TOWARD A MODEL OF EFFECTIVE RESPONSIVE TRAINING
FOR END-USER COMPUTING:
A CONSTRUCTIVIST APPROACH TO END-USER TRAINING

By

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A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy
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Abstract

Modern information technology and data processing systems and the ways in which they are used, are changing very rapidly. With this fast pace of technological innovations, it is the end-user who is facing the challenge to stay on par with technological advances but, typically, is not able to keep up with this race.

Unfortunately, the support measures available for the end-user are often insufficient, and the typical end-user ends up relying on the support of other end-users who managed to overcome the obstacles and proceed to a “higher” level of understanding. Such informal support from other end-users is referred to in this thesis as Responsive Training.

This qualitative study used a grounded theory method to explore the efforts of the end-users to become self-sufficient in this continuously evolving technological age. It explored the problems the end-user faces, the user’s needs resulting from these problems and the type of support that is needed in response to these needs. This study examined effective and ineffective training methods and defined the elements of effective responsive training as a constructivist training approach addressing the user’s problems and needs.
The data collection methods employed included participant observations, focused observations, open and semi-structured interviews, case studies and experiments with various trainers and trainees.

The results presented in this thesis have important implications for the general field of training and instructional theory, and, specifically, end-user training in the face of rapid technological change. The questions and findings that emerged from this study could be of major significance for "Human Factors" research as well as for the implementation of new technologies in the workplace and at home. More generally, this study highlights the need to revisit training and educational theories and especially to bridge the gap between them.
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CHAPTER 1
INTRODUCTION

1.1. The Problem Statement

Modern information technology and data processing systems and the ways they are used, are changing very rapidly. Computers are now widely used and computer literacy has become a "critical filter" for an increasing number of jobs and careers in a growing number of occupations.

With this fast pace of technological innovation it is the end-user who faces the challenge of staying up to date with technological advances but, typically, is not able to keep up with this race. To assist end-users in their attempts at coping with technological innovations, hardware and software developers strive to provide adequate support such as printed or on-screen documentation, training courses, or on-line assistance for their customers. However, the typical end-user is ending up relying on the support of other end-users who have managed to overcome the obstacles and proceed to a "higher" level of understanding and user self-sufficiency.

This thesis examines the journey of the end-users go through in their attempt to use their computers. The thesis focuses on end-users' efforts to become self-sufficient and to be able to use their computers through support provided to them by those who are more computer literate, referred to in this thesis as "Responsive Trainers". Methods for improving the support provision by responsive trainers are sought.

1.2 Background and Rationale

The business world of today is in the midst of a great transition. "The rigid structures and processes of industrial age businesses are slowly giving way to the agile and flexible operations of information-age cybercorps" (Umbaugh, 1998, p. 93). James Martin, a notable information technology (IT) writer and consultant, describes, in his interview with Umbaugh (1998), the future cybercorp as "designed for rapid change, continual learning and constant evolution and growth..." (p. 93). According to Martin, the growth of
cybercorp will result in "a total reinvention of employment...and a new partnership between humans and technology."

Data processing expenditures constitute a significant, growing portion of the overall budget for an increasing number of businesses. However, it is not clear that we necessarily get more worker productivity by putting computers on workers' desks. "Despite a Star Wars-like spending binge all through the '80s, the great technology payoff somehow managed to elude much of corporate America" (Stamp, 1993, p.47). While Umbaugh (1998) suggests that effective implementation of the new technology "requires the cybercorp to redesign the business process of their enterprise" (p.94) the redesign process has not kept pace with data processing expenditures. A detailed study at Ernst and Young's Center for Information Technology (cited in Umbaugh, 1998) found that "in many companies the key processes were last designed well before the rise of information technology. ... The process and structures of most corporations were created before today's understanding of cross functional teams...and markets' demands for fast, fluid, flexible change..."(p.94).

Computer technology has thus not increased productivity as much as was expected. Many available software packages and systems are not used to the extent that was anticipated, or to their full potential (Flowers, 1996, Gross & Ginzberg, 1984; Long, et al., 1983). Turner (1982) estimated that between a third and a half of all systems are never implemented or negligibly used after implementation.

James Martin visualized the "cyberemployee" as an individual who is willing to learn, innovative, challenges the status quo, flexible, and able to continuously change and adapt to new circumstances. However, the current employee is not ready for this challenge. A survey by SBA Accounting Systems, in Sausalito, California, found that 25 million American workers squander about $100 billion a year by spending an estimated 5 billion hours annually engaged in "nonproductive futzing with their PCs" (Stamp, 1993, p. 48). Rather than getting ready to assume the new roles of the cyberemployee, many of today's workers are still spending a great deal of time struggling with simple PC functions. Instead of changing with and contributing to the continuous change of the organization by
"finding new ways to add value" (Umbaugh, 1998, p. 95), workers still have trouble applying simple technology solutions to the basic jobs they were hired to do.

The underlying reason so many systems fail is related to human rather than technical factors (Carroll, 1990; Dresling, 1990; Beard & Peterson, 1988). Examination of the hardware-human cost relationship shows that the greatest cost savings in computing will occur by reducing the human cost of using computers, or increasing the effectiveness of individuals using computers (Nolan & Norton, 1992; Carter, 1984). This requires businesses to take steps to improve the ways in which individuals use these technologies.

Training and support are the key factors to increasing the effectiveness of individuals using computers. According to Martin (as cited in Umbaugh, 1998):

> There is a growing need for education and training that reflects the realities of the cybercorp revolution... Employees must be computer literate; they must be able to quickly adapt to changing markets; and the need to be able to continuously learn. Business schools and training programs must change their curriculum so that they can produce the next generation of employees that can work and thrive in cybercorp (p. 95).

This growing need for training and education is not overlooked by today's organizations. Corporations currently spend large amounts of money on education and ongoing training for their employees. International Data Corp. (IDC) reports that “The IT training and education market stood in 1995 at $13 billion and was expected to grow to $22 billion by 1999” (Umbaugh, 1998, p. 95). However, there is much evidence that, despite the increasing interest of organizations in training and learning, training systems do not provide the expected working knowledge needed for today's end-user, let alone the cyberemployee as described by Martin.

While a lot of research and development efforts are geared toward technology development and some on management and systems change, training is taken for granted and perceived as a black box whose contents are considered obvious. Much research has been done on the importance of training and the relationship between training and productivity (Compeau & Higgins, 1995; Fournies, 1982). However, relatively little research has been conducted concerning the types of training that are most effective or the process issues involved in training (Compeau & Higgins, 1995; Martocchio, 1992). An
examination of 564 abstracts of scholarly papers published around the world between 1996 and 1997 that use the key words “end-user,” “information technology,” “computers,” and “training” reveals that only 4% dealt with some aspect of end-user issues. Those that did deal with training focused on training for specific applications or computing tools such as computer graphics (26%), MS Access (16%), or HTML (4%). None of the studies questions training methods and contents used to deal with technology change. Nor do any of the studies discuss end-user’s problems and needs resulting from this change.

Analyzing current training problems and needs, understanding the user’s difficulties in acquiring computer competencies, and developing instructional approaches that maximize learning in this cybercorp environment are becoming increasingly important. The leading question in any examination and design of training procedures should be whether a particular type of training leads to a “cyberemployee” who is innovative, flexible, challenges the status quo, and is able to continuously change and adapt to new circumstances, as visualized by Martin (as cited in Umbaugh, 1998). No current research examines this approach.

While the majority of the research and development efforts in technology training focus on some type of formal, pre-designed training for specific products, and learning at work is traditionally thought of within the context of formalized training programs, learning in organizations is actually found more frequently outside of formal programs (Thomas, 1991). One of the terms used for this type of learning is informal learning (Marsick & Watkins, 1990), which is “predominantly experiential and non-institutional” (p. 7). The attributes of this kind of learning include the learner’s control over the learning process, the non-classroom based setting, the unplanned outcomes of the process, and the reliance of the learner on others (peer support) as important learning resources (Marsick & Watkins, 1990; Tough, 1979). Although discussions of various aspects of this type of learning are found in the literature, whether as a learning procedure, training form, or learning organization stage (Woolner, 1991), there is little evidence of attempts to evaluate the significance of this type of learning/training and its impact on the organization (Mandefrot, 1997).
One attempt to look more closely at one aspect of non-formal training was done by Nolan & Norton (1992). They argue that there is growing evidence that, despite all the spending on training and support systems, one of the largest cost categories in the end-user computing (EUC) environment is peer support, or the "Ask Fred" method (Stamps, 1993), which organizations rarely measure.

Nolan & Norton's (1992) argument, supported by others (e.g., Stamps, 1993; Pearlstein, 1991), which views non-formal peer support as the most popular end-user support, led to the focus of this study. Attempts to identify the main role "Fred" plays as a peer supporter in the workplace led to the more general concept of responsive training (defined in detail the next section). Responsive training describes the non-formal supporting methods used by "Fred" and other experienced computer users, be they inside or outside the workplace.

Exploring the interaction between end-users and responsive trainers could illuminate important aspects of effective training in the new technology age. Through this exploration, this thesis focuses on the following questions: 1) What are the needs and problems of end-users, as they are reflected in the responsive training interaction? 2) What are the methods used by the responsive trainers? 3) Can effective and ineffective training methods be identified? And 4) If so, how can effective training methods be implemented and improved?

Answering these questions has the potential to contribute to an understanding of training procedures and improving training programs. This understanding could help prepare the cyberemployee to be effective in the future cybercorp or at least support his efforts to keep up with the current technology change. At the theoretical level, this study helps bridge the gap between training theories and educational theories. It also adds an educational perspective to the body of literature dealing with the Human -Computer Interface (HCI), which currently focuses mainly on the technology aspects of this interaction.
1.3. Personal Perspective

For over two decades, I have been involved in research, development, and implementation of training programs for adults in educational, academic, and organizational settings. During this time, I took part in numerous projects, searching for innovative methods and strategies to improve instruction and train-the-trainer procedures carried out by schoolteachers, academic professors, military staff, and organizational personnel. In these projects, we were looking for effective training procedures to bridge the gap between specific identified skills that were required for a well-defined task or job and the entry behaviour of the trainee.

This experience led me to observe organizations through the training perspective and to search for training needs and methods that could be utilized to improve training and its results. This search became more important with the intensive introduction of new computer-based technology into the workplace and the urgent need for skilled workers to control this technology and to use it effectively. Examining business and industry during my work, or through occasional visits, made me realize that more effort must be made to develop innovative training procedures to address and effectively accommodate the new technology.

Another hat I am wearing is that of a computer teacher and trainer of computer teachers and instructors. Searching for effective teaching methods, I started looking at the specific characteristics of this content/skill development area and examined learners' difficulties, especially those encountered by the adult learners, including teachers, who were the majority of my students. Naturally, this path led me to the decision to focus in this thesis on the adult end-user and his training needs.
1.4. Definitions and Conventions

For the purpose of this study, the following definitions will be used:

**End-user Computing (EUC):** The use or development of computing applications via personal technology, where the user decides when and how to manipulate data. EUC includes any type of computing device employed by a user (PC, workstation, or dumb terminal), be it a stand alone machine or one connected to others. It does not include voice communication or production applications in which the user has no control over the application or the data (based on: Nolan & Norton, 1992).

This study focuses on the common use of a PC by a non-information-systems (IS) professional user, for work or for home applications.

EUC is a part of the larger concepts of Electronic Data Processing (EDF) and Information Systems (IS).

**Training:** The process of preparing or upgrading a person towards a specific role or performance mainly in the workplace.

**Responsive Training:** Training in situations that are, initiated by the learner, responding to specific needs and are provided by a user with specific knowledge or expertise. The learning situation is usually a single-time, non-contiguous event conducted in a one-on-one setting. Methods used in responsive training are some of those used by coaches or tutors; the main differences are the focus on the learner's specific needs and the one time nature of the interaction.

**Responsive Trainer (RT):** A person who provides others (in an organizational context, usually a co-worker) with guidance and support in the use and application of EUC. A responsive trainer will be approached based on his specific expertise or knowledge. Training is usually not included in the job description or the career plan of the Responsive Trainer.

**Effective Responsive Training (ERT):** Training that responds to the end-user's need to become a self-sufficient user of technology in a continuously changing environment.
Pronoun conventions

Although this researcher is sensitive to gender issues, and an effort was made in this study to make it gender-neutral, a decision was made to use the older convention of the male pronoun in order to make the reading less awkward. However, it should be clear to the reader that whenever a male pronoun is mentioned it refers to both female and male.

1.5. Thesis Objectives

The main goal of this thesis is to examine responsive training as a method to support the end-user in his striving for self-sufficiency, and to search for methods to make this support more effective. It focuses on the interaction between end-users and responsive trainers in order to identify Effective Responsive Training (ERT) characteristics that support the growth of the end-user in an environment of continuous technological change. Based on a constructivist approach (e.g. Kintsch, 1993, Honebein et al., 1993), this study searches for a “detailed explication of the knowledge and processes required to perform a particular learning task, that takes into account the characteristics of individual learners, their strategies, knowledge, and goals” (Kintsch, 1993, p. 24) as well as their learning environment (Kaptelinin, 1994).

Specifically, this study focuses on three dimensions of end-user responsive training: 1) the end-users’ problems and needs as perceived by the user and observed by the researcher; 2) effective and ineffective training contents, methods, and environmental factors employed by the trainers to respond to these needs, and 3) the process of change that results from the attempt to implement ERT.

The following objectives have been defined for the three dimensions of the end-user responsive training:

1. The End-User

- to identify main end-users’ problems, learning patterns, and training needs with a major focus on the problems and needs emerging from technological change and the change brought about through the responsive training process in a user’s perceived needs;
to verify the problems and needs described by the literature as they are manifested with the use of newer systems and different learning/instructional methods;

2. **Responsive Training**
   - to identify training patterns and strategies used by the responsive trainer;
   - to define effective and ineffective training methods, contents, and environments;
   - to identify methods used by trainers to respond to the user’s needs that emerged in this study, and those used to deal with the discrepancies between the perceived needs and the actual needs;
   - to identify training skills that should be improved to make the training more effective;

3) **The ERT Change Process**
   - to identify train-the-trainer methods for implementing and improving ERT;
   - to examine the dynamic change in the responsive training interaction throughout the implementation of ERT;
   - to identify changes in behaviour of both the end-user and the trainer that resulted from changes in responsive training interaction.

### 1.6. Research Questions

The research questions consider the three perspectives of the responsive training process:

1. **The user**
2. **The training**
3. **The change process**

The main questions this study is trying to answer are as following:

1. **The User**

   1.1 Who is today’s end-user and what are his main problems, learning patterns, and training needs?
1.2 Are there any discrepancies between the user’s declared needs and his actual needs as they emerged from the observed learning process?

1.3 How does recent technology change affect the end-user?

1.4 Do existing training and support agents and tools respond to the user’s needs?

2. The Training

2.1. What are the main characteristics of the training used by responsive trainers?

2.2. Can effective training strategies that support the end-user in his effort to become self-sufficient be identified? If so, what are they?

3. The Change Process

3.1. What procedures can be used to improve the performance of responsive trainers?

3.2 How does the implementation of these procedures affect the training behaviour of responsive trainer and the learning of the end-user?

1.7. The Significance of the Study

This study augments the body of knowledge and practice pertaining to training and support in general, and specifically pertaining to end-user training, in the new, fast-paced technology-development era. The questions raised in this study and the study results could be of major significance to a few bodies of knowledge as well as practices dealing with end-user training and human factors related to the implementation of new technology. More generally, it highlights the need to revisit training and educational theories and especially to establish better connections between the two so as to better meet the needs of the rapid technological change.

Of particular significance are the following issues that emerged from this study:

1. The theoretical location of the study:

The areas of Human-Computer-Interface (HCI) and Human Factors in Information Systems (HFIS) are two main areas dealing with the end-user. However, most of the studies in these areas focus on machine/products/systems-related issues while ignoring major educational factors. The theoretical location of this study is between the above bodies of knowledge and that of adult education. The educational perspective taken in this study illuminates some user problems and needs that these bodies of research have
not adequately addressed. The study also sheds light on some research considerations that should be further pursued.

2. **The need to incorporate educational theories into training practices**

A major issue underlined by this study is the gap between training and educational "belief systems," a gap that has direct impact on the practices used to introduce technology to the end-user. While common training practices adopt the product-oriented "belief system," or the dissemination orientation (Hodgson, 1993), this study is consistent with Hodgson's developmental orientation and focuses on a different approach that incorporates educational perspectives into training.

3. **The need to re-examine educational theories and training practices in view of the rapid and continuous technology change**

While technology has been undergoing dramatic changes over the last two decades, technology-related training and education have remained stagnant. The need to revise the theory and practices in this area to reflect this tremendous change has been virtually ignored. This study highlights the need for technology training and education to evolve with the rapid change in technology. Specifically, it emphasizes the need for training to address not only the new products created by this change but also the change itself.

4. **The need to develop learning skills as part of the training process**

Many studies dealing with individual differences and adult education assume that learning styles and cognitive attributes are fixed (e.g. Ayersman, 1995; Pamela, et al, 1994; Jonassen & Grabowski, 1993); this study questions this assumption, at least within the framework of learning to use technology. It suggests that learning modes that support the self-directed growth of the end-user could and should be developed as an integral part of the educational process.
5. **Effective Responsive Training as an efficient and productive means for supporting the user's need of control in a continuously changing environment**

This study, with its focus on responsive training, uncovers many aspects of this widely used training, which is usually ignored by other studies, and by training experts in organizations. The study reveals the common practices that supportive trainers are using and highlights factors that could make this form of training more effective for both professional and non-professional trainers. Further exploration of this perspective could have major implications for any future end-user training.

In summary, this thesis brings up questions, ideas, and suggestions that could be of major significance for both theory and practice in the areas intersecting with end-user training. Its significance lies in the new perspectives taken herein, the questioning of issues taken for granted, and the examination of unexplored issues.

### 1.8 Organization of the Chapters

The chapters of this study are organized as follows:

**Chapter 1: Introduction.**

The chapter introduced the background of the study and its main purposes and questions. It included the following: the problem statement, background and rationale, personal perspective, definitions, the thesis objectives, the research questions, the significance of the research and this description of the chapters' organization.

**Chapter 2: Literature Background.**

This chapter introduces the literature that is used as a background for this study and supports its rationale, purposes, and research questions. The chapter’s purpose is to give the reader a general view of the areas intersecting with end-user training and the studies conducted in these areas. The chapter also locates this study within its conceptual and theoretical framework. The chapter includes literature on human factors in information system, instructional theories and methods, and literature dealing directly with end-user training.
Chapter 3: Methodology

The chapter presents the methodology used in this study. It starts with a theoretical discussion of the qualitative research approach and, specifically, a discussion of the grounded theory method as it was employed in this study. The chapter continues with a description of the preliminary study conducted to identify research questions, choose research locations, develop research procedures, and define the focus of the study. The chapter also describes the research subjects, medium and procedures, the data collection and the data analysis methods. The chapter concludes with discussions of ethical considerations and the limitations of the study.

Chapters 4 through 6 discuss the findings revealed by the themes and events that emerged from this study. These chapters examine the main research questions in terms of the user, the training, and the change process resulting from attempts to implement effective responsive training. These chapters describe the following research cycles:

Chapter 4: The end-user/ computer/ environment interaction

This chapter examines the interactions between three main factors involved in EUC as they emerged in this thesis. It focuses on the end-user and his interaction with the computer on the one-hand and his interaction with the support/training environment on the other. A major effort is made in this chapter to examine the end-user's needs and the ways these needs are currently supported.

Chapter 5: The change process--From step-by-step training to constructivist learning

This chapter summarizes the attempts to develop effective training strategies based on constructivist theories of learning. It describes the intervention process and the training interaction that results from these interventions. A limited attempt is made to identify enhancement procedures that will induce behavioural change of the trainers and to examine its effect on the behaviour of both the trainer and the end-user.

Chapter 6: Toward a model of effective responsive training.

This chapter deals with the search for a model of ERT. The chapter considers: 1) constructivist theories and studies dealing with better instructional and training methods
based on this approach; 2) The data related to the user’s interaction with the computer and the environment described in Chapter 4. A major focus is on the needs that the ERT must respond to, as discussed in the Chapter 4: the need for control in a changing environment; and 3) the data and theory that emerged from the change process described in the previous chapter (Chapter 5). The chapter examines three factors that generate effective computer experience for the end-user: ERT contents, ERT methods and the ERT environment.

The following model illustrates the structure of the study as it presented in Chapters 4-6:

Figure. 1: The Study Cycles

Chapter 7: Contribution and implications and further research

The final chapter presents the main contributions of this dissertation and its implications for further research and practice. It describes the application of this dissertation’s results to three main areas of research and practice: adult learning and training, end user training and support services, and the area of Computer-Human Interface (CHI).
Emphasis is made on the change from a product-oriented approach to a learner's-oriented approach and its implications to the various areas. The chapter concludes with a recommendation for more collaboration between educators, training developers and technology experts, and for research and development efforts to meet the human needs of the new *cybercorp* era.
CHAPTER 2

LITERATURE BACKGROUND

There are three major sources of literature that can illuminate end-user-training issues.

1. The first source focuses on the end-user and his interaction with the technology. The major areas related to this focus are Human Factors in Information Systems (HFIS) and Human-Computer-Interaction (HCI). Other related fields are those dealing with learning issues, specifically the areas of adult education and adult learning. For the purpose of this review, all of the above will be discussed as part of Human Factors in Information Systems (HFIS).

Three major components of this area are relevant to this study:

- System/user communications
- The end-user: his characteristics, needs, and problems
- Usability/ functionality aspects of the technology use and design

2. The second source of literature deals with instruction/training in general, and specifically in an organizational context. It includes the areas of instructional design, instructional technology, on-the-job training, training strategies and train-the-trainer methods. It also includes the psychological theories that support these areas, such as behaviourism; cognitive psychology and constructivist theories.

The emphasis here is on training methods used in an organizational context, mainly the Instructional System Design (INSTRUCTIONAL SYSTEMS DESIGN) (e.g. Dick & Carey, 1990) and its alternatives. The literature dealing with alternatives to INSTRUCTIONAL SYSTEMS DESIGN is taken mainly from the constructivist theory, which is supported by this study.

3. The third source, which is under-represented in the literature, and which is the main focus of this study, deals directly with various aspects of end-user training. It reviews various studies of end-user training and examines trends and methods used in end-user training research. Emphasis is placed on the gap between technological development and
the development of instructional and learning theories and practices responding to this development.

2.1 Human Factors in Information Systems

There are two major perspectives for looking at human-computer systems. The first of these is the "machine perspective." It is represented by computer science and machine/software developers and focuses on optimizing computer efficiency. Computer science looks mainly at "how to build" questions and stresses the technical aspects of the computer. From this perspective, the user's problems and needs should be dealt with by making the machine more "user friendly" (e.g. Thesen & Beringer, 1986).

The other perspective is the "human/organization perspective", represented by Human Factors in Information Systems (HFIS) (e.g. Beard & Peterson, 1988; Taggart, 1988). "HFIS studies the interaction between people, computers and their work environment" (Beard & Peterson, 1988, p. 9). It focuses on enhancing human/organizational effectiveness by enhancing the user's understanding, learning and usage.

HFIS is about increasing user effectiveness within an organization by enhancing the user interface and other human-computer contacts such as training, and end-user involvement in the system development process (Carey, 1991, p. 11).

The Human-Computer-Interface (HCI) literature includes both perspectives. It focuses on the factors that influence user effectiveness and satisfaction from both the machine perspective and the human perspective. However, in most of the HCI literature, the human user has been regarded as a fixed entity with cognitive properties that are looked at only in the context of design requirements.

The construction of usable human-machine interfaces requires designers to be aware of the inherent competence of the human user ... to understand the resources that the user brings to the interaction (Brouwer-Janse et al., 1994, Introduction).

This study looks at both sets of theories together, since, when dealing with the human factors affecting the end-user in an organizational context, the HFIS and HCI literature overlap or supplement each other.
In an attempt to build taxonomy for HFIS, Beard and Peterson (1988) defined eight areas that have strong relevance to HFIS. Based on their taxonomy, three areas were identified as relevant for this thesis: system/user interaction, the usability/functionality aspects of the interface design and information presentation, and end-user involvement.

2.1.1 System-end-user interaction

Many HCI theories, which are based on the cognitive approach, view the system-user interaction as an "information processing loop" (Kaptelinin, 1994, p. 7). It appears that cognitive psychology can be successfully applied to a number of problems in human computer interaction. Harrington and Bidyuk (1994) and Van-Nes (1994) address the issues of visual perception and the consequences of the principles discovered for the presentation of information by the computer. Munro (1994) introduces the fundamental principles underlying human learning; Van-Hoe (1994), in his discussion of "cognitive load theory," deals with the acquisition of problem-solving skills.

However, cognitive models of skills acquisition have trouble accounting for the qualitative changes that cognitive skills undergo in the process of development and learning (Kaptelinin, 1994). An alternative model for HCI, which is relevant to the issue of training, is the activity theory as described by Bodker (1991) and Kaptelinin (1994). This model deals with the relationship of HCI in the context of the user's activities and environment. It claims that the cognitive approach does not provide an appropriate conceptual basis for studies of computer use in "a social, organizational and cultural context" (p. 7).

In the five principles of his theory, Kaptelinin argues that any learning process should be looked at within the context of activity. In order to understand and predict changes in people's behavior in different situations, it is necessary to take into account the type of behavior in question. According to the activity theory, the computer is just another tool that mediates the interaction of human beings with their environment. To understand HCI, one should look at the mode and level of the activity, the other tools that are available to the user, the social environment around him and the objectives of the user and the group/organization to which he belongs. These principles have important
implications for this thesis mainly in understanding the actual “tools” that are available to the user and the environment he is acting on and within.

2.1.2 System usability and functionality

*Usability* refers to the degree to which an information system can be effectively used by target users in the performance of tasks (Shackel, 1984). With the increasing role computers play in our life, and as more companies use computers and web sites to serve their customers, making the technology usable becomes an important subject.

The interaction of target users with the system, or the usability of the systems, involves the learnability of the system (Baxter & Oatlay, 1991), the type of errors likely to be encountered, the effort to work around system limitations and the compatibility of the system with ongoing tasks (Kling & Scacchi, 1980).

*Functionality* of a system refers to the set of technical capabilities available to fulfill a range of user tasks (Goodwin, 1987; Shackel, 1984). *Functionality* involves the potential utility of the system to the user. Usability and functionality meet at the point where the system functions meet the user task needs. However, the user-based cost of learning and accessing additional functions beyond that point may exceed the utility of those functions to the user (Eason, 1984). Therefore, in many cases, it is better for the user to rely on a small number of well-known functions to complete a task, even when more relevant computer-efficient functions are available (Borgman, 1986; Eason 1984).

The usability of a system varies with the user's characteristics. The literature discusses such factors as the user's experience level (Goodwin, 1987), training and professional experience, organizational roles and attitudes towards work and computing (Mick, Lindsey, and Callahan, 1980).

Guillemette (1991) summarizes the typical usability problems as follows:

Inconsistencies between and within system interfaces; inadequate error notification, reversal, correction and prevention procedures; excessive number of commands, options or inputs; insufficient or delayed feedback; unreadable documentation, messages, reports and screens; unexpected system actions; slow or variable response time and disorientation within the system (p. 66).
Lewis and Mack (1982) found that in many cases, users cannot figure out what the system can do and cannot match their goals with system actions. When errors occur, they do not understand what they have done and cannot find the way to recover from their errors (Carroll, 1990). This thesis reveals very similar problems.

**A model of system usability**

To answer some of the above problems, Guillemette listed the characteristics of a good, usable system within his model of system usability. This model can set criteria for the evaluation of computer systems. Guillemette (1991) describes the following model of system usability, which can be applied to the usability of a good training system (P. 67):

1. The "easy to learn" system should: (a) provide a suitable context for learning; (b) allow learning by doing; (c) enable the user to experiment with the system; (d) support incremental learning processes; and (e) facilitate meaningful learning through conceptual models (Carlson, Grace & Sutton, 1977; Carroll, 1984, 1990; Paxton & Turner, 1984; Lewis & Mack, 1982; Carroll & Aaronson, 1988, Mullins, 1989).
2. **The easy to use system** should: (a) provide a suggestive context for user action, (b) accommodate user cognitive-load constraints, and (c) support incremental user efforts.

3. **Task orientation**: The system should provide adequate task support for the user. The system should be able to handle as many non-task (computerized) operations as possible.

4. **Self descriptiveness**: The system should provide different levels of explanations to users with different expertise level through "help" functions or an overview.

5. **Predictability**: The system should fit the user's expectations; it should have a consistent interface design and provide feedback on the state of the system.

6. **Fault tolerance**: The system should be prepared to prevent, locate and alter sources of errors. Errors should not result in unintended termination of the session and a warning should appear before potential damage might occur (Baily, 1983; Norman, 1983).

7. **Flexibility**: The system must be flexible enough to accommodate change in the work environment (Shackel, 1986) as well as individual differences among users in task handling (Goodwin, 1987).

8. **User control**: The user's need to feel control over a system is a major force in user behaviour (Shneiderman, 1980).

9. **Friendliness**: The system should support the user's confidence by providing cues to facilitate the user's understanding and clear information on errors or the state of the system and by alerting the user to potential problems.

Although Guillemette (1991) designed this model from the "machine point of view" of computer systems, the constructivist approach taken by this model has a direct implication on and relevancy for training. The constructivist approach to training, as described in the next section, is consistent with this model and is used as a major reference for the training model developed in this thesis.

While the HCI literature emphasizes the attempts to create the “perfectly designed interface”, some realize that since the systems will never be perfect, more attempts should be focused on proper training. One perspective that represents these new trends is by Norman (1995). He emphasizes the growing importance of training with the growing functionality of computers.

We argue that training and help are more critical now than ever before. Computer functionality is increasing, hence people must know what is possible and how to achieve it. Computers are integrated into more aspects of work, hence people must learn new tasks and new roles in an organization. Because computer interfaces cannot be “perfectly” designed...people must learn how to adapt to system imperfection. (p. 669)
This approach is consistent with this thesis, which, in its search for better ways to support the end-user, examines the ways end-users cope with systems imperfections.

2.1.3 The End user

Who is the end-user?

The term end-user covers a very broad spectrum. According to Nolan and Norton (1992), the end-user is defined as a person who engages in "the use of or development of computing applications directly, via personal technology, where the user decides when and how to manipulate data" (p. 3).

The literature takes different perspectives on the subject of end-user issues. Three of these perspectives are relevant to this thesis: (a) the end-user as a learner with the focus of individual differences and their relation to learning; (b) the end-user as an adult learner; and (c) the end-user as a user of technology.

Individual differences; cognitive and learning styles

Many studies deal with individual differences and their effect on the user's learning (e.g., Ayersman, 1995; Berg & Poppenhagen, 1985; Cranston & McCort, 1985; Pamela et al., 1994). These studies examine theories of individual differences and concepts such as cognitive styles and learning styles as they relate to end-user learning (e.g. Witkin's Field Dependent-Independent Model (1973); Hudson's (1966) Convergent-Divergent Construct; The Jungian Typology (Jung, 1960); and the individual-differences typology suggested by Jonassen and Grabowski (1993). Many of these studies suggest that identifying the learning or cognitive style of the learner is essential in any instructional design, including the design of end-user training (Richey, 1992; Schmeck, 1988; Witkin, 1973). This thesis examines individual differences as they relate to the user's difficulties and needs. It looks at the learning styles that are effective in acquiring long-term computer skills and present some limited attempts to induce more effective learning styles.
The end-user as an adult learner

Another perspective focuses on the end-user as an adult learner (e.g., Berg & Poppenhagen, 1985; Carter & Honeywell, 1991; Jarvis, 1987; Richey, 1992). This perspective focuses on three main questions regarding the adult learners: (a) what they learn; (b) how they learn; and (c) why they learn.

Although different adult education theories suggest different approaches, most of them emphasize the adult learners as (a) self directed learners who are responsible for their own learning; (b) task oriented learners who work better on tasks relevant to the "real world"; and (c) learners who have both intrinsic and extrinsic motivation for learning (Brookfield, 1986; Brundage & Mackeracher 1980; Knowles, 1970; Nolan & Norton, 1992). These characteristics of the adult learner are consistent with the results of this study and its constructivist approach to the adult end-user training.

The end-user as a user of technology

The last relevant perspective examines the end-user as a user of technology. It looks at his ability to use computers, his job needs and his attitude towards working with and learning how to use computer technology. A major focus is placed on the user's leaning needs, on the definition of computer literacy and on what the end-user should learn in order to become computer literate (e.g., Dresling, 1990; Juliff, 1990, Weil et al, 1990).

Whenever computer training and end-user needs are discussed, attempts are made to define what should be included in computer literacy, or what makes the learner computer literate (Barrie, 1981). The purpose of this study is not to conduct an historical review of the end-user. However, in order to understand the user's needs, it is important to understand the changing role of the end-user and, in particular, his changing needs as they relate to the development of personal computers, and the change in focus of computer literacy. As will be indicated later, these changes have a significant impact on the end-user's problems and needs, and should be a major consideration in any future end-user support development.

Dresling (1990) looks at the development of the end-user starting with the use of output data through participating in data entry, and ending with working directly with the
computer. Others perceive the "historical" role of the end-user mainly as a programmer. For example, when Barrie (1981) discusses end-user training, she means teaching end-users how to program. "Adults who have learned to use the computer, are 'literate' in terms of having acquired, through demonstrated use, a feeling of ownership and a sense of personal control in being able to apply the machine as a personal tool" (p. 108). In her study, she found that to achieve this control the user needs to be able to (a) acquire new language for the purpose of communication; (b) express a new mode of specifying thoughts using a computer language as his medium; and (c) manipulate a discrete number of symbols in new and idiosyncratic patterns. "When the learner says that he has learned that the computer is a tool that he can apply, he has used a newly acquired language in all three of these ways" (p.109).

One of the first studies to bring up the differentiation between computer professionals and computer users is Sackman (1972), who suggests that "the user has very different objectives and entirely different needs from computer programmers. He is basically interested in getting quick and reliable information service. He usually couldn't care less about constructing software tools" (p. 514).

Seidel (1980) names three levels of computer literacy: a) awareness of what the computer means to society; b) knowledge about various applications of computers; and c) becoming adept at program-writing skills (p. 482). Although none of the needs mentioned by Barrie, Sackman or Seidel are applicable to the current computer environment, Barrie's description of the "literate" user, in terms of "having acquired, through demonstrated use, a feeling of ownership and a sense of personal control in being able to apply the machine as a personal tool" (p. 108), is still relevant today.

When trying to understand the user's needs in terms of the use he is making of the computer, or in an attempt to define computer literacy, we should understand that present needs, when it comes to technology, become history in a very short time. Therefore, a major attempt should be made to try to extrapolate the future needs based on the changes we are going through, and with that to try to identify those needs that will persist after the ink on this document dries.
2.2 Instructional and Learning Theories and Methods

2.2.1 Instructional design

Reigeluth (1984) defines *instructional science* as "a discipline concerned with understanding and improving the process of instruction." With the development of a technological society, instructional theory, which traditionally was located within formal education, has emerged from the boundaries of formal schooling into any area where learning occurs. With the rapid change of technology, professional development and training have become an essential part of industry and business. With this change "there will be an increasing need to make our methods of instruction more effective, efficient and motivational" *(ibid, p. 20)*.

The most cited and the most attacked instructional theory, which is the cornerstone for most instructional activities used by organizations, is that of Gagné (1965), together with its development in Gagné, Briggs *et al.* (1988). The *system approach* to instructional design (INSTRUCTIONAL SYSTEMS DESIGN) (Gagné & Briggs, 1979, Gagné, Briggs, Wager, 1988, Mager, 1975) is built to structure the environment in a way that provides the learner with conditions that will support the learning processes (Gagné, Briggs, Wager, 1988). The *INSTRUCTIONAL SYSTEMS DESIGN* designers tried systematically to break the overall instructional goals down into manageable small pieces of skills (objectives) and then to provide training in each piece, step by step. For the purpose of this thesis, it is important to understand this approach, firstly because it is the dominant theory-base for workplace training, and secondly, in order to understand the point of departure for the alternative theories which this study supports.

2.2.2 Cognitive Learning Theories and Constructivism

*Cognitive theories vs. instructional design theories*

The most striking feature of Gagné's theory is its focus on the elaboration of the learning material, regardless of the learner's characteristics and needs (Carroll, 1990; Kintsch, 1993; Snow 1977). Learning theories lies at the other end of the educational process. They deal with the same ideas as expressed above by Reigeluth (1984): "Its [instructional
design theory] major purpose is to prescribe optimal methods to bring about desired learning" (p. 20). It bases its arguments on cognitive, communication and motivational theories, and other related subjects. Like instructional sciences, it deals with the "betterment" of the educational process by means of improving its effectiveness. The main difference is that instead of talking about "efficient instruction" that should lead to efficient learning, the focus is on the factors that influence learning and behavioural change.

A major growing body of knowledge within the cognitive theories deals with the constructivist theory and specifically its application to learning. These theories deal with knowledge representation, its impact on how people acquire knowledge, and the ways to facilitate this acquisition.

Constructivism proposes that knowledge or meaning is not fixed for an object but rather is constructed by individuals through their experience of that object in a particular context.... 'Experience' includes both the physical context in which a person works and the tasks, both cognitive and physical, that a person engages in while in that environment. That is, both the physical context for learning and the activities of the learner determine how something is understood (Honebein et al., 1993, p. 1).

The common assumption underlying the effort to draw educational implications from cognitive research is that

Effective instruction must consider more than the body of information that is to be conveyed. Instead, a more differentiated view of learning is necessary, that reflects a detailed explication of the knowledge and processes required to perform a particular learning task and that takes into account the characteristics of individual learners, their strategies, knowledge, and goals (Kintsch, 1993, p. 24).

Instruction is shifted from content transmission to understanding and supporting the processes by which the learner acquires expert reasoning and problem solving skills in a new domain (Resnick, 1989). In contrast to traditional Instructional Systems Design theories, the goal of instruction, according to constructivist theories, is not to provide ready-made, well-organized knowledge, but to support the individual's own attempts to construct meaning through interpretation, restructuring and use of new knowledge (Brown & Palincsar, 1989). These theories maintain that Instructional Systems Design is
not supportive of the work of construction that needs to be done in the minds of the learners. They claim (e.g. Perkins, 1991) that learners do not just take in and store information. They make tentative interpretations of experience and go on to elaborate and test those interpretations until a satisfactory structure emerges. Lebow (1993) summarized the difference between traditional instructional approaches and constructivism as follows:

Traditional educational technology values of replicability, reliability, communication and control (Heinich, 1984) contrast sharply with the seven primary constructivist values of collaboration, personal autonomy, generativity, reflectivity, active engagement, personal relevance and pluralism (1993, p. 5).

Hodgson (1993) summarizes the difference between the two educational approaches or educational ‘belief systems’. In her model, she distinguishes between dissemination orientation and developmental orientation, which is very similar to distinction between the traditional Instructional Systems Design and the constructivist approaches. Most of the sub-categories of this model are in accord with the categories and themes that emerged from this thesis. The following table summarizes Hodgson’s (1993) model.
Although important advances have been made in the understanding of the learning process, there is not yet a "general theory of how expertise is acquired ... but some agreement regarding instructional principles is beginning to emerge" (Kintsch, 1993, p. 23).

Three basic assumptions are made by any constructivist model:

1. We cannot talk about what is learned separately from how it is learned,
2. The main goal of instruction is to lead the students to become effective, self-directed learners.

3. What is learned is a function of the content, the context, the activity of the learner and the goals of the learner (Savery & Duffy, 1995).

The primary model for instruction that captures the constructivist epistemology of learning and understanding is the apprenticeship model, with its emphasis on embedding learning in a larger, functional context. In this form of learning by doing, the student learns "real world" tasks, skills and knowledge setting in the context of the authentic activity of solving the larger task in hand (Honebein et al., 1993; Collins, Brown & Newman, 1989).

Different constructivist studies emphasize the importance of different elements as essential in creating a constructivist learning environment. Perkins (1991) differentiates between BIG and WIG constructivism. BIG stands for "beyond the information given" and emphasizes the activities of the learner in making given information meaningful and understandable. WIG is the acronym for "without the information given" where the teacher can provide scaffolding and encourage the learner in his exploration without directly providing answers.

Main characteristics of a constructivist environment

Three key principles of constructivist learning environment were drawn from the literature (Savery & Duffy, 1995, Honebein et al., 1993; Collins, Brown & Newman, 1989): global and local activities, authentic activity and "real world" complexity, and ownership by the learner.

1. Global and local activities

The learning activity takes its meaning from and should relate to, a larger world beyond the specific activity. What we learn and how we learn are supposed to support our ability to function more effectively in our world. The concepts of global and local activities distinguish between the current activity and the larger task beyond this activity (Honebein et al., 1993; Collins, Brown & Newman, 1989). In many cases, as in the case of
apprenticeship or training, the global activities or tasks are those that the learner will have to perform independently in the real world. The *global context*, related to the notion of the *zone of proximal development* (Vygotsky, 1978) which is the environment in which we expect the learner to be able to function effectively. The goal of instruction is to provide the level of assistance, or *scaffolds*, that will eventually result in independent performance in this global context. The global activity gives meaning to the local activities while the local activities are driven by the global activities and their changes.

A major question relevant for this thesis is: What is the global context of EUC? An attempt is made to identify the global context of EUC, to identify the local context that relates to this global context and to establish training methods that can support the end-user to better function in this *global context*.

2. **Authentic activity and “real world” complexity**

An activity is authentic to the extent that it captures the essential characteristics of the target global activity or the environment in which the learning will be used. “Thus, authenticity is an issue of transfer with a focus on both the physical and the psychological activity of the learner” (Honebein et al. p. 3).

The *authentic learning environment* is the environment in which the authentic activity is taking place. In this environment, the cognitive demands are consistent with the cognitive demands in the environment for which we are preparing the learner (Honebein et al., 1993). A major argument in the constructivist literature deals with the complexity of the learning environment. While some scholars suggest environment of *increasing complexity* (Collins *et al.*, 1989; Lave, 1988, Carroll, 1990), others support the notion that the task and the learning environment should reflect the complexity of the environment in which the learners should be able to function in at the end of learning (Honebein *et al.*, 1993; Savery & Duffy, 1995):

Rather than simplifying the environment for the learner, we seek to support the learner working in the complex environment. This reflects the importance of context in determining the understanding we have of any particular concept or principle (Savery & Duffy, 1995, p. 33).

Spiro, Vispoel, Schmitz, Samarapungavan and Boerger (1987) go further, suggesting that
Simplification of complex subject matter makes it easier for teachers to teach, for students to take notes and prepare for their tests, for test-givers to construct and grade tests and for authors to write tests. The result is a massive 'conspiracy of convenience' [which leads to] dozens of serious errors in the concepts held by a majority of the ... students ... Instead of inappropriate simplification we work with complex subject matter, acknowledging and teaching towards the complexity inherent in them... Cases and examples must be studied as they really occur, in their natural contexts, not as stripped down 'textbook examples' that conveniently illustrate some principle (in Honebein et al, 1993).

Honebein et al. (1993) continue along the same line, claiming that: "We simply must avoid the temptation to simplify the environment and instead we must search for new strategies to support the learner in working in that environment" (p. 10). This argument is relevant to the constructivist approach taken by this thesis and to the instructional methods suggested here, which emphasize the need to deal with "real world complexity." It contradicts both the minimalist approach suggested by Carroll (1984, 1990), and the "incremental learning processes" approach (Guilmette, 1991; Legdgard, 1987; Meads, 1983).

3. Ownership by the learner:

The emphasis here is on self-directed learning and on the development of the cognitive and metacognitive skills necessary to support it. Scardamelia and Bereiter (1991) suggest that

The students must have control over their own learning. It is only with ownership that the student will have primary responsibility for noticing what is important and what must be learned to accomplish a given task and for setting and evaluating criteria for understanding. Without this ownership the student will fail to develop many of the metacognitive skills and perhaps even the cognitive skills essential for development of the ability to direct and monitor one's learning and performance (in Honebein, p. 5).

Methods that support the learner's ownership

In order to achieve this ownership, the instruction must support the learner in assuming responsibility for establishing and monitoring his goals and strategies. The learning interaction between the instructor and the student are well represented by the apprenticeship model and the concepts of learning scaffoldings and the zone of proximal
development, as described by Vygotsky (1978). Based on this model, Savery and Duffy, (1995) and Honebein et al. (1993), present the following descriptions of the instructor's role:

- Creating an apprenticeship environment with scaffolding designed to support the learner in developing physical and cognitive skills
- Assuming the roles of consultant and coach
- Valuing and challenging the learner's thinking by questioning and presenting "puzzlement" situations
- Refraining from taking over thinking for the learner by telling the learner what to do or how to think
- Encouraging testing ideas against alternative views and alternative contexts
- Providing opportunity for and supporting reflection on both the content learned and the learning process
- Developing skills of self-regulation to support the learner's independent growth
- Supporting the learner in reflection on the strategies for learning as well as on what was learned.

The constructivist principles presented here have been an integral part of the "set of beliefs" of the author of this thesis. In the attempt to identify effective training methods for EUC, the basic assumptions made here were based on the above theory. The roles of the instructor in supporting the learner's ownership, the learning environment and its relation to the "real world" and the learner's authentic activities as proposed above are well supported by the data of this study and the grounded theory that emerged from it.

2.3. End-User Training

Although the body of literature dealing with technological development is growing exponentially, and end-user computing is increasing at almost the same pace, knowledge of and research into the factors essential to end-user learning and training remain largely ignored (Mandefrot, 1997, Telem, 1993, Gattiker, 1991). This becomes particularly evident in the process of examining the training/learning end-user's needs in an environment of rapid technological change.
2.3.1 Existing studies

"Most of the end-user studies center around single software applications and inadequately address the learning process required for effective learning" (Mandefrot, 1997, p. 31). Many studies deal with different aspects of using computers, such as anxiety and computerphobia (Gressard & Loyd, 1986; Bloom, 1990; Nelson et al., 1991; Harington et al., 1990; Weil et al., 1990); differences between novice and expert users, and the effects of experience (Russen et al., 1994; Baxter & Oatlay, 1991; Thompson et al., 1994; Paxton et al., 1984); the effects of learning styles and individual differences on computer learning (Ayersman, 1995; Chu, 1991); or the learner's attitude towards instruction (Hicks et al., 1991; Eamon, 1986). Many studies arrive at general conclusions based on specific applications, or a very limited number of applications such as Lotus (Baxter & Oatlay, 1991, Keer & Payane, 1994, Napier et al., 1992), or word processing (Carroll, 1984, 1990; Czaja, 1986). Most of them treat the computer as a fixed entity and the user's needs and problems as related to any computer, any application, in any time. Very few address the change that resulted, for example, from the growing use of Windows or GUI (Graphic User Interface) environments and the resulting conceptual change (Kachmar, 1991). Questions such as whether the expert user should be considered advanced or novice when he switches to a different environment, and the anxiety caused by this switch, were never addressed.

**Carroll's Minimalist Approach**

The most comprehensive attempt to understand end-user problems and the need to examine training methods for the end-user, which is also the attempt most relevant to this thesis, is presented by Carroll's (1984, 1990) *Minimalist Approach to Computer Skills Instruction*. This approach is offered as an alternative to Gagné and Briggs' (1979), *Systems Approach* on the one hand and to the use of on-line help and tutorials on the other.

The basic goal of end-user instruction according to Carroll is "to teach people what they need to learn in order to do what they need to do" (p. 3). Therefore any instructional
techniques and learning materials should be based on "what people want to do, how they want to do it and the problems they are observed to have" (p. 3).

In his observations, Carroll identified the following end-user problems: making wrong decisions and conclusions based on fragmented reading; using the training material in an unsystematic and uncoordinated manner; following directions unpredictably; and managing prior knowledge, such as the use of typewriter, relatively poorly.

Based on the learner's needs and problems, three instructional principles emerge:

- Allowing learners to start immediately on meaningfully realistic tasks;
- Reducing the amount of reading and other passive activity in training;
- Helping people to make errors and error recovery less traumatic and more pedagogically productive.

The Nurnberg Funnel is a description of a series of experiments starting with the attempt to identify the main end-users' learning problems, and continuing with different versions of the *Minimal Manuals* and supporting environments, both based on the *Minimalist Approach*. This series of experiments is an in-depth explorative study aimed at understanding the user's learning needs and problems and examining new methods for improving the learning process. In his description, Carroll emphasizes the importance of basing research design on an "analysis of the problems of real users in realistic learning situations and in a theoretically grounded analysis of learning possible intervention strategies" (p. 186).

The above conclusion served as a major foundation for the methods and procedures used for this thesis. Carroll's suggestion that in order to develop a successful training strategy, the intervention strategies should be built and analyzed based on the learner's needs and problems and the relevant instructional and learning theory, were applied to the three-cycled structure of this study described in Chapter 1.7.

A re-examination of the user's problems and the methods suggested by Carroll "a few computer generations" after his work is of major importance in understanding end-user problems from the perspective of technological change. While this study accepts most of the principles and methods suggested by Carroll, a few issues are contested:
• **The role of peer helpers** was mentioned by Carroll as an existing fact but was not considered as a factor through the data collection. Here, in accord with the constructivist approach, the assumption is that proper peer support can and does make a significant difference.

• **The evolving technology** did not have much impact on the end-user in Carol's time. This study views technological change as a major factor in end-user training today.

• **Reduced complexity** is one of the main elements of the minimalist approach. In this thesis, following the constructivist approach (Savery & Duffy, 1995; Honebein et al., 1993; Collins, Brown & Newman, 1989), an attempt is made to identify methods for supporting the end-user in "real life tasks" with "real life complexity."

2.3.2 The gap between technological development and instructional and learning theories

The gap between technological development and the development of instructional and learning theories related to technology training has been discussed previously. Mandefrot (1997), who examined dozens of end-user-related studies, concludes that: "... adequate discussion is lacking on how people learn computing; how learning proceeds and what factors influence the learning process" (p. 12). A previous ERIC search conducted by Telem (1993) came to a very similar conclusion. Gattiker (1992) discusses the "lack of knowledge about the process and variables involved in the acquisition of computer skills" (p.562), and Avison and Fitzgerald (1991), bring up the lack of understanding of human factors in computerized functions.

A similar Boolean search for all studies published world-wide in 1996-1997, using the subject headings computer, training and end-user, produced a list of 564 records. A breakdown of the found titles based on the subject heading showed that most of the studies focused on technical training in specific skills or packages, or on new technologies available to the end-user. For example, 26% appeared under the subject heading computer graphics 16% under MS Access. A total of 38% were devoted to different Microsoft products. Of all these, only 4% appeared under the heading end-user.

A further breakdown of this heading showed that most of them dealt with the technical aspects of end-user interfaces, organizational aspects of EUC, surveys of EUC in different organizations and Internet-related training issues. Only four of these publications dealt with some general aspects of end-user training, and even those examined mainly course contents and curriculum issues. These findings clearly point to the gap between the
growing need for new approaches to end-user training and the degree to which such training is actually researched and supported both in the academic community and in the high-tech industry.

2.3.3 Training practices and the realities of the cybercorp revolution

Some studies do emphasize the growing need for training. Umbaugh (1998) presents a report done by the International Data Corp. (IDC) indicating that "in 1995, the worldwide IT training and education market stood at $13 billion and was expected to grow to $22 billion by 1999" (p. 95). Martin (in Umbaugh, 1998), in his futuristic discussion of the cybercorp, states that "There is a growing need for education and training that reflects the realities of the cybercorp revolution" (p. 93). He goes to describe the needs that this learning should address for employees: "... employees must be computer literate; they must be able to quickly adapt to changing markets; and they need to be able to continuously learn ..." (p.93). However, while claiming that "these new skills sets will require a fundamentally new way to educate and train people, one that focuses on preparing students for a work world that is competitive, demanding and ever evolving" (p. 96) (emphasis mine), he takes the training methods for granted, without including them in the "fundamentally new way" suggested. The only suggestions he makes address the need for education to be more cost-efficient, by establishing a "school for entrepreneurs [that] would be funded by an alliance of cybercorps" (p. 96).

Like most of those discussing the need for training, Bradley (1994) - who examines "the type and extent of gaps, if any, existing between the PC skills that business needs and the training that is presently provided" (p. 45) - focuses on software packages and their relevancy to the immediate needs of the user. In his conclusions, he suggests more courses, in the form of in-house training. For Bradley (1994), as for most of those who have dealt with EUC, training is perceived as learning to perform a specific current role better (Newman, 1993). "It has very specific objective and focus" (Rubenson & Schutze, 1995, p. 97) and it's usually regarded in terms of formal instruction. Pearlstein (1991) suggests that the common belief is "that the best preparation for end-users is telling them all about computer systems and showing them as many computer functions as possible"
(p. 1). Karten (1986b), in her somewhat cynical description of current training procedures, states that:

All you have to do for end-user training is round up users, line them up one or two per PC, show them how to make their software sing and voila, you have got a bunch of skilled users (p.7).

Karten claims that this method of “attend and forget” or “show and tell”, which focuses on software features and functions, is the most common approach to end-user training. This product-oriented training helps users to master the mechanics of software but does not adequately prepare them to use computers effectively.

Bradley (1994), like others who have questioned the effectiveness of current training programs, takes the common, product-oriented formal training for granted, and does not consider the idea that training methods, contents and environment, in terms of preparing the employees for “continuous learning in an ever evolving working environment”, must be addressed as well. Watkins (1995) argues that this type of training “focuses on acquiring specific competencies rather than generalized skills, contextualized reasoning rather than symbol manipulations and tool manipulation rather than thought activities” (p. 9). Watkins’s (1995) view is taken further in this thesis, which questions and examines current training theories and practices in an attempt to identify effective training factors in terms of preparing the end-user not only to function better with current job requirements but also to be more effective as a cyberemployee who can survive in the ever-evolving cybercorp environment.

2.3.4 Learning by doing in end-user training

The hands-on approach or learning-by-doing methods, which seem to be the buzz words for innovative training that supposedly responds to the end-user’s needs, have never been seriously examined or questioned in the context of end-user training. Although any trainer, training organization or training material claims to apply a hands-on approach or learning by doing, “The relative efficiency of these methods toward improved acquisition of computer skills is not clear” (Mandefrot, 1997, p. 54).

Learning by doing and different versions of active learning derived from the constructivist approach (see Section 2.2) are extensively discussed in the educational
literature. Studies aimed at making this approach more effective in contributing to the cognitive development of the school student are constructing a growing body of knowledge in the educational literature. However, when it comes to learning situations that do not fall under the definition of "education," and specifically end-user training, anything that includes "touching the keys" (Carter & Honeywell, 1991) or the *show and tell* approach, as it was defined by Karten (1986), is considered learning-by-doing.

Some studies imply that learning by doing in the context of end-user training does not work. For example, Waern (1993) suggests that "People do not learn very efficiently by doing, because they have difficulty in choosing alternative actions, observing outcomes and interpreting them" (p. 323). Darrah (1995) suggests that the learner, and especially the novice learner, needs "structure, systematic presentation of material, guidance and coaching both during and after the process" (p. 34); Pearlstein (1991) blames the computercentric approach taken by trainers, which forces the user to learn irrelevant information.

Most of those dealing with learning by doing in end-user training assume that such learning relates only to the specific task learned, or to the *local context* (Honebein *et al.*, 1993; Collins, Brown & Newman, 1989). Waern (1993) reports that general principles or structures, or what she calls "the system", which should take the user beyond the specific task, cannot be conveyed through this type of learning. She goes on to state:

> We have found that users do not think that they can learn a system only by getting instructed. Instead they mean that they do not understand the system until they try it out in their own tasks. And in order to succeed here, they need support by somebody who can suggest how to use the system as tools in their own tasks (p. 333).

These findings help Waern to conclude that "people after all may not learn by doing. They may try to learn by doing, but they fail, and therefore need help from somebody else" (p. 333).

In her search for explanations for why people fail while trying to learn by doing, she suggests that
Learning by doing is the equivalent to learning in a problem-solving situation. Problem solving can be described as a search in a problem space" ... learning the computer system in isolation from the task to be performed may not help in understanding the problem space for this particular task. Neither will the learning of utilizing the system for one task necessarily facilitate the learning of performing another task with the system (p. 334).

The end-user's ability to acquire general understanding of the computer that goes beyond the specific task, or, in Waern's terms, "create a new efficient problem space for a particular task," depends on a few conditions (p. 336):

- The user must allow himself to "play around" with the system in order to investigate functions other than those immediately necessary. He must vary his actions in order to give the system a chance to show what else it can do.
- The user must attend to unexpected outcomes of his actions [or what will be referred to, later in this thesis, incidental learning]
- The user must reflect upon the observations made.
- The user must create a mental model of the system that can be used for several tasks.

But the primary condition for all the above is that it has to be worthwhile for the user to acquire such knowledge. This depends on two main factors: the risk involved in trying new actions and the effort required in searching for new actions.

Most of Waern's (1993) conclusions and principles are in accordance with the constructivist theory described above, including the need for activities that support a larger problem space. This idea is very similar to the concepts of global-local contexts, the learner's need for exploration activities, and the creation of mental models of the activities that go beyond the specific task.

However, Waern (1993) ignores one important element of the constructivist environment, which leads her to the conclusion that "people cannot learn by doing and therefore need help from somebody else." Lieberman and Linn (1991) add this element by suggesting that learning by doing can be partly self-directed. It can be supported by combining instruction, scaffolding and encouragement to develop better knowledge, skills and self-monitoring. These suggestions fit in with the apprenticeship model and the provision of scaffolding that is gradually removed (Vygotsky, 1978).

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1 An initial situation has to be transformed to the goal situation by means of some set of operators. The
This thesis supports the combination of the approaches of Waern (1993) and Lieberman and Linn (1991) which together can be viewed as a specific application of the constructivist approach described earlier. Waern viewed the need for support as a proof of the failure of learning by doing. This thesis, however, argues that the need for support or responsive training, is an integral part of the learning by doing process and should support the end-user in his effort to become a self-directed learner.

This thesis explores the effectiveness of the common hands-on or learning by doing methods used by trainers. It searches for more effective strategies that turn end-user training into the experience of learning by doing through which the user can widen his problem space. In constructivist's terminology, this is a search for local activities that will support computer use in the global environment of the end-user. By combining the learning of "the system" with the task performed, the user not only follows directions and touches the keyboard to complete a specific task, but is also able to make decisions and develop his learning skills and learning styles. This development supports his evolution as a self-learner who can grow and develop as the technology changes in order to fit into the cybercorp.

2.3.5 Formal and informal training

Although some of the literature points out that the formal, product-oriented approach does not work, very few of them suggest meaningful alternatives to end-user training. Most overlook the current informal practices, which are actually doing the job presumably being done by training courses.

Shoemaker (1993), who has examined the efficiency of training courses, states that "In practice, much time and money was spent in asking questions of colleagues and going back to all kinds of documentation. As a consequence, the overall conclusion is that the efficiency rate acquired through training has been low." Figures indicating an efficiency level of 20% resulting from the initial training have been mentioned. The other 80% of a worker's proficiency tends to be acquired in an implicit way at the workplace, incurring high and not planned-for costs (Gery, 1991). This evidence is supported by Nolan and
Norton (1992), who found that: "An interesting aspect of the training issue is the growing evidence that in spite of all the spending on training and support systems, the largest cost category in the EUC environment is peer support" (p. 12). Stamps (1993), who arrived at the same conclusion, claims that the "Ask Fred" method is the most common practice through which end-users actually learn to use the computer, and one which organizations rarely acknowledge or examine.

Although the literature indicates the significant role "Fred," or the peer helper, plays in end-user training, no attempt has been made to further understand the advantages of this type of training, compared with other types that make it a major source of user support. By focusing on the type of training provided by peer helpers, and the practices employed by them, this thesis arrives at the concept of responsive training that defines the approach and methods used by "Fred." Further exploration of this concept and a search for effective strategies that use this type of training and make it more applicable to fulfilling the needs of the cyberemployee, form the core of this thesis.
CHAPTER 3

METHODOLOGY

3.1 The Research Approach

3.1.1 Qualitative paradigms

The term *Qualitative Research* is used as an umbrella term that refers to several research paradigms that share certain characteristics. Under this umbrella one can find different variations such as *field research*, which is an alternative to laboratory or other researcher-controlled sites, *naturalistic research*, which focuses on the naturalistic setting of the research and the interest of the researcher in the natural behaviour of people (Guba, 1978), *ethnographic method*, and the *interpretive approach* (Carr and Kemmis, 1983) both of which attempt to understand the meaning of action.

Bogdan (1992) summarizes the main characteristics of the different qualitative research approaches as follows:

> The data collected have been termed soft, that is, rich in descriptions of people, places, and conversations, and not easily handled by statistical procedures. Research questions are not framed by operationalizing variables; rather, they are formulated to investigate topics in all their complexity, in context. While people conducting qualitative research may develop a focus as they collect the data, they do not approach the research with specific questions to ask or hypotheses to test... They tend to collect their data through sustained contact with people in settings where subjects normally spend their time (p. 2).

A qualitative research approach was chosen for this study both for personal and theoretical-practical reasons. The researcher’s values and beliefs regarding methods used for the exploration of human behaviour fit better with the qualitative approach. The researcher believes that methods that allow the researcher to discover significant aspects of the complicated human experiences that remain inaccessible with traditional study could make a meaningful contribution to theory and practice in the human sciences. This perspective is consistent with the justification made by Merriam (1988):

> I chose this paradigm because I believe that research focused on discovery, insight and understanding from the perspectives of those being studied
offers the greatest promise of making significant contributions to the knowledge base and practice of education (p.3).

With the purposes of this research aimed at understanding the learner's and the trainer's needs and problems and identifying the behaviour patterns that characterize this learning/training situation, a qualitative approach was considered more appropriate than a quantitative approach. Within the variety of qualitative paradigms the grounded theory methods were found to be the most suitable for this research. These methods allow the researcher to collect data on the study's subjects from the 'inside,' that is, from their own perspective, and data from 'outside' observations. By collecting both types of information, "grounded theory methods bridge interpretative analyses with traditional positivist assumptions" (Charmaz, 1996, p. 36) and provide comprehensive description of the investigated phenomena.

3.1.2 Grounded theory methods

Grounded theory methods emerged from the work of Glazer and Strauss (1967) during the 1960s to contest the common perceptions of research theories. Their theory challenged (1) the arbitrary division of theory and research; (2) the prevailing view of qualitative research as primarily a precursor to more rigorous quantitative methods by claiming the legitimacy of qualitative work in its own right; (3) the belief that qualitative methods were impressionistic and unsystematic; (4) the separation of data collection and analysis phases of research; and (5) the assumption that qualitative research only produced descriptive case-studies rather than theory development. These researchers changed the oral tradition of qualitative studies by offering a clear set of written guidelines for conducting qualitative research that includes a logically consistent set of data collection and analytic procedures aimed at developing theory.

The purpose of grounded theory is to develop a theoretical analysis of the data that fits the data and has relevance to the area of study. The procedures within the method are then aimed to further theory development. In contrast with traditional research design that generates data to test existing theories by logically deducing hypotheses from them, grounded theory offers a set of systematic procedures that enables qualitative researchers to generate ideas that may later be verified through traditional logico-deductive methods.
(Charmaz, 1996.) With this approach, grounded theory methods explicitly unite the research process with theoretical development while blurring the often rigid boundaries between data collection and data analysis phases of research.

The distinguishing characteristics of grounded theory methods include:

- The simultaneous involvement of the researcher in data collection and the analysis of that data
- The creation of analytic codes and categories developed from data, not from preconceived hypotheses
- The development of middle-range theories to explain behaviour and processes
- The capacity to allow the researcher to gather both 'inside' data taken from the subject's perspective and 'outside' data taken from the observer's.
- The ability, through the use of enough verbatim material, to demonstrate the connection between the data and the analysis while emphasizing concepts derived from the data
- The conceptual analysis of the data, including a comparison of existing literature in the field with study results woven into the work (Charmaz, 1996, p. 47).

The research procedures include five main phases that are interwoven: rich data collection; memo making; coding and categorizing; theoretical sampling, and reporting procedures.

While Charmaz (1996) views grounded theory methods as a "clear set of written guidelines for conducting qualitative research" (p. 48), Strauss (1989) emphasizes the researcher's freedom to make his own interpretations of the methods. Regarding the grounded theory method, Strauss (1989) states:

It is not really a specific method or technique. Rather, it is a style of doing qualitative analysis that includes a number of distinct features, such as theoretical sampling and certain methodological guidelines, such as the making of constant comparison and the use of a coding paradigm, to ensure conceptual development and density (p. 5).

He continues to emphasize the researcher's freedom by stating that:

Researchers also have quite different investigatory styles, let alone different talent and gifts, so that a standardization of methods would only constrain and even stifle social researchers' best efforts... Hence, we take the stand about our own suggested methods that they are by no means to be regarded as hard and fixed rules for converting data into effective
theory. They constitute guidelines that should help most researchers in their enterprise (p. 8).

This study follows the guidelines presented by Strauss (1989), Glazer and Strauss (1967), and Charmaz (1996). It employs most of the procedures and phases described by the above. However, some freedom was taken in interpreting the theoretical sampling, mainly in the way the literature was interwoven into the study. While keeping the principle of generating conceptual analysis of the data before referring to the literature, this study views the literature as part of the “researcher’s scholarly knowledge” (Strauss 1989, p. 34). Therefore, literature references that derive their relevancy from the conceptualization of the emerging data is viewed as an integral part of the coding process and the memo taking (Strauss, 1989). As both Strauss and Charmaz (1996) suggest, the final document presents a solid finished paper in which the literature is interwoven explicitly.

3.2 Research Procedure and Data Collection

3.2.1 Data collection and recording

Simultaneous involvement in data collection and analysis means that the researcher’s emerging analysis shapes his or her data collection procedures. Such simultaneous involvement focuses grounded theory studies and thus not only directs the researcher’s efforts, but also fosters his or her taking control of the data. The early analytic work leads the researcher subsequently to collect more data around emerging themes and questions (Charmaz, 1996, p. 31).

Based on the above, the research procedures of this study were not conducted in a linear fashion. They developed and changed throughout the data collection and analysis process. In many cases, different searching activities in different settings were employed at the same time as specific questions or themes emerged. However, four main phases in the research process can be identified:

1. The preliminary study

A wide-scope, unfocused exploration, intended to establish the main directions and focus of the research. Preliminary observations were made on different end-users' learning situations (courses, self-learning, peer-helping, tutorials, help desks, etc.). In
addition, different manuals, self-learning booklets, and curriculum for computer training were examined. The method of data recording was mainly field-notes.

The main result of this stage was the identification of the main characteristics of responsive training as a dominant paradigm of non-formal training in the workplace. This led to the decision to focus on responsive training and responsive trainers and to take this perspective in examining effective and less-effective training methods for EUC.

2. Responsive training sessions with paying trainees (PT)

Six dyads of responsive trainers and their customers (for details see section 3.3.3.) were observed in two-hour formal, one-on-one, training sessions each. Four of the sessions were audio-recorded and field notes were taken (in the other two, only field notes were taken). The trainers were interviewed immediately after the sessions and the trainees were interviewed two to three weeks later. The main foci of this stage were 1) the end-user's problems and needs from the user's and the trainer's perspectives, and 2) the methods and strategies employed by responsive trainers. A main theme that emerged in this stage was the need for control in a technologically changing environment, a theme that was continuously supported by the data collected during this study. Many questions regarding the training methods emerged during this stage. However, since the observations were conducted on real clients, the researcher's ability to participate or intervene was limited. Another limitation of these settings was the poor quality of the audio recording resulting from the conditions at the customer's site. This led to the decision to continue with volunteering trainees with whom more manipulation and active researcher participation could be applied.

3. Training sessions with volunteers (VT)

"I assume that the interaction between the researcher and the researched produces the data and therefore the meaning that the researcher observes and defines" (Charmaz, 1996, p. 35).
To obtain more control and the ability to interact with those doing the training and the trainees, the researcher conducted this phase with volunteers (non-paid trainers). This phase consisted of four dyads of volunteering trainers and trainees. The training situation was very similar to the above. The trainers dealt with real problems the trainees had and the trainers treated the sessions as real training interactions. However, the fact that the trainees did not pay for the training and agreed to participate in the training as an experiment, allowed the researcher to participate in the training, to interfere and ask clarification questions, and to try to manipulate some of the training procedures. Following the 90-120 minutes training sessions, interviews were conducted with both trainees and trainers.

In this phase the researcher continued to examine the data according to the main categories that emerged in the previous phase. However, more emphasis was made in this phase on training procedures and alternative training procedures that would address the main theme that emerged in the previous phase which in this phase was well defined. In this phase, the themes of effective and less-effective training procedures were addressed with a primary focus on another paired themes, emerged at this stage, of constructive knowledge and operational knowledge representing the two different training approaches to EUC training.

This stage included revisiting the literature to augment and support the descriptions of the categories, and to “ground” the categories and themes that emerged in the broader perspective suggested by the literature. It also included revisiting the course materials and manuals to identify the different training approaches used in different training situations.

4. Focused experiments, case studies and field observations

In this phase the main foci were: (1) augmenting and supporting specific categories that emerged in the previous stages (2) experimenting with different training procedures to support the ERT theory that emerged in the previous phase. This phase included the following:

- Observations on and interviews with end-users in natural settings
- Experiments with end-users using alternative training methods and contents
- A six-hour train-the-trainer workshop to introduce the ERT procedures to the trainers
- Two case studies through which the researcher attempted to induce and implement ERT procedures into the training sessions.

The analysis of this stage and mainly of the case studies resulted in a description of the change process trainers and trainees go through while attempting to employ ERT methods, contents and environment.

The table below summarizes the four phases of the study.
<table>
<thead>
<tr>
<th>Phase</th>
<th>Subjects</th>
<th>Learning situation</th>
<th>Method and Instruments</th>
<th>Time</th>
<th>Recording methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Preliminary study</td>
<td>instructors, trainers, peer-helpers, trainee, self-learners</td>
<td>courses; on-the-job learning; self-learning with manuals</td>
<td>observations, participant observations, interviews</td>
<td>variable, based on the situation</td>
<td>field notes</td>
</tr>
<tr>
<td>2. PT training session</td>
<td>4 dyads of responsive trainers and real (paying) trainees</td>
<td>one-to-one real supporting session (PT)</td>
<td>observations, interview with trainers and trainee</td>
<td>2 hours each ~30 min. 60-120 min.</td>
<td>audio recording, field notes</td>
</tr>
<tr>
<td>(Paying Trainees)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3. VT training session</td>
<td>4 pairs of volunteering trainees and trainers</td>
<td>one-to-one supporting session (VT)</td>
<td>participant observations, interview with trainers and trainee</td>
<td>90-120 min. ~30 min. ~30 min.</td>
<td>video-recording, field notes</td>
</tr>
<tr>
<td>(Volunteering trainers/trainees)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>4. Supporting study</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiments with training procedures</td>
<td>4 dyads of RTs and volunteering trainees (novice and experienced)</td>
<td>one-to-one training with manipulations focusing on the application of specific methods, contents and training environment</td>
<td>Participant observations, Experimentation Interviews</td>
<td>60-120 min.</td>
<td>Audio/video recording, field notes</td>
</tr>
<tr>
<td>End-users in natural setting</td>
<td>22 end-users</td>
<td>computer labs, workplace, home</td>
<td>Participant observations, Interviews</td>
<td>short and focused observation</td>
<td>field notes</td>
</tr>
<tr>
<td>Train-the-trainer workshop</td>
<td>8 responsive trainers</td>
<td>simulated training</td>
<td>Participant observations, Interviews</td>
<td>6 hours</td>
<td>video recording field notes</td>
</tr>
<tr>
<td>Case studies</td>
<td>2 dyads of volunteering trainers and trainees</td>
<td>one-to-one responsive training focusing on implementation of constructivist's methods, with researcher's interventions</td>
<td>Participant observations, interviews</td>
<td>2 hours 30 min.</td>
<td>Video rec. Field notes</td>
</tr>
</tbody>
</table>
3.2.2 Preliminary Study

To identify the main foci of this thesis, a preliminary study was conducted. This study was based on the funnel paradigm of data collection presented by Merriam (1988) and Bogdan (1992). This paradigm fits well with the grounded theory approach by leading to events and people through which the grounded theory will emerge.

The funnel paradigm of data collection

Merriam (1988) and Bogdan (1992) use the metaphor of a funnel to describe research design. The researcher starts with general questions, which are the wide end of the funnel. He continues scouting for possible places and people that might be the subjects or the sources of data. Then he finds the location he thinks he wants to study, and then casts a wide net trying to judge the feasibility of the site or data source for his purposes. Finally, he begins to collect data, review and explore it, and make decisions about where to go with the study.

He then decides how to distribute his time, whom to interview, and what to explore in depth. He may throw aside old ideas and plans and develop new ones. He continually modifies the design and chooses procedures as he learns more about the topic of study. In time, his work develops a focus. The data collection and research activities narrow to sites, subjects, materials, topics and themes. From broad exploratory beginnings, he moves towards more directed data collection and analysis.

The wide part of the funnel in this model corresponds to the procedures employed in the preliminary part of this research. The narrowing down phase began when the decision about the main focus of the research was made, the main groups of participants were identified, and the methods through which to collect and analyze the data were chosen.

The preliminary study description

Based on the funnel model of qualitative research, a preliminary study was conducted to identify research questions, choose research locations, develop research procedures, and eventually define the focus of this study. At the beginning of the study, the open concept
was kept. The study later focused on users' needs and problems on the one hand, and on non-formal training and peer-helpers on the other.

The preliminary study included the following:

- observing technology and technology-based training in different organizations
- observing computer training courses, including observing peer-helping during these courses
- analyzing a variety of training materials and self-learning materials, including on-line help and tutorials
- conducting and analyzing participant observations on end-users' learning supported by self-learning materials
- interviewing users, trainers, and peer-helpers

Since this study attempted to be as open as possible, no preliminary questions or targets were posed and the main recordings were field notes.

**Preliminary findings**

Some of the findings of this preliminary study were the following:

*The instructor-lead formal training* usually resulted in the user acquiring only some vague idea about the learned content. Most of the learners did not feel they could start using what they had learned, whether it was a piece of complicated technology or a simple word processor. Most planned to use the written material to overcome this problem. Those who took the course as part of their work planned to "ask Fred" or to use trial and error methods to solve the problems as they occurred.

Surprisingly, most of the learners did not expect to end the course with any working knowledge of the course material. Likewise, the instructors, even in the courses that made the promise of hands-on learning, did not expect the learners to have enough knowledge to start using any of the learned skills.
The written material

Examining the written material indicated that in many cases:

- The material was written in a language that was impossible for the learner to comprehend and made heavy use of jargon or professional terminology. For example, material that used engineering terminology was given to learners with low technical background. In this particular example, only one out of the 14 participants in the course said that he was going to try to read the material.

- Most of the instructional manuals and tutorials, even those for beginners, used subject-specific terminology without thorough explanations. In many cases, the instructions in these manuals were given with the presumption that the user was already familiar with the basic features of the material, which was not always true. This confused the user and caused him to feel helpless unless he could approach somebody for help.

- When in-depth explanations were given, mainly in the “how to” books containing a few hundred pages of detailed explanations, which were not always relevant for the learner, the learner became impatient, looked for shortcuts and ways to bypass the long reading, and eventually found it very difficult to continue. This fits well with the second principle of Carroll (1990) of reducing the amount of reading and other passive activity in training (see Chapter 2.3).

Error Recovery

Another aspect that highlighted the significance of peer helpers was the issue of errors and unexpected features. As indicated by Carroll (1990), a major emphasis in training should be on making errors and error recovery less traumatic and more pedagogically productive. The main reason users froze and had to call for help, whether they were trying to learn from manuals or trying to apply learned skills, was the appearance of unexpected features due either to error or to features that were not mentioned in the training. In many cases, if help was not available, this resulted in useless trial and error or in withdrawal behaviour.
The supporting behaviour of the helpers varied. Most of them took control, found the error, or demonstrated the next step, and went back to their work. For some of the users, this was enough, at least for a while, but for many this was enough only until the next unexpected feature. Eventually it was clear for the researcher that "pedagogically productive" support was needed for many users.

Informal training, and peer support ("Ask Fred")

As was indicated in the literature (Nolan & Norton, 1992; Stamp, 1993; Shoenmaker 1993), peer support plays a major and sometimes crucial role in the introduction of technology into the workplace. The use of peer support was the major solution indicated by end-users for solving problems emerging while working with computer-based technology. Some of the end-users observed (mainly those returning from courses) attempted to use the written material for support. However, whenever a "Fred" was available and willing to help, he was the first resource used.

The main characteristics of the peer-training interaction, as they were revealed in this preliminary study, were in accordance with the definition of responsive training (see section 1.4):

- the trainer is responding to a specific need of the trainee
- Fred is available when a specific need or problem arose
- Fred is willing to help, although he sometimes loses his patience after a while;
- the training setting is one-to-one (although the same patterns could also be identified when working with small groups wherein one of the group members had a better knowledge than the rest)
- the trainer is treated as an expert in the specific task/applications/skill and as a superior source of knowledge
- the interaction terminates when the specific problem is solved.
- Since peer helping is a phenomenon occurring spontaneously, and is usually quite short, a direct study of this phenomenon, beyond what has been done in this preliminary study, has been found difficult to conduct. However, since the major characteristics of Fred's training behaviour are similar to those described in the definition of responsive training (section 1.4), examining responsive trainers in a more convenient setting could shed light on Fred's training behaviour as well as on the learner's problems as reflected in the responsive training interaction.
The main conclusions of this stage were:

1. The three main principles of the minimalist approach (see section 2.3) are important in any learning of new technology and specifically in the use of computer technology. Their application should be examined not only in the design of new manuals, as described by Carroll (1990), but also in any other types of training or support systems.

2. The findings support the description made by Nolan and Norton (1992), Stamp (1993), and Shoemaker (1993) regarding the role peer helpers play in end-user training. They also support the previously-mentioned problems with formal training and manual-based courses. They suggest that peer helpers or responsive trainers play a major role in the acquisition of workable knowledge of the use of new technology. This led to the decision to examine responsive training interactions with a focus on the training behaviour of the responsive trainers and the learner's needs and problems as evidenced by these interactions. This examination could help foster an understanding of the adult learner using computer-based technology and consequently lead to the development of methods that would support his attempts to acquire computer skills.

3.3.3. The main study

Research settings and information sources

Five major settings served as sources for data collection; some were part of the original research plan while others emerged as the study progressed. The five settings included responsive training sessions, train-the-trainer workshops, interviews with trainees, trainers, and end-users, observations of end-users in natural settings; and a comprehensive review of documents, manuals, and work-books.

Training sessions

The main sources of data were one-to-one responsive training sessions. The main characteristics of these sessions were the following:

- the sessions lasted 90-120 minutes each
they took place at the home of the trainee\(^2\)
the training was not pre-designed but rather focused on the trainee’s requests and on the availability of software on the user’s computer.

Three types of training sessions were observed:

1) **Paid Training (PT) sessions**

   These sessions included real clients who called for help and Responsive Trainers (RT) working for Helping Services\(^3\) (HS). The trainers were paid for their services. The data collection was limited to field notes and audio-recordings of the sessions. A total of four PT sessions were observed\(^4\).

2) **Volunteer Training (VT) sessions**

   These sessions included volunteer trainees and RTs. Most of the RTs were HS trainers with the exception of Samuel, who was a knowledgeable co-worker of the trainee (Fred). These sessions lent themselves well to data collection. They included some interventions by the researcher and were video-taped. A total of four VT sessions were observed.

3) **Focused Training (FT) sessions**

   These sessions were conducted and observed in the fourth phase of the study. The sessions with volunteer trainees and trainers were conducted as follows:

   (a) four sessions focused on trainee’s specific problems and experimentation with specific training methods (in three of the sessions the trainer was the researcher). These sessions were audio recorded;

   (b) two case studies with volunteer trainees and HS trainers focusing on the implementation of constructivist training procedures (see Chapter 5). These sessions were video-recorded.

---

\(^{2}\) Except for two sessions in which the researcher was the trainer. In this case, the training was in the trainer’s home.

\(^{3}\) Code name for the main company that provided the training services.

\(^{4}\) Two additional PT observations were conducted but were not included in the data since the training resulted in technical solutions with no training interaction.
A total of 14 responsive training sessions were conducted, observed, and audio/video recorded. Field notes were taken throughout all sessions and immediately following each session.

**Train-the-trainer workshop**

A six-hour train-the-trainer workshop was conducted during the fourth phase of the study. The purpose of the workshop was to introduce the trainers to basic constructivist principles (see section 2.2). This workshop included training simulations conducted before the actual training. The results of the simulations were then used as pretests against which the changing behaviour of the trainers could be compared. The workshop also served to identify typical responsive training behaviour before any treatment.

**Interviews**

Three sets of interviews were conducted:

1) **Interviews with trainees**

After each training session an open interview with the trainee was conducted. The interviews with the PT trainees were conducted two to three weeks after the sessions; the interviews with the VT trainees were conducted immediately after the session. The interviews focused on the trainee's problems and needs from their point of view, their expectations from the training sessions, and their assessment of the training methods used. The interviews also asked respondents about their previous training experiences. The delayed interviews with the PT groups provided important data regarding the retention of the training contents and procedures and the ability of the trainee's to apply the learned contents. The interviews varied in length from thirty minutes to two hours. The longer interviews were usually a result of the need of the trainees to tell their stories in fine detail (e.g., Rachel and Leah, in Chapter 4). All interviews were audio-tape recorded and field notes were taken.

---

5 No interview was conducted with Reuben as he could not be reached.
6 This allowed the trainee to choose a convenient time.
2) Interviews with trainers

A short interview was conducted with most of the trainers after each training session. (For technical reasons, some of the trainers were not available for interview). The interviews focused on the trainee’s problems and needs from the trainer’s perspective, the training methods used, the rationale for using these methods, the trainer’s previous training experience and experience with computers, and his own methods of learning how to use new systems and applications. Some of the interviews were audio-taped while for others only field notes were taken during and/or after the interview. A total of ten trainers who participated in training sessions were interviewed.

3) Interviews with end-users

Twenty-two short interviews were conducted with end-users. The interviews focused mainly on three topics: the complexity of computer use and the main applications users use, the problems users had with the systems and applications they were using, and the training background of the users. The end-users were interviewed in university computer rooms and in random meetings. A few end-users from this group were individuals who had heard about this particular study and asked to be interviewed, mainly to express their frustration. Two interviewees sent me recorded cassettes with lists of problems they had. With the other interviewees, field notes were taken throughout the interview or directly after the interview. The differences between these interviews and the interviews with the trainees is that the latter focused mainly on the training experience, was an in-depth and planned interview, and was recorded and analyzed verbatim, while the former were short, random interviews aimed at clarifying a few specific issues.

Observations on end-users in natural settings

Throughout this study, and particularly in the fourth phase, observations were made on end-users in natural settings. The settings included university computer rooms and the homes and offices of users. The main focus of these observations was the type of problems users have the applications they use, and the support they get when they need
help. Similar observations were made during the preliminary study and were used to establish the focus of this study.

Documents, manuals, and work-books

Reviewing documentation manuals and work-books was an essential part of the preliminary study. However, a second examination was done in the fourth phase to validate and augment the emerging categories, mainly those dealing with common methods used by trainers and training programs.

The research subjects

Three main groups participated in the study: trainers, trainees, and random end-users.

The trainers

Most of the trainers (14), including the participants in the workshop, were part-time consultants working with Health Services (HS). Three trainers were knowledgeable end-users or “Freds”, who supported other users. Three trainers, including the researcher, were professional trainers. Most of the trainers (except the researcher and another two trainers) were not trained for professional computer training and did not have any other instructional or teaching experience. All the trainers were DOS and MS Windows users. Only three had experience with Macintosh OS. All the trainers volunteered to participate in this study after being informed of the purposes of the study and methods (see Appendix I). All signed a consent form (see section 3.7 and also, Appendix II). Four participated while simultaneously getting paid for their support services. A total of 19 trainers participated in this study. Three of the trainers were females, 16 were males.

The trainees

The trainees were end-users with computer experience ranging from total novice to eight years of computer experience. All had had problems in working with the computer that led them to seek help. Four of the trainees were clients of HS and paid for their training, the rest volunteered to participate in this study. The volunteer trainees were obtained through personal referrals. As with the other participants, the trainees signed a consent
letter after being properly informed about the research. A total of 14 trainees participated in the study, five were male, nine were female.

The random end-users

The last group of participants included mainly graduate students from universities in two provinces of Canada. Some were observed while working in the computer rooms of their school, others were approached in their home or office and were obtained through personal referrals or by contacting the researcher. A total of 20 random end-users were observed or interviewed, six were male, fourteen female.

The table below summarizes the list of participants, their roles in the study, the data collected from them, and the name of their trainer/trainee. The workshop participants were all HS trainers, however, the table below describes their simulated role in the training workshop. All names have been changed to respect the privacy of those who participated. All participants were given coded biblical names. The gender of the participant was kept in the coded names.

Table. 3: The research subjects

<table>
<thead>
<tr>
<th>Name</th>
<th>Role as participant</th>
<th>Setting</th>
<th>data collection methods</th>
<th>trained by/trainee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rachel</td>
<td>Trainee (p)</td>
<td>training session</td>
<td>Observation; interview</td>
<td>trained by Jacob</td>
</tr>
<tr>
<td>Lea + Dan</td>
<td>Trainees (p)</td>
<td>training session</td>
<td>Observation; interview</td>
<td>Jacob</td>
</tr>
<tr>
<td>Rebecca</td>
<td>Trainee (p)</td>
<td>training session</td>
<td>Observation; interview</td>
<td>Salomon</td>
</tr>
<tr>
<td>Rueben</td>
<td>Trainee (p)</td>
<td>training session</td>
<td>Observation</td>
<td>Isaac</td>
</tr>
<tr>
<td>Levi</td>
<td>Trainee (p)</td>
<td>training session</td>
<td>Observation; interview</td>
<td>Simon</td>
</tr>
<tr>
<td>Deborah</td>
<td>Trainee (v)</td>
<td>training session</td>
<td>Observation; interview</td>
<td>Barak</td>
</tr>
<tr>
<td>David</td>
<td>Trainee (v)</td>
<td>training session</td>
<td>Observation; interview</td>
<td>Saul &amp; Jonathan</td>
</tr>
<tr>
<td>Noah</td>
<td>Trainee (v)</td>
<td>training session</td>
<td>Observation; interview</td>
<td>Samuel</td>
</tr>
<tr>
<td>Ruth</td>
<td>Trainee (v)</td>
<td>focused case study</td>
<td>Participant observation; experiment; interview</td>
<td>Isaiah</td>
</tr>
<tr>
<td>Name</td>
<td>Role as participant</td>
<td>Setting</td>
<td>data collection methods</td>
<td>trained by/trainee</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------</td>
<td>--------------------</td>
<td>------------------------------------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>Naomi</td>
<td>Trainee (v)</td>
<td>focused case study</td>
<td>Participant observation; experiment; interview</td>
<td>Jonah</td>
</tr>
<tr>
<td>Esther</td>
<td>trainee (v)</td>
<td>focused experiment</td>
<td>Experiment; observations; field notes; interview</td>
<td>Bat-Sheba</td>
</tr>
<tr>
<td>Eve</td>
<td>trainee (v)</td>
<td>focused experiment</td>
<td>Experiment; observations; field notes; interview</td>
<td>Dina (myself)</td>
</tr>
<tr>
<td>Jacob</td>
<td>trainer (HS)</td>
<td>training session</td>
<td>Observation; interview</td>
<td>trained Lea &amp; Dan; Rachel</td>
</tr>
<tr>
<td>Salomon</td>
<td>trainer (HS)</td>
<td>training session</td>
<td>Observation; interview</td>
<td>Rebecca</td>
</tr>
<tr>
<td>Barak</td>
<td>trainer (HS)</td>
<td>training session</td>
<td>Observation; interview</td>
<td>Deborah</td>
</tr>
<tr>
<td>Saul</td>
<td>trainer (HS)</td>
<td>training session</td>
<td>Observation</td>
<td>David</td>
</tr>
<tr>
<td>Jonathan</td>
<td>trainer (HS)</td>
<td>training session</td>
<td>Observation; interview</td>
<td>David</td>
</tr>
<tr>
<td>Isaac</td>
<td>trainer (HS)</td>
<td>training session</td>
<td>Observation; interview</td>
<td>Rueben</td>
</tr>
<tr>
<td>Simon</td>
<td>trainer (HS)</td>
<td>training session;</td>
<td>Observation; interview</td>
<td>Levi</td>
</tr>
<tr>
<td></td>
<td>trainee (sim)</td>
<td>workshop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Samuel</td>
<td>trainer</td>
<td>training session</td>
<td>Observation; interview</td>
<td>Noah</td>
</tr>
<tr>
<td>Isaiah</td>
<td>trainer (HS)</td>
<td>case study; workshop</td>
<td>Participant observation; experiment; interview</td>
<td>Ruth</td>
</tr>
<tr>
<td></td>
<td>trainer (sim)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jonah</td>
<td>trainer (HS)</td>
<td>case study; workshop</td>
<td>Participant observation; experiment; interview</td>
<td>Naomi</td>
</tr>
<tr>
<td></td>
<td>trainee (sim)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jeremiah</td>
<td>trainer (sim)</td>
<td>Workshop</td>
<td>Participant observation</td>
<td>Nathan</td>
</tr>
<tr>
<td>Nathan</td>
<td>trainee (sim)</td>
<td>Workshop</td>
<td>Participant observation</td>
<td>Jeremiah</td>
</tr>
<tr>
<td>Samson</td>
<td>trainer (sim)</td>
<td>Workshop</td>
<td>Participant observation</td>
<td>Delilah</td>
</tr>
<tr>
<td>Delilah</td>
<td>trainee (sim)</td>
<td>Workshop</td>
<td>Participant observation</td>
<td>Samson</td>
</tr>
<tr>
<td>Benjamin</td>
<td>trainee (sim)</td>
<td>Workshop</td>
<td>Participant observation</td>
<td>Jonah</td>
</tr>
<tr>
<td>Bat-Sheba</td>
<td>trainer</td>
<td>focused</td>
<td>Participant observation;</td>
<td>Ester</td>
</tr>
<tr>
<td>Name</td>
<td>Role as participant</td>
<td>Setting</td>
<td>data collection methods</td>
<td>trained by/trainee</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------</td>
<td>------------------------------</td>
<td>----------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Dina (Myself)</td>
<td>trainer</td>
<td>focused experiment</td>
<td>Experiments; interview; field notes</td>
<td>Eve, Hagar</td>
</tr>
<tr>
<td>Hannah</td>
<td>student end-user</td>
<td>Work</td>
<td>field notes; interview</td>
<td>by herself</td>
</tr>
<tr>
<td>Melah</td>
<td>student end-user</td>
<td>home</td>
<td>field notes; interview</td>
<td>by herself</td>
</tr>
<tr>
<td>Sarah</td>
<td>end-user</td>
<td>Work</td>
<td>Observations; interview</td>
<td>by herself</td>
</tr>
<tr>
<td>Hagar</td>
<td>end-user</td>
<td>home use</td>
<td>Observations; experiments</td>
<td>Dina</td>
</tr>
<tr>
<td>Tamar</td>
<td>student end-user</td>
<td>Work</td>
<td>Interview; observations</td>
<td>by herself</td>
</tr>
<tr>
<td>Merav</td>
<td>student end-user</td>
<td>Work</td>
<td>Interview; observations</td>
<td>by herself</td>
</tr>
<tr>
<td>Joseph</td>
<td>end-user</td>
<td>Work</td>
<td>Interview</td>
<td>by himself</td>
</tr>
<tr>
<td>Merriam</td>
<td>end-user</td>
<td>Work</td>
<td>Interview</td>
<td>by herself</td>
</tr>
<tr>
<td>Joshua</td>
<td>end-user</td>
<td>Work</td>
<td>Interview</td>
<td>by himself</td>
</tr>
<tr>
<td>Gabrielle</td>
<td>end-user</td>
<td>home; work</td>
<td>Interview</td>
<td>by himself</td>
</tr>
<tr>
<td>Ephraim</td>
<td>prof. trainer</td>
<td>Work</td>
<td>Interview</td>
<td>by himself</td>
</tr>
<tr>
<td>Raphael</td>
<td>prof. trainer</td>
<td>Work</td>
<td>Interview</td>
<td>by himself</td>
</tr>
<tr>
<td>random un-named end-users</td>
<td>end-user</td>
<td>university’s computer rooms; home and office</td>
<td>Observations; interviews</td>
<td>occasionally support by the facility support staff</td>
</tr>
</tbody>
</table>

**The Research Medium**

The research medium was not pre-defined. Since part of the study was to examine the applications the end-users were actually using, no attempt was made to focus on specific applications. However, the dominant tools used through the study were Microsoft Word 6
or 7 and the Internet browsers, MS Explorer and Netscape. Some of the users requested help with WordPerfect and some used MS Works. The older software end-users used included mainly old versions of WordPerfect and in one case an old version of MS Power-Point. All the users (except in the focused experiments) worked in a PC (IBM compatible) environment with a Windows 3.1 or Windows 95 operating system. Some end-users (mainly in the universities) worked in a DOS environment.

Part of the experimentation sessions included experimentation with different environments and software packages. A major focus in these sessions was on exploring the use of multimedia and graphics. For this purpose, the graphic mode of Claris Works 4.0 was used in a MAC OS environment and MS Power Point in a Windows environment.

3.4 Data Coding and Analysis

The purpose of the data analysis was to "bring order structure and meaning to the mass of collected data" (Marshall & Rossman, 1989, p. 112). In grounded theory, data analysis begins as soon as one begins to collect data. "The constant comparative method of analysis for which grounded theory is known, involves a constant process of categorization, sorting and resorting of data in search for emerging categories and themes" (Rafus & Moon, 1996, p. 64). Although the data collection and data analysis in this study are described separately, the processes were simultaneous and each phase of the study was based on the analysis of previous phases or even on specific categories, themes, and questions that emerged during the course of the study.

In grounded theory, three major procedures are interwoven within the data-analysis process: data coding; focused coding and memo-writing.

1. Data coding

The first step of data analysis, which was usually done as closely as possible to the data collection, is the coding process. Coding is the pivotal link between collecting data and developing an emergent theory to explain this data:
Coding is the process of defining what the data are all about... in qualitative grounded theory coding means creating the codes as you study your data... Coding is the pivotal link between collecting data and developing an emerging theory to explain these data. The crucial phase of coding leads directly to developing theoretical categories (Charmaz, 1996, p. 37).

The analysis process started with coding the transcripts taken from the video/audio recordings and the field notes. The first step of coding was the line-by-line coding.

Line-by-line coding means naming each line of data... It helps you begin to take an analytic stance towards your work... through line-by-line coding, you begin to build your analysis from the ground up without taking off on theoretical flights of fancy (Charmaz, p. 37).

Different technical solutions for the coding were examined, including the use of spreadsheets and databases. Eventually, since the new word processors provide sorting functions within the tables functions, the table solution was found to be the most convenient.

The text was arranged in four column tables, as follows:

<table>
<thead>
<tr>
<th>Name (trainer, trainee, comment of the researcher)</th>
<th>Text</th>
<th>code</th>
<th>category</th>
</tr>
</thead>
</table>

In the first stage of the line-by-line coding, the category column was left empty. The codes used in this stage attempted to describe the specific event of the coded section by using either in vivo codes taken directly from the coded section, or codes chosen by the researcher as best describing the relevant essence of the sentence/event.

Data coding helps in making decisions about new research directions and additional data that needs to be collected. In many instances during this study, another set of data collection thus followed the data coding.

2. Focused coding

Focused coding is the process under which more generic categories emerge from the line-by-line codes.
Here you take a limited number of interesting line-by-line codes and apply them to large amounts of data. By the time you engage in focused coding, you have decided which of your earlier codes make the most analytic sense and categorize your data most accurately and completely (Charmaz, 1996, p.40).

Rafuls and Moon (1996) describe two phases of this process: axial coding and selective coding. In the first phase, the researcher establishes connections between the different codes by “examining, comparing, conceptualizing and categorizing data” (Rafuls & Moon, 1996, p. 71). The second phase of selective coding, involves the process of identifying core categories or themes, systematically relating it to the other categories, validating those relationships and filling in those categories that need further refinement and development (Strauss & Corbin, 1990).

Technically, the fourth column of the coding table was used and re-used for this process. The categories in this column changed continuously and expanded as the data and its line-by-line codes accumulated. The categories and themes of this stage eventually became the skeleton and the guiding outline of this thesis.

3. Memo writing

Notes, or memo writing, accumulated during the coding process had an essential role in developing the grounded theory of this research.

Memo writing is the intermediate step between coding and the first draft of your completed analysis. Memo writing helps you to elaborate process, assumptions and actions that are subsumed under your code. When memo-writing, you begin to look at your coding as process to explore rather than as solely ways to sort data into topics (Charmaz, 1996 p. 43).

Through the coding process (line-by-line and focused coding), additional rows were added to the table between the categories and served as an ideas-building area. These ideas were continuously refined and expanded when new codes and categories emerged. A major guideline for the memo writing was the recommendation of Charmaz (1996) to “do it for your eyes only and use it to help you think about you data” (p. 44). Eventually, the memos served as the main sources for the first draft of this thesis.
3.5 Ethical Considerations

To maintain the confidentiality and anonymity of the subjects in this study, the names of participants were deleted and replaced by codes known only to the investigator (to emphasize the fact that the names were coded, biblical names were given to all participants). The data gathered for the study was stored in locked files during the study period. At the end of the study, all written data will be shredded, and the magnetic-stored data (video, audio, and computer devices) will be erased.

All participants in the study were given a letter that described the study objectives, procedures, and the steps taken to maintain anonymity of the subjects (Appendix I). Participants were also asked to sign a letter of consent that would also be signed by the administration (see Appendix II). The letter of invitation, and the letter of consent, included the following note “each participant is free to withdraw from the study at any time. In this event, all data collected from this individual will be destroyed.” In addition, the letter indicated that every attempt would be made to avoid any non-relevant personal or group evaluation.

A brief summary of the study results and a thank you letter will be sent to all study participants. Personal feedback regarding the possible improvement of training skills was provided to each trainer. HS (the help agency) obtained general feedback regarding training needs and problems, and suggestions for further development of training procedures.
CHAPTER 4
THE END-USER PROBLEMS AND NEEDS

4.1. Introduction: The End-User Computing (EUC) Loop

This chapter examines the interactions between three main factors involved in EUC as they emerged in this thesis. It focuses on the end-user and his interaction with the computer on the one hand and his interaction with the support/training environment on the other hand.

The literature dealing with the user’s problems brings up a number of user difficulties that vary by different populations (women, adults, novice-experienced, etc.), the state of technology at the time the research was done, and the computing tools examined. However, most of these studies viewed technological change as a solution to the current problems rather than a process that generates new types of users, as well as new computer procedures and their consequent problems that require specific solutions.

One attempt to look at EUC as a continuous process is the activity theory (Bodker, 1991; Kaptelinin, 1994). This model deals with the Human-Computer Interface (HCI) in the context of the end-user’s activities and his environment. According to activity theory, the computer is just another tool that mediates the interaction of human beings with their environment. Other tools available to the user include the social environment around him and the objectives of the user and the group/organization to which he belongs to.

The main principle drawn from the activity theory and supported by this thesis is that to understand the HCI and the user’s problems, needs, and training methods to support these needs, the learning activity should be viewed as a dynamic process. According to Kaptelinin (1994), learning to use the computer is a triangular process that comprises a continuous feedback loop between the user, the computer and the environment. Through this developmental process, the attributes of each node are continuously changing.
This chapter describes the end-user’s problems and needs as they emerged from this study. The description is guided by examining the EUC loop, its components, and interactions. A major focus is placed on the changing technology and its effect on the end-user and his interaction with the computer and the support/training environment.

4.2 Who is the End-User?

Whenever computer training and end-user needs are discussed, attempts are made to define what should be included in computer literacy, that is, what makes a learner computer literate? To understand a user’s needs, it is important to understand the changing role of the end-user and, in particular, how his needs change as the personal computer develops and changes. As will be indicated later, changes in technology have a significant effect on the user’s problems and needs, and should be a major consideration in any future end-user support development.

The literature review (Chapter 2) presented different aspects, descriptions, and definitions of the end-user. This section looks at the end-user as he was observed in this study. It tries to present both the common characteristics and the differences between the participants of this study and the meaning of computer literacy for them.

4.2.1 The characteristics of the end-users in this study

Rachel is a single mother in her thirties. She started her struggle with the computer about three years ago, when she enrolled in a two-year diploma program in a community college. Computer courses constituted a major part of her program and computer literacy
was considered an essential qualification for the job she was trained for. Her endless struggle, which continues today with her efforts to accommodate herself to the workplace’s computer requirements, represents dozens of other stories of those who participated, formally or informally, in this study.

Joseph, a successful medical specialist and researcher, needs the computer for his everyday work and mainly for writing his publications and grant proposals. Unlike Rachel, he can be considered an experienced user. He has been using the computer for many years, and has replaced his computer a few times to keep himself current with new technological developments. However, he feels devastated “to waste all this time (sometime days) on some nuisance that has nothing to do with my job, just to make one part or another of my computer or software work”. He is frustrated that he can not make the computer work the way he expects it to work (which is, as will be discussed later, not too much to ask).

Leah is a consultant with an insurance company. In her work, she uses commercial software applications to maintain clients’ records and for data entry. She has no problems with these tasks. Her home computer is used mainly for home applications and entertainment. On the surface, Leah seemed to be the perfect end-user. She seemed to be an experienced and sophisticated user who makes full use of her computer. She has been using the computer quite intensively for the last six years with a variety of programs from word-processing to databases, encyclopedias, games, and automatic dialing through address books. She maintains a basic database for her recipes and another to keep a record of the movies she tapes on her VCR. She is using a computer application for keeping her finances and writing her checks, and appears to be an expert with the Internet, from which she retrieves various materials, including audio and video files. The computer keeps her and her husband busy for long hours during the evenings and weekends.

But Leah is struggling too. Though she enjoys using the computer, especially the Internet, she feels frustrated. She keeps “messing up” her computer, and continually gets stuck.
I feel like a dummy, I feel like I really don't know what I am doing...I probably know one percent about computers...I know very little, very little about computers...I only use them in a limited way.

After observing Leah (and her husband Dan) and further examining her knowledge, I was surprised to discover that she was correct in her self-assessment. Both Leah and her husband were totally lost. As will be demonstrated later, they could use a very limited number of functions; once any change in these functions occurred, they were lost.

The end-users observed in this study are well represented by Rachel, Joseph, and Leah. Although there is very little in common among them, these three represent the adult end-user and his problems. Despite the differences among them, they have a lot in common in terms of their computer learning, and mainly in their struggle and frustration with the technology. They also have a lot in common with many other end-users that the author observed and interviewed throughout this study.

In comparing the needs of these three end-users (and all the others observed for this study) to those described in the literature (e.g., Barrie, 1981; Juliff, 1990), we can see how much things have changed. For example, Seidel's (1980) computer literacy included three elements: 1) an awareness of what the computer means to society; 2) knowledge about various applications of computers, and, 3) being adept at program-writing skills (p. 482).

Rachel, Joseph, and Leah all know very well the meaning of computers to their lives. Knowing about computer applications is not enough for them, and the ultimate level of computer literacy, programming, or the ability "to manipulate a discrete number of symbols in new and idiosyncratic patterns" (Barrie. 1981, p. 108), is not relevant anymore for the end-user. They need to be able to utilize computer applications and to cope with the rapid change of those applications. These are computer literacy issues that were never mentioned in these historical documents and are hardly discussed in today's literature. From all the efforts to describe computer literacy in the last two decades, one description has remained relevant:

Adults who have learned to use the computer, are "literate" in terms of having acquired, through demonstrated use, a feeling of ownership and a
sense of personal control in being able to apply the machine as a personal tool (Barrie, 1981, p. 108).

When trying to explicate the users' needs in terms of the use they are making of the computer, we should understand that the present needs, in terms of specific tasks or tools, become history in a very short time when it comes to technology. A major attempt should therefore be made to identify the "literacy" that eventually will give the user a "feeling of ownership and a sense of personal control." This kind of literacy will survive the evolving technology and will last after the ink on this document dries.

4.3 The End-User-System Interaction

4.3.1 Introduction: The effect of the evolving technology

This section examines the user's problems from the perspective of technology change. It looks at the accelerating gap between technology development and the ability of the end-user to handle this development. A major focus is on the problems the change itself has created.

Throughout this study, it became clearer that although some of the problems mentioned in the literature and their consequences were found in the data collected for this thesis, the main theme, when dealing with user's problems, is the change itself. The fact that we are living in a revolutionary era and must accommodate continuous change into every step of our life where technology is involved is a major source of the user's problems and should be a major concern for any support system.

4.3.2 The gap between functionality and usability

From the end-user's point of view, changes in technology occur mainly in two related areas: the usability and the functionality of the computer systems. The concepts of usability and functionality and their related literature have been defined and discussed in Chapter 2. This section examines the effect of technology change on the end-user from the usability/functionality perspective in a search for ways that will make the functionality more usable for the end-user.
The functionality change of computers in the last two decades, mainly through the development of personal computers and the massive transfer to GUI systems, has made computers much more usable for and accessible to more users. However, with the massive development of new hardware and software that has made the use of computers in many ways so much easier, users still employ only a small fraction of the functionality available to them and spend a lot of time and energy in trying to make the computer more usable.

The categories that emerged under the functionality/usability section were organized into four sections: 1) limited use of computer functionality, 2) limited knowledge of the very basics, 3) unfamiliar terminology non-intuitive symbols, and misconceptions, and 4) loss of control and drowning in the functions-and-concepts ocean.

**Limited Use of Computer Functionality**

One striking finding of this study, which is consistent with the findings of Nilsen et al. (1993), is that despite the exponential growth and upgrades of software and systems, very little added functionality is actually used. Most of the subjects of this study were using only a small fraction of the functions on their computer. Usually it was a limited use of a word-processor, or a specific application like an accounting, statistics, or database package that the user employed for his work. In recent years, an increasing number of users have been taking advantage of the Internet, which has become a major application for non-IS computer users, but as with other functions, the use of the Internet functions is also very fragmented and limited.

Very few users observed in this study, even those who had been using the computer for a number of years, used functions that could be considered advanced functions such as advanced formatting, multi-document processing or using macros. These findings were not surprising and were in line with the literature and the main arguments of this thesis. However, in a few cases, it was surprising to find how unaware the users were about functions that could make a significant difference for them. One example is the *revisions* function available on MS Word 6.0 and more recent versions of the software7. This

7 A similar function is available in WordPerfect 6.0 and up (or 3.5 Mac version).
function could save (and did for me) days and months for any user who provides or uses editing services. Yet, none of the people interviewed or observed for this study, many of whom are graduate students who are using editing services regularly, used this function or any similar one. All were surprised to hear about it. Both editors and users of editing services indicated that they are using hand written marks for editing, a tedious correction process mainly for the user of the editing service. Using the revisions option could take the user as little as two seconds to enter the corrections he decided to accept.

The main problem was not with sophisticated options such as the above. The resistance to change went far beyond that. It was amazing to meet a number of users (mainly graduate students) who had access to new computers loaded with new software who preferred to work with old DOS versions of WordPerfect, using tedious procedures for editing. They felt they were using the right tools and did not want to spend more time and energy on learning to use better tools. All they wanted was to get their job done. They did not care whether there might be a more sophisticated, easy to use tool. None of the users observed used the more sophisticated functions available and very few of them tried to explore them beyond what they perceived as their immediate need.

This study found users who spent thousands of dollars on high-end, state-of-the-art computers only to be able to use them as typewriters and, more recently, to retrieve very specific and limited Internet information. None of these users made any use of the graphics capability of their computer and were surprised to hear that their word-processor included graphics tools. Special effort was needed to convince some of the users to try the graphics features on their computer, since all of them felt this is “professional stuff.” Other tools such as “database” and “spreadsheet” (tools that could be fairly simple with some applications) were considered professional tools beyond their reach.

The following are some specific examples of the limited use of the functionality available:

David knows that the computer can help him in his role as CEO and President of his mid-sized, successful company. Right now, his only use of his $4000 IBM laptop is reading articles from his favorite overseas newspaper via the Internet, a function that was set up
for him by a friend. He wants to be able to use a word processor so that he won't have to depend on his secretaries, but for him, the successful businessman, to be able to write a letter using the computer looks worse than climbing the Everest:

> Usually after a few attempts, I get so frustrated that I start screaming, if nobody is there. If I knew how to do it fast and efficiently, without being frustrated, I would do it all the way.

Melcah, a successful graduate student, has used the computer to write her papers for the last four years. Like most of the participants of this study, she is using the computer only as a very limited word-processor. In the past year, she started to make limited use of the e-mail service provided by her university. Although she has MS Word on her computer, she continues to use an old version of MS Works with which she has worked for the last three years, and even this limited tool is used with only a few functions. Though she knows she has better tools with better functions available for her on her computer, she does not have the confidence to go through the learning process needed to upgrade to newer tools.

The last example is that of Rueben, a retired senior, who bought a $3000 IBM computer with the hope that he would be able to enjoy playing Bridge with his friends through the Internet. Unfortunately, three months after he bought the computer, he could not even connect the computer to the Internet. He therefore did not use his expensive, brand-name computer for the one purpose which he thought he would use it for.

While computer vendors and the media keep telling us how much we can do with computers, this study, which focuses on the average home and office user, found very few who actually make use of the variety of functions available for them. Understanding the gap between computer functionality and usability for the end-user could contribute to the development of both functions with increased usability and support systems that will actually enhance this usability.

**Limited knowledge of basic computer functions**

While software and hardware developers continue to focus on more and more sophisticated functions, applications, and tools, which few users ever explore, the main problem lies with the basic functions with which users still have difficulties. While the
limited use of the more sophisticated functions do not hold the user back, the inability of the user to use what had been defined as basic functions did obstruct his ability to work even on simple tasks. During the initial coding process of the data, a dominant code that appeared in many of the observations was: lack of very basic knowledge. This code was not given to any advanced functions, but to those functions that seemed to be taken for granted by computer trainers.

What follows are some examples of questions that were frequently asked in many of the cases examined. Some of the users, such as Rachel and Lea, have been using computers for over two years; basics that are taken for granted by any trainer were not clear to these users. However they were afraid to ask for assistance because “it would sound stupid”:

1. **Rachel**

Rachel (to Jacob): Now, I have a question: Does it matter, because I have been afraid to ask it, does it matter in which sequence you turn the machine on?”

In another instance, Rachel wonders why she cannot use the grayed-out copy function (a very frequent problem): “I have a question on this, the gray parts that are light, that means that I have no access to those?”

When she wants to save her document she asks:

   Rachel: “I don’t have a disk here now, so I can not save it?”
   [another common question]
   Jacob: “You can save it onto the machine and pull it back out”
   Rachel: “You have to show me how.”

2. **David** (with a $4000 laptop) who really wanted to learn to use a word processor admits: “I don’t even know if I have a word-processor on my computer.”

3. **Rebecca** (who has six years experience as an end-user!) was shocked to learn that she has Windows on her computer: “I do have Windows? Oh my gosh! Oh what a discovery! You see this is what is so bad, to have this unit and not to know what you have.”
4. Sara called for help to find out she needed a modem to use the Internet. She was even more surprised to discover that she did not have one.

5. Leah, who was introduced earlier, declared that: "I feel like I really don't know what I am doing, I probably know 1% about computers." She proved her point by describing the event in which she discovered what “Windows” stands for. She was using Windows for a long time and never realized that, unlike with DOS, she could have more than one window on her desktop, and that she could resize them and work with more than one document or application at the same time. This is how she found out:

   I was watching television the other day, Canada A.M. and the guy in there showing the difference between MS Internet Explorer and Netscape, and he has got them both up on the same screen and they are both working, and I say: "Wow, that's cool! If I can do that!". I had no idea, I finally asked the computer guy at work, and so he just clicked and he said: "you know how you change the size of the boxes and everything...."

When she told this story in her interview, it was the first time she realized that the ‘boxes’ she was describing were actually windows. Leah tried to explain why, after so many years of using the computer, her knowledge and level of using the functionality of the computer was so limited:

   Maybe because I don't know what to do. If I thought I want to do this, but I don't know what the computer is capable of doing. That goes back to the chicken-egg scenario. If I knew all the different things that I could do with the computer I could probably set my mind to do it.

These examples are only a sample of the experiences from the long list of data accumulated under the code of the very basics. It is clear that not only does the added functionality not reach many of the end-users, but even the basic, obvious functions are lost within the ocean of functions the user finds on his screen, without the ability to control them.

   Unfamiliar terminology, non-intuitive symbols and misconceptions

Changing technology has been accompanied by exponential growth of new terminology and symbols, which has become a major overloading factor. Users find themselves bombarded with new and unknown concepts and icons in any step they choose and in any support they get, which adds to their feelings of incompetence.
None of the subjects of this study, including myself, were familiar with all the icons on their desktop. Most used only a limited number of them. When asked about the functions represented by the icons, all responded that the symbols are not intuitive.

Rebecca found the use of icons inconvenient for her: "I have to go to these little icons on the top, and it don't seem to bear any relation to reality." Joseph indicated that the designer of the icons did not always think about the end-user's perception:

> The icons are sometimes pretty hard to understand. Some of them showing a printer or opening a folder or scissors are more straight forward but when the icon becomes sufficiently obscure, I am not sure that is of any help.

None of the subjects wanted to spend extra time learning to use the icons, and stated that they use only those that they recognized. My personal experience was very similar and it was only after observing and interviewing users for a long time that I decided to review all my icons and customize my toolbar to suit my own needs.

The users found unfamiliar technical words in every selection and every decision point. Through the observations made for this study, most of the wrong selections users made were due to a misunderstanding of the terminology used in the dialogue boxes. In many cases, users seemed to understand the meaning of the words, but their misconceptions sometimes led to disastrous results. The most striking examples were the misconceptions of the most common use of *file* and *save*. These two concepts seemed to be so obvious that none of the trainers suspected that there could be any conceptual problem when they asked the user to create a document and/or save it. But this study revealed some very profound problems.

The question: "What happened to my document? Its gone!" was heard throughout this study with almost every user who accidentally deleted a document or could not retrieve a document the user assumed he saved. Losing a document or not being able to retrieve one can be a devastating and discouraging experience. One of these two experiences occurred to almost every participant of this study. Users did not know where their saved documents were stored and confused the meaning of the different saving options. In many attempts to retrieve saved documents, dozens of versions of the same document were found in different files or under different names.
One example is the experience of Melcah, who had as many as twenty versions of the same document saved. She insisted that something was wrong with the computer since she selected *don’t save* each time she was asked if she wants to save. The most common misunderstandings and misconceptions were the following:

- *don’t save* means delete the file (any file, old or new)
- *Save* means leave the old file untouched
- *Save As* means rename the file (delete the old file)
- Many users understood that whenever they made changes, they had to rename the file using *Save As*, and the old file will be discarded
- Users did not know how to select a specific file for storing their documents and as a result had major difficulties in finding their files

The following vignette, taken from the training session with Esther and Bat-Sheba, demonstrates the problems and misconceptions user’s have with the *Save* functions:

**Bat-Sheba:** “do *Save As*, and give the document a name.”

**Esther:** “I don’t want to lose the document, I already gave it a name.”

**Bat-Sheba:** “If you do *Save As*, you will keep both the old and the new with different names”

**Esther:** “If I do *Save As*, it will save the original...Let’s say that I took the document ‘letter 5’ and I worked on it and changed it. If I will type *Save As* ‘letter 5’ it means that ‘letter 5’ will be saved as it was before the changes; I am telling the computer to ignore all the changes that were done.”

**Bat-Sheba:** “No, in this case you have to select *Don’t Save.*”

**Esther:** “But then I will loose ‘letter 5’.”

**Bat-Sheba:** “No, ‘letter 5’ is already saved, the only way to get rid of it is to trash it (demonstrate). As long as you did not trash it, it is saved.”

This example is a good representation of that misconceptions and problems that emerged with other users in this study. Further examples of attempting to deal with misconceptions about how to save files, as well as other knowledge gaps, are presented in Chapter 5.

Another example of file management misconception was found in the way that new files were perceived. As mentioned earlier, almost none of the participants changed the default
file for saving; when it came to creating a new file, the confusion was common to most users.

Samuel called Noah for help when he could not understand why, when he opened a new file by selecting \textit{File}$\Rightarrow$\textit{New}, and named the file \textit{instruments}, he could not save anything in this file. He also did not understand why he always had to give a new name when he selected \textit{File}$\Rightarrow$\textit{New}, nor why he then had all his documents in a big pile in his main file: \textit{Samuel}. As can be seen from the following dialogue, it took Noah, the computer expert of the company, a long time to understand where the problem was:

\begin{quote}
Samuel: "I want to put all the stuff that relates to \textit{equipment} in the same file. Right now, when I go to \textit{file}, and select \textit{new}, I get another file, but I cannot get them in the same file."

Noah: "The simplest way is have a directory [unknown terminology] as a folder, which is equivalent to whatever you want to call it, and then have files within that."

Samuel: "This is my file "Samuel", if I want to open another file it will be another document?"
\end{quote}

As this dialogue continues, Both Samuel, the novice, and Noah, the expert, share the confusion:

\begin{quote}
Noah: "Click on \textit{file} and \textit{open}... Oh this is the wrong one ... Let's try that again. \textit{File} and \textit{new} (discovers that in the menu there are now two \textit{new} menu items.) I wonder why there is \textit{new} twice. Anyway I will take this one down with the arrow there, and then..." (discovers the selection of new folder)

Samuel: "How am I suppose to know that?"

Noah: "I don't know what this \textit{new} is (laughing)."

Samuel: "I guess this \textit{new} is opening the Word document"

Noah: "I have not seen that before"

Samuel: So, let's decide that the other \textit{new} is one or more options"

The confusion increases when strange messages appear on the screen:

\footnote{For the reader who is unfamiliar with MS Word: the terms file/folder/directories are alternative terms for a "container" which can store other files or documents. In MS Word a new document is opened when the user pull down the "file" menu and chooses "new" (the menu does not indicate that what is actually "open" is a new document).}
Samuel: (Tries to open the renamed document. A message appears warning that: “the file might become unusable”).

Noah: “It did not like it, it can not get rid of the extension [???]”

Samuel: (Tries to open the file, the file does not open).

Noah: “I think it’s a bit confused, because there should be an extension on it. [Although they are working in GUI environment they cannot get rid of DOS in their thinking.]”

Samuel: “It does not confuse me, I don’t know anything about extensions.”

Noah: (Goes back to the new issue) “I don’t know why with new it decided to open Word, that’s strange. It was a general icon and it was not supposed to know what it is…”

This dialogue, which continued for a long time before Samuel understood the difference between file and document and managed to create a new file, is an excellent example, not only of the misconceptions of the function File⇒New, but also of many other issues discussed in this chapter. It demonstrates problems such as the novice-advanced loop (Noah is considered to be a computer expert), the non-smooth transfer from a DOS to a Windows environment, incomprehensible messages, use of unknown terminology, and the difficulties with the very basics. However, the example mainly demonstrates how common procedures are not easy to use, even for the person who is considered to be an advanced user.

Interviews with many other users indicated very clearly that not only were very few users using the new file management tools available on Windows, but most of them perceived the function File⇒New to mean “open a new file” (or folder/directory) that could store other documents in it.

**Loss of control**

Loss of control emerged as a major theme throughout the data analysis of this study. Two sub-categories of control are: drowning in the functions ocean, and you’re just stuck. These sub-categories represent the frustrated end-user who cannot manage to work independently with his computer, sometimes even with simple tasks. The users observed in this study, were tired of “fighting” with their computers. If they were novices, they were overwhelmed by the “excessive number of commands, options or inputs”
(Guillemette, 1991). Their first encounter with a seemingly endless number of functions, and the duplication of functions through different selection methods, discouraged them from exploring their software programs. It led them to stick to the functions they needed to complete their immediate tasks, even if those tasks could be done in a more efficient manner.

In most cases, novice users, who were not experienced with the exploration process, needed to expend a great deal of effort just to access their computer's basic functionality. For many users, such effort did not seem worth the benefits that might result from it.

Rachel's interview abounds with stories of crashes. In some of them, she lost many hours of work.

I think I tried to close the file and the file would not close for me. And I went back and it said this is now read only. I could not go back in, I could not shut it, it was just stuck. So finally I got a friend to go back into the file manager and delete the whole thing for me, and I started over...Somewhere along the way whenever I do something, I would get snagged and there was nothing for me to follow to get out of that process. And even this fellow [an experienced friend] said I just have to go back to the file manager and delete it and start all over again.

But the feeling of frustration and loss of control was not only a novice's problem. As is described in the next section (4.3.2), many of the advanced user's observed in this study were tired of being caught in the advanced-novice vicious circle. The statement: "I don't have the time/energy/patience to sit down and learn it all over again" is found, in one version or another, in most of the scripts of this study. The advanced users, who were already in the routine of using the computer's functions in a specific way, felt frustrated with and in many cases angry at having to change their routine and of their inability to apply (in many cases) their old expertise.

The additional functionality does not always help the end-user. Only a small fraction of the abundant number of options and tools were ever accessed by the user. The plethora of options, did, however make a major impact on his feeling of helplessness, frustration, and inability to cope.
4.3.3 Does Experience Help?

The novice-advanced loop

When trying to identify the user’s problems, a major question was: Are the problems observed mainly a novice’s problems, as some scholars claim, or does even the advanced and experienced user have trouble with the computer?

In other areas of expertise, one would expect that old knowledge in the area will always support the accommodation of new knowledge and will make learning easier. When it comes to computers, however, in many cases not only does the old knowledge not help, but it actually interferes with new learning. Many examples in this study demonstrate the paradox of computer users who continuously find themselves in the novice-advanced loop where accumulated knowledge becomes obsolete and sometimes interferes with the acquisition of new knowledge.

The following examples illustrate various aspects of the novice-advanced vicious circle:

*Joshua relearns how to use PowerPoint: “It was so easy to use before”*

Joshua, a prominent physicist, had been using MS PowerPoint since his undergraduate years. In his interview for this research, he complained that this formerly very simple application, with which he could easily create his transparencies and graphics, had become cumbersome and complicated. When he stated that when he recently tried to use it, “I couldn’t find the functions I used before. And I found these templates which I really did not like but I could not find how to change them...Why did they have to change it, it was so easy to use before?”

Moreover, it took him some time to realize that PowerPoint's word processor is different from Word 7.0, although they both belong to the same Microsoft suite. Therefore, he not only had to re-learn PowerPoint and cope with the unfamiliar and unnecessary templates, he had to re-learn the word-processing functions of this program, despite the fact that he was proficient (after a long struggle) with Word 7.0.

Despite his frustrations, Joshua managed to cope. Like him, many end-users who moved between different versions, or different applications, found themselves in a continuous
struggle with the need to start again with new features that in many cases did not have many connections with the old ones.

A much more serious manifestation of the novice-advanced loop is found among those users who transferred from the old DOS-based systems to GUI or Windows-based technology. For many subjects of this study, the transfer to the new system has been a difficult and frustrating experience. Six subjects of this study, (and 10 of the occasional participants), were proficient with DOS applications before switching to their current GUI system. Increased anxiety, lower self-esteem, and a feeling of incompetence were some of the feeling resulting from this transfer.

Sarah learns to use her fax: "I don’t want to start all over again."

Sarah is a real estate agent in her 40s. She has had previous experience with the computer as an administrative assistant in a public organization. In her previous job in an accounting department, she worked for four years with the DOS version of WordPerfect and with data entry. In this capacity, she was considered a computer expert. She felt she knew everything that should be known about the computer, including all the codes and procedures to enter different documents or retrieve requested data.

After starting a new career in real estate, she learned very quickly to cope with the real estate database (DOS based). She managed very well with all the codes, and performed all the needed functions of the program, such as retrieving lists of houses sold in a range of time, identifying housing prices, zooming in on one of the items or its picture, or printing the listing.

She managed to get into MS Works and type simple letters using the basic icons, but could not go much further than using the word-processor as an upgraded typewriter. Her serious problems started when she tried to use her fax. There was no way for her to figure out how to operate it. She had no idea about what she saw on her screen and could not even identify which button was used for the fax. She had no ideas about how to explore her computer and she had neither the patience nor the time to read the manual (as was discovered later, it would not have helped in any case). She could not use the on-screen help because she did not know what she was looking for. When she tried to call the help
line, she experienced a frustrating series of conversations with consultants who seemed to know as little as she did about how to handle her problems. After two weeks of calling the help line, talking to a dozen different consultants, and continuous help from a knowledgeable friend, she finally managed to send her first fax. If she had had any motivation to learn the new features on her new computer, it was gone as a result of this experience.

I don’t mind any more. It’s enough for me that I can send and get faxes and can use my real estate program at home. I wish I had the old WordPerfect [DOS version] on this computer so I could write my letters, but I don’t mind any more. For me what I can do with MS Works is good enough. I don’t have time to start learning everything all over again.

Sarah’s previous experience did help her to continue with the type of tasks she had done before on the computer. But once she tried working with Windows, she had no tools with which to learn in the new environment, and she felt helpless. In this case, her experience not only did not help her, but was a setback for her ability and motivation to “start all over again.”

Rebecca tries to use her old computer: “I need to take a year of classes for this”

Rebecca’s story is quite similar. Before starting her own import business, Rebecca worked with her husband in his printing business. In the past six years, she did all the accounting work for the company using a DOS accounting program (ACPAC). She said, “I do accounting without thinking about it, but it is not the same thing.” She also used WordPerfect 3.0 to write some of the business letters. Everything worked well for Rebecca and she managed to do everything she felt she needed with her old 386 PC.

Now Rebecca’s new business is picking up. She needs to know more about using the computer to be able to conduct her basic business functions. In the two-hour personal training she had with Isaac, there were no traces of her previous experience. She was confused and hesitant, and felt totally helpless. Even when she tried to use the word-processor she had used a year before, she could not remember any of the functions. In the time that had elapsed since she had used the word processor, the software had shifted to being mouse-driven and had a new look. The basic functions of changing the fonts and
the size of the letters seemed to her so complicated that she felt she had to "take a year of classes for this."

When it came to basic Windows and mouse functions, Rebecca had to be led step-by-step, even with the very simple functions. Using the mouse was very confusing and difficult for her. Selecting icons, re-sizing windows, and finding the program she wanted to work with seemed to be impossible.

In her interview she admitted: "I don't remember anything, and I can not use any of the functions he showed me." Rebecca expressed her frustration in the conclusion of the session by asking: "How do you set up your own business and continuously get into the high-tech field at the same time?"

Rachel is drowning in the systems-versions ocean: "you learned a program and then it's obsolete"

The most striking example of an end-user drowning in the systems-versions ocean is Rachel. Rachel did almost everything she could to make sure she would make it, but she didn't. When she was assigned to a new job, she had one wish: "I wish I knew what program I will need when I finish school...I just hope it's WordPerfect 6.1 because I cannot remember a lot of my 5.1."

Throughout the two years of the diploma program she took, Rachel's major struggle was with trying to juggle the different versions of word-processors. "We started two years ago with 5.1, that's what we had to learn, it was basic 5.1 training." When she had difficulties, she tried to get help from various people and software vendors. She faced the reality that:

Nobody else was doing it anymore...and they told me that 5.1 was obsolete, that nobody was selling it and nobody had any...and I had a girlfriend who had 5.1 on Windows but mine was on DOS, so she could not help me and nobody could help me.

Finally, Rachel managed to overcome most of the troubles she had with 5.1; then 5.1 was no longer being taught. She had to start all over again with WordPerfect 6.1. When asked, in the interview, if her experience with 5.1 helped her with 6.1, she answered: "no, 6.1 is
different from 5.1, you cannot use a single command from 5.1 in 6.1...I don't believe the functions are the same, you learned a program and then it's obsolete.

Her story ended (for the researcher) when she got her first job assignment and... "It was WordPerfect 5.1." After two years of training that was supposed to prepare her for this job, she had to start all over again and she was frustrated (emphasis mine).

Even Jacob (Rachel's Trainer), who was considered a computer expert, could not avoid finding himself in a novice position. When addressing Rachel's problems with WordPerfect 6.1, he assumed that his expertise with WordPerfect 6.0 would be adequate to allow him to help Rachel. Nonetheless, he found himself very quickly embarrassed and confused. He had to start learning the new version as if it was an entirely different program.

Even Leah, who seemed to be doing very well with Windows, and who enjoyed numerous Windows programs, did not overcome the resistance to change when it came to a tool she had been using for long time. Her experience did not help her in this case, nor did it even play a role in her resistance to change.

_Leah, the sophisticated user: “I don't have a clue how to use it”_

Like Rebecca, Leah saw the great advantage of using Windows, although the transfer was not easy for her:

I first resisted getting to Windows, because when I first started using Windows I found that confusing. I have spent all this time learning DOS and DOS shell, and I knew how to do that, and I guess you sort of resist change and Windows is such a different format than DOS format was.

When it came to switching to a program she was fluent with and had been using for a long time, Leah stayed with the known version:

I have got the 6.1 on my computer, but I don't have a clue how to use it. It's completely different, none of the functions work the way that I am used to, like shift+F7 is not print anymore, I don't know, I have to go to these little icons on the top, and it does not seem to bear any relation to reality. I know how to make macros on 5.1, I learned how to do that, I cannot do that on 6.1. I guess I have to sit down with the manual or the help and learn again but I cannot bother, I just can not be bothered.
A very similar picture of resistance to change was found with all the participant of this study whether they were occasional computer users, or frequent users of a specific program. All participants found the transfer from the DOS version of a program to the Windows version very difficult and many of them, like Leah and Rachel, did not feel there was sufficient reason for them to change.

When does experience help?

The difficulties experienced end-users had with new applications or new versions of the same application brought up a new set of questions regarding the type of experience that support or do not support new learning.

At this stage in the research, I went back to the scripts to find out whether there was another perspective that had been overlooked, one that would indicate a different direction or explanation. While in the first round the focus was on the learners, or the trainees, whose previous experience was usually in working with a few specific DOS programs such as ACPAC, WordPerfect 5.1, or a specific databases, this time I examined the learning patterns of the trainers themselves. In the specific situations of this study, the trainers in many cases were asked to help with functions, versions, and programs they had never used before. This forced them to go through their own learning experiences while acting as trainers (e.g., Jacob in the previous section). Though in many cases they found themselves in difficult and embarrassing situations, eventually they managed to overcome obstacles and find the solutions. When examining the tools they used, it was obvious that it was not their experience with a specific program that gave them the ability to find these solutions, nor was it their programming knowledge or their knowledge of handling programs using DOS. The tools they were using were different.

The tools that lead them to the solutions were their heuristic tools, their searching experience, their competence in making sense of the different titles and the help instructions, and their ability to make the right choices when dialogue boxes appeared. This experience consisted of many hours spent exploring a variety of programs and searching for functions and tools rather than just using specific programs and applications.
All the studies reviewed for this thesis that dealt with previous experience treated all experience in the same fashion. This study indicates that the question: "Does previous experience help?" a question frequently asked in previous studies, does not differentiate between various types of experiences. A more proper question should be: What type of previous experience helps? This question has not been found in any of the studies examined and will be examined in this study, mainly in the discussion dealing with training contents and methods.

4.3.4 Can technology development give the user more control?

A common assumption is that the additional functionality of computers developed in recent years could make the computer more usable by allowing the user more control over his computing operations. Many features that have been added to new systems and programs do lead to more control, or at least have the potential to do so. The shift from command-based systems to GUI systems is itself driven by the need to give the user more control. It has released the user from restrictive long lists of meaningless commands, and provides him with a choice of functions and operation methods to suit his needs.

To illustrate the gap between functionality, which should allow the user to have more control, and its actual use, three groups of functions that have been developed towards providing the user more control where chosen:

(1) Safety net, (2) file management functions, and (3) preferences and default,

1. Safety net

A major issue surrounding the user's attempts to have more control is his fear of damaging either work that has already been done or damaging the computer itself. Users often feel totally lost when unexpected events occur as a result of a wrong action. Throughout the training interactions, users waited for the trainer to approve every step they made, to make sure that a disaster would not happen. When users pressed the wrong key, or made a wrong choice in a dialogue screen, they were terrified, and felt they would never be able to control the computer.
Deborah expressed this feeling: “I am afraid that I will touch something by mistake and would not know what I did, and that I will be stuck or lose everything I did.”

New programs have many improvements available to the users that should ease their fear of causing irreversible damage. Generally, the hardware and software now available are much more robust and reliable; the probability of causing serious damage is very low. Moreover, more functions have been added that allow the user to safely try different options. Two examples of such functions that allow users to build a better “safety net” are: the *undo* and the *save* functions:

1. **Undo**- the undo and the *repeated undo* functions allow the user to learn through trial and error and return to the starting point;

2. **Save**- the save functions allow the users to save their document in a file with meaningful name, and easily retrieve it. All these are possible if the user knows how to use them.

Proper use of these functions allows the end-user to explore the computer and to experiment with different options without the fear of loosing documents, making irreversible mistakes, or damaging the computer. However, very few users and trainers perceived the importance of these functions as safety net tools and used them accordingly.

2. **File management**

Great advancements have been made in recent years, making computer file-management easier and more understandable. However, it was amazing to see how little advantage users take of these organizing capabilities. The result of not using these new capabilities is frequent and time-consuming searches for missing files through long, unorganized lists of documents, mistakenly overwriting documents, and, inadvertently creating redundant copies of the same document under different names or in different locations.

Melcah, Leah, Sarah and others had continual problems in finding the files they had saved. Not one of the subjects could make the distinction between file (or folder) and document, and none of them ever tried to organize or sort their documents. Melcah needed help after she retyped a document three times and could not find it. She did not
know how to search for her document and did not understand why she could not see it on
the list when she selected File-Open. She never realized that her documents were sorted
by default options that could be controlled. She did not even understand the meaning of
default as a changeable option.

Leah's computer could be compared to an expensive and sophisticated executive desk
with a number of invisible drawers and storage compartments, intended to make
everything organized and easy to find and to store. However, despite the storage spaces
available, she left everything on the desktop to make sure she would be able to find it.
She had no idea why she might need all the drawers when everything she needed was on
the desktop.

She called for help when she could not find files she had downloaded from the Internet.
When asked whether she knew how to organize her files, she could not figure out why
she would need to do that:

. No, I have not even thought of doing that, I might be able to figure it out if
I felt a need to do that but I don't feel need to do that.

Like Leah, the end-users observed in this study used the file management system in the
same fashion as it was used ten years ago under the DOS system, completely unaware of
the new tools available to them today. Appropriate use of the new management tools
could help users organize their documents in a way that would give them much more
control over their work.

3. Preferences and Default

A major change in programs and applications in recent years has been the opportunity
given to the user to choose between using ready-made templates and default options, and
creating his own settings and selecting his preferred options. The user can now decide
how his desktop will look and what tools will be on it. He can choose the selection
methods, the speed of his mouse click, and a variety of tools he wants to work with. For
example, the popular program MS Word has four different methods of selection for each
function (icons, menu selection, keyboard shortcut, and keyboard functions). However,
the users observed in this study did not know they had these choices. They did not know
that they don’t need to have all the options on their desktop and that they can choose what to use. Many of them did not even know that these selection methods were interchangeable and that they did not have to know all the alternatives. For them, the huge number of selections and options was confusing and intimidating.

Joseph presented his experience with the word processor he was using as follows:

“In general, I find the program has too much stress on flexibility of the display and not enough consistency of a display.”

Users were also bothered by the selection chosen by whoever programmed the final version of the program as the default. They did not understand the concept of default and the fact that any default is changeable.

Joseph, a well-organized scientist, made a long list of things that bothered him about the computer. Most items on his list would not have been there (and were eliminated after a very short training session) had Joseph recognized the two concepts of preferences and default.

A good example of the lack of understanding of these two concepts is the use of the AutoCorrect function. Incidentally, I met Joseph a few days after discovering this highly useful function that automatically types frequently used terms or corrects frequent spelling mistakes. For me, this was one of the most important functions available. A few minutes after this discovery, I had a long list of terms and words that would automatically appear corrected in my text with one keystroke. By using this function, I did not have to worry about capitalizing the first letter in a sentence; when writing “i” the program would automatically change to “I”; and I did not have to correct the word “and,” which I often typed as “adn.” It was obvious to me that this was a great improvement for any user. It was interesting to see how Joseph perceived the same feature:

Another problem that I have with Windows MS word is the fact that it seems to change characters. For instance, if I use subscript in a technical notation, it will decide for whatever reason that it should appear in large script and will change a small “i” to a large ‘I’. And I have no idea why I should want to do this, because it was a technical notation in the first place and it shouldn’t change that.
Joseph continued his list of problems with the music that annoyed him and he did not realize that these annoyances did not have to be there:

Another thing is that I can do without the music, I do not think it adds anything and I think that although it would be useful to have some kind of auditory feedback, I'm not sure exactly what the best use would be. Certainly, the existing noises are not particularly helpful.

In another incident, Sarah complained of her inability to adjust the screen to be the way she wanted it:

When I log on to that program, when I first see the icons they are in inappropriate places or in a small part of the screen. I always have to readjust it so that it will fill up the screen, I do not know how to make the screen appear constant all the time, and that's a pain.

For Rachel, the difference between the selection of icons on her computer and the ones she encountered in school was a major source of confusion and a frustration. Even when she called Jacob and expressed her frustration, she was not provided with the simple customizing tool that could solve her problem.

Many other users complained about the abundance of icons and functions on their computer that they did not use, while other required features that were missing. Joseph, Sarah, and most of the other participants did not realize that almost every icon, setup, and function on their computer was changeable, and was a result of a default chosen by somebody. They did not realize that they could eliminate all the icons from their screen and all the items from the menus and use only keyboard functions. The variety of icons they found on their computers were “annoying, disturbing, or in fact becoming more of a nuisance than anything else” as stated by Joseph.

Through my interviews and observations, I found numerous examples of users who were struggling with features they did not need and going through unnecessarily long procedures to access those they frequently used. None understood that they have a choice and none of them tried to conveniently customize the functions they were using. Moreover, like Jacob, none of the trainers observed considered using the customizing functions or trained the user to use them because they were perceived by all as being very advanced material.
The last example is taken from my own introspection. After being amazed by the gap found between the great potential functionality available to end-users, and the actual use they made of these functions, I decided to re-examine my own desktop. It was then that I discovered that my tool-bar included many functions that I never use, and a few functions that I had not realized were there. I continuously went through a long path to arrive at those functions.

The more I have examined the different functions available to the user, the more I have realized how wide is the gap is between the actual use of these functions and their potential use. It is evident that they have great potential to support the user as he strives for control, and are not more complicated than any other functions. Why do not most of the users bother to find out what is there for them and use it is a major question, which emerged through this study.

4.4. The End-User/Environment Interaction:

4.4.1 Training and support system

This section examines the most common support tools and services available to the end-user in his learning process with a focus on the end-user's difficulties. Based on this study's findings, five categories of support are discussed: on-line help, help-lines (telephone), books and manuals, formal training, and responsive training, which is the focus of this study.

Analyzing the support systems available could be the topic for many studies and is beyond the scope of this thesis. However, understanding the learning environment in which the end-user acquires his computing knowledge and the difficulties he has with the different support systems can illuminate the end-user's needs and help in developing training methods and tools to support those needs.
Formal Training

An enormous training industry, providing courses for almost everything related to computers and its peripherals, has developed over the last decade. Corporate organizations and individuals are spending a significant amount of their budget on high-priced courses. Learning at work is traditionally thought of within the context of formal training. Most organizations use computer courses (internal and external) as their main methods to train their employees (Thomas, 1991, Bradley, 1994, Nolan & Norton, 1992). However, there is growing evidence that the effectiveness level of these courses (i.e. the resulting level of proficiency) is as low as 20% (Schoenmaker, 1993). The other 80% of worker's proficiency tend to be acquired in an implicit way at the workplace (Schoenmaker, 1993; Stamps, 1993; Nolan & Norton, 1992; Gery, 1991).

G. M. Forsberg's experience (cited in Mandefrot 1997 p. 3) with formal training well represents the descriptions from the participants in this study:

I was able to follow the first half day of the course, but I understood nothing. When we asked for explanations of specialist terms, they used even more specialized terms and jargon. He told us which buttons to press... When we asked for explanations, we were virtually told that it was so complicated that we should not try to understand it. "Do as I say, and do not ask so many questions."

Consistent with the literature, the findings of this study lead to very similar descriptions and conclusions: formal training was not effective for the adult learners, who eventually had to seek other types of support in some form of responsive training. Although some of the participants, who never took formal training, felt they would know more if they had the opportunity to take a course (e.g., Rebecca and Leah), none of those who attended courses felt the courses were effective. All participants in courses needed support throughout the course or when they tried to apply the learned material.

There was a major difference, however, between those who took the course because they wanted to know more about computers and those who learned specific applications as a preparation for work. While none of those who took courses for the sake of knowledge retained any of the skills taught in the course, those who had to take a course, usually an application they needed for work (or at least believed they needed) were more inclined to
struggle. These users were much more upset with the way the courses were delivered and mainly with the fact that in many cases what they learned was not useful.

David took a few courses in one of the colleges two years before I met him. Among those courses were Lotus 1-2-3 and another database program that he could not recall: “I do not remember the name, I think it was database.” At the time, he was led to believe that these courses would help him with his business.

When I finished the courses, I did not know what to do with them. I hardly understood what it was good for. After a short time I did not remember even how to open the programs.

Deborah took an introduction course to Claris Works on the Macintosh. She was promised that this course would give her all the basic knowledge to understand the main functions of the computer, and that she would be able to use these functions on a basic level. In her first interview, two months after she finished the course, when asked if she applied anything at home, she replied, “I could not figure out what I really wanted to do with it.” When she eventually tried, she did not even know where to start. Nothing was retained. When her friend asked her if she recommend the course, she answered: “take the course only if you are going to use it, otherwise you will be wasting you time.” A few months later, when I was invited to observe her second attempt to learn to use the computer, this time with Jonah on the PC, there was no reminiscence that she had ever learned how to use the computer, and she definitely did not understand the basics.

The most vivid stories came from Rachel, who brought up a story in both her interview and in her personal training session with Jacob, that represents well the struggle of the adult learner in a formal learning environment.

He just did not explain things, he just couldn’t explain things. He went over the different functions, he gave us exercises, but he could not explain anything. He would give us the exercise without a formal explanation, and unfortunately the book could not cover the way he wanted us to do the exercise.

Rachel expected the teacher to present the contents to be exercised before starting to work with it; the teacher wanted the trainees to struggle with the material themselves:
When I was having problems, when the computer would not operate for me, I would put up my hand and then I would wait a whole period, until he would come and answer my question....I had the book but I could not find it in the book...Sometimes I asked another student, but they were all busy too.

The fear of asking questions that would sound stupid was repeated by many of the participants. In many cases, after asking once, students didn't dare to ask again:

When I did ask the question, the couple of teachers we had would just make me feel so stupid... I thought that I was asking stupid questions. No, it was not me and everybody who was there said the same thing... I was listening to her, and I tried to follow and I was maybe one or two steps behind, and she went “just watch the other girl’s screen,”...I was so furious, it took me two weeks before I approached her again.

Similar stories have been observed and heard from many other end-users. The main problem was not the fact that the formal classroom did not allow the user who is stuck to get much help, but the fact that in most of the cases, as described earlier, the knowledge acquired in the course was usually not usable afterwards. Users who learned to use WordPerfect 5.1, needed to use Word 7; those who had learned WordPerfect for Windows found themselves in a lawyer’s office with WordPerfect 5.1. Those who were convinced they should learn Windows 3.1 never used it, and those who had an introductory course could not make any sense of it when they had to start working with the computer on their own.

In summary, the two arguments made by Lewis (1993) were supported by the results of this study:

1. Learning, especially when concerned with technology, is a dynamic process. No structured course can support this process very well.

2. Selecting relevant information for a course that will continue to be relevant after the course is a “mission impossible” for any course designer.

These arguments serve as key assumptions in the section discussing the user needs.
Books and Manuals

The helplessness of the end-user and his need to find answers wherever he can have lead to the fast-growing computer books industry, which is probably one of the most rapidly growing sectors in the book industry. Thousands of new computer books, dealing with all aspects of the computer, appear on bookstore shelves every year. Many stores specializing in computer books are doing a booming business. Books that promise any "dummy" success with his computer are best sellers. Most of these books end up on the user's shelves unused.

Though the use of manuals and books was not explicitly examined in this study, all study subjects were asked if they had been using books or manuals. All had some type of reference books, mainly the "dummies" books, and many had tried to use them. None felt the books were helpful.

The main difficulty with reference books and manuals was revealed when the users were trying to use the written materials for a specific task. Most of the users complained that when they tried to search for a specific function, they could not find it in the book. "You have to know what/where to look for" was a common answer to the question: "what was difficult with the use of the reference material?" End-users complained that "if you do not know the name of what you need, or you're simply stuck and you do not know why, there is no way the book or the manual will help you."

When Rachel was stuck, for example, she tried to find out how to use the insert function in the book:

I had the book but I could not find it in the book. I went through the book, but I could not find it. I thought maybe it's me, it's not the book and I just do not know where to look. I asked other students and they say, no, it's not in the book anywhere...It's easy to do once you know how to do it, it is very easy to do, but it was not in the book and you have to know what to look for.

The only way one can be helped by the book is to go step-by-step or page-by-page. However, none of those interviewed was willing to do this, nor did anyone feel he had the time necessary to find what he needed. Books and manuals were perceived by the end-users as having too many non-relevant details, and as being a time consuming tool that is
hard to use both for learning new functions and for searching for specific required function.

**On-line help**

On-line help has a lot in common with manuals and books. As with manuals and books, on-line help was perceived as having too many non-relevant details and was too complicated to read. In addition, as is also the case with manuals and books, users found it very difficult to search for a needed function or topic when it is not well defined.

Each of the participants was asked the following questions regarding the use of the on-line help:

1) Have you tried to use the help? What problems have you had with it?
2) Did anybody direct you to look at the “help” when you asked for support?
3) Can you give examples where the “help” did help you?

Most of the participants in this study had tried to use the on-line help. However, no one found much help in it. The end-users in this study generally found the on-line help difficult to use.

Two major problems were mentioned:

1. If you do not know the name of what you are looking for, or you are “just stuck,” you cannot find help.

Hannah tried to describe this when she said:

> It’s not like with the thesaurus, that when I search for a word and I do not know the word, I can start from something that I know and choose words that bring me closer to the word I am looking for. With the help if you do not know the exact name or the name of the topic, you cannot find it.

2. The explanations were too long with too many non-relevant details using unknown terminology. Most of the users said that even when they found the right term for their search they could not follow the instructions.

When Bilhah wanted to have the spacing icons on her toolbar that she had used frequently with her old simple word processor, she went to *Help*. 
I chose in the index: “L”, and found the term line spacing. And then there were five screens filled with detailed information about spaces and indents, and I really didn’t want to read it. Then came a long list of instructions about how to change the spaces using the Format menu. I tried to do it all but then, it was really annoying, and it took me a long time, and then I realized it was not there, and I had to look for it somewhere else.

Joseph, who is a more sophisticated user, searched for a multiple cut-and-paste or copy-and-paste tool that would allow him to paste non-sequential items from other documents or different locations in the same document. Using his logic, he tried to search for “multiple,” with no results. After searching around for over an hour, he found that the topic “moving text” would lead him to the term “spike” which eventually brought him to the tool he was searching for. In its description, the spike is defined as a multiple cut-and-paste tool, but using the words multiple, cut or paste in the search process did not lead to any meaningful result.

The use of Help seemed complicated not only for novice users, but also for those who supported the end-users. None of the end-users who asked for support or who attended formal training, was directed to the “help” as a learning or support tool. Many of them perceived the help as a very advanced feature that novices could not use.

In summary:

- few users found the Help useful;
- most of the Help features were perceived as too complicated, having too many non-relevant details, and lacking search engines sufficiently powerful or flexible to support a search that is not specifically defined;
- for most users, Help that used visual presentation and had specific relevant directions was perceived as a “better helper;”
- trainers, in both formal and informal training situations did not introduce the Help tools to the trainees, and did not encourage end-users to use the “help” features as a supporting tool.

Help-line support

The development of help desks intensified a common problem faced by both computer specialists and users. The specialists were found to be overworked, frustrated, and unable to cope with user calls. Common cries for help from users included a printer that would not print, a computer that
would not boot, etc. These were actually requests for help to learn how to use the computer (Mandefrot, 1997, p. 3).

The worst emotional reaction from this study's subjects came when they were asked about the help-line support. Hundreds of pages could be easily filled with the descriptions heard throughout this study of frustrated users attempting to get support from help-line support.

Leah tried for days to get connected to the Internet. This was the main reason she purchased a new Pentium computer. She even paid for an official copy of Netscape. When I asked her if she tried to use help-line support, she screamed into the tape-recorder, begging me to cite her with her full name:

Don't talk to me about 800 numbers, who did I call?...[the name omitted] lousy lousy help line. I got a mechanical voice, making squeaking sounds: "please press 1, please press 1", and you are going on and on, I wanted to talk to a human being, you think I could get to a person? No! It just kept bouncing from one mechanical voice to another "what is the problem? "I was ready to tear the phone out of the wall, I was so frustrated, I think that's terrible and I don't know how many of these help phones are operated this way, probably a lot on mechanical voices.

Q: "Did you manage to get any answer?"

Leah: "Finally, I persisted because I was getting really, really annoyed, so finally I must have hit some button that accessed me to a person, but I still don't know how I got to that person. But I must have bounced this way for a long time trying to get through, I mean I got through right away, the phone was answered, I was just trying to get to a human, and then he said: "blllllla...la", and I said : "I don't understand", and he continued "blllllla...la...", and I say again, "I don't understand, I am a novice, I don't understand what you are saying," he was going so fast and I was going to this and going to that and click this and open this and shut that and I don't know what I was doing, ... I just kept saying, just slow down, I don't understand, I just did not appreciate it"

"This guy got really annoyed at me, because I could not understand and he probably had a Ph.D. in computers or something, and he is talking to little old Leah from Toronto. He is down there in the States thinking he is Mr. computer whiz, and it's like... I don't think they should be so high handed because I am probably quite like typical people that are getting on the Internet. I finally gave up and that's when I called Jacob [paid trainer], I called him that very night and made the appointment, I was so frustrated."
Some would assume that I, as an experienced user, would have an easier time with help-line support. But my personal experience was similar to the description above and maybe even worse. Over a period of more than two years during which the data for this study was being collected, I tried to get different information from dozens of different help-line supports. The feelings of being belittled and the frustration that resulted from these attempts were similar to those experienced by Leah.

In one case, it took me two weeks of talking to people at 12 different 800 numbers and a few more paid international calls with a total of over 30 hours on the phone, to try to solve a modem problem. I finally managed to solve the problem by finding the company’s address and driving there with my modem. The 30 hours of long distance calls probably cost the manufacturer more than the cost of my modem. This did not encourage the manufacturer to try to develop a service that would eventually reduce the work load of “helpers.”

Sarah’s attempts to solve her fax problems were described in section 4.3.2. This type of story was heard throughout the study. Even when the problem an end-user had was eventually explained or solved through the step-by-step procedures conducted by the help-line support, users always felt frustrated, belittled, and helpless by the process. All of them mentioned that if the same problem were to occur again, they would not know what to do, since they just followed the instructions without understanding what was wrong and how it was fixed.

The data gathered for this study, like the other resources available for the end-user, indicate that help-line support does not help as it should. It does not support the end-user in his effort to become a self-sufficient, independent user. Further, this type of support eventually leads the user to the one resort that does help, that is, the responsive trainer.
Responsive training

The term *responsive training* has been coined in this study to describe the non-formal support widely used in the workplace. It was defined in Chapter 1, the introduction, as the following:

A training situation initiated by the learner, responding to specific needs and provided by an experienced computer user with specific knowledge or expertise. The learning situation is usually a single time, non-contiguous event conducted in a one-to-one setting. Methods used in responsive training are some of those used by coaches or tutors; the main differences are the focus on the learner's specific needs and the one-time nature of the interaction.

This study focused on responsive training interaction in an attempt to better understand this widely used training method. At the same time, it explored the end-user problems and needs as reflected in this type of interaction. Responsive training was found, both in the literature and in this study, to be the most useful method for supporting the end-user, at least in coping with his immediate learning needs. However, this support was not effective enough in supporting the end-user in his effort to become a self-sufficient learner. This study therefore focused on the responsive training interaction in an attempt to describe the training methods used by the responsive trainers and to identify directions to improve it.

The most common approach taken by the responsive trainers observed and interviewed for this study was the *step-by-step* approach. This approach, as demonstrated in the examples below, usually consists of the following steps:

1) The trainer makes sure that the computer is set up with specific features to make it "ready to go;"

2) *show and tell:* The trainer demonstrates certain operations or functions which usually includes different options;

3) *show and follow:* The user is given instructions before each step and follows these instructions (the instructor points to the location);
4) **error prevention:** The trainer makes sure that making any wrong selection will be prevented; when a choice of options has to be made, the trainer directs the user or points to the right option.

Following are some examples taken from the training sessions observed for this study.

1. *Show & Tell with Simon & Levi*

The following example presents a few vignettes from a training session with Simon and Levi. This session was chosen because it demonstrates the different patterns of the common *step-by-step* training. Although it was taken from one particular session, many of the trainers and end-users observed or interviewed throughout this study could easily identify themselves in many parts of this session.

Levi is a total beginner. Like many other users observed, he decided it was time to “get computed” and bought himself an expensive, top-of-the-line computer, with all the bells and whistles offered by the dealer. His son took control of the computer from the first minute, and the proud father looked admiringly at his offspring managing to get impressive clip-art and video-clips. At first, Levi counted on his twelve year old son for learning: “he knows everything, he will show me how to work with it”. But he soon realized he needed some help to get started. That is when Simon was called.

Simon is a typical *responsive trainer*. He never had a formal training job, but is a person whom people call for help when they are stuck with their computer. Although he took some computer courses, he is mainly self-taught and claims to be able to find his way very easily with any computer system or software. Simon was one of the participants of the trainer’s workshops described in Chapter 5. However, as the following description shows, the workshop did not lead to significant change for him.

The examples given here present only a fraction of the whole session, which consisted of the same patterns. The somewhat lengthy inserts are provided to illustrate for the reader both the training environment created with this type of training and the amount of information presented in this type of session.
In harmony with Pearlstein's *Computer Centrism* (1991), Simon makes sure that every detail encountered will be presented and explained.

Simon: (while holding the mouse and executing the different steps) "We go to the *Start* button- to *program*-*to Microsoft Application*. Microsoft has database, spreadsheet and Word-Processor. It's a handy, simple Word Processor. Spreadsheet ... are you familiar with spreadsheet?"

Levi: (totally confused and embarrassed) "He (points to his son) is going to help me out. He knows about it more than I do."

Simon: "It is used for financial recording, and *Data Base* which is for storing phone numbers and addresses, any kind of recipes, businesses and so on."

After a long *show and tell* explanation, the researcher decided to interrupt and asked Simon and Levi to switch seats to allow Levi to take the 'driver's seat' (and maybe some control). This started the *show and follow* part of this *step-by-step training*:

Simon: "You go to *Start Programs* (points, Levi follows), then go to Microsoft (points, Levi follows) and then *MS Works*. All you have to do is click on *Word-Processor* - it will take you there."

Levi: Yes? I did not know it. Then I have to go here?" (Points on the screen)

Simon: "No, first you have to highlight it. The cursor here (points), hold the mouse key and drag it down" [Terminology-using words such as *cursor*, *highlight* and *drag down* which were not clear to the user]. Now you can change the font or highlight it. This is the *fonts* and this is the *size*. (Points, Levi follows)

Levi: "Now how do I get rid of this dark shadow".[a good proof that Levi did not get the term *highlight*]

Simon: "You just click somewhere on the screen"

In this approximately three-minute period, Simon led Levi through nine different functions or selections, and introduced him to at least five probably unknown terms. When it was finished, there was no review or assessment of the learning. As with most of the trainers observed, once the task had been completed, the objective was assumed to have been achieved. He continued to the next operation without any attempt to verify the learning or to find out how Levi felt about it.

Similar to many other situations observed, Simon continued with the *show & tell* part of the step-by-step approach, presenting the different icons on the toolbars. He went through
the icons, one-by-one, explaining what each of them does, with some demonstration. After a long show & tell presentation that took over 15 minutes, Simon finally allowed Levi to touch the keys.

Simon: “Try to type a few more letters. Let’s say that you want to change the order of the words” (Once Levi finishes typing, Simon takes the mouse and demonstrates how to use the drag and drop feature, and from here continue again to hold the mouse).

You can go to the scissors and cut and paste it (demonstrates). You can also copy it. You put your cursor here and highlight the text. Now put your cursor here again and hit the enter key once and now hit the enter key once more and now click on your past button again and now you copied it.

Levi: (laughing cynically) “Simple.”

The session continues in the same fashion, examining icon after icon with long explanations about each icon and some directed but limited trials by Levi. Once the icons are “covered,” they continue with the menus, with Levi opening the menu and getting one of the functions, and Simon explaining the functions:

Simon: Normal, layout, draft, that’s if you are writing a book... Page break, let’s go to insert page break... If you got a full page with text or let’s say, if you have a half of page and you want the rest to be blank, you insert a page break there, and it automatically makes this page blank. Footnotes will be placing notes at the bottom of the page...charts and spread sheets... pictures...thesaurus...envelopes...print setting.

The approach used by Simon in the interview following the session echoed almost all the trainers I talked to throughout this study:

Just get them to do something. Once they have actually printed out a document of their own, once they have written something, done a little bit of formatting, changed a little bit, learned a little bit about the icons at the top, and then actually printed something. Then they start to feel more comfortable. They have gotten something to work, they have got a product to show.

The results of this session were obvious. Levi was overwhelmed and confused. The only functions he remembered in the post-session interview where a few of the first functions (fonts, size, bold) and some functions Simon allowed him to explore at the end of the
session. In the interview he said that: "This seems to be too complicated. If I have to work with it, I don’t know if I will be able to do it."

In this session, as in many other similar training sessions, the novice end-user was presented with a lot of information. This session presented Levi, the new end-user who had little previous experience with computers, with over fifty(!) different functions and a few dozen technical words he had never heard before. This was all in less than two hours. This description matches Pearlstein’s (1991) description of the computer-centric trainer who believes that “good training should be comprehensive and include details on most or all functions, regardless of how infrequently they might be used” (p. 2).

2. Rebecca and Isaac: “I need a year of classes for this.”

The session with Rebecca and Isaac was different from the previous one. However, the basic patterns of the step-by-step approach, with the various characteristics of the Computer Centrism (Pearlstein, 1991), were repeated here. Rebecca had been using a computer for a while, although without much success. She needed to use the computer for her work. Her questions were thus more specific, and many of them related to specific problems she had. Another difference was that, unlike Levi, Rebecca had had many frustrating experiences with the computer, which Levi has not experienced yet. Her feelings of frustration were expressed throughout the session.

When they explore the Windows features (Windows 3.1), Isaac started with long explanations of the screen-adjustment options. Most of the explanation was done verbally with very little demonstration (show and tell), and no opportunity to practice.

Isaac: This button controls the window, you can move it, change the size, close it, this is the minimizing button, what it does is close the window, make it smaller, kind of out of the way. The window itself is not closed, just made smaller, I don’t know if I am confusing you, if I am, just say so.

Rebecca: “...All right, a little bit.”

Isaac: And this is the other way, and this is the adjust size, just make it in the middle... If you want to work on a word-processing document you want to see as much text as you can see, so you maximize it, but if you
are working with WordPerfect on one window and Lotus on another window....

Rebecca: “O...that is much too confusing for me!”

After a long explanation Isaac lets Rebecca try (show and follow):

Isaac: “Go to the edge...” (points, when Rebecca cannot find the right point he takes the mouse and demonstrates) You find the point where it would change, and you just click and hold and you pull it out.”

Rebecca: “You’re just kidding!”

Isaac: “Click right on the corner (Rebecca follows), close the window (Rebecca follows).”

When they got to the same operation presented in the beginning of the previous example, changing fonts, Isaac chose to start with the regular show & tell:

Isaac: “To change the font you point and click on that button and you can see the pull down menu, and these are all the fonts that you have. You hold the mouse key and you move over you pull the mouse key and you pull it down.”

Rebecca: “Can I do it one at a time? I need a year of classes for this.”

When it finally came time to practice, the same pattern of show and follow, as was presented above, continues: Isaac gave the instruction (go here, click here...) while Rebecca followed. The main difference here is that in this case, Rebecca got carried away by any feature she encountered. Before completing one task, Rebecca kept asking for, and got answers to questions related to variety of functions.

By the end of the session, Rebecca managed to produce and print a template for her business, [the final product each trainer is aiming for, as was discussed by Simon in his interview]. However, in her interview two weeks later, she reflected:

It was too fast and too confusing. When he showed me what to do and where to go, I could do it but now I cannot remember anything we did.

Rachel and Jacob: Another combination of show & tell and show & follow

Rachel’s experiences were described in detail earlier. She had very specific problems and very specific tests to pass for her college diploma. After she realized she could not cope with her problems without help and her college instructor could not help her, she called Jacob for help.
Throughout the session, Jacob had to respond to many gaps, misconceptions, and specific problems in Rachel's knowledge. Although the training sequence was prioritized by Rachel, the show & tells and show & follow patterns were used during most of the session. For example, when Rachel had difficulty with the Tab functions, Jacob explained while demonstrating (show & tell):

Jacob: Now let's say you want to clear all the tabs and start again, you go under the format menu and then you choose line, the second option, and then you do a tab set, O.K.?... And say that you want to clear them all, you just say, clear all.

Rachel: "That's nice."

Jacob: And they are all gone. Also you can set your tabs from here (points) as well, it depends how you feel more comfortable, I personally feel more comfortable doing it from here (points), from the ruler bar, because it's easier. If you want to set it up from here, all you have to do is select what type of tab you want. You have left, justified or a centre. These are the option you have. Now just with the arrows you increase or decrease the number to the number you want, and that you delete, and that you do at tab set, because you want to set a tab.

After presenting the different functions (show & tell), Jacob continued with show & follow, asking Rachel to try the demonstrated functions:

Jacob: So let's do it again: Format-Line-Tab-Type of tab (Rachel follows) and then you select where you want the tab to be. Or, if you need to set two tabs you do one and then change the position and do that again. You don't press the O.K. button until you finish setting up the tabs, [error prevention] O.K. is the last thing you do. Now, above this area here (points), because you might come across this, what this is, it tells the program how to calculate where the tab is going to be set.

Rachel: "O.K."

The same patterns continued throughout the session with a combination of show & tell and show & follow, while Jacob demonstrated the problematic function.

In her interview three weeks later (after she had completed her exams), Rachel, like the others, felt she didn't remember much and did not feel that she could manage by herself with unknown functions.
He did not solve my problems, he helped me with some things but other things, no... If you are not inclined towards the computer, if you are not told the steps, its hard to find.

Rachel’s perceived needs were to learn how to use specific functions she assumed were needed for her job. These perceived needs directed the methods used in the training and the way the training was evaluated by her. However, this approach, as in other similar cases, did not take Rachel far enough. She consequently learned only a few useless functions and was unable to cope with forgotten functions that would be needed for her new job.

4.5 The End-User’s Needs

This section describes the end-users’ needs as they emerged from this study and mainly as they are revealed by the problems described earlier. It examines the user’s perceived or expressed needs, tries to identify the user’s “real needs,” and examines the gap between the two as expressed by the repeated theme of the trainer’s dilemma.

Two key themes reappeared throughout the data and in discussions about the user’s problems: the need for control and the changing environment. These two concepts led to the user’s primary need, the need for control in a changing environment, which is a main theme of this study. The gap between the “real” needs and the user’s perceived and expressed needs, and the process through which this gap is reduced or the expressed needs are changed, leads to a different instructional and support approach, which is described in the next chapters. The training approach supported by this thesis is based on this main need.

4.5.1 The user’s expressed needs

Starting with the approach taken by most of the phenomenological studies attempting to “understand the subjects from their own point of view” (Bogdan & Biklen, 1992), this study initially focused on the user’s expressed needs. Looking at the data collected, the picture was quite consistent at first glance. The repeated need expressed by most of the users could be represented by any of the following statements:
• "I want somebody who would put the steps right there, and me just learn those steps and use them" (Miriam).

• "I expected the instructor, for this time, to show me the steps. With Jacob I knew the functions that I would need, and I could pass the test and go on to the next course, that's all" (Rachel).

• "I needed somebody who would say, I know what you need and come and do it, and once its all done, entering is not a problem" (Rebecca).

• "I don't know anything about it so if he is not going to show me I am not going to do anything" (Levi).

Most of the trainers perceived such expressed needs as the user's "real" needs. They responded to these needs by providing function-product centred instruction, or, as it is called later: operational knowledge. This seemed to be a "quick-fix" solution which kept the user satisfied for a while, but not for very long, as was demonstrated in the previous discussion.

Using the user's perception as the only source of data could be misleading. Further exploration of the user's needs showed that responding to these needs does not take the user very far. Moreover, changing the training environment, and employing a constructivist approach, which eventually gave the user more control, helped the users realize that their needs are actually different (as will be presented in Chapter 5).

4.5.2 The trainer's dilemma

What follows are a few examples illustrating the training interaction based on the user's expressed needs. These examples demonstrate the dilemma each trainer faced in choosing between providing support that will be more effective for the end-user and responding to the user's request, which, as will be seen, tends to be different.

1. Rebecca learns to create an invoice

With her six years of experience with computers, Rebecca was accustomed to having "somebody who would say, I know what you need and come and do it." As the person
responsible for the accounting for her husband's business, Rebecca uses the accounting program on her computer regularly.

Rebecca: "I am doing all the accounting at the office, but it's all set up, I just enter everything and you know, it's all set up, I did not have to set it up. And it's...I don't understand how it is set."

Q: "Did you set it up the first time?"

Rebecca: "No, somebody from the company came in and spent quite a few days, and we entered everything from year end into the computer and once it was set up, all I have to do is enter the data."

Q: "What do you do if there are changes?"

Rebecca: "I get them in, I phone them up and say: help!"

After six years of calling "help!" to make her program work, Rebecca felt she was a total computer novice. When she called Solomon "to show her what to do," she had practically no understanding of the very basics, and the maximum she could do was use her computer as a typewriter. Rebecca's inability to control the computer even after years of experience is very similar to other experienced users, as was previously described in the novice-advanced loop section of this chapter.

Solomon, like most of the trainers observed, responded to her need:

Rebecca: The gentleman who came with you [Solomon], he had set up the invoice for me somewhere in the computer, and I could not find it, that "saved as"... I could not find it in my files...

Q: You don't know how to search for it?

Rebecca: No, I could not find it, so I had to make one from scratch again, but it did not look as nice as the one that he had done. I have the copy of it, so I just made up my own little invoice [presented a document that used only the typewriter-like features of the computer], but I did not know how to set-up the margins...and I really can not do what he showed me.

Rebecca did have her invoice done when Solomon guided her. He took care that everything was set up and worked correctly. When she was on her own, not only could she not recall what she had learned during the training, she could not even find the one document she created. She realized that the two hours she had spent with Solomon did not add anything to her ability to use the computer. In fact, she was stuck where she was
before: “I don’t know if I can even remember what he taught me, so I am a disaster case, right?”

2. Lea and Dan searching for their lost files

When Leah and Dan called Jeremiah to help them retrieve files they had downloaded from the Internet and could not find, they went further with the expression of the “quick fix” need. They told Jacob: “Go ahead and do your thing...This is far beyond me, and then show me some stuff.”

For the next hours Jeremiah did what he had been asked to do, namely, go to the files list (switching to his familiar habits, using DOS), pull out the files, and store them in a new file he had created. Leah and Dan watched him and the black screen presenting a continuous flow of DOS lists, overwhelmed, not sure that if they even learned just one Windows’ command - find - they would be able to easily do it by themselves later. In the interview two weeks later, Leah admitted:

He showed us certain things and that was fine, but Jeremiah was so fast, and I thought that I had learned much more than I actually did. I didn’t retain anything and when the time passed I asked, how to do this and how to get into that and I couldn’t remember.

3. Rachel: “I expected him to show me the steps, for this time”

Jacob responded to Rachel’s expressed need for him to show her how to use different functions before her college exam: “I expected him to show me the steps for this time” She passed the test and received her diploma. When she was assigned to work, though, she had to start all over again. In her interview she realized: “I guess if he would show me more how to find things, it would help.”

When she reflected on her learning experience, she added:

If I’m really looking, I want to know the whole thing, not just a few functions. Not just how to insert, automatic page, automatic paragraphing etc. I know there is a lot more to that. I would like a lot more of how things work here.

Similar examples are described in section 4.4 and can be found in most training and support situations, mainly those provided by various help-desks and help-lines. The user’s
expressed needs are usually responded to, but very soon the user finds himself just as helpless and frustrated as he had been before the request for help.

4. Levi: “I want it to be easy”

The last example is taken from the interaction between Simon, a typical trainer, and Levi, a computer novice. In this session, the researcher tried to encourage Levi to be more active during his training and to try to experiment, rather than being shown how to do everything. This vignette is a good example of the trainer’s dilemma where the frightened user resists any attempts to get him take some initiative, and instead insists that what he needs is to be shown what to do. The trainer then faces the dilemma of whether to follow the user’s expressed needs and avoid conflict, or to present methods that he believes will lead the user to better understanding and, eventually, to independence and control.

R [researcher]: “Let him try it”
Simon: “Let’s find a piece of text that you can work on”
Levi: “That’s fine. I want it to be easy and she [the researcher] does not let me.”
Simon: “Here we have some text, why don’t you try to see how the spell-checker can help you correct this text?”
Levi: “I don’t know anything about it so if he is not going to tell me I am not going to do anything.”
R: “Let’s see. Let him play around with it. Let’s see how far he can go.”
Levi: “I promise you I won’t go too far.”

After a few more attempts at getting Levi to experiment, Levi agreed to try using the spell-checker. He sat by the computer, took the mouse in his hands, and started selecting different options and finding out how the spell-checker worked while Simon attempted to reduce his explanations. Levi went on to other functions, while gaining increasing confidence.

When Levi was asked after the session what he had learned, the first thing he mentioned was: “I can now take a word that is spelled wrong and correct it.” Although he “promised” during the session that there was no use in attempting to “activate” him, he now he viewed the situation differently:
R: "How did you feel with the switching of the chairs. Simon was sitting there before, holding the mouse and I asked you to switch places."

Levi: "It is different when you do it yourself, you learn faster, because you can try it and see where you have difficulty and then you try it again. Now I can do it myself. If I would just watch, then if I try to do it later I am not sure I could."

"Forcing" Levi to "take control" and Simon to "let go" brought Levi to view his own needs differently and, after seeing the results, Simon's dilemma lessened. In his interview, after the session, he described his own learning experience:

R: "So, what did this experience do for you?"

Simon: "I learned to be more patient with clients. Let them make mistakes and learn from their mistakes, do it themselves rather than trying to lead them all the time. So instead of me telling them: "do this and do this", just let them do part of it themselves and if they make mistakes we can always correct them."

R: "What is the difference. What do you think happens when you show somebody what there is or what to do?"

Simon: "They would forget it as soon as I was gone. They can do it one time but they will not remember it. If they did it themselves they will remember, especially if they make mistakes, they will remember even better how to do it right when they do it wrong."

This example is one of many cases, revealed in this study, in which the user's needs as perceived by both the user and the trainer changed once the training environment changed. In this case, the change was instigated by the researcher.

Unlike the view taken in previous studies and in most training situations, which consider the user's needs to be fixed and unchangeable, the data from this study reveal a different picture. This study indicates that the user's perceived needs depend heavily on his learning environment, including the hardware and software used, the context and purpose of the training, the physical environment, and, most importantly, the type of training and support available. The user's perceived needs are not constant and, as the above examples demonstrate, can be changed once the computing environment and the type of support changes. To further explore this theme, two case studies conducted as a result of this finding are presented in Chapter 5.
4.5.3 The need for control in a continuously changing environment

The previous discussion described some major problems adult end-users have in their attempts to gain control over technology in an era of continuous change. The data accumulated for this study and the literature revealed a major theme: the user's need to become a self-sufficient user of technology by gaining control over the technology in a continuously changing environment. Almost two decades ago, in an era that can be considered as the prehistoric computing era, Barrie (1981) encountered a similar theme. She wrote:

The major concern of the learner is to gain a sense of personal control over a machine that in the early stages of learning can be both feared and intensively disliked. (p. 127)

The major difference between these two themes is the effect of the technology change. Barrie (1981) assumed that technology change, in the form of new software (i.e., friendlier programming languages), would provide the user with better control. However, as the present study reveals, this did not happen.

Despite all the added functionality that has made computers more user friendly over the past two decades, the user still does not experience the needed sense of control. Moreover, as was described in section 4.3, the continuously accelerating change in technology is itself a major factor in reducing the end-user’s sense of control. This is true even for the end-user who already had a sense of control and yet, had to start all over again.

Any design of a system aimed at supporting the end-user, whether through formal or non-formal instruction or with technology-based support, should look at this main theme as a primary design factor. This conclusion does not contradict other descriptions of the user’s needs, but views them as subsets or factors of this main need. For example, the needs of the user as an adult learner to be self sufficient, to set his own objectives, and to work with relevant and meaningful contents are considered here as training principles, or

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9 It is important to mention that Barrie’s thesis was not included in the original literature review, and was revisited and introduced into this thesis after discovering the similarity between Barrie’s finding and the findings of this study.
factors that generate effective computer/technology exposure for the end-user. These factors will be explored further in the chapter discussing training strategies.

The main purpose of this study was to search for effective responsive training (ERT) strategies, methods, contents, and environment that respond to the need for control in a changing environment. The following two chapters examine training strategies and methods in an attempt to identify those strategies that are effective in leading the user towards being self-sufficient with the changing technology. Chapter 5 describes two case studies attempting to induce those strategies that were found effective, while observing the change in the perceived needs of both the user and the trainer. Chapter 6 describes the ERT model, a training model based on factors that generate effective computer/technology exposure for the end-user.

Summary

The purpose of this chapter was to review the main problems and needs of the end-user in his endeavor to become a self-sufficient computer user and to identify his "real" needs based on these problems. It examined the two main types of interaction of the EUC process: the interaction between the end-user and the computer, and the interaction between the end-user and his environment, namely, the services and support systems.

The examination of the interaction between the end-user and the computer indicates that with all the new functionality offered by the new technology developments, the end-user observed in this study uses only a small fraction of the functions and applications available for him. The user also still has difficulties with very basic operations. Moreover, in many cases, the technology development left the end-user with more problems to deal with, such as over-functionality and the need to cope with continual change.

However, the study also indicates that many of the newly developed functions have the potential to give the user better control. If used effectively, these tools could support his goal of self-sufficiency. Moreover, the study suggests that individuals who used exploration and heuristic techniques were able to overcome the technology change and find their way with new applications and programs.
The examination of the interaction between the end-user and the different support resources available for him revealed "product-oriented" support that deals mainly with "quick fixes" using step-by-step methods. This approach does not provide the end-user with more control and does not help him deal with technology change in his efforts to stay up-to-date with this change.

The last section dealt with the end-user's perceived and "real" needs as they emerged in this study. It suggested that the user's perceived needs are not necessarily his "real" needs and that these needs could change once the end-user goes through a different learning experience. The "real" need that emerged from this study is the need for control in a changing environment. This should be the cornerstone for any system or service aimed at supporting the end-user in his efforts to become a self sufficient user of technology.
CHAPTER 5

THE CHANGE PROCESS -- FROM STEP-BY-STEP TRAINING TO CONSTRUCTIVIST LEARNING

5.1 Introduction

This chapter deals with the developmental process of both the trainer and the end-user. The chapter draws on the activity theory of Kaptelinin (1994) to explicate the learning-training process as a continuous feedback loop that includes the ongoing change of the learner and the trainer.

In an attempt to develop effective responsive training (ERT) by applying constructivist methods (see section 2.2.2) to the learning/training process, two-stage train-the-trainer (TTT) procedures were designed and applied. The first stage included pre-service and a short train-the-trainer workshop using microteaching techniques. The second stage included on-the-job TTT procedures.

Two case studies from the second stage are described below. These case studies illustrate the change process of both the trainer and the trainee and the new learning/training needs and skills that emerged as a result of this process.

This chapter examines and demonstrates the user’s and the trainer’s developmental process, starting with the common step-by-step procedures. This is followed by applying constructivist-training methods and ends with the end-user as a constructive learner who develops along with technological change. Figure 3 presents the three-stage process through which the user evolves from a passive learner to an active participant in a two-way communication, which in turn changes the instructional methods applied by the trainer. Finally the user reaches the ultimate goal of applying constructive learning methods in his growth towards being an independent learner who uses the support of a responsive trainer as part of his learning environment.

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10 It is important to emphasize that this stage was designed as a preliminary study, and not as a controlled research project. The main purpose of this chapter is to focus on the change that occurred in the users and the trainers after the short training, and not the training itself. More research is needed in order to draw further conclusions regarding the actual training procedures.
5.2 The train-the-trainer procedures

In an attempt to enhance the use of effective training methods by the responsive trainers who participated in this study, a two-tiered training procedure was carried out by the researcher. The first stage included a pre-service, short train-the-trainer (TTT) workshop using microteaching techniques. The second stage included on-the-job TTT procedures.

5.2.1 Train-the-trainer workshop

The workshop design was based on the preliminary observations of training that formed the foundation of the data described in the previous chapter. Using microteaching principles\(^1\) (Allen, 1980), significant events\(^2\) were drawn from the previous observations and critical skills\(^3\) were identified by the researcher. The events and the skills were used

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\(^1\) Microteaching is a training technique that provides a safe but realistic skills practice setting. Its main characteristics are: (1) Reflection in action, (2) Learning by doing, (3) Positive reinforcement (4) Reduced complexity, and (5) Variety of feedback sources.

\(^2\) The significant events were examples taken from the experiences of the trainers who participated in this study which were used for role playing.

\(^3\) Microteaching training focuses on a few critical skills that are the main skills used by the specific trainer in his specific role. For example, in regular teacher training, critical skills will include class management, evaluation, and asking questions.
in the role-playing sessions. The sessions were videotaped, and used as a feedback source for the participants.

The workshop included the following:

1. A short introduction to the microteaching principles and the workshop procedures;

2. A five minute pre-test in which dyads of trainers participated in role-playing vignettes that presented segments of training sessions;

3. A discussion of the trainer’s role as a facilitator of learning (30 minutes). The main theme emphasized was “leading the client to success,” which focused on giving control to the user, or ERT methods.

4. Eight role-playing vignettes lasting 5-8 minutes each in which participants practiced a combination of the critical skills. Throughout the role-playing sessions, the main emphasis was on discovery learning and assuming “let-go techniques.” Each session was videotaped and discussed after the session. Feedback was provided by the videotapes, the group (with major emphasis on input from the subject who played the role of end-user), and the workshop facilitator.

The training methods exhibited during the pre-test were similar to those previously observed and therefore represent the pre-change skills of the trainers. When discussing the change process, these skills will be treated as the starting point.

Since the focus of this chapter is not on train-the-trainer procedures, but on the change process occurring to “real” end-users and trainers, the details of the workshop are not described here.

5.2.2 On-the-job train-the-trainer stimulation:

*From Show & Tell to user-controlled learning*

Following the short train-the-trainer workshop, real-life follow-up sessions were conducted with some of the workshop participants. In these sessions, the trainers were

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14 This would require a different design of study.
observed as they trained actual end-users, who were either volunteers or clients. While some of the results were disappointing (see the case of Simon and Levi, Chapter 4), others were good examples of both the user's and the trainer's change process. It was evident from the sessions that simply discussing the advantage of using effective training methods with little opportunity for practice, as was done in the workshop, is not adequate. The workshop worked well as far as the understanding and acceptance of the new approach by the trainers was concerned, but it was not enough to create a real behavioural change.

One thing that seemed to work well in this type of short training was the facilitator's interventions "forcing" the practicing trainer towards a specific direction and setting clear rules such as: "Let him try, don't say anything," or "you are not allowed to explain anything for the next two minutes." The last round of role-playing in the workshop with Isaiah (trainer) and Simon showed that these interventions had the potential of creating instantaneous change.

Follow-up experiments were therefore conducted with two dyads which consisted of two workshop participants (Jonah and Isaiah) and volunteer end-users. These two case-studies focused on creating change in both the trainee and the trainer by setting clear "rules of the game" and applying interventions directing the user to take control and the trainer to let go.

The main purposes of these case studies were:

- to find out whether the behavioural change that the trainers experienced in the workshop would be transferred into real training experience;
- to identify ERT characteristics that emerge when applying the let go approach
- to examine the nature of the behavioural change of the trainees and to identify major categories of this change;
- to verify the consistency of the behavioral change of both the trainer and the trainee observed in both case studies.
The case study of Naomi and Jonah

The case study of Naomi and Jonah is an excellent illustration of the change process of both the trainer and the trainee. It shows the four-stage process through which Naomi develops from a hesitant and confused end-user to a competent user who enjoys the ability to control the computer. At the same time, Jonah, who started at the first stage (as in the pre-test) with typical step-by-step instruction, gradually reduces the use of show & tell and show & follow methods and replaces them with more effective responsive training (ERT) methods. Through this process, the interaction environment changes from formal instruction to a relaxed and enjoyable interaction.

Naomi is not a novice user. She has been using the computer for a few years, applying limited word-processing functions. However, she is not able to reconstruct most of the functions she learned before and, as will be seen later, she lacks much of what was defined previously as the very basics. When she meets Jonah, she has already saved a letter she wrote to her mother on a disk. The file she has save is called 'Mother;' this is what they use as practice material.

The following is a detailed description of the change process of both Jonah and Naomi during her training session. Four stages have been identified through this process: Resistance to change; Transition; Transformation and Effective Responsive Training. The Transformation stage includes the turning point in which the new rules of interaction are clearly established.

Stage 1 - RESISTANCE TO CHANGE: Jonah focuses on show & tell and show & follow: Naomi follows

As with other trainers, and consistent with the methods he used in the pre-test, Jonah starts with the combination of show & tell and show & follow, without letting Naomi make any decisions or choices herself. He also insists on explaining the alternative options available for each function, and using unfamiliar terminology (e.g. default, directory, object, etc.). Like the other trainers, he assumes that if Naomi manages to follow his set of instructions, she will automatically retain the information and/or the skills being taught. Jonah then feels entitled to continue without any further assessment.
The following vignettes represent the interaction patterns in this stage up to the first intervention by the researcher:

Jonah: Let's say for example that we want to bold the first line. What you need to do is take the mouse and position it here (pointing). Click right there and drag the mouse and now you go there (pointing) and click on B or you can use the keyboard with CNRL+B... (demonstrating)...

Naomi's question regarding the use of the “automated date” is responded to by the following instruction:

<table>
<thead>
<tr>
<th>Jonah: “What you can do now is enter, now what we want to do is take the mouse from this position, (showing) we can do it in two ways: one is taking the mouse here (to the Edit menu) and click on Insert, or you can do the shortcut by hitting Alt+I</th>
<th>Show &amp; tell; Alternative options (before experimenting) Using shortcuts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naomi: I is for insert?</td>
<td>Show &amp; tell; Alternative options (before experimenting)</td>
</tr>
<tr>
<td>Jonah: Yes. And now, for the date and time, you use the mouse button or the keyboard, you can go to Format, and it offers you a choice, these are different formats. You can double click or click once and say okay [giving alternatives]. What happened here is every time you close and open the document it will update the date.</td>
<td></td>
</tr>
</tbody>
</table>

Later, Naomi wants to learn how to insert graphics (the first time the end-user shows an interest in non-word-processing functions). Jonah continues with show & tell and show & follow, while offering different alternatives to each function and continuing to use unfamiliar terminology without explanation or verification.

When it comes to saving the document, Naomi was given the following show & follow instructions while following with the mouse:
Stage 2: TRANSITION: Naomi is asked to take control

When Naomi wants to print her document, she tries to recall the procedures for controlling the different print quality options. At this point, the researcher decides to "force" Naomi to take more control, which triggers Naomi’s change process starting with asking “Can I” questions. However, at this stage Jonah still responds with the same show & tell and show & follow patterns he used before. In the following table the trainee’s behaviour column has been added to record Naomi’s behavioural changes and the new behavioural characteristics.
After being prompted by the researcher once more, this time encouraging her to experiment, Naomi no longer waits for directions and explanations. She actively searches for solutions herself and starts to ask questions and think about problems she had or might have. Instead of waiting for directions, she is using inquiry methods and experiments with different functions. Through her research, she encounters *incidental learning* and *error recovery* experiences, a type of learning that could not have happened with *step-by-step* instruction. She does not let Jonah lead her anymore, but she still needs his approval for each step she takes.

With Naomi’s behavioural change, Jonah, though forced to reduce his explanations, is not yet part of the ‘game.’ Jonah still tries to answer with explanations, which are taken now only to the point where Naomi can continue by herself.
Researcher: Can you try it yourself?  

<table>
<thead>
<tr>
<th>Naomi: “I’ll try myself? (surprised and scared) OK! I can try! I’ll go to File, I’ll go to Print, and I’ll go to Printer. Then I’ll go to Options, and click on the...(thinking) lower, OK, shall I go on?”</th>
<th>Prompting Naomi to take control</th>
<th>Experimentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jonah: “Yes”</td>
<td>Approval</td>
<td></td>
</tr>
<tr>
<td>Naomi: “And then I choose this one, and then I do OK and then it will Print?”</td>
<td>Experimentation</td>
<td></td>
</tr>
<tr>
<td>Jonah: “Yes”</td>
<td>Approval</td>
<td></td>
</tr>
<tr>
<td>Naomi: “Now, if I want to...(examining the options), I would like to choose quantity, I want to print ten of them. I don’t see how I do this.”</td>
<td>Exploration</td>
<td></td>
</tr>
<tr>
<td>Jonah: (Pointing, preparing to explain) “Copy is...”</td>
<td>Starting explanation</td>
<td></td>
</tr>
<tr>
<td>Naomi: (finding the right function) “Here, I see!”</td>
<td>Discovery</td>
<td></td>
</tr>
</tbody>
</table>

By playing with different keys and moving between windows, Naomi losing her way; Jonah introduces her to the *alt-tab* key.

<table>
<thead>
<tr>
<th>Naomi: “What does it do?”</th>
<th>Inquiry Question</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Jonah: “That allows you to switch programs or documents.”</td>
<td>Explanation</td>
<td></td>
</tr>
<tr>
<td>Naomi: “So actually what I did, I left what I was doing, and I went back to what I was doing before and I did that with the <em>alt-tab</em>?”</td>
<td>Error Reconstruction</td>
<td></td>
</tr>
<tr>
<td>Jonah: “Yes”</td>
<td>Approval</td>
<td></td>
</tr>
<tr>
<td>Naomi: ‘If I want to go to what I did before, can I use the <em>alt-tab</em> again?’</td>
<td>“Can I” Question</td>
<td></td>
</tr>
<tr>
<td>Jonah: “You can always come back here.”</td>
<td>Approval</td>
<td></td>
</tr>
<tr>
<td>Naomi: (Playing with switching the windows using <em>alt-tab</em> , appears very happy) “Oh, that’s nice! It’s really handy!”</td>
<td>Mission Accomplished</td>
<td></td>
</tr>
</tbody>
</table>

Comment: [When Naomi takes control, the whole atmosphere changes and the interaction becomes more relaxed with laughing and a feeling of accomplishment for both of them].
Stage 3 TRANSFORMATION: One step forward towards independence.

Naomi succeeds in finding her saved file by herself; Jonah manages to 'let go'

At this stage, after Naomi has started enjoying the inquiry process and her success with it, it is time to focus on Jonah, who does understand the advantage of let go but cannot apply it. An attempt is made to minimize Jonah's talking and to encourage him to ask questions instead of explaining and to let go with Naomi as much as possible.

In the beginning of this stage, Jonah still continues with some show & tell and show & follow instruction. However, as the interaction develops, he reaches the turning point when it's clear that he does not only know what he is suppose to do, but he can actually implement it and enjoy it. In this stage, he still feels a responsibility to explain and direct when a question is asked, but now he mixes it with new types of behaviour. This is the first time he uses try it expressions, asks probing questions and attempts to avoid responding with explanations. Now he uses encouragement and reinforcement rather than the previously used “yes” or “no.”

Naomi is now fully engaged with her inquiry process. She enjoys her ability to inquire about the different options and to be able to find her way. She feels the excitement of mission accomplished when she can finally activate a process she had been struggling with since she was first introduced to the computer. However, she still needs the directions of Jonah on some points. At this stage, she still asks some “what to do” questions.

This part of the session is an excellent example of the opportunities the let go method opens for incidental learning and error recovery that would not occur during regular step-by-step instruction. It also reveals how complicated the file management procedures are, a difficulty none of the previously observed trainers realized. Only let go methods allow the trainer to identify and respond to those gaps that most of the step-by-step trainers do not have the opportunity to encounter.

Once Naomi takes the challenge and Jonah reduces his control, the whole learning atmosphere changes. The learning environment becomes much more informal and relaxed with descriptive expressions such as laughing and expressions of enjoyment.
<table>
<thead>
<tr>
<th>Researcher (to Jonah): “Can you close everything down, and let her try to retrieve everything back. Remember, give her as few instructions as you can.”</th>
<th>Prompting Jonah To <em>Let Go</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Jonah: “OK (laughing) what we are going to do is close this file.”</td>
<td>Setting Target</td>
</tr>
<tr>
<td>Naomi: (Thinking)</td>
<td>Thinking</td>
</tr>
<tr>
<td>Jonah: “You are going to tell me what you are going to do.” [Now he joined the game]</td>
<td>“Try It”</td>
</tr>
<tr>
<td>Naomi: “I want to get my document back.”</td>
<td>Setting Target</td>
</tr>
<tr>
<td>Jonah: “OK”</td>
<td></td>
</tr>
<tr>
<td>Naomi: (talking while doing) “I’ll probably go to File again... (OK) and click open and I have to type the name of the document. If I am not wrong it was “Mother” (typing), now I have to... so how do I do this, how do I know where?”</td>
<td>Experimentation</td>
</tr>
<tr>
<td>Jonah. “Do you remember where you saved it?”</td>
<td>Probing Question</td>
</tr>
<tr>
<td>Naomi: “What bothers me now is that I typed the name of the file and it disappeared.”</td>
<td>Incidental Learning; Error Discovery</td>
</tr>
<tr>
<td><strong>comment:</strong> [A good example of incidental learning, or the need to cope with error recovery that could not happen with step-by-step instruction]</td>
<td></td>
</tr>
<tr>
<td>Jonah: “It disappeared because you by accident hit the mouse.”</td>
<td>Error Reconstruction</td>
</tr>
<tr>
<td>Jonah. ... (Naomi searching for her file) “Which drive do you think you should go to?”</td>
<td>Providing Scaffolding</td>
</tr>
<tr>
<td>Naomi: (thinking) “C. what should I do?”</td>
<td>“What To Do” Question</td>
</tr>
<tr>
<td>Jonah: “You can either double click on the C or click once and say OK”</td>
<td>Responding To A Need With Show &amp; Tell</td>
</tr>
</tbody>
</table>
Comment: [Handling this type of choice, including this specific one, had been demonstrated by Jonah several times during the previous stages, but Naomi always had followed his step-by-step instructions. She therefore never learned what to do when not instructed. Now, when she finally tries to function on her own, she actually has to learn a new skill: how to decide or find what to do when not led step-by-step. In this case, although Jonah directs her again, it is as a response to her need. Naomi thus has a better chance of retaining what she has learned. An even better practice would be to ask her to try by herself].

<table>
<thead>
<tr>
<th>Jonah: “You see, here you have all the directories you have on C.”</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naomi: (Accidentally, highlights one of the directories which happened to be the one she was looking for) “Oops, what have I done?”</td>
<td>Incidental Learning</td>
</tr>
<tr>
<td>Jonah: “Click on it.”</td>
<td>Show &amp; Tell</td>
</tr>
<tr>
<td>Naomi: “Click or double click?”</td>
<td>“What To Do” Question</td>
</tr>
</tbody>
</table>

Comment: [Until Naomi is instructed to try by herself, the click-double-click problem that reappeared many time throughout this session is not solved]

<table>
<thead>
<tr>
<th>Jonah: “Double click”</th>
<th>Show &amp; Follow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naomi: OK I have it there, OK? (laughing),</td>
<td>“I Found It”</td>
</tr>
<tr>
<td>Jonah: “No, you have to select it first.”</td>
<td>Probing Further Activity</td>
</tr>
</tbody>
</table>
The turning point

The turning point comes when Naomi, after conducting limited independent searches, finally manages to find her file without any instructions from Jonah. Now Naomi is ready and willing to "take the risk" of reconstructing the process herself. Jonah, until this point, had tried to follow the "rules of the game" because he was instructed to do so. At this point, he finally expresses his understanding and acceptance of the new let go rules. The whole training environment then changes. Now, the two are partners in this new adventure. Now, both recognize the advantage of the let go approach and with that, the rigid, formal manner in which the training started turns into a cheerful experiment in which both participants feel confident and enjoy sharing.

<table>
<thead>
<tr>
<th>Naomi: “Where are we? (searching, finding the right file name and click)... and then “Mother” comes!! Hello!!” (the document appears, Naomi is happy and proud that she managed to find the file)</th>
<th>“I Found It”; Success</th>
</tr>
</thead>
</table>

**Comment:** [With all the difficulties she had, there was no way Naomi would have been able to learn so readily if she had been left with the step-by-step method. Now that she has experienced the difficulties, the puzzling situations, and the decision-making process, there is a chance she will be able to cope with new learning situations.]

| Naomi: “Hello Mother!” (the name of the document)  
Jonah: (Enjoys the game) “‘Mother’ comes in writing.” (laughing). | Laughing; Enjoyment of Success |
|---|---|

<table>
<thead>
<tr>
<th>Naomi: (Now, with full confidence, enjoying her ability to control the process) “OK, shall I close it and reopen it?”</th>
<th>Ready for Reconstruction</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Jonah: (To the researcher, tries to clarify the rules he has to follow) “Let her do everything by herself?”</th>
<th>Confirming the Rules</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Researcher: “If she can.”</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Naomi: “I have to remember what to do. (Laughing).”</th>
<th>Process Reconstruction</th>
</tr>
</thead>
</table>

| Jonah: “You do it once or twice on your own and you never forget.” | Acceptance of the new rules |
**Comment:** [Jonah finally not only understands but manages to adopt the rules of the game.]

<table>
<thead>
<tr>
<th><strong>Naomi:</strong> “I guess I have to start all over again.”</th>
<th>Accepting the Rules Ready for Reconstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Jonah:</strong> “Start all over from the beginning, until you get to ‘Mother’ (laughing)”</td>
<td>“Try It”</td>
</tr>
<tr>
<td><strong>Naomi:</strong> (Searching, opens a few files until she manages to find the requested file and open it) “OK!! It’s done!” [Sounds very happy]</td>
<td>Mission Accomplished</td>
</tr>
<tr>
<td><strong>Jonah:</strong> “Very good, it’s done.”</td>
<td>Encouragement</td>
</tr>
</tbody>
</table>

**STAGE 4 EFFECTIVE RESPONSIVE TRAINING INTERACTION**

In the last stage, Naomi is asked to use different options for her printing, procedures that she had previously found to be very complicated. At this stage, no interventions are needed anymore. The ‘rules of the game’ are clear to Naomi and Jonah and both enjoy the new ‘game.’ The only statements Jonah makes are those encouraging Naomi to try or providing positive feedback.

<table>
<thead>
<tr>
<th><strong>Naomi:</strong> “OK I remember that if I clicked the printer it would print. A…”</th>
<th>Process reconstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Jonah:</strong> “How did we find out if it’s low resolution or high resolution?”</td>
<td>Probing question</td>
</tr>
<tr>
<td><strong>Naomi:</strong> ????</td>
<td>thinking</td>
</tr>
<tr>
<td><strong>Jonah:</strong> “The only way to find out is to try. What is the worst that can happened?”</td>
<td>“try it”</td>
</tr>
<tr>
<td><strong>Comment:</strong> [This is the first time that Jonah feels confident enough not to donate any information and to encourage Naomi that it is safe to experiment.]</td>
<td></td>
</tr>
<tr>
<td><strong>Naomi:</strong> (Trying to find the right option) “Oh!!... This is really an achievement (laughing), go to... printer... options... and I want the low?”</td>
<td>exploration discovery; success</td>
</tr>
<tr>
<td><strong>Jonah:</strong> “Where would you go to change the paper you want to print on?”</td>
<td>probing question</td>
</tr>
</tbody>
</table>
Naomi: "Options, and if I want...then and if I want...(thinking, trying different options) then if I don't want to mess up with it anymore then...and that's it. And then I close it.

re-capping the options; mission accomplished

Comment: This time Naomi goes over all the options and shows that she is in control; she seems to be very satisfied with herself and her ability. It seems that she has made a huge step forward in understanding the selection method and discovering the options available to her, even though no one showed her directly.

At this stage, Jonah demonstrates his understanding of the new role he has evolved into. Now he is there to provide some scaffolding and encouragement to Naomi so she will be able to continue her exploration and build her own inquiry methods. Naomi is not totally independent yet, but she knows where and how she can conduct her search and how to identify the missing information she needs from another source.

This case study is a good example of the developmental process of both the trainer and the end-user. Each of the four stages exemplified by this process revealed a new class of behavioural characteristics for both the trainer and the trainee. These characteristics evolved from stage to stage until the ultimate goal of ERT was reached. The characteristics included exploration, discovery, and encouragement.

Jonah started as a typical trainer, using step-by-step show & tell methods. He ended up as a responsive trainer who replaces long explanations and directions with questions and encouragement, motivates the end-user to try and experiment because “What is the worst that can happen?” Jonah did not finish his journey, and he has to improve many skills. However, the last part of the session indicated that he is well on his way. If he keeps in mind the learning he acquired in this session, and if he finds an environment that accepts this new approach, he will further develop with each new training experience.

Naomi started as a typical end-user who was afraid to make any step out of a concern that she might destroy the computer. When she was asked in the beginning of the session what she needed to learn, she made a list of functions and skills. By the end of the session, she started to fulfill a need she did not know she had. She started to gain control over the computer and to find her way through the different options without much external help.
She started to believe that she could actually learn new computer skills without being taught what to do and how to do it. This resulted in both Jonah and her being happy and satisfied.

To make the results more conclusive, and to be able to suggest some consistency in the four-stage change process that could lead to generalization of the results, another similar case study was conducted and analyzed.

**Second case study: Isaiah and Ruth**

The second case study with Isaiah (a trainer) and Ruth (volunteer trainee) presents a process similar to the previous one. As in the previous case study, the training started with a "resistance to change" stage consisting of typical step-by-step procedures. It ended with ERT where the user takes control while being encouraged by the trainer. However, in this case study a more profound change was observed, with many new and stronger ERT characteristics emerging. In this case study, the participants were prompted to assume the *let go* approach from the beginning of the session. The change process thus started earlier and accelerated much faster. As a result, categories such as *incidental learning*, *error recovery*, and *identifying gaps and misconceptions* that were not as apparent in the previous case study were more apparent more frequently in this one.

Like most of the trainees, who participated in this study, Ruth has computer experience but in some ways is still a novice end-user. She has been using a computer for over two years, but, like the others, she has used it mainly as a typewriter with a very limited number of functions. She has never tried to find out what else she could do with her high-end computer, which is loaded with updated software used by her son. She never cared about using more functions than she does. She feels that any attempt to experiment with the computer could bring disaster, so she sticks with the limited knowledge she has. If she encounters difficulties, or wants something specific to be done, she calls her son, a typical "whiz kid", who would get her out of the problem she has. However, she never realized she could learn to do things by herself.
Ruth never thought of asking her son for explanations. The computer always seemed to her to be too complicated and too technical to try to learn. For her, a computer is only a word processor; even this use is not very exciting to her: “I prefer to write my letters by hand. Using the computer makes the letter look impersonal, and I don’t like it. I really don’t feel the computer can make much change in what I am doing.”

Her case seemed to be rather tough for Isaiah. In the beginning, Ruth did not feel any need to learn more than she already had learned about the computer. If she had not been asked to participate in this experiment, it would probably have been a long time before she felt any need to develop her computer knowledge.

The change process presented in this case study is a good illustration of the reciprocal development process of both the trainer and the trainee and is very similar to the process described in the previous case study. The following summarizes the four stages of the change process:

- At the beginning, *(the Resistance to change stage)* Ruth is very hesitant and nervous. Isaiah starts as a typical step-by-step instructor.

- Once Isaiah starts making attempts to develop a new repertoire of training skills that will fit the new directions he receives, Ruth starts to change her own learning style and learning behaviour. This is followed by expressions of new needs. At this stage *(the Transition stage)*, Isaiah still occasionally falls back into long explanations and *show & follow* procedures.

- As the session develops *(the Transformation stage)*, Ruth shows more and more enthusiasm and is more willing to try. She eventually takes the lead in the session and forces Isaiah to “let her go.” As a result, Isaiah’s step-by-step patterns of behaviour gradually give way to more ERT methods.

- As a result *(the ERT stage)*, Ruth develops into an end-user who is actively involved in her own training and wants to understand and find her own way. She starts asking “what if?” and “can I?” questions and she brings up problems she had never bothered to investigate before. Eventually she takes the opportunity to have Isaiah’s support as
she explores the computer. The technical and emotional safety-net provided by Isaiah allows her to make errors and take risks she would not have otherwise considered. She is also able to get support in incidental learning situations where in other cases she would have been lost.

Before the session started, Isaiah was given a general instruction to let Ruth experiment with minimal explanation or guidance from him. Ruth was asked to try to explore the functions she was interested in by herself as much as possible. During the session, more specific instructions were given to enhance the use of more ERT methods and to reduce the use of methods that appear to be non-effective.

Stage 1 RESISTANCE TO CHANGE: the familiar show & tell, show & follow instruction

The session starts with a search for a document they can work on. At this stage, Isaiah keeps the old habits of the show & tell, show & follow combination. He starts with a long explanation that includes a good deal of computer terminology, without verifying if Ruth understands it. At this stage, Ruth follows his instructions without feeling any need for a different pattern of learning:

| Isaiah | “So what we will do first is go to View, (Ruth follows). You are in Page layout. So, what it allows you to do is see the whole page, one page at a time. if you go into Normal, just click on Normal, you see more than one page, you can see where your page breaks are, but that’s OK it’s faster, if you work with page layout it works more slowly. The thing I usually do is type everything I want to type in and then you do your formatting out. So don’t worry about your headings and paragraph, but essentially get your text onto the document... Go to File. You see down at the bottom 1,2,3,4, those were the last four Word documents that were used if you want to use it...” |
| Show & Follow | Show & Tell |

When they try to find a file on Ruth’s disk, Isaiah takes control of the mouse and starts another set of show & tell, show & follow instructions:

Isaiah: “Go to file, see where it says drives, click on there. I am sorry, click on A, so you can look for all the files on this floppy disk or just the Word documents or just the document templates or just rich text
format or text files. So, if you really don’t know you will look for all of them. Now you’re just looking for *Word* files.

You can double click on the file name or can click once and click OK.....”

**Stage 2 TRANSITION: mixed environment**

After ten minutes with the same patterns of behaviour, the researcher steps in and re-enforces the “rules”:

Researcher: “What I would like you to do is guide her to search by herself without showing her what to open or explaining to her what she gets.”

Although we cannot observe a dramatic change right away, from this point onward, the change process starts to roll. The following vignette demonstrates the beginning of the change process for both Isaiah and Ruth. Isaiah starts asking questions, verifying the current knowledge of Ruth (*Assessment of entry behaviour*) and encourages Ruth to search and ask questions. Ruth is taking more control. After some initial hesitation, she decides to try searching on her own. Once she does, she starts asking “what if?” and “can I?” questions while searching for other options to use on her computer.

<table>
<thead>
<tr>
<th>Isaiah: “Do you know how to find the file?”</th>
<th>Entry behaviour assessment</th>
<th>Searching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruth: (Searching for a document which is supposed to be on a disk; hesitates what to do, gets into the directories).</td>
<td></td>
<td>Asking for approval</td>
</tr>
<tr>
<td>“Is it right?”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isaiah: “Yes it is! This is the A drive and this is normally the B drive. The main drive in the computer is usually C”.</td>
<td>Approval show &amp; tell</td>
<td></td>
</tr>
<tr>
<td>“Do you know what this file is called?”</td>
<td>Entry behaviour assessment</td>
<td></td>
</tr>
</tbody>
</table>

*Note: The table above illustrates the interaction between Isaiah and Ruth during the transition phase.*
Ruth: "If I put the disk here and I don’t know the name of the file I am looking for but I know it’s in this disk, why can’t I just ask the machine to give me the list?"

Isaiah: "Yes, you can and I will show you how."

"What if" and "Can I" questions

Responding to a specific need

At the end of this vignette, Isaiah falls back into explanation and show & follow instruction. This pattern continues when they discuss changing the location of the page break and start dealing with margins and defaults.

**Stage 3 TRANSFORMATION: from listen and follow to exploration and question from show & tell to encouraging exploration and answering questions**

**The turning point**

After Isaiah falls back to a show & tell, show & follow method of training the researcher decides to get Isaiah back to the rules of the game:

"Let her explore the margins by herself and see what happens."

For a moment it seems that nothing changes. Isaiah continues with his show & follow instruction, but not for long. In the middle of his long explanation, he catches himself and from there the real change develops.

| Isaiah: "So, two things will happen. When you print, it won’t print to the end of the page. Because, believe it or not there are margins set up, so, go to File.... That allows you to lay out the page, and it tells you that at the top there is going to be one inch space before the text starts and the same in the bottom and then..."
| **Explanation** |

| Ruth: "Is this automatic design - or I did it some time?"
| Clarifying Question |

| Isaiah: "Somebody did it at one time or another. Normally, it is set up one inch at the top and one at the bottom and half on both sides, and you can change them. You can see, ..."
| **Explanation** |
At this point, the change process starts to roll with very little regression. Isaiah develops and applies more and more ERT skills and Ruth focuses on exploration while attempting to close the gaps in her knowledge and generalize previous knowledge.

**The change process builds up**

The following vignette describes the next fifteen minutes of the session, which was devoted to the exploration of the margins. An examination of the script shows a significant reduction in the amount of talking done by Isaiah and increasing space devoted to descriptions of Ruth's exploration (marked with brackets) and questions.

In this section, a new set of ERT skills appears for both Ruth and Isaiah. Ruth takes the lead and explores different options and asks questions. In the beginning, the main questions were “what is” type of question. These gradually give way to generalization and explanation questions. Ruth uncovers new learning opportunities through *incidental learning* situations when her exploration leads her to unexpected results. At this stage, Isaiah is still providing pieces of information, but this time it is in response to specific needs expressed by Ruth. At the same time, Isaiah provides emotional and technical safety nets that encourage Ruth to experiment.

<table>
<thead>
<tr>
<th>Ruth: “I can change it by clicking here and here” (Ruth starts exploring the dialogue box with all the options, trying different options and examining the results)</th>
<th>Exploration</th>
</tr>
</thead>
</table>

| Isaiah: “One of the things about being afraid of computers is don’t ever be afraid of changing things.” | Building Emotional Safety-Net |

| Ruth: (Makes changes) “I see, so I can do this and this and I can do this too, now I can do this too and I can do this too...This is inch or minus?”... | Exploration |
**Comment:** Ruth gets to all the details of the dialogue box, knowing there is somebody to support her. At the same time, she is practicing inquiry techniques, and finding all the little items she would never get to in an organized, formal learning procedure. Though some of these items are considered non-important or advanced functions, this supported exploration prevents the often confusing occasions wherein the user incidentally discovers features and has no idea what to do with them or whether or not they are important. Ruth might not need these functions immediately, but she learns that they exist and she is going through the decision making process of choosing the relevant features. She learns how to search for them if she needs them in the future.

<table>
<thead>
<tr>
<th>Ruth: “What is gutter?”</th>
<th>Exploration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isaiah: “This is a good question, to tell you the truth I don’t know.”</td>
<td>I Don’t Know.”</td>
</tr>
<tr>
<td>“Try to push it up” (changing the measures to find out what the function is actually doing – finds that it is an allowance used for punching holes). “It’s like a margin, and it gives you space here like hole punch”...</td>
<td>Demonstration Of Exploration Techniques</td>
</tr>
</tbody>
</table>

**Comment:** In this atmosphere of “learning together” it is legitimate for the trainer to not know everything. It is also an opportunity for him to demonstrate his own exploration techniques.

<table>
<thead>
<tr>
<th>Ruth: “...What is a header?”</th>
<th>Exploration: What Is Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isaiah: “A header is a space at the top of each page where”...</td>
<td>Answering Question</td>
</tr>
<tr>
<td>Ruth: “What is this mirror margin?”</td>
<td>What Is Question</td>
</tr>
</tbody>
</table>

Ruth’s exploration continues. She discovers new concepts and functions and plays with them. The notes taken during this part indicate that “Ruth enjoys being able to control the computer and being able to go back and forth and try different options.” Isaiah continuously reinforces her and gives very short answers or “Yes” or “No” approvals. When Ruth hesitates at trying some options, Isaiah reminds her that there is a safety-net that secures her from causing any catastrophic result:

“When in doubt, don’t be afraid to click on it because you can always move it back, it always allows it. You could even cancel it,
and none of your changes will take effect so you are right back at the beginning. So if you ever feel afraid that you changed something...

Ruth’s first *incidental learning* occurs when she changes the margins and realizes that only part of her document has changed. This incident, though scary at first, triggers a long exploration in which Ruth attempts to understand what went wrong. Through this exploration, Ruth is provided with the most important and most effective safety-net tool: the *undo* function that allows her to feel free to explore until she fully understands what happened. Her free exploration allows Isaiah to identify many misconceptions and knowledge gaps that he had previously taken for granted. These misconceptions include Ruth’s misunderstanding of the terms *menu* and *highlight* and the saving functions and the *default*, concepts that were discussed previously (see Chapter 4).

<table>
<thead>
<tr>
<th>Ruth: &quot;Hey, what did it do? It changed only part of it.&quot;</th>
<th>Incidental Learning: Surprise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isaiah: &quot;It changed only the paragraph that you are in, see how the cursor is in the first paragraph?&quot;</td>
<td>Explanation, Clarification</td>
</tr>
<tr>
<td>Ruth: (Trying to move the cursor to get the margins on her full document. Does not manage.)</td>
<td>Exploration</td>
</tr>
<tr>
<td>See that, the thing that’s scaring me is that I’m doing things and I’m losing control.</td>
<td>Need To Control</td>
</tr>
<tr>
<td>Isaiah: OK you see your Ctrl key? Hold that down, and press Z, that is called an undo key...</td>
<td>Safety-Net Tool: Undo</td>
</tr>
<tr>
<td>Ruth: <em>Let me try</em> what I did because again I’m frustrated now and I don’t know what I have done wrong. You said that I can control the margin by moving these little arrows...</td>
<td>Error Reconstruction</td>
</tr>
<tr>
<td>Isaiah: &quot;...If you want to change the margins of the whole document, you have to select the whole document. You know what I mean by selecting the whole document?&quot;</td>
<td>Clarification Of Terminology; Identifying Knowledge Gap</td>
</tr>
<tr>
<td>Ruth: “No”</td>
<td><em>very basic gap</em></td>
</tr>
</tbody>
</table>
Stage 4 EFFECTIVE RESPONSIVE TRAINING: Trainer supported exploration

At this stage the researcher decides to push the training one step forward, and encourages Isaiah to let Ruth find the answers by herself. This time the instruction was:

"Let her look around and try to find out how to do it"

| Isaiah: “I need to select all the text so if I press...” | Start With Explanation |

Ruth: “Selecting the whole document? I don’t know, may be clicking on something that will highlight the whole thing?”

| Ruth: “Try to look at the menus” | providing scaffolding |

| Isaiah: “Yes” | responding to knowledge gap |

Ruth: “When you say menu you mean those (opening and pointing)

| Ruth: Thank you, that’s the main help I needed... | expressing need |

| Ruth: (continues in her search) “I guess Edit is part of what I was doing” | guessing, searching for possible options |

| Isaiah: “Yes! You are going in the right direction” | Reinforcement |

| Ruth: (Examines the Edit menu and reads aloud the titles). Cut Copy, Paste, I don’t want to cut or past, .. Select All... Oh HELLO!!” (laughing loudly with joy and satisfaction). | Discovery, Satisfaction |

| Isaiah: “Beautiful!” (laughing together) | Reinforcement; Satisfaction |

Comment: [There is an atmosphere of satisfaction and achievement for both of them: Ruth managed by herself to find a function she needed and Isaiah managed to apply a training method he knew he should use but could not until he was directly instructed to do so.]
Isaiah: "So where are we? We selected the whole text."
What you do with the text will affect the whole document. What changes you want to do?"

<table>
<thead>
<tr>
<th>Isaiah: “Don’t be afraid to use the tool bar.”</th>
<th>Providing Scaffolding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isaiah: “Do you know what a toolbar is?”</td>
<td>Identifying possible very basic gap</td>
</tr>
<tr>
<td>Ruth: “No”</td>
<td>confirming a gap</td>
</tr>
<tr>
<td>Isaiah: OK this is...</td>
<td>starting explanation</td>
</tr>
</tbody>
</table>

**A little scaffolding is all you need**

After discussing different options to view the whole document, Ruth is sent on the journey almost by herself. Isaiah plays the “I don’t know game” while providing her with some scaffolding in the form of small suggestions. At the same time, he has the opportunity to detect some gaps in “very basic concepts.”

After searching the different menus, Ruth gets to the *File* menu and to *Print Preview*. Through this search, she examines the different options to view her document and plays back and forth with them. Isaiah watches her until he is sure that she does not notice that there is a new toolbar that she needs to use. He suggests:

Isaiah starts explaining but does not proceed very far. Ruth does not need a long explanation. She has already started exploring the different icons and has discovered the labels. She goes back and forth until she finds the button that allows her to see the whole document. Through her search, Isaiah is plays a “dummy” so perfectly that it is hard to
tell if he is pretending or really does not know how to find the function they are looking for.

The session becomes exciting for Ruth. and she enjoys the exploration process. She asks “what if?” and “why?” questions and finds the answers. Now she is really excited about her exploration and enjoying her ability to find things by herself.

<table>
<thead>
<tr>
<th>Ruth: “What if I had nine pages, would I see them all?”</th>
<th>“What if” question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isaiah: “How many pages do you have now?”</td>
<td>identifying a gap</td>
</tr>
<tr>
<td>Ruth: “Six.”</td>
<td>Confirming a gap</td>
</tr>
<tr>
<td>Isaiah: (laughing) “I’ll make you a bet you have seven.”</td>
<td>using humour</td>
</tr>
<tr>
<td>Ruth: “Let’s click here and see...you see it’s page 6!”</td>
<td>exploring together</td>
</tr>
<tr>
<td>Isaiah: “Yes, it’s really confusing, why don’t you look at the bottom of the screen?”</td>
<td>Providing scaffolding</td>
</tr>
<tr>
<td>Ruth: (with a losing expression) “Seven.”</td>
<td>Discovery</td>
</tr>
<tr>
<td>Isaiah: “This tells you what page you are on and how many pages you have.”</td>
<td></td>
</tr>
<tr>
<td>Ruth: “So, it’s seven, but why does it show seven when the seventh page is empty?”</td>
<td>“Why” (inquiry) question</td>
</tr>
</tbody>
</table>

In their summarizing discussion, both Ruth and Isaiah indicate that all Ruth needed was to notice the new toolbar:
Isaiah: “She got her way to the right screen and I just helped her to use the toolbar.”

Ruth: “I finally got to the Print Preview but I could not set it up to see the whole document. Once I discovered the toolbar, I could play with it and find the right icon.”

What Ruth needed was not a long explanation, as she would have received from a step-by-step instructor, but just some limited scaffolding which would direct her attention to the new toolbar that appeared on the screen. Once she saw what she needed, she could manage by herself. The next time she finds herself in a similar situation, she might not need this scaffolding anymore.

Error recovery

After playing with the different options for viewing her document, Ruth accidentally closes the document and everything disappears. When one has had a similar experience in the past, it becomes easier to not panic. However, Ruth is now in control and understands the safety-net principles. The document is saved, and can be retrieved, and with some effort she can now do it herself. Instead of panic, the incident brought up a new challenge and a new opportunity for exploration through an error recovery process.

The following vignette is an excellent example of an error-recovery inquiry process wherein the user reconstructs the steps that brought her to the error until she identifies the faulty steps. Ruth also starts a skill-building process by searching for the right steps until she reaches the discovery point where she fully understands the variety of options and their functions. Through this process, the trainer does not provide any new information. He encourages the user to continue her search and, by reinforcing the right selections, he provides scaffoldings when needed. He also identifies and fills knowledge gaps that emerge through the process. But his main role is to provide a safe environment for inquiry and experimentation wherein the user can make errors and try different options without the fear of causing any damage or looking stupid.

<table>
<thead>
<tr>
<th>Inquiry Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulating inquiry</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ruth: “What happened?”</th>
<th>Inquiry Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isaiah: “Let’s go through it again and see what happened.”</td>
<td></td>
</tr>
<tr>
<td>You remember how you set it up last time?</td>
<td>Error reconstruction</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Ruth: &quot;Yes, and I was here.&quot;</td>
<td></td>
</tr>
<tr>
<td>Isaiah: &quot;Right!&quot;</td>
<td>Reinforcement</td>
</tr>
<tr>
<td>Ruth: &quot;I clicked cancel!&quot;</td>
<td>Error Reconstruction</td>
</tr>
<tr>
<td>Isaiah: &quot;Right!&quot;</td>
<td></td>
</tr>
<tr>
<td>Ruth: &quot;...and then I wanted to close it. So...(thinking) this was the faulty step, should I have clicked here?...&quot;</td>
<td>Identifying the Faulty Step</td>
</tr>
<tr>
<td>Isaiah: &quot;That would work?&quot;</td>
<td>Probing question</td>
</tr>
<tr>
<td>(both laughing)</td>
<td></td>
</tr>
<tr>
<td>Ruth: &quot;I guess...&quot;</td>
<td></td>
</tr>
<tr>
<td>Isaiah: &quot;<strong>Try that again</strong>, just go through the series one more time.&quot;</td>
<td>Try it</td>
</tr>
<tr>
<td>Ruth: (searching for which option to choose to close the <em>Print Preview</em>, she finally picks the Close command from the File menu)</td>
<td>Inquiry, Incidental learning: Unknown variation of the same function</td>
</tr>
<tr>
<td>&quot;I guess that's what I did before, but why didn't it ask me if I want to save?</td>
<td>Filling knowledge gap</td>
</tr>
<tr>
<td>Isaiah: &quot;We did not make any changes. If you had made any changes it would ask you.&quot;</td>
<td></td>
</tr>
<tr>
<td>Ruth: &quot;All these zillion things are really confusing&quot;</td>
<td>Frustration; Confusion</td>
</tr>
<tr>
<td>Isaiah: (Explains the parallel use of the sets of functions)</td>
<td>Scaffold: Organize confusing knowledge</td>
</tr>
<tr>
<td>Ruth: &quot;Could I close the <em>Print Preview</em> by clicking <em>Close</em>?&quot;</td>
<td>Searching For Solution</td>
</tr>
<tr>
<td>Isaiah: &quot;Let's open the document first&quot;</td>
<td>Scaffold</td>
</tr>
<tr>
<td>Ruth: (Manages to get her document with no problems; opens the Print Preview screen)</td>
<td>Reconstruction</td>
</tr>
<tr>
<td><strong>Isaiah:</strong> “Print Preview, here we go. Now, I can’t give you anymore hints (laughing). My hints for this one are all used up.”</td>
<td>Reinforcement; Re-setting the rules</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Ruth:</strong> (Thinking) “How about this?” (finds the button and reverts to normal view).</td>
<td>Experimentation</td>
</tr>
<tr>
<td><strong>Isaiah:</strong> “That’s the easiest way to do it.”</td>
<td></td>
</tr>
<tr>
<td><strong>Ruth:</strong> “But what is the difference between this close and...I can’t even see where the other close was that I clicked.”</td>
<td>Knowledge Gap</td>
</tr>
<tr>
<td><strong>Isaiah:</strong> “There is a special toolbar, just for the Print Preview.”</td>
<td>Filling the gap</td>
</tr>
<tr>
<td><strong>Ruth:</strong> “Aha... so when I got to Print Preview, something here actually changed?”</td>
<td>Discovery</td>
</tr>
<tr>
<td><strong>Isaiah:</strong> “The whole toolbar…”</td>
<td>Discovery, Approval</td>
</tr>
<tr>
<td><strong>Ruth:</strong> (Astonished) “Aha... so I cannot use the other close because I don’t have any other close. Aha…” (exited, laughing)</td>
<td>Discovery Confirmation</td>
</tr>
</tbody>
</table>

**Comment:** Though Ruth previously used the specific preview set of icons, with the confusion she expressed of having “a zillion icons” she has not noticed that she actually was using different sets. Another example of discovery that would never have happened in step-by-step training.

Toward the end of the sessions, the development process is easily seen. Ruth is now genuinely interested in finding her way through problems and tasks she could not cope with before. Isaiah is now ready to let go. He does not rush to offer information unless it is necessary. He encourages Ruth to explore different options and not be afraid to make errors. He reminds Ruth that the safety net is there. At the same time, he is very alert to pick up any possible misconceptions or gaps in Ruth’s knowledge and finds the right opportunity to deal with it.
The following vignette includes many of the ERT elements discussed before as they are illustrated by the behaviour of both the trainee and the trainer. In this stage, Ruth is the one leading the learning process; Isaiah is providing the necessary scaffolding and gap fillings. This process allows Ruth to explore many functions and routines, some of which she used before but did not fully understand. The incidental learning supported by Isaiah gives her the opportunity to be exposed to problems and functions she would never have been able to confront while working within well-defined, step-by-step instruction. It also gives both of them the opportunity to identify and deal with various misconceptions and knowledge gaps and clarify "the very basics," basic concepts that previously observed trainers took for granted but which was discovered to be poorly understood.

<table>
<thead>
<tr>
<th>Ruth: “If I want to take this (points to a sequence of words within the text) and put it up here (points) as the title, can I do it?”</th>
<th>“What If” question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isaiah: “Do you want to take it out of there or just add it?”</td>
<td>Probing question, leading to the discrimination between <em>copy</em> and <em>cut</em></td>
</tr>
<tr>
<td>Ruth: “I want just to use it as a title, I want to leave it there but to use it in order to create a new headline.”</td>
<td>Emerging knowledge gaps</td>
</tr>
</tbody>
</table>

**Comment:** [This dialogue indicates that Ruth does not fully understand the copy function even though she had been using it before].

<table>
<thead>
<tr>
<th>Isaiah: “I’m going to ask you to search for what you need. Search either in <em>tool bar</em> or the <em>menu-bar</em>.”</th>
<th>Stimulating inquiry; providing scaffolding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruth: (searching) “I believe it has to do with <em>cut</em> and <em>paste</em>, I don’t know... Should I go to <em>edit</em>?” (opens the <em>edit</em> menu and reads aloud the different options.)</td>
<td>Exploration</td>
</tr>
</tbody>
</table>

**Comment:** [Ruth recognized the names she used before, but her previous step-by-step learning prevented her from generalizing the knowledge.]
<table>
<thead>
<tr>
<th>Action</th>
<th>Isiah Comment</th>
<th>Ruth Comment</th>
<th>Probing question</th>
<th>Reinforcement</th>
<th>Inquiry question</th>
<th>Discovery</th>
<th>Silence (non-verbal reinforcement)</th>
<th>Incidental learning; Making errors</th>
<th>Starting error recovery process; Error reconstruction</th>
<th>Starting reflection on action</th>
<th>Taking control; Applying newly acquired skills</th>
<th>Feeling of satisfaction</th>
<th>Expressing feeling of success</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Now, before you do anything, guess what would be the differences between Copy and Cut? Don’t be afraid to be wrong.&quot;</td>
<td></td>
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</tr>
<tr>
<td>Ruth: &quot;Copy, is what I need! (happy) I need to copy it, <strong>if I cut it won’t be here anymore</strong>.&quot;</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Isaiah: &quot;That’s right.&quot;</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Ruth: &quot;<strong>But how do I mark</strong> the place that I want to copy to?&quot;</td>
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<tr>
<td>Isaiah: (waiting) [At this point, Isaiah trusts Ruth to find the solution by herself]</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Ruth: (Highlights the segment; clicks the copy button; drags the segment...)</td>
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</tr>
<tr>
<td>&quot;I lost it, I cannot find it anymore!&quot;</td>
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</tr>
<tr>
<td>Isaiah: &quot;<strong>Can you describe what you just did?</strong>&quot;</td>
<td></td>
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</tr>
<tr>
<td>Ruth: &quot;I copied and then I clicked to highlight the words and I dragged it to another place&quot;</td>
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<tr>
<td>Isaiah: &quot;And then what happened?&quot;</td>
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</tr>
<tr>
<td>Ruth: &quot;It disappeared.&quot;</td>
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<td></td>
</tr>
<tr>
<td>Isaiah: &quot;What in fact you did...&quot;</td>
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<td></td>
</tr>
<tr>
<td>Ruth: (cut Isaiah explanation) Shall I use Ctrl and Z?</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Comment: [This time Ruth is determined to find her way, and does not want explanations; she demonstrates her understanding and ability to apply the *undo* function.]

(Both laughing loudly, satisfaction that the safety measures taken before did help.)

Ruth: **"I always remember magic!"**
<table>
<thead>
<tr>
<th>Isaiah: “You were doing two different things at the same time. You can use... These are two separate functions.”</th>
<th>Summarizing previous experience; Filling knowledge gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruth: “But when I clicked Edit and asked it to copy, it did not do anything.”</td>
<td>Emerging misconceptions</td>
</tr>
</tbody>
</table>

**Comment:** [This is an excellent example of this very common misconception. The concept of Copy is not as intuitive as it seems to be, and unless the concept of clipboard is clarified, users have major difficulty in understanding what is actually happening when they use Copy.]

<table>
<thead>
<tr>
<th>Isaiah: “You copied it.”</th>
<th>Providing scaffolding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruth: “Where? I can’t see it anywhere?”</td>
<td>Knowledge gap</td>
</tr>
<tr>
<td>Isaiah: It’s copied to what’s called a clipboard; you cannot see it”</td>
<td>filling knowledge gap</td>
</tr>
<tr>
<td>Ruth: “So how can I go to the clipboard to see what’s in it.”</td>
<td>Inquiry question: “How can I”</td>
</tr>
<tr>
<td>Isaiah: “You don’t need to go to the clipboard, you just have to trust it.”(laughing) Now where do you want to put it?”</td>
<td>Re-focusing the inquiry process</td>
</tr>
</tbody>
</table>

**Comment:** [This might be a knowledge gap of the trainer, who does not know that the content of the clipboard can be viewed.]

<table>
<thead>
<tr>
<th>Ruth: “On top of this (the text on the first line). I don’t have a space here but I want to make another title on top of this.”</th>
<th>Defining target; Emerging knowledge gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isaiah: “There are couple of ways to do it. You can...”</td>
<td>Providing scaffolding</td>
</tr>
<tr>
<td>Ruth: (Brings the pointer to the top.)</td>
<td>Experimentation</td>
</tr>
<tr>
<td>Isaiah: “That’s OK, you can make the space. You want one space?”</td>
<td>Reinforcement; Reflection of action</td>
</tr>
<tr>
<td>Ruth: (Places the pointer and hits return few times to get space in the top, nothing happens on the top).</td>
<td>Incidental learning</td>
</tr>
</tbody>
</table>
Isaiah: "What happened?"

Ruth: “I want it here!”(pointing with the arrow)

Isaiah: “You have to tell it exactly where you want it. Do you know the difference between the cursor and the arrow?”

Ruth: “Should I click on the top to get a cursor?”

Isaiah: “That’s right”

Ruth: “Let’s say that this is the place that I want it.”

Isaiah: (Waiting) “I am not supposed to tell you anything.”

(Both laughing loudly.)

Isaiah: “So what do you want to do now?”

Ruth: “I want to bring it here!” (points to the top of the page).

Isaiah: “Yes you do, so let’s go back to your menu.”

Ruth: (Searching the Edit, reading the functions, going back and forth until clicking on the Paste. Expresses excitement at getting the new title) (screaming) “Hello, I did it!!

Knowledge confirmation and application

At this point, a step-by-step trainer would assume that the mission had been completed. Ruth managed to get her title where she wanted it and, at this point, any other trainer (e.g. Chapter 4) would continue to the next topic. However, Isaiah, who is now very attentive to any possible gaps or misconceptions, sensed an unfinished issue. When he followed Ruth moving the pointer, he realized that she did not really understand the difference between the cursor and the pointer. When he asked her, she responded as if she knew it. Assuming ERT methods, Isaiah put it aside and waited for the next opportunity. Before moving on, Isaiah decided to re-examine Ruth’s understanding of this important issue.
### Example Interaction

<table>
<thead>
<tr>
<th>Isaiah: “Something funny happened here. When you clicked off, you moved your cursor, so it did not paste it in the right place.”</th>
<th>Identifying misconception</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruth: “What?” (she did not notice)</td>
<td>Demonstrates Unrecognized need</td>
</tr>
</tbody>
</table>

**Comment:** [Good illustration of the difference between the user’s needs as perceived by the user and by the instructor.]

<table>
<thead>
<tr>
<th>Isaiah: “Try to play with it (the cursor) and position it in different places”</th>
<th>Stimulating experimentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruth: (Moving the cursor)</td>
<td></td>
</tr>
<tr>
<td>Isaiah: “You see that it is flashing, that’s where the text will be. <strong>Try to move</strong> it into another paragraph (Ruth follows)...”</td>
<td>Summarizing explanation</td>
</tr>
</tbody>
</table>

**Comment:** [In an ideal ERT, Isaiah should encourage Ruth to summarize it.]

<table>
<thead>
<tr>
<th>Ruth: Wow! <strong>Now I understand</strong> why it did not go up the first time!</th>
<th>Insight, Learning has been completed</th>
</tr>
</thead>
</table>

This type of insight regarding a very common gap emerges again a few minutes later when Ruth tries to change the fonts of her title. After searching, she finds the fonts in the format menu.

<table>
<thead>
<tr>
<th>Ruth: “Why was it not there before?”(it was greyed out)</th>
<th>Incidental learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isaiah: “Because your text was not highlighted.”</td>
<td>Filling knowledge gap</td>
</tr>
<tr>
<td>Ruth: “<strong>Now I understand.</strong> I knew it should be there but I did not understand why I could not find it. So you can use it only if you highlight the text first.”</td>
<td>Insight</td>
</tr>
<tr>
<td>Isaiah: “You did the right thing, you used the menu bar button, and you could also use the format.”</td>
<td>Reinforcement; summarizing explanation</td>
</tr>
</tbody>
</table>

**Comment:** Unlike other cases (e.g. Jonah and Naomi), Isaiah offers the alternatives after the trainee has already controlled and fully understood the function.
Towards the end of the session, Ruth is asked to save and close the document. At this point, there was very little talking to transcribe. Ruth quietly gives herself instructions: “So now I want to go here,” and, “Yes I know it! I have to choose this file!” and so on. This time she easily finds her way through the saving options, including the decision where she wants the file to be saved. Now she is in full control and needs very little support, except for some reinforcements from Isaiah when she needs to make a new decision.

Isaiah kept quiet during most of this period. Now he could, and had to, trust Ruth to find her way. Once in a while he added “OK”, “That’s right!”, and “You are doing well!” reinforcements, but most of the time he kept quiet. A note taken during this period indicates “A very relaxed environment with much laughing and feeling of partnership, achievement and satisfaction.”:

From operational knowledge to constructive knowledge: the four-stage change process

This last stage of Isaiah and Ruth interaction clearly shows the dramatic change both Isaiah and Ruth went through. Isaiah developed from a very typical step-by-step trainer whose training is dominated by show & tell and show & follow to an effective responsive trainer who encourages the user to take control and experiment with the computer. Instead of telling Ruth what to do and where to go, he asks leading and clarifying questions and reinforces her exploration. He does not offer information or explanations unless it summarizes an experience Ruth has already been through. He allows incidental learning to happen by letting Ruth search and try different paths, some of which she would not have tried otherwise. Ruth is allowed to make errors while trusting Isaiah’s support through emotional and technical safety methods, and scaffolding. “Letting Ruth go” allows both of them to explore and discover how far Ruth can go by herself. At the same time, it allows them to identify those gaps and misconceptions that have to be dealt

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15 Constructive and operational knowledge are two themes that emerged through the data analysis and coding process. This section illustrates these two themes through the learning process of the trainee. The next chapter discusses these two themes in further details.
with, which would have very little chance of surfacing with the traditional step-by-step training (as illustrated in Chapter 4).

Ruth's incidental learning, the type of problems that emerged and were solved through this learning, and the growing confidence she gained through this experience demonstrate the importance of using ERT methods. Allowing incidental learning to occur uncovers many misconceptions and gaps that would never be detected in formal learning or in any other form of step-by-step instruction. Encouraging Ruth to experiment with and investigate the computer while being provided with gradually reduced scaffolding, emotional and technical safety-nets and minimal explanation, helps to build Ruth's confidence. It allows her to gain control over her computer, control that she will be able to use with reduced need for support in her future development.

Ruth learned how to use many new computer functions and concepts, corrected many of her misconceptions, closed gaps in her knowledge and managed to generalize known specific concepts, many of which would never have been identified as learning needs in a different training environment. But what she gained was much more than that.

Unlike step-by-step training, which focuses on specific functions and skills, Ruth's learning was not restricted to the use of specific functions chosen by the instructor. She learned how to explore the computer by herself and find out what she needed and wanted to learn. She learned how to recover from errors and how to use very basic functions, those that were called safety-net functions, that allowed her to feel safe in her exploration, knowing that no disaster could happen. In traditional instruction, she would complete a training session knowing how to use specific functions, operations, and concepts that would help her deal with specific software or tasks. In this type of training, there is a good probability, as has been seen in previous chapters, that whatever she learned and did not use immediately would be forgotten after a short time. Ruth's learning experience was different.

*Constructive Knowledge*

Ruth developed a new type of knowledge which is referred to here as *constructive knowledge.* This knowledge combines exploratory, problem solving, and error recovery
skills with the understanding that the computer is controllable, safe, and fun to explore. This knowledge goes far beyond specific functions and procedures (Operational Knowledge) that will probably be different in the next version of the same application, and allows her to continue her exploration and develop new understanding on her own. She still has a long way to go and will probably need more support before she will be on her own, but she is now much better equipped for the journey. When she gets support in the future, she knows “the rules of the game” and, as the end of this session shows, she won’t let show & tell, show & follow presentations last too long. Now she can grow and develop towards being a self-sufficient end-user who can experiment with new versions of different applications with reduced dependence on other more knowledgeable users.

This type of constructive knowledge as illustrated in this case study, is important for the end-user who needs to get control over the technology in a continuously changing environment (see Chapter 4). The end-user, who can gain control over the technology, will be able to get out of the novice-advanced loop of computer users (see Chapter 4) and will be able to continuously develop and enjoy technology change. Recognizing this type of knowledge as the user’s main need is essential for any trainer who is sincerely interested in responding to the end-user’s real needs.

The following table summarizes the four stages of the training development process, with major categories and characteristics that emerged at each stage of the two case studies. It reveals how the training evolves from the typical product-oriented, step-by-step instruction into Effective Responsive Training that supports the user’s growth towards becoming a self-sufficient user in a changing technology environment. These categories are used as the main source for Effective Responsive Training model described in the next chapter.

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16 At least as far as this case study analysis indicate.
Table 4: The four stage-change process to establish effective responsive training

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>main user's behavioural characteristics</th>
<th>Training methods</th>
<th>Training contents</th>
<th>Training Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance to Change</td>
<td>product oriented step-by-step instruction</td>
<td>hear &amp; follow; &quot;How to&quot;, Where is&quot; questions</td>
<td>show &amp; tell show &amp; follow explanation - &quot;I am the expert&quot;</td>
<td>functions and procedures; mainly word-processing; chosen and sorted by the trainer</td>
<td>one way formal communication, planned and controlled by the trainer</td>
</tr>
<tr>
<td>Transition</td>
<td>mixed environment; starting the process of change</td>
<td>end-user starts taking control; &quot;Can I&quot; questions; supported experimentation; each step needs to be approved</td>
<td>reduced explanations; encouraging limited explorations; actively involved in each step</td>
<td>chosen by the user; specific to the working task; some exploration skills;</td>
<td>user get more control over the process; more open communication based on the user's needs</td>
</tr>
<tr>
<td>Transformation</td>
<td>trainer-supported user's inquiry</td>
<td>free exploration; incidental learning; error recovery; still some &quot;what to do&quot; questions</td>
<td>exhibit acceptance of the new rules; encouraging experimentation; providing scaffolding; identifying gaps and misconceptions; responding to a need with show &amp; tell</td>
<td>exploration tools; safety-net functions; filling knowledge gaps and correcting misconceptions</td>
<td>open co-operative environment; safety and relaxation; enjoyment of the mutual success</td>
</tr>
<tr>
<td>ERT</td>
<td>&quot;let go&quot;; emotional supported user's control</td>
<td>setting the targets; experimentation and exploration; discovery learning; searching for different options; ask for help only when cannot manage</td>
<td>providing emotional safety-net; very little verbal communication; re-enforcing the &quot;new rules&quot;; assessing and filling knowledge gaps; use of humour</td>
<td>functions and procedures serve as material for exploration activities; building constructive knowledge; understanding of main EUC concepts</td>
<td>both recognize the advantages of the &quot;new game&quot;; mutual agreement to play according to the &quot;rules&quot;; enjoyment and satisfaction; working together towards success with the new targets</td>
</tr>
</tbody>
</table>
Nordenbo (1993) (see Chapter 2) sees the "foundation for a didactics for adult computer novices" in the "understanding of the adult global understanding or the intentions, beliefs, and symbolic systems of the adult end-user" (p. 72). In contrast, this thesis and specifically these case studies indicate that the global understanding is not necessarily an entry behaviour, or a set of fixed characteristics of the end-user, and it can be (and should be) changed and developed. The trainer should understand what intentions, beliefs, and symbolic systems the user needs in order to cope with technology change. Comprehension by both the trainer and the trainee of the needed global understanding and search for ways to develop it will lead to a successful training interaction resulting with the user's ability to cope and grow with technology change.

Summary

This chapter summarizes the attempts to apply effective training strategies based on constructivist theories of learning. It describes the intervention process and the training interaction that results from these interventions. A limited attempt is made to identify enhancement procedures that will induce behavioural change of the trainers and to examine its effect on the behaviour of both the trainer and the end-user.

The first part of the chapter described a short, microteaching workshop with eight trainers. It included a pre-test and two short practice sessions for each trainer. The pre-test taken in the beginning of the workshop was used as an indication of the entry behaviour of the trainer prior to any intervention.

The second part described two follow-up case studies with two of the workshop participants and volunteered trainees. These two-hour sessions included on-the-job interventions aimed at giving more control to the end-user. It illustrated the behavioural change process of both the responsive trainers and volunteer end-user trainees. The chapter concluded with a summary of the four-stage change the training went through including the main characteristics of each stage.
CHAPTER 6

TOWARDS A MODEL OF EFFECTIVE RESPONSIVE TRAINING: DISCUSSION AND CONCLUSIONS

This chapter combines the results from the previous two chapters with the relevant literature to characterize the main factors that comprise a constructivist approach to end-user training, which is called Effective Responsive Training (ERT) in this study.

The chapter starts with a discussion of a major theme that has emerged in this study: the controversy between product-oriented and user-oriented approaches to computer training. It explores the sources of this debate in education and training and the current, widespread dichotomy between education and training which characterizes this controversy.

The chapter continues with the search for factors that generate effective computer exposure for the end-user. These factors should respond to the user’s main need as it was described in the previous chapters, namely, the need to control the technology in a changing environment. They should serve as major components in any system or tool designed to support the end-user.

In an attempt to construct a user-oriented training model, the main themes that emerged from the previous two chapters are combined with the relevant literature as it relates to these themes. The themes and the relevant literature, have been organized into three main categories:

1. What end-users need to learn (contents): This section examines learning contents that were taken for granted throughout the last decade, both in research and in practice. We emphasize the type of knowledge needed and the learning skills and contents that can lead the individual to become an independent learner. Two main categories associated with training knowledge are discussed in this section: constructive knowledge and operational knowledge and the classification of the learning content to beginner-advanced material.
2. *How end-users need to learn (methods)*: This section examines learning and instructional methods used in end-user training and focuses on the meaning of *hands-on learning* or *learning-by-doing* when approaching computer technology. It looks at the types of support that will help the user to acquire not only specific skills, but also the ability to become a self-sufficient learner.

3. *Learning environment*: This section looks at the type of environment that supports the user, contextually, physically and emotionally, in his learning efforts. A major focus is placed on the environmental conditions that allow the user to safely and fearlessly experiment with a computer.

### 6.1 Product-Oriented and User-Oriented Approaches

This section extends the discussion started in the previous chapters about the dichotomy between two major training and development approaches, the *product-oriented approach* and the *user-oriented* approach. The focus of this chapter is on the product/user debate as it is reflected in the context of end-user training and support. The researcher maintains that the line between these two approaches is the same as that drawn between top-down and bottom-up approaches and the one drawn between the *whole program* approach and the *gramatic* approach as ways to teach computer programming (Barrie, 1981). In a broader perspective, the debate is part of the controversy between *behaviourism* as the theoretical background of *instructional design system* (IDS) and *constructivism* as the foundation for *active learning* (for details see section 2.2.). Though there are some differences, mainly in emphasis, between these viewpoints, they share major similarities in their educational “belief system” with a distinctive line separating those holding “educational” beliefs and those focusing on “training.”

The same type of distinction as described above is found through the various attempts in the literature to distinguish between training and education. Training is usually viewed as a discipline dealing with the details and application of knowledge, while education is about patterns, theories, and understanding (Dearden, 1984; Lloyd, 1990). Resnick (cited in Watkins, 1995) views training as focusing on “acquiring specific competencies rather
than generalized skills, contextualized reasoning rather than symbol manipulations and tool manipulations rather than thought activities" (p. 9). Schoenmaker (1993) describes training in the workplace as follows:

In business the focus is primarily on training, rather than education. A difference is that, in training, objectives are precisely defined and related directly to knowledge and skills to be applied in the workplace (p. 182).

The cornerstone of this approach to training in the workplace is the **instructional system design** (ISD) approach (Gagné, 1965, Gagné and Briggs, 1979, Gagné et al., 1988) which is still the dominant approach to training, guiding most of the training programs in the workplace. This approach is in agreement with the **computer Centrism** described by Pearlstein, (1991) and with Hodgson’s (1993) dissemination orientation.

Following the attempts to identify and meet the end-user’s “real needs,” as they were presented in the previous two chapters, this chapter argues that in an era of continuous change, the border between “education” and “training” must be removed. Only by embracing Hodgson’s (1993) **developmental orientation**, and other constructivist principles (see section 2.2.2.) that view the human user, rather than the machine, as the target of training, will there be a real change in the way the user’s training is perceived and, with that, a trend toward common training practices. Such a change in perception and consequent training approaches can lead to a more self-sufficient user who can control the technology and continuously develop along with technology.

### 6.2 Factors that Generate Effective Computer Exposure for the End-User

This section addresses two major questions that generated from the above discussion and from the various studies dealing with adults’ computer use.

1. Can adults acquire autonomy in their everyday use of technology?
2. If it is possible for adults to acquire autonomy in their everyday use of technology, what is the best way to foster it?

Almost two decades ago, Barrie (1981) searched for possible solutions by looking at instructional methods:
What is it about this learning experience that made it one so dominated by the learners’ unhappiness? Would it not be possible to reduce or eliminate negative feelings through changes in instructional design? (p. 17)

Although technology has gone through a few revolutionary changes, and computer literacy is at a different level than it was in the early 1980s, the instructional design questions asked in Barrie’s time and the training methods used are still very much the same. However, one important element that should now be addressed is the continuously changing environment of computer exposure. “What is seemingly useful at a certain moment, might become obsolete the next day” (Schoenmaker, 1993, p. 182). The need to support the end-user in his efforts to handle this change, or as Schoenmaker (1993) presented it, “to ‘empower’ the learner in an individualized learning process”, must be a major factor in any training program.

One conclusion drawn from the discussion of the user’s problems (Chapter 4) is that any attempt to identify effective training and support factors should focus on the educational/training approach taken. Although many attempts have been made to identify factors that generate effective computer exposure for the end-user (e.g. Russon, 1994; Ayersman, 1995; Fournies, 1982), few have tried to re-examine the dichotomy between product-oriented and user-oriented approaches. Further, few studies have contested the dominance of the product-oriented approach in training and support. All the training sessions observed in this study (with the exception of those that purposefully focused on the user, e.g. Chapter 5), as well as the formal training courses and training material examined, were aimed at delivering the product knowledge (functionality). Developing the user’s ability to have effective, lasting computer exposure (usability) were not part of the considerations in these courses.

A common assumption is that acquisition of the product knowledge is enough to support the user. This assumption is in accordance with the computer centrisim approach presented by Pearlstein (1991). However, this thesis supports Schoenmaker’s (1993) claim that: “fixed product models do not apply. We need to have the option of flexibility” (p. 182). We need to build constructive knowledge that will serve beyond the current
learned contents and/or operations, which leads to the search for factors that generate effective computer exposure from the perspective of the constructivist approach.

6.2.1 What the end-user needs to learn

Different approaches to the question of what the end-user needs to learn are presented in the literature. According to Dresling (1990) and Juliff (1990) the typical end-user of the last decade should have "operational knowledge" of the system and the use of basic applications. This type of non-specialist user perceives the computer as a tool for completing tasks. Some scholars have addressed changing technology and the type of knowledge needed to be in harmony with these changes (e.g. Dresling, 1990, Shoenmaker, 1993). However, most researchers maintained the old distinction between advanced and beginner contents. They viewed a general understanding of the technology, and the skills enabling the end-user to cope with new developments, as advanced information mainly related to the professional or advanced user. Few scholars attempted to analyze the type of knowledge required to keep up with the changing technology. Even fewer questioned the product-oriented approach or the existing beginner-advanced sorting of the knowledge.

The consequence of the prevalence of the views just discussed is formal training that focuses on software features and functions, as it did two decades ago. This product-oriented training sometimes helps users master the mechanics of software but does not adequately prepare them to use computers effectively (Karten, 1986). As was described in the previous chapter, formal training then results in minimal use of available computer functionality, poor retention of information, and no transfer of the learned contents, even when the user spends significant amounts of time, effort, and money on learning to use the computer effectively.

Lewis (1993), in his attempt to challenge formal training, examines the characteristics of the new knowledge. In the rationale for his just-in-time knowledge transfer (JITOL) model, Lewis presents two characteristics of the new knowledge: a) the dynamic nature of the learning process and (b) the appropriateness of knowledge provided to solve actual problems. He describes the following characteristics of the new knowledge:
Today's state of knowledge is becoming increasingly complex, quantitatively difficult to comprehend and constantly changing. Therefore, it is more and more a challenge to select appropriate information for individuals to enhance their knowledge or to solve specific problems. In consequence, only knowledge bases which progressively integrate learners' requirements stand a chance of meeting real needs. This is true for learners at early stages of training and for the updating of highly-skilled professionals (p. 179) (emphasis mine).

The data collected in this study support Lewis' (1993) perception of the new knowledge. Lewis’s conclusions led him to attempt to develop a computerized responsive training system which would deal with the increased complexity of knowledge and “progressively integrate learners’ requirements”. This study examines the existing and widely-used human responsive training to understand the ways this supporting method responds to the user’s needs and, primarily, to search for ways to improve its functioning.

In this section the researcher attempts to combine the knowledge concepts as they are they are presented by Karten (1986), Lewis (1993), Shoenmaker (1993), Hodgson (1993) and others with the themes that emerged in the previous two phases. The purpose of this is to identify the main characteristics of the knowledge that will respond to the end-users needs as they were defined earlier. Three categories are included in the necessary knowledge:

- **The function of knowledge**: discussing the implications of the product orientation-user orientation debate as it is reflected in the selection of training materials that support the building of constructive or operational knowledge.

- **The classification of knowledge**: examining the criteria for classification and selection of the EUC contents into novice and advanced contents.

- **Constructive tools available for the end-user**: computer functions and operations that could support the end-user in his striving for autonomy and give him more control.

**Constructive and Operational Knowledge**

The question “What type of knowledge is needed to support the end-user?” is connected with the continual attempts in the literature to differentiate between training and education. Mandefrot (1997), in his wide review of the end-user literature, summarized the topics dealt with in the literature (p. 31). He found a substantial literature on single
software programs, learning to program, classification of users and other topics. However, none of the hundreds of titles reviewed by Mandefrot (1997) deals with the question of what has to be learned. This narrow focus of training is widely taken for granted. The prevalent assumption is that the skills that have to be acquired are the specific operational functions.

As has been presented in the previous chapters, focusing on specific skills, or using product-oriented training gives the end-user momentary relief. However, a user who has received product-oriented training eventually finds himself caught in the novice-advanced loop (Chapter 4), unable to cope with the endless functions and with the continuous change of technology. He is likely to become confused and frustrated and will likely have to rely on the support of those who have managed to acquire generalized skills and contextualized reasoning (Watkins, 1995). These later individuals eventually become the responsive trainers, or the "Freds."

The data and themes that emerge from this study support the claims made by Lewis (1993) that with the changes occurring in technology, the simplified form of product-oriented training does not match the needs of the end-user. The narrow view of training and practice in product-oriented training does not support the end-user in his efforts to keep up with the changing and increasingly complex technology.

Attempts to categorize the training content dealt with in this study revealed two main themes: constructive knowledge and operational knowledge. These two themes distinguish between knowledge that supports the end-user in the long run (as can be seen in Chapter 5) and knowledge that simply helps the end-user to make another temporary step or solve a specific problem (Chapter 4).

In light of these two main themes, it is interesting to re-examine the literature (as part of the grounded theory effort), and to find that this type of classification of knowledge already exists in different contexts. This search leads to the distinction between constructive and operational Knowledge as described by Shoenmaker (1993) and the similar one made by Hodgson (1993) (see table 1). Although these researchers apply the
concepts in different contexts than are studied here\(^{17}\) (which is why these important sources were ignored before those themes emerged from the data), the characteristics of these two types of knowledge are consistent with the descriptions that emerge from this study. Not surprisingly, similar lines can be drawn from these descriptions to the distinction between education and training and further on to the distinction between the Instructional System Design (ISD), (e.g. Dick and Carey, 1990) approach and constructive learning (Kintsch, 1993; Honebein et al., 1993).

Shoenmaker (1993) defines operational knowledge as follows:

> Operational knowledge addresses facts and procedures. Much of CBT of the drill and tutorial types is directed towards acquisition of this type of knowledge. This type of knowledge is objective, and particular or specific in terms of the model of relationships which we can apply to the content structures involved.

He continues with the need to build constructive knowledge:

> The constructivist view is based on the belief that knowledge is personally constructed from internal presentations by individuals using their experiences as a foundation. So individual experience is essential and one builds his ‘own world’ in learning. Seen from this perspective, we have to ‘empower’ learners with knowledge construction tools, with which they can create experience [and learn]...Of course since there is by definition a high degree of learner control in this sort of approach, evaluation will mostly take place around deliverables. (p. 184) (emphasis mine)

Hodgson (1993) argues that the selection of type of knowledge is “primarily more a reflection of the dominant educational and belief systems than it is of the intrinsic logic of computers” (p. 33). This important idea leads to the understanding that we are dealing not with mere semantic or technical differences but with fundamentally different philosophies.

Holding the “educational belief system” as represented by Hodgson (1993), this thesis supports the assumption that the type of knowledge developed should be viewed as “a process engaging with and attributing meaning to the world” (item 1 in table 2). An EUC training course should be “based on process of planning, deciding and experimenting”

\(^{17}\) Shoenmaker deals with new directions in developing educational technology. The two types of knowledge are part of a larger model of knowledge types. Hodgson (1993) is dealing with types of
and not on "organized sequencing of course material" (item 6). Finally, learning should not be only the "acquisition and addition of facts, concepts and skills" (Item 2).

Examining the user's problems as related to the type of knowledge with which he was engaged, and mainly the difficulties non-beginner users had, strongly supports the above approach. As the previous two chapters show, users who acquired operational knowledge were able to use this knowledge only for a specific task, and only if practical use followed the learning. Otherwise, users were caught in the novice-advanced loop without being able to cope with new versions, systems, or tools. The lack of the heuristics skills and "enhancements of personal competence, irrelevancy of the learned content" and other elements described by Shoenmaker (1993) and Hodgson (1993), made "the product-oriented facts, concepts and skills" ineffective for the acquisition of new knowledge emerging from the new developing technology.

**Beginner and advanced knowledge**

Previous research results indicate that only a fraction of the computer functionality is actually used. Some researchers estimate that users recognize or actually use in their applications less than ten percent of a computer capacity (Napier et al., 1992, Shoenmaker, 1993). These statistics relate only to the limited applications that the end-users are using. The actual ratio between the functions that are actually used and those that are available should be much lower, considering the limited number of applications used by most of the end-users. This conclusion is strongly supported by the present study in which a majority of the users and trainers viewed most of the non-word-processing applications as advanced applications that were rarely introduced to the end-user, unless a special request was made. Furthermore, even with the word processor, the only application that was frequently used, a small portion of the functions were considered basics and actually used.

In searching for explanation to the limited use for computer functionality the theme of beginner-advanced criterion emerged. This was a theme that repeated in all the observations, interviews, and records examined. Our study revealed a theme not
discussed in the literature or with computer instructional designers and trainers. The beginner-advance criterion has a major effect on the choice of topics, applications, functions, and skills made by trainers and training programs. The criterion used for choosing the learning contents do not reflect the changes in computer technology, or, more importantly, the changing needs of the end-user. Specifically, they do not reflect the recent advances, which have made a variety of computer functions, applications, and exploration tools accessible to the lay end-user. Nor do they reflect the novice user difficulties resulting from this growing functionality (Chapter 4).

A unified approach of trainers and training agents to sorting the computer modes of operation was found in both formal learning (in classes and in written material) and in responsive training sessions. For most users, the computer was associated with the word-processor. Their main effort was spent on acquiring the ability to use the computer as an advanced typewriter. Furthermore, most of the users interviewed (and all of those interviewed in an academic setting) reacted with surprise when asked: “What do you do with the computer except word-processing?” A common answer was “What do you need the computer for except word-processing?”. Both trainers and users commonly responded “This is too complicated” when asked to give their perceptions of graphics, spreadsheets, or databases.

Considering the extensive development of various tools and computing environments, and the tremendous change the computer has undergone, it was alarming to discover how far apart the technology is from the common end-user.18

**Criteria for classifying beginner and advanced knowledge**

While searching for an explanation of the gap between functionality and usability, and the limited use of computer functionality, as was presented in Chapter 4, an interesting phenomenon surfaced, namely, the historical criteria for sorting knowledge. While in

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18 To be accurate with the data, it is important to mention that mainly in the last year, a new different trend of computer use has emerged and started reaching the adult end-user: the Internet. Although the use of the Internet could serve as a good example of employing the principles presented in this thesis it is beyond the scope of this thesis. In this study, only one subject asked for support using the Internet and even then, the problem was technical and not functional. The Internet should and probably will take a major role in future end-user studies.
most curriculum-development theories and practice there is usually an understanding that any instructional design should look at both the nature of knowledge developed (including the changes it has undergone) and the learner’s needs. When it comes to end-user training the picture is different.

Observations and examination of learning material reveal a different unwritten and unrecognized criterion, namely, the historical (or pre-GUI) perception. According to this criterion, advanced functions and applications are those that are complicated, difficult, or did not exist under the pre-GUI command-driven operating systems.

Through this study, it has become clear that the classification of knowledge, by formal and non-formal trainers and training programs, was not based on an examination of the new ways functions and applications are used, nor did it look at those functions that could give the user more control. The major selection factor was the traditional perception taken from the DOS era, when users could not work on more than one application at a time, and anything other than word-processing was generally considered too difficult to try.

An extreme example of this approach is Merriam, who tried to register for a Windows 95 course. The course registrar informed her that if she really wanted to benefit from the course she “has to take Windows 3.1 first.” Merriam spent another month, and a couple hundred dollars learning an obsolete operating system that functions quite differently from Windows 95 but which was considered “the very basic” for the school she chose to attend. In her interview, Merriam cited her Windows 95 teacher, who assured her that she wouldn’t understand Windows 95 unless she first learned Windows 3.1. Examination of the learning materials Merriam received for the Windows 95 course confirmed the teacher’s assumptions. The Window 95 course was built on concepts and keystrokes taken from Windows 3.1 and it continuously compared the systems.

At first glance, the advice to take the Windows 3.1 course appeared to be a marketing technique to get students to register for two courses. However, additional discussions with trainers revealed that they honestly believed Windows 3.1 to be the foundation for Window 95. Many of them even added DOS to the “foundations” list. This is analogous
to recommending that driving students start their driving experience with a manual-shift
car before driving one with an automatic transmission.

Hannah had a very similar experience when she was required to take a WordPerfect 3.1
course (in 1996) as part of an unemployment re-training program, before she was allowed
to take a Microsoft Word 6.0 course. Only when she started to work did she realize the
extent to which the time and energy she spent on this government-subsidized course was
wasted.

This approach of seeing the new technology as “advanced material” and the old
technology as its basis is a theme repeated throughout this study. During the training
sessions, the traces of the old systems are mainly evident in two ways: the classification
of functions as either “easy” or “difficult,” and the selection of operating methods to
activate these functions. Trainers’ remarks such as “You don’t need that, it’s too
advanced” made by Simon when Michael chose the graphic icon (Chapter 4), are
common throughout the scripts. Usually, trainers who came from command-based
systems avoided the use of the mouse or menu-driven commands whenever they could.
They also frequently replaced them with memory-based keyboard commands. This type
of work does not encourage the use of the major feature of GUI systems, which allows the
users to find the functions as needed rather than loading their memory with lists of
keystroke commands.\footnote{More examples can be found in Chapters 4 and 5.}

The conclusions drawn from this thesis are that:

- GUI-based applications and functions that go unutilized are not necessarily more
  complicated or difficult to learn simply because they were complicated under the old
  systems.

- The traditional criterion for sorting computer knowledge is one of the factors that
  prevents end-users from accessing new applications and functions that are actually
designed for them.
In many cases (as demonstrated in Chapter 5) using some of the new functions can help the user solve his problems and mainly supports his confidence and control.

**Constructive tools available for the end-user**

Chapter 5 presents a few attempts to identify and develop constructive knowledge. A major focus of these attempts was on encouraging the end-user to employ computer functions that could support his knowledge building. While in pre-GUI (or pre-Windows) computing, the user could search and discover the computer functions only after becoming a fairly advanced user, the Graphic User Interface (GUI) environment allows the user to experiment with and explore the computer once he is familiar with a few basic skills.

Shoenmaker (1993) described the new technology tools (or media tools in his terms) which could serve as “construction tools, with which they can create experience” (p.184):

He suggests that: “The degree of interactivity with the learner is related to the user’s actions. Current system software supporting the use of windows, menus, icons, pointing and dragging gives us basic elements to implement various kinds of interactions [and explorations]”, p. 184.

A major question that has been raised through this study is whether the availability of these new construction tools affects the choice of EUC contents presented to the learner. Specifically, it is interesting to examine whether trainers and training programs altered their perception concerning novice or advanced material as a result of the changing technology to include construction tools or as it referred to here, constructive tools that include functions and other computer tools that could support the end-user in his striving for autonomy.

Four groups of functions and procedures that, if used properly, will provide the end-user more control and will support the end-user in his strive for autonomy, emerged from the previous two chapters. These included the following:
1) **the taken-for-granted functions**: Important, simple fundamental functions that any end-user should know and yet were taken for granted by the trainers and training programs.

2) **Safety-net functions**: functions that allow the user to safely experiment with the computer.

3) **Organizational functions**: e.g. file management.

4) **Customizing functions** that allow the end-user to control his interface and the variety of functions available for him.

**1) The functions taken for granted:**

Many examples of the “taken for granted” functions were described in Chapter 4 and Chapter 5. These examples included users who did not know how to turn on their computer, how to save and retrieve their documents, or the meaning of very basic symbols and icons. The main difference between the two chapters is that in Chapter 5, emphasis was placed on the diagnosis of misconceptions and gaps in knowledge. In these instances there the trainer managed to identify and correct the problem and restore the end-user’s confidence.

In the following example, Isaiah and Ruth are searching for text saved on Ruth’s floppy disk:

Isaiah: “We need a document with a text on it. Stick it in (the disk), we will see what happened.”

Ruth: “I am not sure which way, (trying to insert the disk) like that?”

Isaiah: “Yes, right, in there”

Ruth: (looking at the computer, waiting)

Isaiah: “Nothing happens until you ask it to happen...”

Ruth: (hesitates) “I am not sure, can you help me?”

The descriptions of the misconceptions and the lack of understanding of the many features that are rarely explained to users is a research topic in itself. For the purposes of this study, it is important to emphasize the need to re-examine the trainers’ perception of
advanced and beginner functions and, of main importance, to identify those functions that are taken for granted. The best way to discover what the end-user needs to learn, where he is stuck, and what functions support his confidence and independence, is to use constructivist support that is built on the user’s needs, as they reveal through the learning process. Using this type of support, or Effective Responsive Training, is presented in Chapter 5. It demonstrates, along with other skills, the methods used to identify the lack of the very basics and the end-user’s misconceptions.

2) Building a safety-net:

The category of safety net included functions that allowed the user to feel free to explore the computer, knowing that he is on safe ground and will always be able to return to his starting point or to get back his original document. Two such functions were found to be essential support for the user’s confidence once they are used properly: the saving and undo functions.

The undo function, which is one of the simplest functions available to correct almost any mistake, was hardly used and was seldom introduced by the trainers. Once introduced and practiced properly, as was demonstrated in Chapter 5, it had a major effect on the training environment. Understanding the reversibility of his actions and knowing that nothing serious could happen allowed the user to feel safe to experiment.

The scarce use of this function could support two main themes that emerged in this study:

1. The approaches taken by trainers and training systems are product oriented and not user oriented. They attempt to convey sets of functions rather than the ability to explore those functions or to feel comfortable using them.

2. The undo function is reasonably new, at least in its current simple form. The fact that this important tool is rarely used supports the assumption made earlier, that the perception of novice-advanced functions is determined by traditional methods and not by the actual difficulty or the significance of the function in supporting the end-user.

Save functions the problems users have with the saving functions and their related misconceptions were presented in the previous chapters. This save-related group is
another example of functions that are taken for granted and are perceived incorrectly by trainers as being obvious. Incorrect use of these functions caused almost all the participants of this study many serious troubles. The repeated misconceptions and the difficulties users have with these functions, which were described in Chapter 4, are indications of their complexity. This complexity is not understood by the trainers and is not presented in a proper way, either on-line (in the menus or the help) or in any of the sessions observed.

Attempts to deal with the save-related misconceptions and other knowledge gaps are presented in Chapter 5. The discussion and examples given there lead to the conclusion that only effective responsive training, focusing on the user's development, provides the means for the trainer to identify these problems and hence, to deal with them.

Organizational tools

Another important development that supports the user's control is the presence of those functions that allow the user to store his document in a designated place under an understandable meaningful name. However, as indicated in Chapter 4, these functions are scarcely use in this way.

A typical example of introducing the saving and organizational functions is taken from one of the instructional manuals (taken from a 1996 workbook used by Ephraim):

> When the cursor is blinking in the upper left-hand corner, right under the "File Name:" title, type in the name for your report, "ABCFGH" (which can be up to a maximum of 8 letters). Click on the OK button in the upper right-hand corner. WORD will now save your report on your hard drive (emphasis mine).

This type of instruction was found in many other examples and is a very typical way to introduce the saving/filing procedures. As with pre-GUI saving procedures, the term file is neither well-explained nor particularly meaningful, and files are not saved with a meaningful name or in a meaningful folder (file/directory), but just "on the hard drive."
File-finding procedures are based on the assumptions that one does not sort one's files and that one does not work with more than one file at a time (as in the old times):

Click on “Exit” to exit WORD. Then start WORD again and click on “File”, then click on “Open”. Find your report in the list of names represented along the left side, click on it, and then click on OK in the upper right-hand corner...

After reviewing similar instructions, it was very clear why users who used the computer for many years, some of whom were using very advanced applications (e.g. the example of Leah in the Problems discussion), did not know that they could sort their documents. Such evidence suggests that most of the developments intended to make more advanced functions accessible for the end-user (and with that to give him more control) are neglected, and the old practices are maintained.

Customizing tools

As described in the problems section (Chapter 4), very few users used more than a few icons on their toolbars and none of them knew what the rest of the icons meant. The trainers and instructional material treated the icons as a form of fixed templates with fixed contents and location (the same type of templates used in old DOS-type word processors, but this time they were activated with the mouse):

To complete the formatting of your heading, you want to centre it. Just to the immediate right of the “U” underline bottom on the Formatting Toolbar, there are 4 buttons with horizontal lines on them... (From the instructional book used by Ephraim)

Many of the problems described in the Problems discussion (e.g. Rachel), were results of this approach that left the users helpless and confused when their computer’s default toolbar was different from the one used in the class. None of the users knew that the interface is customizable, as are the toolbars and keyboard. None of them were introduced to the various customizing and option tools available in most of the advanced word-processors or tried to use the help function to learn how to use these functions. Many of the complaints described in the problems section regarding word-processor functionality (e.g. Joseph, Chapter 4), represent the user’s lack of knowledge as to the availability of these tools as well as their inability to use the help as a learning aid. All the above
functions were considered advanced, although they could solve many of the novice's problems and give them more control.

This thesis takes a different perspective regarding these functions. It proposes that any function that can help the user gain more confidence and more of a sense of control should be considered basic. Furthermore, it suggests that with the new tools available for the users, utilizing these functions is not more complicated than bolding or italicizing fonts. The common novice-advanced sorting is a result of a traditional computing approach and training methods and does not represent the actual difficulty of these functions.

6.2.2 How the end-user needs to learn:

The training/education debate and its implications on EUC instructional methods

The discussion regarding effective methods of supporting the end-user in his learning efforts has been an ongoing debate during the last two decades. In her literature review, Barrie (1981) describes different approaches to computer programming instruction. Although almost twenty years have passed since she did her study, and the main subject of computer instruction today is not programming, the dilemma of choosing the right instructional method is still very much the same.

The argument central to the discussion regarding teaching programming, which is relevant to any other domain of teaching, is similar to the dichotomy described in the previous section discussing constructive and operational knowledge. In the historical case the argument presents the distinction between the “top down” or holistic approach and the “line by line” or grammatic approach.

Yourdon (1975) suggested teaching a person to program in top down hierarchical fashion instead of looking at the program line by line in order to reduce the “cognitive load” involved in understanding how a program should function. A similar method is the whole program approach suggested by Bork (1980). In this approach the learners are introduced to a conceptual model of a program at the beginning of a course, in order to focus
attention on what the program is intended to accomplish instead of on the details of the grammar and syntax.

*The spiral approach* (Shneiderman, 1977) combines the more holistic approaches with the grammatical approach by introducing students to small increments of semantic and parallel systematic information, while providing them with a meaningful learning set (Ausbef, 1968; Bruner, 1966). This contributes to the ability of the learner to integrate new knowledge and new experience into a new meaningful set, or, as was presented by Mayer (1975), “An important variable in instruction, in addition to the presentation of needed facts, is the presence or absence of a conceptual model” (p. 733).

The contents of learning have changed dramatically since the time of Barrie (1981), Mayer (1975), Shneiderman (1977) and others. The belief scholars held two decades ago, that with new technology development this discussion would become redundant, has not materialized. Technology did not reach the stage where it could provide the typical user with enough tools to become self-sufficient.

The search for instructional methods that combine meaningful conceptual models with the teaching of the detailed facts has been a part of theoretical discussions since Shneiderman (1977) presented his spiral model. However, the dominant practice, whether in programming or in teaching computer applications, focuses on operational knowledge while perceiving its main role as being the transfer of facts, or “having the attitude of computer centrism” (Pearlstein, 1991, p. 1).

The belief that everyone is as fascinated as computer professionals with the details of computer systems, and that everyone who uses computer systems should have extensive knowledge of them” (p. 1).

Pearlstein (1991) concluded that:

> When *computer centrism* drives design, training is lengthy and supplies few job aids, provides information on most system functions, and does not enable most users to do much of anything when they return to work... And, when *computer centrism* is entrenched, it is difficult to institute more suitable performance improvement interventions.

Recognition that the model used was not effective is not enough to overcome *computer centrism*. As presented by Hodgson (1993), “The methods and contents chosen by
instructors are primarily more a reflection of the dominant educational and belief systems than it is of the intrinsic logic of computers” (p. 33). As long as the product-oriented approach is dominant in the ‘educational belief’ of training, while education and training are considered to be separate domains, introduction of an holistic-constructivist belief system which is perceived as ‘educational’ is impossible.

One example of training professionals’ inability to cross the border between the two separated worlds can be taken from an attempt described in the literature to develop “new approaches to train adults to use computers” (Carter & Honeywell, 1991). Carter & Honeywell (1991) analysis of older users’ difficulties, reflects the findings described in Chapter 4. They attempt to present an alternative approach to train adults to use computers. They argue that:

The problem is more than likely your approach to instructional design. While older adults can learn new technologies and information, they do require a different methodology of learning than do younger adults...start planning instructional approaches that foster success (p. 9).

Until this point, it seemed that Carter & Honeywell (1991) were in agreement with Pearlstein's criticism and with the constructivist approach adopted by this thesis. But then they describe the reason why adults need a different approach. It is not because we have new technology that can allow us and in a way force us to do things better; not because the old ones did not work even for the young adults and therefore we have to look for better methods. The main reason we have to treat adults differently is that: “... there is a significant difference in the ways younger and older people process information into memory...this can be a critical issue in training” (p. 9). In other words, traditional, rote memory-based training is acceptable for younger adults who can load their memory with hundreds of facts, functions, and key strokes. With older adults one should consider different instructional design. The authors make some important suggestions that should not be ignored, such as “the need to translate computer concepts into lay terminology” (p. 10). However, the body of the article includes a very standard class-oriented instructional design, which emphasizes the “content delivery” and the “logical, meaningful sequence” of instruction.” Most typical is their perception of the hands-on-approach:
Computer training is further complicated by the requirement for hands-on training and practice. Other methods of training will re-enforce the subject matter but there is no escaping the fact that to learn to use the computer, the student will have to press the keys. (p. 10) (emphasis mine)

Carter & Honeywell, (1991) perceive the concept of hands-on-approach literally as the old users’ need to press the keys. As was discussed in the literature background, the concept of a hands-on approach, or learning-by-doing, is assigned totally different meaning in the two worlds of ‘training’ and ‘education.’ When it comes to training, and as was continuously observed in this study, seeing only the literal meaning of hands-on approach is a common practice in almost any area of training.

Does it take the form of learning-by-doing as perceived by constructivist theories? As far as the data of this study indicate, unless specific effort is made to change the training perception, the literal approach remains the common practice. However, as has been indicated in Chapter 5, attempts to change this approach can lead to a totally different type of learning.

Like most of the instructional design studies, that of Carter & Honeywell (1991), with their “content delivery” focus, remains within the traditional instructional design, in spite of its inability to deal with the fast pace of technology change, as it is reflected in the Problem discussion (Chapter 4). The problems users have indicate that as long as trainers locate themselves within the traditional instructional design side of the educational debate --a camp that views the role of training as content delivery along with all the other elements found in the first column in Hodgson (1993) (see table 1, in Chapter 2) -- the gap between technology development and the user’s ability (young or old) to cope with this development will increase.

Most of the previous studies, which take the operational knowledge approach, do not consider the following factors supported by this thesis and mainly by the change process presented in Chapter 5:

1) Learning to use the computer is not only a product of a teaching process but is also a learning and personal development process (Hodgson’s category (3) in table 1).
2) Learning to use the computer is a three-way learning process that includes a continuous feedback loop among the user, the trainer, and the environment (including the computer) (Kaptelinin, 1994). Through this process, the characteristics of each node undergo continuous change. Therefore, the characteristics of the user and his global understanding of the computer technology are continuously changing and are strongly dependent on the computer system he is using and on his learning. As a result,

3) the user should not be treated as a fixed entity, but as a learner who is developing and changing through the learning process and with the changing technology as shown in Chapter 5.

This thesis suggests that, in order to support the end-user in his efforts to stay up-to-date with technology change, overcoming computer centrism should be a major target of any training design or implementation. Closing the gap between ‘education’ and ‘training’ by introducing constructivist approach into the product-oriented training systems is necessary to create a system that responds to the user’s needs in an era of a fast changing technology.

Learning by doing and the step-by-step approach

The data collected in this study through observations, interviews, and examination of course materials regarding methods employed by the trainers supports the existence of the main dichotomy described above. It differentiates between methods that support the acquisition of constructive knowledge and those that take the product-orientation viewpoint and focus on the transmission of operational knowledge. In compliance with the training literature, the dominant training behaviour both in formal and non-formal situations was directed towards the transmission of operational knowledge. However, as demonstrated in Chapter 5, constructivist methods or as it was called here, Effective Responsive Training, can be applied to end-user training.

In the search for effective training methods that support the user’s need for control, an important theme that emerged from the data as well as from the literature was the
concept, originally taken from constructivist approaches, of learning-by-doing (LBD). At first glance, it seemed that everything done in modern computer training is connected to LBD. However, a further analysis of the data brought up another theme. It clearly exposed the contradictory meanings assigned to this concept by different trainers, program developers and scholars.

As was found in the literature (see section 2.3.4), the term learning-by-doing (LBD) or its analogue term hands-on approach, appeared as the “politically correct” terms used by any trainer interviewed and by any instructional booklet examined through this study. At first glance, it seemed that a real change in training perception did occur. However, re-examining the practical meaning assigned to LBD by different people, indicated that the term LBD holds different meaning for different people, depending on the ‘educational belief system’ of the term user, which take us back the ‘training’/‘education’ debate.

One example was already given in the previous section with the description of the way LBD was perceived by Carter & Honeywell (1991), who described traditional formal methods as effective methods to “re-enforce the subject matter.” However they maintain that: “there is no escaping the fact that to learn to use the computer, the student will have to press the keys” (p. 10). For them, and for almost any trainer met through this study as well as for any help-line and guidance booklet, the fact that the user is “pressing the keys” means he is translating the learning from presentation-based instruction to LBD.

The widely used term for this approach is step-by-step approach. Chapters 4 and 5 suggest that the main training characteristics of this approach are: show and tell, show and follow, and error prevention ready to go learning situation (see details and examples in section 4.4.5

The step-by-step approach:
- “protects” the user from making errors or selecting wrong options
- is based on memorizing specific sequence of operations
- prevents the user from taking any opportunity to make his own decisions
- does not encourage the user to try any option that is not in the “ready to go set”
- does not expose the user to the “not-chosen” options
As a result the user is:

- totally dependent on memorizing the “right” sequence;
- confused and lost when he makes an error or comes across features that have not been presented in the original “set”;
- totally dependent on being shown what to do; unable to search or find functions to which he has not been introduced.

The *step-by-step* approach, with the above characteristics, is the most common approach taken by the trainers observed and interviewed for this study (see section 4.4.5.), excluding those that were successfully trained to practice ERT methods, as was described in Chapter 5.

This type of *step-by-step* training was typical to all training sessions observed. An even more linear and strictly *product-oriented* approach is taken by any training material examined. Some examples from written manuals were presented earlier. The following example is taken from Ephraim’s training material, which introduces the use of MS Excel:

Click in the cell where you want to enter the text or value. Type the text or number date. Press [Enter] or click the Enter box in the formula bar. Select the cell that will display the answer. Click a...Press...Type...Repeat steps 4 and 5 as needed to complete the formulas...Press [Enter]

This format dominates Ephraim’s self-instruction manual as well as any other material examined. Terms and operations such as “search”, “find”, “explore”, and “try” were never found in these materials, though these would be the ones most important to an independent user. In his interview, Ephraim insisted that he is taking a hands-on approach and his instructional booklet is a good example of *learning-by-doing*, or in his words: “they have to touch the keys and to make the selections, in-order to learn”.

This type of *learning-by-doing* is definitely not what was meant by the ”educational belief system” represented by the *constructivist* approach. The *constructivist* approach viewed LBD as a method designed to encourage the self development of the learner and “to support the individual’s own attempts to construct meaning through interpretation, re-structuring and use of new knowledge” (Brown & Palincsar, 1989).
Constructivist learning-by-doing

While examining the learning process, it became clear that the above step-by-step instruction is not the type of learning that the constructivists envisioned (see section 2.2.2). The data collected indicated that these step-by-step procedures did not support long-term goals. Even those users who were happy to overcome a problem they had by getting this type of support, eventually admitted that they did not retain much after the session. In all cases, they had to go back and explore the same functions by themselves and then they became confused and frustrated.

Based on Lewis (1993), Hodgson (1991), the constructivist literature (see section 2.2.2), and on the data collected here, this study maintains that only the development of appropriate heuristics and exploration methods that the user will be able to use after the training or in the global task environment (Honebein et. Al, 1993), will result in real, long-lasting learning, and will support the user in coping with technology change.

Carroll (1990) drew three important practical principles for LBD:

- Allowing learners to start immediately on meaningful realistic tasks
- Reducing the amount of reading and other passive activity in training
- Helping people to make errors, and making error recovery un-traumatic and pedagogically productive.

These principles should be major factors in any system designed for efficient and effective learning of computing tasks. They serve as a foundation for building the user's confidence and sense of relevancy and productivity, which are key factors in any adult learning. However, these principles were drawn up at a time when the number of applications and functions the user had to control was limited\textsuperscript{20}. Keeping in mind the fast pace of change since Carroll's experiments, further attention should be given to other aspects of supporting the end-user. It should include those principles supporting the end-user not only in his efforts to learn a few word-processing functions, but also to those supporting his ability to keep pace with the continuous development of technology and to be in control of his computer system.

\textsuperscript{20} Carroll did his experiment on a very small selection of word-processing functions.
In order to encourage the self-development of the individual towards being an independent user, a constructivist approach should be taken; an approach that focuses on this development. This approach should be based on discovery learning that allows the user to explore and experiment with different options and with finding the relevant ones. It should be flexible, giving the user control over the working environment by letting him adapt his working environment to his own abilities and needs, and it should provide the user with technical and emotional support in a form that builds safety-nets, scaffolding, and reinforcement of his exploration and experimentation. This will allow the users to grow in their work with incremental complexity according to their abilities, knowledge, and needs. For example, users can decide which selection methods they want to use and which icons they want to see on their interface.

This type of learning by doing approach views the doing not only with its literally meaning of touching the keys, but more importantly as discovery learning. It emphasizes the "mental doing," including decision making processes, experiencing and recovering from errors, experimentation, and building a conceptual model of the learned contents, as a key factor in the learner's development. Therefore, any learning/instructional system that claims to support the end-user in his endeavor to become a self-sufficient user should examine the meaning it gives to the concept of learning by doing.

**Characteristics of effective responsive training (ERT) methods**

Chapter 5 presents some initial efforts to induce the constructivist approach into responsive training interactions. The results of these case studies combined with the conclusions from the previous chapters and the constructivist's principles (section 2.2.2) formed the foundation for the ERT Effective Responsive Training (ERT) model.

The leading theme of this framework was the main need of the end-user, as defined previously: becoming a self-sufficient user by gaining control over technology in a continuously changing environment (see section 4.5.3). Any method that has been found by this study or in the literature as contributing to this need is considered an ERT method. Any method that causes the user to be more dependent, confused, frustrated or unable to develop with technology change is considered a less effective method.
Drawing upon Carol's (1990) Minimalist Approach, Guilemette's (1991) easy to use system, Hodgson's (1993) developmental orientation and other literature, and from the categories that emerged from this study, the effective responsive training methods (ERT) should do the following:

1. Provide maximum User Control: The user's need to feel control over a system is a major force in user behaviour (Shneiderman, 1980; Barrie, 1982; Guilemette, 1991)

2. Provide effective use of available resources: ERT should help the learner get the most from any resource available to him. "The successful tutor is the one who capitalizes on the strengths of each resource" (Lewis, p. 173).

3. Allow learning by doing: ERT should allow experimentation with the system using realistic tasks; it should provide proper support and scaffolding to promote independent learning (Guilemette, 1991; Carroll, 1990; Carroll & Anderson, 1984; Mullins, 1989; Bo, 1980)

4. Support error recovery: Help in making errors and error recovery less traumatic and more pedagogically productive (Carroll, 1984, 1990)

5. Support incremental learning processes: To relieve the physiological effects of lengthy learning periods and the learner's need to apply the learned content in a fairly short period of time (Ledfgard, 1987; Meads, 1983) the training system (Marcus, 1982, Carroll, 1984, 1990, Pearlstein, 1991) should focus on the initial presentation of a few core functions. More advanced functions and conditions may be disabled until the user gains confidence in the system's use. The user should be able to control the selection of the functions (see section 6.2.1.)

6. Facilitate meaningful learning through conceptual models: Rote memorization of step-by-step procedures usually results in a simplistic, fuzzy, incomplete, inconsistent, inaccurate and unstable conceptual model of the system (Norman, 1983). Meaningful learning may result from presentation of a conceptual model, or model-based training (Borgman, 1986);

7. Adaptive explanation: The ERT should provide different levels of explanations to different level of users

8. Flexibility: The ERT must be flexible enough to accommodate change in the work environment (Shackel, 1986) as well as individual differences among users in task handling (Goodwin, 1987)

9. Friendliness: The ERT should support the user's confidence by providing cues (scaffoldings) to facilitate the user's understanding;

---

21 On this point, Carroll (1990) and Guilemette (1991) are at odds. While Guilemette (1991) suggests that the system should include: "clear information on errors or the state of the system and by alerting the user to potential problems" this thesis supports the provision of error recovery methods suggested by Carroll (1990).
10. **Emotional support:** The ERT should directly provide the user with support to ease feelings of anxiety and frustration (Ayersman, 1995) and reduce the negative emotional reactions.

The approach to ERT taken in this thesis is a continuation of Hodgson's (1993) *developmental orientation* or the *user oriented* approach as opposed to the *dissemination orientation* or the *product oriented* approach.
Table 5 summarizes the difference between these two approaches as it related to training methods used.

**Table 5: Product oriented approach and user’s oriented approach**

<table>
<thead>
<tr>
<th>Category</th>
<th>Product oriented approach</th>
<th>User’s oriented approach (ERT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>User control</td>
<td>achieved mainly by experts; minimal through the learning process</td>
<td>main learning target; essential through the learning process; achieved with conceptual knowledge</td>
</tr>
<tr>
<td>Trainer main role</td>
<td>transmission of knowledge</td>
<td>support the user’s development and independent knowledge building through using of resources available</td>
</tr>
<tr>
<td>Meaning of Learning by doing</td>
<td>touching keys; step by step approach</td>
<td>exploration, experimentation, discovery learning</td>
</tr>
<tr>
<td>Error recovery</td>
<td>errors should be prevented; the user is protected from making wrong selections</td>
<td>error recovery methods are an important part of the learning process</td>
</tr>
<tr>
<td>Learning sequence</td>
<td>all the functions related to the same topic are presented in a linear mode</td>
<td>incremental learning process based on user’s abilities and needs</td>
</tr>
<tr>
<td>Content presentation</td>
<td>memory-based step-by-step, detail-oriented presentation</td>
<td>spiral model, combining conceptual models with the discovery of relevant details</td>
</tr>
<tr>
<td>Level of explanation</td>
<td>predetermined; based on traditional advance-beginner perception of contents</td>
<td>changes with the user’s development</td>
</tr>
<tr>
<td>Flexibility</td>
<td>switching to new environment usually requires new learning</td>
<td>accommodates change in work environment and individual differences</td>
</tr>
<tr>
<td>User confidence</td>
<td>growing up with user’s experience</td>
<td>provide scaffolding and safety-net to support user’s growth &amp; confidence</td>
</tr>
<tr>
<td>Emotional support</td>
<td>achieved through a successful completion of tasks</td>
<td>main concern in any adult training; part of the learning process</td>
</tr>
</tbody>
</table>

This table presents the difference between ‘what is’ and what should be in training, if the user-oriented approach or the ‘educational’ constructivist approach is adopted. The left
column description is based on the data collected as it was presented in Chapter 4, which included the description of 'what is' as it was found in the data. Major sources for the characteristics described in the right column of the table above are the data analysis presented in Chapter 5. This chapter examined the 'what should be'. It described the attempts to promote constructivist-training approach, resulting in the ERT characteristics presented above.

6.2.3 Training Environment

**Training environment as part of the training/education debate**

The training-education dichotomy described earlier continues with the discussion of learning environment, though the gap is not as extreme as with methods and contents. While the *product-oriented* approach emphasizes those environmental conditions that make information transfer easier and faster, the *user-oriented* approach searches for environmental conditions that will allow the user to feel free and safe to experiment and develop heuristic methods that eventually will allow the process of independent knowledge building.

A typical *product-oriented* approach was presented by Carter and Honeywell (1991), who explored ways for "training older adults to use computers." They suggested that, in addition to careful content planning and structured content delivery, the following environmental conditions are necessary for successful computer learning: "attractive surroundings, optimal acoustics, minimal background noise, comfortable seating, adequate illumination, minimal eyestrain and sufficient number of terminals" (p. 11).

**Constructivist training environment for EUC**

The constructivist approach taken by this thesis views the learning environment in a different way. While different constructivist studies emphasize the importance of different elements as essential in creating a constructivist learning environment, there are three key principles that are common to any constructivist environment: global and local
activities, authentic learning environment, and ownership by the learner (Honebein et al., 1993; see also section 2.2.2.). Three more principles emerged from this study (see Chapter 5): safety; relaxation and freedom to explore; and trainer-trainee "contract."

**Global and local activities**

As was explained in the Literature Background (section 2.2.2.), the learning activity takes its meaning from, and should relate to, a larger world beyond the specific activity. What we learn and how we learn are supposed to support our ability to function more effectively in our world. The concepts of *global* and *local activities* distinguish between the current activity and the larger task beyond this activity (Honebein et al., 1993; Collins, Brown & Newman, 1989). The goal of instruction is to provide the level of assistance, or *scaffolding*, that will eventually result in independent performance in this *global context*.

A major question relevant for this thesis is: **What is the global context of EUC?**

Most of the EUC literature views the global context as the application of the specific tool or program learned, (e.g. one learns WordPerfect 5.1 in order to be able to use WordPerfect 5.1 at the office or at home).

Schoenmaker (1991), who studied learning organization factors, emphasized a different approach. He viewed the continuous learning and development of the user as a major factor, suggesting the following:

> Firstly, learning is basically a dynamic and continuous process. Therefore, structured courses at fixed times do not correspond to the nature of learning needs of humans whose main concerns are their daily professional tasks. A continuously evolving, interactive open environment is more appropriate in this situation.

Schoenmaker (1991) emphasized the need for integration of work and learning as a major environmental factor. In his model of *Integrated Performance-Support (IPS)*, he suggested the integration of learning with the work environment, claiming that real learning gets its meaning only within the right context:

> A need for a more flexible and integrated performance-support environment becomes evident. In response to this, integrated performance-
support (IPS) environments deliver to the worker, on the basis of his tasks dedicated training, advice, information and tools ... No resource or medium, such as computers or interactive video, by itself will decide the learning outcome alone. Media only get their meaning in a context. (p. 181)

The arguments used by Shoenmaker illuminate the environmental conditions at the root of the widespread “ask Fred” phenomenon which triggered this study. They explain why users eventually end up with some type of responsive trainers, even after they had been formally trained to use a specific application or tool. Though Shoenmaker presented computerized responsive training, his description is relevant for the human responsive trainer as well:

In IPS support is always available on the basis of a clear work flow describing the worker’s task. Training is taking place closer to the real world situation, it is accessible and learning is very much learning by doing.

Many of the arguments presented by Shoenmaker are well supported by the data that emerged throughout this study. The view of learning as a “dynamic and continuous process,” emerged as a major theme and was demonstrated in Chapter 5. The descriptions revealed by the cumulative data strongly support the notion that the responsive training environment should be flexible, accessible, close to the real-world situation, and allow learning by doing.

However, while Shoenmaker (1991) suggests a continuous support for the end-user, to support his changing needs, in form of “computerized Fred”, this thesis views the local context in a different way. It suggests that the continuously changing environment and the need of training to take place “closer to the real world situation” should lead to a different view of the local context or the training contents. Instead of teaching specific skills and procedures, the local context should include those skills and knowledge building tools that will serve the end-user in the ever-changing global context, as was discussed in section 6.2.1.
**Authentic learning environment**

"An activity is authentic to the extent that it captures the essential characteristics of the target global activity or the environment in which the learning will be used" (Honebein *et al.* p. 3). In the authentic learning environment, the cognitive demands are consistent with the cognitive demands in the environment for which we are preparing the learner (see also section 2.2.2.).

This notion of *authentic activity* explains why most of the participants of this study did not retain much and were not able to use most of the "step by step" training they had received. This training, which included the four main features of: *show and tell, show and follow, error prevention,* and *ready to go learning situation* (see section 4.4.5), had very little in common, cognitively and physically, with the target environment for which the learner should be prepared for. In the user's "real world" environment, the computing environment was usually different and continuously changing with any action he took; in this environment he had to initiate actions and make choices and decisions, and not just follow instructions. In this environment he had to find ways to recover from errors which during his training he was prevented from doing; and mainly, in this environment he was alone. All these in a situation in which he is trying to apply the specific learned contents. Adding to it the continuously changing environment, in which most of the learned contents become obsolete in a very short time (the novice-advanced loop section 4.3.3.1), leads to the confused and frustrated user described in Chapter 4 of this study, or the one describe by Barrie (1981) almost two decades ago.

As was described in Chapter 2, a major argument in the constructivist literature deals with the complexity of the learning environment. Some scholars suggest an environment of *increasing complexity* (Collins *et al.*, 1989; Lave, 1988; Carroll, 1990). Others support the notion that the task and the learning environment should reflect the complexity of the environment in which the learners should be able to function at the end of learning (Honebein *et al.*, 1993; Savery & Duffy, 1995).

The minimalist approach suggested by Carroll (1984, 1990), and the "incremental learning processes" approach (Guillemette, 1991; Legdgard, 1987; Meads, 1983), both
support the introduction of *increasing complexity* environment. This thesis supports the
need of the user to cope with his environment as closely as possible to the global context
to which he will have to apply his learning. Along with Honebein *et al.* (1993), who
claimed that: “We simply must avoid the temptation to simplify the environment and
instead we must search for new strategies to support the learner in working in that
environment” (p. 10), this thesis suggests that the reduced complexity will be achieved
not by changing the learning context but by adding scaffolding, as described in Chapter 2.
This type of scaffolding provided by the *Effective Responsive Training* that identifies the
end-user’s problems, misconceptions, and knowledge gaps, and supports his efforts by
guiding him to find the right solutions (see Chapter 5) will lead the end-user, eventually,
to be able to cope with the complex environment by himself.

**Ownership by the learner**

The emphasis here is on self-directed learning and on the development of the cognitive
and *metacognitive skills* necessary to support it. According to Scardamalia and Bereiter
(1991) (cited in section 2.2.2), learners must have control over their own learning. They
should be responsible for the decisions made through their learning and for establishing
criteria for evaluating their understanding. Only with this ownership will the learner be
able to develop the cognitive skills essential for developing, directing, and monitoring his
learning and performance.

In order to achieve this ownership, the instruction must support the learner in assuming
responsibility for establishing and monitoring his goals and strategies. Based on the
apprenticeship model, the concepts of learning scaffoldings and the zone of proximal
development, as described by Vygotsky (1978), Honebein *et al.* (1993) suggest the
following instructor’s roles:

- Creating an apprenticeship environment with scaffolding designed to support the
learner in developing physical and cognitive skills
- Assuming the roles of consultant and coach
- Refraining from taking over thinking for the learner by telling the learner what to do
  or how to think
- Developing skills of self-regulation to support the learner’s independent growth
Supporting the learner in reflection on the strategies for learning as well as on what was learned.

Supporting the learner's growth of independence and his striving for control was an important theme of this thesis. Any factor included in the ERT model should be directed towards this goal.

Two other categories emerged in this thesis that should be major elements of the constructivist environment. They are: safety, relaxation and freedom to explore; and the trainer-trainee "contract."

Safety, relaxation and freedom to explore

Developing a learning or training culture involves creating an environment where individuals are not afraid of making mistakes (Wilson, 1995). Frustration and fear were two descriptive terms repeated throughout the study. "I am afraid that I will mess up my computer" or, "I don't want to touch anything, I might lose everything" were two types of expressions frequently heard together with real disaster experiences users had that sometimes resulted in losing precious work that had taken a long time to create. Some examples were presented in the Problems section of Chapter 4 (e.g. Rachel). The introduction of basic safety-net tools was discussed in the beginning of this chapter.

However, as has been seen in the previous chapter, a safety-net goes beyond the tools available. It presents a major environmental factor, where the user is feeling free and safe to explore and experiment and encouraged to do so, knowing that nothing serious could happen. This perception is a result of two elements of a safety net:

- The emotional safety net that provides the user with the continuous assurance and encouragement to try and experiment, together with reinforcements approving the steps he is taking. It offers the user partnership in his educational process and an environment of cooperation that supports him in any error-recovery efforts;

- The technical safety net that provides the user with the previously-described computing tools available that allow him to feel free and safe.
In a learning environment that provides this type of safety-net, descriptions and research notes such as “laughing,” “feelings of satisfaction,” “feelings of success” (see Chapter 5) are very common. This environmental element was found to be an important element in creating the feeling of control and, with that, in encouraging the user to continue in the exploration process to become less-dependent end-user.

The trainer-trainee “contract”

The above elements are essential in creating an environment of cooperation and partnership. However, the evidence from this study indicates that the one-way efforts of the trainer to establish this environment are not enough. In examining the different cases observed, a puzzling question arose: Why did some trainers manage to create an ERT environment and implement the ERT principles (e.g. Isaiah and Ruth, Chapter 5) while others failed to do so (e.g. Simon and Levi, Chapter 4), even when they seemed to have the same understanding of the main ERT principles.

Re-examining the data revealed an important condition for creating an ERT environment: the understanding of both trainer and end-user of ERT principles and mutual agreement to practice them. For example, in the case study of Ruth and Isaiah (Chapter 5), the real change occurred when Ruth discovered the advantage of experimenting and being in control. At first it seemed to her (as it did to most of the other participants) to be time-consuming and irrelevant to her perceived needs. However, once she managed to discover functions she previously could not grasp and recover from errors that in the past seemed to be disastrous, her perceived needs changed, and she became the main player in creating the ERT environment. A similar situation occurred with Naomi in her training with Jonah. A detailed description of this changing process in found in Chapter 5.

In contrast to this example, in many of the other cases empowering the user is not always easy. Even when the trainer acknowledged the advantages of applying ERT methods and supported strongly (in the interview) the need for the user to be active and take control (e.g., Levi and Simon; Jacob and Rachel Chapter 4), any attempt to empower the user failed. In these cases, the user was either convinced that he needed to be led step-by-step, insisting on being instructed how to use specific functions and tools, or he did not believe
in his ability to take control and resisted any attempt to let go. This resistance is well represented by saying (Chapter 4) “I don’t know anything about it so if he is not going to tell me I am not going to do anything.”

In becomes clear that, in order to create an ERT environment, both trainer and trainee need to understand and accept the advantages of ERT principles, and both must agree to apply them in the training process. Only the trainee who understands and enjoys the advantages of being independent can truly benefit from ERT principles; only the trainer who understands the advantages of these principles can apply them; and only when the two meet an ERT environment can be created.

Chapter 5 describes the development of a cooperative, relevant, fear-free environment that includes the above factors. It describes the change in the training process of two dyads: Naomi and Jonah and Ruth and Isaiah. The description emphasizes the change in the perceived needs of the users and consequently, the change in the user’s involvement in the training process.

Summary

This chapter deals with the search for a model of Effective Responsive Training. It combines the results from the previous two chapters with the relevant literature to characterize the main factors that comprise a constructivist approach to end-user training.

The focus is on factors that generate effective computer exposure for the end-user by better responding to his needs. Three main factors are examined: Effective Responsive Training (ERT) contents, ERT methods, and ERT environment.

The chapter discusses the limitation of existing training contents, methods and environments as they emerge in this study (Chapter 3). It presents alternatives that will better respond to the end-user need for control in a continuously changing environment, that emerged as the main theme of this thesis.

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22 Even if the initiation to this understanding was a "contract" that at first did not make sense to him.
CHAPTER 7
CONTRIBUTION AND IMPLICATIONS
FOR FURTHER RESEARCH AND PRACTICE

The results of this study apply to three areas of research and practice:

1. training in general and specifically End-User Computing (EUC) training
2. the areas dealing with the intersection between human factors and computers: Computer Human Interface (CHI) and Human Factors in Information Systems (HFIS) and,
3. Adult Education in general and specifically technological education for the adult learner.

The major implications of this dissertation, incorporating the above-mentioned areas, are rooted in two major facts. First, computers are becoming increasingly central to business and everyday life both in the workplace and at home. Computer use is continually growing and computer literacy has become a "critical filter" for an increasing number of jobs and careers in a growing number of occupations. The second fact is the continuously rapid change of the technology, which is well represented by the prediction of Microsoft’s Bill Gates that “today’s home computers will be obsolete and virtually worthless within five years.” (reported by Ian Haysom, The Vancouver Sun, Feb. 18, 1997). While technology is continuously changing and “there is a growing need for education and training that reflects the realities of the cyberecorp revolution” (Umbaugh, 1998, p.95), the results of this dissertation indicate that the growing need for appropriate training and education is not reflected in the methods used for end user-training, or in adult training programs and theories.

Continuous effort has been made in technological development and in searching for innovations and performance improvements. However, the end-user aspect of technological change has been overlooked. “While the cry for productivity and efficiency is persistently stressed, helping people to learn to better use available technology is neglected (Mandefrot, 1997, p. 206). Few have questioned the appropriateness of training strategies and methods used to introduce the end-user to the changing technology.
The major contribution of this dissertation lies with its questioning of the widely used product-oriented approach and its attempt to present an alternative model for end-user training. This model is based on the *end-user's need for control in a continuously changing environment* – a main theme that emerged through this study.

In an attempt to identify instructional approaches that better respond to the needs of the end-user in the cybercorp era, this study explored end-user training from three main perspectives: (1) end user problems and needs, (2) training methods used for end-user training and, (3) the change process resulting from the implementation of a constructivist approach in end-user training. The results of this exploration led to the construction of the *Effective Responsive Training* (ERT) model, which is an initial attempt to identify methods, instructional contents, and a learning environment that support the end-user’s need for control in a continuously changing environment.

The implications of this dissertation for research and practice are numerous. One conclusion drawn in this thesis relates to the need to view the theory and practice in adult education as inseparable domains. Therefore, in this summary of the study’s implications, I have chosen not to separate research and practical implications but rather, to present them together.

Three areas stand out as implications for research and practice:

(1) implications for end-user training and support, (2) implications for adult learning and training in general and, (3) implications for CHI and specifically end-user interface design.
7.1 Implications for End-User Training and Support Services

This thesis is not unique in its search for effective methods for end-user training. Other studies have dealt with various aspects of end-user training. Some previous studies dealt with similar users' difficulties, which were replicated in this study, while other studies suggested different training procedures, platforms, and tools.

The grounded theory approach taken in this thesis allowed the researcher to examine the main factors associated with end-user training, and the way they relate to each other, from a different perspective than previous studies. Moreover, it led to the examination of new themes that emerged through this study that had not been dealt with before. This resulted in some new findings focusing on a different view of end-user’s “real” needs and on training methods that respond to these needs in the context of a continuously changing environment. These findings can support the development of better approaches to end-user support and training as well as better user-friendly technology.

7.1.1. End-user problems and needs

There is not much published research and development that examines the end-user needs within the broader perspective of technological change. Few studies explored the need to develop transferable skills that will serve the end-user beyond the use of a specific application.

The main theme that emerged in this thesis—the end-user’s need for control in a continuously changing environment—was found as the central theme that connected all the factors relating to end-user training in this new millennium era. This thesis presents a first attempt to examine end-user’s needs and training approaches that respond to these needs within the context of the changing environment. One of its main conclusions is that the continuously changing environment should be a major factor in any training design aiming at supporting the end-user and ultimately making computer usage easier for the end-user.
This study found that, in fact, the computer was not "easy to learn", nor "easy to use" as most of the end-users are led to believe by the marketing efforts of the computer industry. The numerous difficulties the user had with the computer as was exposed in this study, need further exploration. However, the strong indication of the gap between technology development and the ability of the end-user to cope with this development should be taken very seriously.

Mandefrot (1997) found that "most participants consider themselves definitely novice, even though they have used a computer for more than eight years" (p. 209). This novice-advanced loop is another significant finding that needs further exploration. It shows that extensive computer experience does not always help, a finding that is contrary to any other experiences in our lives. Unlike Mandefrot (1997), the researcher in this thesis went further to explore in which circumstances experience does help. As a result, a more appropriate training approach that can provide the learner with "experience that does help" was identified. According to this approach, empowering the end-user to become a self-sufficient user who can control his learning environment is a key element that should remain the predominant factor in training situations.

More research and development should focus on:

1) Identifying end-users' problems, for example, everyday problems of the adult end-user at home and in the office, rather than the more common focus on a specific software package, or the specific computing environment
2) Exploring problems experienced end-users have when they change to another application or different version of the same application
3) Exploring learning methods employed by users who manage to cope with technology change.

7.1.2. A constructivist approach to end-user training

Gayeski (1998) maintains that "step-by-step procedures are too linear and time-consuming to be practical in the real world of training on fast-changing topics" (p. 37). The findings within this study supported Geyski's conclusion that there is a need for a different approach to replace the commonly used ISD or step-by-step approach. The
themes that emerged at various stages in this thesis led to the constructivist based ERT model that transfers the focus of training from the common, product-oriented approach to the end-user-oriented approach.

This model includes various suggestions and guidelines for implementing a constructivist approach to end-user training. Three categories emerge: learning content, training methods, and training environment, which need further exploration and development.

The following findings need special attention.

1. The learned contents
   
   **Static and constructive knowledge**
   
   Most of the research and practice in end-user training focuses on informational or *static knowledge* which includes facts, procedures, and rules (Schön, 1987). The results of this thesis shed light on a different type of knowledge the end-users need in order to be able to cope with the cybercorp era. This type of knowledge is referred in this thesis as *constructive knowledge* or what Schön (1987) refers to as *knowing in action* which includes “The skillful judgments, decisions and actions we undertake spontaneously without being able to state the rules or procedures we follow” (p. 24). According to Schön this knowledge, is “learnable, coachable but not teachable” (p. 154).

   The development and use of constructive knowledge was demonstrated in Chapter 5. However, more research needs to be done to better define this knowledge and its properties. A specific topic that has not been developed in this study and needs to be further explored is the topic of conceptual models and its implications to constructive knowledge in the context of end-user learning.

   **Novice and advanced contents**

   The findings of this dissertation regarding the sorting of applications and tools into beginner and advanced level of contents may be of special interest for training providers,
developers and researchers. The findings point to the “historic criteria” for sorting training contents, where “new” is associated with “advanced” and the “old” with the “beginning” level. This includes some recently introduced tools that could be very effective in supporting the end-users’ effort to gain control, but are considered to be too advanced for the beginner user. A few examples are presented in detail, including the use of the undo, save, and customize functions (Chapter 6).

Further research is needed to examine the choice of content and the suitability of different applications for various levels of learning. This research is important in providing the novice end-user with adequate, available tools to support his striving for independence. Specifically, this re-examination should explore the use of the many applications and tools (e.g. graphical and customizing tools) that were very complicated in the past and therefore rarely used by non-professional users. With today’s technology these tools can easily support the productivity of most end-users if introduced properly.

Incorporating computer functions and tools based on their ability to support the end-user’s self-development, regardless of their history, would enhance the independence of the end-user and thereby increase his productivity and satisfaction.

2. Instructional methods

The wider implication of the constructivist approach for training will be discussed later. A major aspect of this discussion is the finding regarding the meaning of learning by doing (LBD). In the specific context of end-user training it was found that trainers usually perceived LBD to mean allowing the learner to touch the keys. Re-examining the meaning of learning by doing in end-user training is essential to identify better methods to meet the end-users “real” needs.

Additional indications emerged in this dissertation:

1. The importance of allowing the learner to make errors and develop recovery procedures in order to develop a sense of control.
2. ERT as an approach that allows the end-user to develop and apply his own learning style.

3. ERT as an approach that allows the trainer to identify training gaps and training needs as they emerge throughout the learning process.

4. ERT as an approach to end-user learning which supports incremental learning, adaptive explanation, emotional support, and flexibility; provides more user control.

All the above and other ERT elements (see Chapter 6) are important factors in providing meaningful, lasting learning for the end-user. These insights, which contradict almost every approach that is currently being used in end-user training, as was revealed in this study, are significant in supporting the end-user’s efforts and should be further explored and developed.

Further research should look at:

- The application of these ERT methods and techniques in end-user training and their ability to enhance training results and reduce trainee frustration.

- The effect of these ERT methods on the end-user ability to cope with the changing computing environment.

3. Training environment

Three elements of a constructivist educational environment, global and local activities, authentic learning, and ownership by the learner were examined in this dissertation within the specific context of end-user training. The results indicate that these elements are essential to any attempt to implement a constructivist approach to end-user training.

Two additional elements that emerged in this study that were found to be significant in end-user training are (1) the end-user’s feelings of safety, relaxation and freedom to explore, and (2) the trainer-trainee contract. These two were found as essential conditions in creating an environment of cooperation and partnership in which the learner feels free to explore and develop while the trainer provides him with a safety net and emotional support. According to this agreement, the trainer can practice let go methods where the learner is active while the trainer can remain silent, without feeling that he is
not doing his job. Any attempt to apply a learner-oriented approach in end-user training should explore ways to develop these two conditions and to include them in the educational efforts.

4. The four-stage change process

An interesting four-stage change process emerged through the analysis of the change process of the trainer and the trainee while moving from a product-oriented to a learner-oriented (constructivist) approach. Although the same process appeared clearly in the two case studies, further research has to be conducted to verify this process and the conditions in which it occurs. This is important in identifying methods to introduce and induce a constructivist approach to end-user training, and in building clear guidelines for trainers and training developers.

5. Train-the-trainer procedures

Developing train-the-trainer procedures was beyond the scope of this study. Therefore, although some train-the-trainer procedures were conducted they were very limited and not systematic enough to draw any conclusions. Further research focusing on train-the-trainer issues is needed to identify efficient and effective methods to transform trainers training approach from a product-oriented, step-by-step approach to a trainee-centered constructivist approach. Some methods used in the case-studies, such as on-the-job interventions and micro-teaching (Allen, 1980), may be excellent starting points for researchers.

6. Individual differences

Ayersman (1995), who dealt with individual differences in the context of end-user training reported that: “to date research has verified that individual differences do exist, and when learner characteristics are appropriately matched, students perform better than when they are mismatched” (p.389). However, no research was found that examined the new computer environment as an environment that could be more flexible in meeting end-user individual differences. The evidence from this dissertation clearly indicates that (1) the current Instructional Systems Design (ISD) methods used by trainers do not
support individual differences; and, (2) the new computer environment has the potential to provide support for individual differences if training methods different from those currently used, will be applied.

The constructivist approach taken in this dissertation allowed the end-user to take ownership of his learning. Apparently, this also allowed the end-user to apply his own learning style. However, more research should be done to examine two main questions:

1) Could a constructivist approach change the learning style of the end-users., and

2) How the constructivist approach allows the user to apply his own learning style

These questions could have major implications for end-user training. There may be an important impact for the growing body of knowledge dealing with the relationship between individual differences and the learning environment.

7.2 Implication for Adult Learning and Training

Although this dissertation deals with the specific area of end-user training, the questions raised by this study could apply to the wider area of technology training and the general strategies used in today's training systems.

7.2.1 The rigor-practice chasm

Schön (1987) discusses the gap between the academic research and what is supposed to be its practical use in the workplace as follows: "in recent years there has been a growing perception that researchers who are supposed to feed the professional schools with useful knowledge have less and less to say that practitioners find useful" (p. 10). Rein & White (1980) add that not only does research not deal with practical needs, it has been increasingly captured by its own agenda.

In accordance with Schön (1987) and Rein & White (1980), this study points to the need to bridge the existing gap between adult education and its practical aspect -- training. This gap has a major impact on both the methods used in adult education programs and the
content areas considered ‘adult education’. This is particularly true in the area of technology training, which has been traditionally identified as part of adult training. Therefore, technology training has not captured the attention of adult educators and was left for the technicians.

The results of this study indicate that attempts should be made by technology practitioners, developers and trainers to incorporate educational research and practice into technology training. At the same time, adult educators should realize that technology training is an integral part of their domain. Thus, there is a need for those involved in adult education to further examine the ways in which adult education can contribute to technology training. Incorporating technology training within the domain of adult education could contribute to the recognition of adult education as an equal partner with the IT practitioners in technology training.

7.2.2 Product-oriented and learner-oriented approach

Another perspective of the education-training separation deals with the training approach taken. Similar to other studies, (e.g. Pearlstein, 1991; Mandefrot, 1997) this study found that in training, the product-oriented approach, that focuses on “what is learned”, is dominant. While educational research and programs have made a major attempt to emphasize approaches that view the learner and his development as the target of the educational process, few similar attempts were found in studies and practices dealing with training and specifically with end-user training. While a major focus is made on examining different training mediums (e.g. on-the-job tools; Internet-based training), or the need to have more training, no one seems to question the content of training or search for methods that would best meet the end-user needs.

The findings of this study indicate that the product-oriented approach and its two main delivery methods: step-by-step and show-and-tell, have a very limited and short-term effect. Eventually this method leaves many of the learners dependent and caught in what was referred to in this thesis as the “novice-advanced loop”, when they may need to use different applications or even different versions of the same application.
The case studies presented in Chapter 5, where a constructivist approach was induced, indicate that an instructional approach which focuses on the learner’s development provides better personal tools to cope with learning new content, and can contribute to feelings of learner control when the environment changes.

More research and development efforts should be made to:

- identify best practices in applying a learner-oriented approach
- examine the results of applying learner-oriented approach in terms of the ability of the learner to cope with "continual learning and constant evolution" (Umbaugh, 1998, p. 93).

Although this study focused on end-user training, the implications are relevant and apply to almost any area of adult learning where continual and rapid change occurs.

7.2.3 Constructivism and its application to adult education and technology training

Constructivist theories deal with knowledge representation, its impact on how people construct knowledge, and the ways to facilitate this acquisition. Instruction is shifted from content transmission to understanding and supporting the processes by which the learner acquires expert reasoning and problem solving skills in a new domain.

A growing body of knowledge, mainly within K-12 education, deals with a variety of applications from constructivist theories to learning and education. However, in training research and practice, the dominant approach is the Instructional Systems Design (ISD) (e.g. Gagné et. al, 1988) that focuses on the transmission of knowledge. As was discussed above, theories and practices that are based on the educational belief system (Hodgson, 1993), or the learner-oriented approach, such as constructivism, that could lead to new directions and solutions in adult education and specifically in technology training, have not been explored so far.

This thesis presents two case studies in which constructivist principles were applied to end-user training. The results of these case-studies, although limited in their scope,
suggest that the constructivist approach could be effective in supporting the adult learner who needs to be able to "continuously change and adapt to new circumstances" (Umbaugh, 1998). It also suggests a four-stage change process of both the trainer and the trainee occurring while attempting to implement constructivist strategies. These findings, which emerged in both case studies, could have major implications for any attempt to implement constructivist methods both in educational and training contexts.

Further research and development should be conducted to identify instructional methods and applications of constructivist theories to the areas that fall within the definition and boundaries of training. These studies should attempt to identify and verify the stages through which both the trainers and the trainees go during this process. Better understanding of this process will support the implementation of these constructivist strategies.

### 7.2.4. Effective responsive training

The effective responsive training model (ERT) is a primary attempt to identify and organize factors that generate effective computer exposure for the end-user from a constructivist viewpoint. Although it was constructed within the limited scope of end-user training, its generic applications can go far beyond this topic. For educators, it can add another layer in the attempt to identify instructional principles and procedures for implementing the constructivist philosophy and theory in educational practice. However, the main implication of the ERT model is for both practitioners and researchers dealing with adult training.

The ERT model is a first attempt to introduce a set of instructional principles and methods for training as an alternative to the dominant, product-oriented approach and its implementation through ISD models and strategies. The ERT model, with its three main categories: contents, methods, and environment, delineates principles with which the trainer can carry out his coaching role. This role allows him to respond to the learners' needs while providing the learners with ownership of their learning, and while supporting
their development as independent learners who are gaining control over their changing environment.

This model can provide trainers and training developers with numerous usable ideas and principles. However, its main strength is marking a new direction for those dealing with training, and laying some milestones along the way. Nevertheless, much more research and development should be done to verify the findings of this study, and to develop a more robust set of principles, methods, and tools that trainers can use in applying the constructivist approach in their training.

7.2.5. The meaning of learning-by-doing

One of the interesting themes that emerged from this study relates to the widely used concept of learning-by-doing (LBD). The term LBD is found in any educational and training program that claims to focus on the individual learner. However, while in “educational” contexts it is common to find LBD connected with theories and practices focusing on the learner’s development (e.g. knowledge building, Scardamalia and Bereiter, 1991), this study suggested a different meaning for LBD in a training context. In this context learning by doing has been found to be associated with two major procedures: step-by-step and show and tell. The findings of this thesis indicate that these procedures have a short term effect, if any, and do not support the self development and growth of the learner. The ERT model includes a set of criteria and methods to implement effective LBD. These methods and criteria are additional steps in the process of creating practical applications of constructivism.

The main contribution of this thesis, in the context of LBD, is encouraging both educators and trainers to re-examine what the concept of LBD means to them. It suggests long term development of learners and their knowledge building as main criteria in identifying whether educators and trainers are “really” using LBD or just directing learners to follow instructions without creating any meaning to their actions. It is important that practitioners, when using LBD, identify what type of learning they are encouraging, and
whether this learning responds to the learner’s immediate request or supports the long-term needs of the learner which may go beyond their currently visible needs.

7.3 Implication for Computer Human Interaction (CHI)

CHI is the area where educators, psychologists and IS professionals should collaborate in an effort to meet today’s end-user’s needs. However, as pointed out earlier, the CHI literature focuses on the IS perspective, while input from bodies of knowledge that emphasize the human perspective is undermined. This collaboration is essential for the development of educational approaches that meet the ever-changing needs of the cybercorp end-user.

The results of this dissertation and specifically those dealing with the end-user’s problems could have major implications for anyone who attempts to develop useful computer tools for the non-sophisticated user. These results clearly indicate that there is a huge gap between the research and development efforts invested in technology improvement and the corresponding efforts invested in research and development focusing on the end-user.

More research has to be done, focusing on end-user needs in a changing environment. Any development of new environments and tools should take the end-user’s need for control as a major factor to be considered. Those innovations should be explored not only from their functionality perspective but mainly from their usability perspective.

Any testing process of new environments and tools should include the intended users of the product and not just “technology managers and information technology experts as surrogate users” (Mandefrot, 1997, p. 212).

More research and development efforts should examine:

- The usability and the learnability of new products
- The transfer process from a previously used environment to a new one.
Use of qualitative methods that include close observations and interviews with end-users, similar to those conducted in this study, could provide Information Systems (IS) developers and researchers with data that they seem to lack in their current practices.

**Summary**

This chapter presents the main contributions of this dissertation and its implications for further research and practice. It describes the application of this study's results to three main areas of research and practice: adult learning and training, end user training and support services, and the area of Computer-Human Interface (CHI).

The main contributions of this thesis as presented in this chapter are:

1. The use of a grounded theory research approach to allow for the emergence of end-user training aspects, contexts and issues that were not dealt with in the literature covered for this study.

2. The examination of end-user problems and needs, and training methods that respond to these needs within the context of the continuous technologically changing environment.

3. An exploratory study of the implementation of a constructivist approach to end-user training which resulted in the Effective Responsive Training (ERT) model. This model presents suggestions for learning contents, instructional methods and learning environment that support the introduction of a constructivist approach to end-user training.

The main implications of this study are to the area of end-user training and development. However, these implications can be generalized to a variety of educational, training and technology areas that involve the human use of technology or training in a continuously changing environment. A main area challenged by this dissertation is the area of adult training and the dominant product-oriented approaches used by practitioners in this area. This study suggests the application of a constructivist approach to training as a more effective training method in an era of "rapid change, continual learning and constant
evolution and growth" (Umbaugh, 1998). Recommendations are made for more collaboration between educators, training developers and technology experts, and for research and development efforts to meet the human needs of the new cybercorp era.
REFERENCES


Appendix I:

Letter of Invitation

Date: October 9, 1996

Dear:

I am a doctoral student in the Department of Adult Education at the Ontario Institute of Studies in Education currently conducting research studying some aspects of computer's end-user training. The purpose of the study is to look at the difficulties the user has when using a new application, the kind of solutions s/he finds and the kind of support s/he is getting. A specific focus is made on the way more experienced users are supporting the new users in coping with new computer applications (which will be called here: responsive trainers). I believe that this study will help us to better understanding the needs of the trainer and the trainee and in developing better training programs.

This study is using both qualitative and quantitative methods, such as observations, interviews, questioners and data collected from video/audio recording.

Through this study, I would like

- To observe and record the interaction between responsive trainers and end-users in one-on-one training situation.
- To interview both the trainer and the trainee
- To ask you to fill up a short questionnaire deals with your previous experience and your ideas about computer training.

I would like to assure you that every attempt will be made to avoid any personal evaluation of you or the organization you are working with. My study will be strictly confidential. names will be coded and pseudonyms will be used when reporting the findings. All data will be kept strictly confidential, and all the information will be organized in an aggregated form, so no individual information will be identified.

Each participant is free to withdraw the study at any time. In this event, all data collected from this individual will be destroyed.
I believe that my research could make a major contribution to the training methods used for the introduction of new technology. I will be very happy to share with you the results of my study and hope that it can contribute to your training or learning experience.

If you have any questions or requests, you can reach me at the above address, by phone (631-1442) or by e-mail dbartfeld@oise.on.ca

Thank you for your help

Sincerely Yours

Dina Bartfeld
Appendix II:
Letter of Informed Consent

Dina Bartfeld  
Department of Adult Education  
The Ontario Institute for Studies in Education  
252 Bloor St. W.  
Toronto, Ontario, M5S 1V6

Dear Ms. Bartfeld

I have read the attached letter describing the research project you plan to carry out in connection with your doctoral dissertation.

I agree to participate in the study.

I understand that my participation is voluntary and I may withdraw from the study at any time.

Participant’s Name (Please Print) ____________________________

Company (if relevant) ____________________________

Research Participant’s Signature___________________________

Date ____________________________
Appendix III

Definition and Glossary of Terms

Computer terms:

ACPAC  Accounting program
DOS    Disk Operating System; Systems used on PC's (IBM compatible personal computers) prior to the use of Windows
GUI    Graphic User Interface; mouse driven computer interface used in systems such as Windows or Macintosh
MAC OS  Operation system used on Macintosh computers
MS Explorer  Microsoft Internet browser
MS PowerPoint  Microsoft Graphic program used mainly for presentations
MS Windows  Microsoft Windows: Operation system used in PC computers (replaced the DOS system).
MS word    Microsoft Word: the most popular word-processing program
NetScape  NetScape Navigator: an Internet browser
PC      Personal Computers: Term used for DOS or Windows-based computers. (IBM compatible)
IS      Information Systems

Other terms and abbreviations

“Ask Fred” method  Peer support in the workplace (Stamp, 1993)
BIG/WIG  Beyond the Information Given/ Without the Information Given. Acronym coined by Perkins (1991) to differentiate between two approaches to constructivism.
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tbody>
<tr>
<td>Cybercorp</td>
<td>The future workplace according to Umbaugh (1998)</td>
</tr>
<tr>
<td>Cyberemployee</td>
<td>The future workplace employee (Umbaugh, 1988)</td>
</tr>
<tr>
<td>End-User</td>
<td>The common term for non-IS-professional computer user</td>
</tr>
<tr>
<td>EUC</td>
<td>End-User-Computing: The use or development of computing applications via personal technology</td>
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<tr>
<td>ERT</td>
<td>Effective Responsive Training: Term used to describe the elements of a constructivist approach to training developed in this thesis</td>
</tr>
<tr>
<td>HFIS</td>
<td>Human Factor in Information Systems: An area of research and development dealing with the human aspects of computing mainly in the workplace</td>
</tr>
<tr>
<td>HS</td>
<td>Help-Services: A code name for the training company observed in this study</td>
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<tr>
<td>HCI</td>
<td>Human-Computer-Interface</td>
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<tr>
<td>LBD</td>
<td>Learning By Doing</td>
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<tr>
<td>“Let Go”</td>
<td>An alternative constructivist method suggested by this study</td>
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<tr>
<td>Responsive Training</td>
<td>A training situation, initiated by the learner, responding to specific needs and provided by a user with specific knowledge or expertise.</td>
</tr>
<tr>
<td>RT</td>
<td>Responsive Trainer: A person who provides others with guidance and support in the use and application of EUC</td>
</tr>
<tr>
<td>Step-by-step</td>
<td>The most common training method for EUC</td>
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