	264					
Org B2	294					
Org B2	308					
Org B2	413					

Organis:	excel bef	word bef	ppnt bef	exce aft	word aft	pp aft
Org C						
Org C	186	174	54	443	289	231
Org C	268	277	100	353	284	142
Org C						
Org C	151	148	65	172	173	69
Org C	100	186	144	250	331	179
Org C			88			
Org C	126	238	78	221	312	52
Org C						
Org C	208	164	54	228	209	76
Org D						
Org D						
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ALL DATA GATHERED FROM ORGANISATIONS

							Learning Styles calculations										
Organisati	ref	age	Gend	h qual	Yrs emp	WPT s	E score	C score	O score	Ξ score	Gen. Sk	Comp us	C - CE	E - RO	style code	U expecta	Self-effic
Org A	731	45	1	3	30	24	15	38	34	33	17	30	23	-1	3	42	34
Org A	732	37	1	3	20	21	19	22	38	41	19	50	3	3	2	40	32
Org A	733	35	1	2	20	25	28	32	20	40	16	25	4	20	4	42	28
Org A	762	36	1	3	17	23	22	26	33	39	15	25	4	6	4	43	32
Org A	763	26	1	3	6.5	27	25	22	36	37	15	30	-3	1	2	36	26
Org A	764	52	1	3	37	17	24	24	32	40	14.5	40	0	8	1	38	25
Org A	765	51	1	3	34	24	27	28	31	34	17	20	1	3	2	42	23
Org A	766	27	1	4	5	21	23	30	30	37	16.5	40	7	7	4	42	32
Org A	767	59	1	2	30	23	27	21	33	39	14	27	-6	6	1	49	23
Org A	768	53	1	2	37	21	37	27	19	37	14	20	-10	18	4	50	24
Org A	769	32	1	2	17	19	23	26	33	38	16	40	3	5	2	35	12
Org A	770	28	1	3	9	22					13	35				35	18
Org A	771	28	1	3	10	25	27	29	23	41	16	22	2	18	1	38	31
AVERAGE		39.15		2.77	20.96	22.46	24.75	27.08	30.17	38.00	15.62	31.08				40.92	26.15
STD DEV		11.47		0.60	11.58	2.70	5.38	4.83	6.16	2.56	1.60	9.28				4.73	6.35
Org B1	717	43	2	1	26	16	17	39	35	29	11	40	22	-6	3	33	22
Org B1	718	45	2	2	29	27	23	34	31	32	8	5	11	1	3	38	15
Org B1	719	43	2	2	23	20	25	29	25	41	14	27	4	16	4	42	40
Org B1	720	45	2	2	28	21	19	30	37	34	12	20	11	-3	3	40	30
Org B1	721	49	2	1	34	19	24	29	34	33	13	30	5	-1	3	48	32
Org B1	722	43	2	2	23	21	20	21	41	38	7	8	1	-3	2	38	11
Org B1	723	59	2	3	45	26	32	34	15	39	13	20	2	24	1	46	28
AVERAGE		46.71		1.86	29.71	21.43	22.86	30.86	31.14	35.14	11.14	21.43				40.71	25.43
STD DEV		5.82		0.69	7.74	3.87	4.95	5.64	8.69	4.30	2.67	12.27				5.12	10.10

Organisati	ref	age	Gendjh	qual	Yrs emp	WPT s	E score	C score	O score	score	Gen. Sk	Comp us	C - CE	E - RO	style code	U expecta	Self-effic
Org B2	751	42	2	2	25	24	24	26	28	42	10	12	2	14	1	47	9
Org B2	752	44	2	3	28	22					7	4				42	6
Org B2	753	25	2	4	4	25	19	45	27	29	13	42	26	2	3	24	29
Org B2	754	28	2	5	6	27	34	21	34	31	12	40	-13	-3	2	35	24
Org B2	755	37	1	2	20	19	21	32	34	33	10	40	11	-1	3	36	21
Org B2	756	27	1	4	6	27	23	21	30	46	14	40	-2	16	1	32	23
Org B2	757	50	1	2	30	30	19	34	38	29	15	42	15	-9	3	47	30
Org B2	758	33	1	2	12	20	34	19	25	42	13	30	-15	17	1	37	24
Org B2	759	33	2	3	14	27	25	27	29	39	12	50	2	10	1	44	31
Org B2	760	47	2	3	28	16	29	24	24	43	14	30	-5	19	1	39	26
Org B2	761	33	2	2	15	22	27	17	37	39	12	40	-10	2	2	33	23
AVERAGE		36.27		2.91	17.09	23.55	25.50	26.60	30.60	37.30	12.00	33.64				37.82	22.36
STD DEV		8.43		1.04	9.66	4.18	5.50	8.45	4.90	6.27	2.28	13.94				6.97	8.03
Org C	701	26	2	4	6	25	29	42	17	32	19	2	13	15	4		
Org C	702	22	1	2	4	20	35	39	25	21	11	1.5	4	-4	3	32	31
Org C	703	43	2	3	20	17	22	32	38	28	14	5	10	-10	3	19	23
Org C	704	38	1	1	9	22	31	19	33	37	7	1	-12	4	2		
Org C	705	35	2	3	19	22	25	22	31	42	8	0.5	-3	11	1	37	25
Org C	706	46	1	2	20	32	36	27	31	26	15	5	-9	-5	2	37	27
Org C	707	26	1	4	6	28	27	32	35	26	10	5	5	-9	3	40	13
Org C	708	28	2	3	11	31	19	37	36	28	11	15	18	-8	3	42	25
Org C	709	27	2	4	8	28	24	38	36	22	12	5	14	-14	3		
Org C	710	30	2	2	13	19	34	40	31	15	11	7	6	-16	3	34	21
AVERAGE		32.10		2.80	11.60	24.40	28.20	32.80	31.30	27.70	11.80	4.70				34.43	23.57
STD DEV		8.02		1.03	6.13	5.19	5.79	7.90	6.24	7.85	3.49	4.22				7.59	5.62

Organisati	ref	age	Gendɟh	qual	Yrs emɟ	WPT s:E score	C score	O score	Ξ score	Gen. Sk	Comp us\C - CE	E - RO	style code	U expecta	Self-effi
Org D	736	28	1	4	10	25	28	35	33	24	18	50	7	-9	3	36	32
Org D	737	25	1	3		18	19	31	24	46	16	10	12	22	4	50	30
Org D	738	34	2	3	17	26	19	26	32	43	13	3	7	11	4	40	25
Org D	739	38	2	3	23	27	34	26	19	41	13	35	-8	22	1	40	15
Org D	740	37	1	3	15	14	18	30	44	28	9	12	12	-16	3	38	14
Org D	741	24	1	5	2.5	29	19	39	26	36	14	7	20	10	4	36	34
Org D	742	23	1	3	4	15	30	21	22	47	17	37	-9	25	1	38	30
Org D	743	22	1	3	2	24	27	35	32	26	17	40	8	-6	3	45	25
Org D	744	23	2	2	4	28	32	34	25	29	11	30	2	4	2	37	15
Org D	745	29	1	3	10	25	27	31	28	34	14	20	4	6	4	40	23
Org D	746	39	2	3	5	18	28	45	27	20	10	3	17	-7	3	28	21
Org D	747	22	1	2	4	27					14	12				44	33
Org D	748	39	1	4		27	29	29	28	34	18	8	0	6	1	37	37
Org D	749	21	2	3	3	17					19	30				50	24
Org D	750	23	1	3	5	19	20	23	33	44	19	50	3	11	1	35	28
AVERAGE		28.47		3.13	8.04	22.60	25.38	31.15	28.69	34.77	14.80	23.13				39.60	25.73
STD DEV		6.96		0.74	6.58	5.15	5.61	6.58	6.32	8.95	3.23	16.66				5.77	7.23
TOTAL AVERAG		35.41		2.79	16.46	22.93	25.46	29.62	30.23	34.69	13.45	23.54				39.02	24.81
TOTAL STD DE\		6.99		0.49	8.45	1.13	1.92	2.72	1.05	4.09	2.00	11.35				2.68	1.61

Gender key	Count	%
1 Fema	31	55%
2 Male	25	45%
	56	

KLSI key	Count	%
1 Accommodating	14	27%
2 Diverging	10	19%
3 Assimilating	18	35%
4 Converging	10	19%
	52	

Qualifications k	Count	%
1 No qualifications	3	5%
2 Any school quali	18	32%
3 A Polytech Dip o	25	45%
4 An undergraduat	8	14%
5 A postgraduate c	2	4%
	56	

					Calculation data					
Organisati	kill Before	kill After	Inc/dec	inc/dec	excel bef	word bef	wpoint bef	exce aft	word aft	pp aft
Org A	438	480	42	10%		438			480	
Org A	454	465	11	2%		454			465	
Org A	375	455	80	21%		375			455	
Org A	313	351	38	12%		313			351	
Org A	445	401	-44	-10%		445			401	
Org A	315	419	104	33%		315			419	
Org A										
Org A	354	383	29	8%		354			383	
Org A	324	382	58	18%		324			382	
Org A	306	383	77	25%		306			383	
Org A	297	376	79	27%		297			376	
Org A		303	303						303	
Org A	450	489	39	9%		450			489	
AVERAGE	370.09	407.25	68.00	14%						
STD DEV	64.65	56.08	83.50	12%						
Org B1	538	618	80	15%	236	195	107	234	267	117
Org B1	297	418	121	41%	109	125	63	193	141	84
Org B1	1035	1030	-5	0%	395	409	231	422	373	235
Org B1	437		-437		160	189	88			
Org B1	636	728	92	14%	287	229	120	325	257	146
Org B1	350	446	96	27%	178	110	62	240	143	63
Org B1	809		-809		374	272	163			
AVERAGE	586.00	648.00	-123.14	19%						
STD DEV	263.80	248.46	360.10	15%						

Organisati	kill Before	kill After	Inc/dec	inc/dec	excel bef	word bef	wpoint bef	exce aft	word aft	pp aft
Org B2	138		-138		138					
Org B2	129		-129		129					
Org B2	362	355	-7	-2%	362			355		
Org B2	309	450	141	46%	309			450		
Org B2	311	422	111	36%	311			422		
Org B2	339	371	32	9%	339			371		
Org B2	241	376	135	56%	241			376		
Org B2	264		-264		264					
Org B2	294		-294		294					
Org B2	308		-308		308					
Org B2	413		-413		413					
AVERAGE	282.55	394.80	-103.09	29%						
STD DEV	86.80	39.66	197.95	24%						
Org C										
Org C	414	963	549	133%	186	174	54	443	289	231
Org C	645	779	134	21%	268	277	100	353	284	142
Org C										
Org C	364	414	50	14%	151	148	65	172	173	69
Org C	430	760	330	77%	100	186	144	250	331	179
Org C	88		-88				88			
Org C	442	585	143	32%	126	238	78	221	312	52
Org C										
Org C	426	513	87	20%	208	164	54	228	209	76
AVERAGE	401.29	669.00	172.14	49%						
STD DEV	164.41	201.61	207.80	47%						

Organisati	kill Before	ill After	Inc/dec	inc/dec	excel bef	word bef	wpoint bef	exce aft	word aft	pp aft
	NORMALISED SCALES									
Org D	65	75	10	15%						
Org D	55	73	18	33%						
Org D	40	65	25	63%						
Org D	40	74	34	85%						
Org D	20	60	40	200%						
Org D	45	67	22	49%						
Org D	60	64	4	7%						
Org D	60	67	7	12%						
Org D	30	64	34	113%						
Org D	45	59	14	31%						
Org D	25	53	28	112%						
Org D	45	49	4	9%						
Org D	65	79	14	22%						
Org D	70	87	17	24%						
Org D	70	61	-9	-13%						
AVERAGE	49.00	66.47	17.47	36%						
STD DEV	16.17	9.93	13.35	56%						
TOTAL AV	290.69	351.44	5.52	35%						
TOTAL ST	195.66	244.08	122.63	14%						

COMPLETE DATA FROM ORGANISATIONS USED FOR ANALYSIS

Organisatio	ref	age	Gende	high qua	Yrs empl	WPT scor	Gen. Skill	Comp use	Lstyle cd	U expecta	lf-efficacy	ikill Before	ikill After	Inc/dec	%inc/dec
Org A	731	45	1	3	30	24	17	30	3	42	34	438	480	42	10%
Org A	732	37	1	3	20	21	19	50	2	40	32	454	465	11	2%
Org A	733	35	1	2	20	25	16	25	4	42	28	375	455	80	21%
Org A	762	36	1	3	17	23	15	25	4	43	32	313	351	38	12%
Org A	763	26	1	3	6.5	27	15	30	2	36	26	445	401	-44	-10%
Org A	764	52	1	3	37	17	14.5	40	1	38	25	315	419	104	33%
Org A	766	27	1	4	5	21	16.5	40	4	42	32	354	383	29	8%
Org A	767	59	1	2	30	23	14	27	1	49	23	324	382	58	18%
Org A	768	53	1	2	37	21	14	20	4	50	24	306	383	77	25%
Org A	769	32	1	2	17	19	16	40	2	35	12	297	376	79	27%
Org A	771	28	1	3	10	25	16	22	1	38	31	450	489	39	9%
AVERAGE		39.09		2.73	20.86	22.36	15.73	31.73		41.36	27.18	370.09	416.73	46.64	14%
STD DEV		11.46		0.65	11.38	2.91	1.47	9.43		4.80	6.29	64.65	47.68	40.56	12%
Org B1	717	43	2	1	26	16	11	40	3	33	22	538	618	80	15%
Org B1	718	45	2	2	29	27	8	5	3	38	15	297	418	121	41%
Org B1	719	43	2	2	23	20	14	27	4	42	40	1035	1030	-5	0%
Org B1	721	49	2	1	34	19	13	30	3	48	32	636	728	92	14%
Org B1	722	43	2	2	23	21	7	8	2	38	11	350	446	96	27%
AVERAGE		44.6		1.6	27	20.6	10.6	22		39.8	24	571.2	648	76.8	19%
STD DEV		2.61		0.55	4.64	4.04	3.05	14.98		5.59	11.98	293.48	248.46	48.10	15%
Org B2	753	25	2	4	4	25	13	42	3	24	29	362	355	-7	-2%
Org B2	754	28	2	5	6	27	12	40	2	35	24	309	450	141	46%
Org B2	755	37	1	2	20	19	10	40	3	36	21	311	422	111	36%
Org B2	756	27	1	4	6	27	14	40	1	32	23	339	371	32	9%
Org B2	757	50	1	2	30	30	15	42	3	47	30	241	376	135	56%
AVERAGE		33.40		3.40	13.20	25.60	12.80	40.80		34.80	25.40	312.40	394.80	82.40	29%
STD DEV		10.36		1.34	11.37	4.10	1.92	1.10		8.29	3.91	45.50	39.66	66.24	24%

Organisatio	ref	age	Gende	high qua	Yrs empl	WPT scor	Gen. Skill	Comp use	Lstyle cd	U expecta	lf-efficacy	ikill Before	ikill After	Inc/dec	%inc/dec
Org C	702	22	1	2	4	20	11	1.5	3	32	31	414	963	549	133%
Org C	703	43	2	3	20	17	14	5	3	19	23	645	779	134	21%
Org C	705	35	2	3	19	22	8	0.5	1	37	25	364	414	50	14%
Org C	706	46	1	2	20	32	15	5	2	37	27	430	760	330	77%
Org C	708	28	2	3	11	31	11	15	3	42	25	442	585	143	32%
Org C	710	30	2	2	13	19	11	7	3	34	21	426	513	87	20%
AVERAGE		34.00		2.50	14.50	23.50	11.67	5.67		33.50	25.33	453.50	669.00	215.50	49%
STD DEV		9.19		0.55	6.41	6.41	2.50	5.17		7.87	3.44	97.66	201.61	189.81	47%
												NORMALISED SCALES			
Org D	736	28	1	4	10	25	18	50	3	36	32	65	75	10	15%
Org D	737	25	1	3		18	16	10	4	50	30	55	73	18	33%
Org D	738	34	2	3	17	26	13	3	4	40	25	40	65	25	63%
Org D	739	38	2	3	23	27	13	35	1	40	15	40	74	34	85%
Org D	740	37	1	3	15	14	9	12	3	38	14	20	60	40	200%
Org D	741	24	1	5	2.5	29	14	7	4	36	34	45	67	22	49%
Org D	742	23	1	3	4	15	17	37	1	38	30	60	64	4	7%
Org D	743	22	1	3	2	24	17	40	3	45	25	60	67	7	12%
Org D	744	23	2	2	4	28	11	30	2	37	15	30	64	34	113%
Org D	745	29	1	3	10	25	14	20	4	40	23	45	59	14	31%
Org D	746	39	2	3	5	18	10	3	3	28	21	25	53	28	112%
Org D	747	22	1	2	4	27	14	12		44	33	45	49	4	9%
Org D	748	39	1	4		27	18	8	1	37	37	65	79	14	22%
Org D	749	21	2	3	3	17	19	30		50	24	70	87	17	24%
Org D	750	23	1	3	5	19	19	50	1	35	28	70	61	-9	-13%
AVERAGE		28.47		3.13	8.04	22.60	14.80	23.13		39.60	25.73	49.00	66.47	17.47	36%
STD DEV		6.96		0.74	6.58	5.15	3.23	16.66		5.77	7.23	16.17	9.93	13.35	56%
TOTALS															
AVERAGE		34.55		2.7857	14.8095	22.78571	13.85714	24.85714		38.6429	25.80952	284.4048	352.6	68.1905	35%
STD DEV		10.08		0.8981	10.8403	4.588085	3.086726	15.53724		6.51386	6.73628	217.7871	261.32	98.9176	42%
MEDIAN		34.5		3	14	23	14	27		38	25	312	382.5	38.5	21%
CORRELATION		0.04		-0.07	-0.0486	-0.0443	-0.46393	-0.38577		-0.12073	-0.41481	-0.34282	-0.1243	0.42644	
COVARIANCE		0.145		-0.026	-0.2138	-0.08254	-0.58154	-2.43407		-0.31935	-1.13475	-30.3204	-13.19	17.1304	

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