DEVELOPMENT OF A CONSTRUCTION METHODOLOGY OF GOAL DIRECTED, OPTIMAL COMPLEXITY, FLEXIBLE & TASK ORIENTED (GOFT) TRAINING MATERIALS FOR NOVICE COMPUTER USERS. APPLICATION & EVALUATION IN ADULTS WITH MENTAL HEALTH PROBLEMS.

Christalena Kattami

Doctoral Thesis

CITY UNIVERSITY
Rehabilitation Research Centre,
System Science Department

February 1996

PAGE NUMBERS CUT OFF IN THE ORIGINAL

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGMENT

TO MY HUSBAND, APOSTOLOS
FOR HIS MORAL SUPPORT, CONSIDERATION
& CONTINUOUS ENCOURAGEMENT !!!

TO MY PARENTS
FOR THE ACADEMIC ASPIRATION !!!

TO MY CHILDREN, ELENA & MYRTO
FOR THEIR PATIENCE !!!

DECLARATION

I grant powers of discretion to the University Librarian to allow this thesis to be copied in whole or in part without further reference to me. This permission covers only single copies made for study purposes, subject to normal conditions of acknowledgement

ABSTRACT

A number of information technology schemes have been developed in order to provide people with mental health problems the opportunity to acquire skills in micro-computer technology. Even though positive results have been reported a high incidence of dropouts during the beginning of the training have been found.

The research is based on the assumption that in order for a computer training method to be effective in fostering computer skills and confidence to adult novice users with mental health problems has to: (a) bridge the gap between the user's capacities, needs, and preferences and the demands of the computer interfaces and their real task applications;(b) consider the ways adult novice users prefer to learn and the skill acquisition theories;(c) facilitate a goal directed interaction with the computer system; (d) maintain an optimal complexity level across training; and (e) allow flexibility of use.

Based on the relevant literature, a methodology model and a set of design propositions and construction guidelines have been derived and have been implemented for the development of Goal-directed, Optimal complexity, Flexible & Task oriented (GOFT) training materials for adult, novice users with mental health problems. The GOFT training materials were based on three different models, the one for the creation of a goal directed instruction format and the other two for the organisation of the training, and the estimation of the difficulty level of each new computer operation or real task application.

Evaluation of use of the GOFT Training Materials by 34 adult, novice users (aged 18-51) with mental health problems revealed positive results. More specifically,the use of the GOFT training materials as compared to traditional methods resulted in a significant increase in the number of participants at the different training stages (85.3% versus 47.2%; and 44.5% versus 22.2% at three and twelve months respectively), in perfect & regular attendance rate (44,12% versus 11.11% & 32.35% versus 16.67%) and in the performance level (means of 3.75 versus 2.67) of the users.The subjective evaluation by the users also revealed significant differences between the GOFT and traditional training materials. In their evaluation the GOFT materials were rated significantly higher in terms of systematic arrangement, personal affect, understandability, task relevance, fitness, sense of control, confidence in using the mastered functions and in supporting goal directed learning approach.

INTRODUCTION

A number of training projects in Information Technology have been developed in order to provide people with mental health problems the opportunity to acquire skills in microcomputer technology (Evans, 1990). It can be argued that microcomputer technology has not created many new occupations but that microcomputer technology has made existing occupations easier to enter for people with mental health problems by providing greater flexibility to work schedules and working environments.

The purpose of many of those projects was to give participants sufficient skills and the opportunity to obtain qualifications, which would enable them to enter open employment. Underlying such a rationale was the assumption that chronic psychiatric patients fail to obtain jobs because of lack of commercially valued skills as well as because of discrimination against them. (Lipsedge & Summerfield, Lazzari, & Van Beeston, 1987). Nevertheless, regardless of whether or not computer training has resulted in employment, participation in a computer course resulted in the acquisition of highly-regarded skills and the production of valued work, helping to enhance the self confidence and self-esteem of people with mental health problems, thus fulfilling a main objective of rehabilitation.

Even though positive responses to the use of computers in training people with mental health problems have been reported (Evans, 1990) nevertheless a high rate of initial dropout was evident (Lipsedge et al., 1987, Summerfield & Lipsedge, 1987). This initial dropout can be attributed to the difficulties every novice user encounters when learning to use computerised packages, which combined with the weak self esteem and self confidence, the reduced cognitive abilities and attentional stamina and the low level of frustration tolerance and high anxiety level, that characterise people with mental health problems, lead many of them to quit in the first weeks.

The position contemplated in this research is that in order for a computer training model to be effective in fostering computer skills, self confidence and self esteem, it has first to: (a) consider limitations of the cognitive processes relevant to computer skill acquisition; (b) analyse the way adults prefer to learn; (c) take into consideration the common problems and difficulties novice users face; (d) examine the demands and characteristics of the interface system; and (e) meet the specific needs of people with mental health problems which may hinder the acquisition of computer skills.

From the available literature concerning the above premises a methodology model, a set of theoretical propositions and specific construction guidelines were derived for the development of effective training materials. The training materials must : (a) encourage an independent, goal-directed approach, by providing all necessary information; (b) have an easy, and average difficulty level in every session based on the complexity of the computer procedures and the difficulty of the tasks; (c) provide a sufficient number of opportunities to practise the functions in realistic tasks to ensure mastery and confidence; (d) preserve privacy and flexibility.

From the examination of the available task analysis models of the human computer interaction, it was found that no single task analysis model provided neither the necessary and relevant information for the user to assume a goal-directed problem solving approach nor a way to estimate the difficulty level of each computer task. For this reason, three different task analysis models were combined for the formation of Goal-directed, Optimal difficulty, Flexible, Task Oriented (GOFT) Training Materials; one for the creation of the format of the instructions of the training materials and the other two for the construction of the hierarchy and the context of each training session. More specifically, the models used included a modified version of the GOMS model (Carroll, 1987) for the construction of the format; the CCT model (Polson,1987; Polson & Kieras, 1985a) for the estimation of the complexity of the computer procedures; and the Cognitive Map Analysis model of Feuerstein (1979) which was altered to meet the requirements of assessing the difficulty of real computer tasks (McAnaney, Duffy, 1988).

Plan of the Report

This report is composed of four different parts: the theoretical background; the development of the GOFT Training Materials; the research designs and their findings; and the overall discussion.

The first section on the theoretical background, an account of the available literature on topics relevant to the human computer interaction is given. This section includes: (a) the limitations of the cognitive processes relevant to computer skill acquisition **(chapter 1)**; (b) the ways adult users prefer to learn **(Chapter 2.1)**; (c) the common problems and difficulties novice users face **(Chapter 2.2)**; (d) the specific needs of people with mental health problems **(Chapter 3)**; and (e) the examination of the available Task Analysis Models of the Human Computer Interaction **(Chapter 4)**.

The second section elaborates on the creation of a methodology for the construction of effective Training Materials and its application in developing training materials for the use of adult novice users with mental health problems. The first part discusses in more detail an overall methodology of effective training development, the propositions of construction, in relation to the theories they were derived from, and the specific guidelines for the format, content, organisation, difficulty evaluation and way of implementation of effective training materials in **Chapters 5.1, 5.1.1, & 5.1.2.**

The application of these guidelines in the construction of the developed training materials for adult novice users with mental health problems is examined in the second part. A description of the rationale, structure, applications, modifications and ways of implementation of the three models used for the construction of the GOFT Training Materials is included in **Chapter 5.2**. The objectives and a detailed description of the two different components of the GOFT Training Materials,- the instructional and the application part - in addition to the developed and used difficulty evaluation model is elaborated in **Chapters 5.3, 5.4, and 5.5**. Furthermore, a brief account of the development of the GOFT Training Materials is presented in **Chapter 5.6.**

The third section describes the actual research designs for the study of the effectiveness of the developed Training Materials for novice users with mental health problems at the Speedwell Information Technology Project. In this study the effects of the developed Training Materials on the computer training of people with mental health problems have been assessed through: (a) observations and the personal statements of users **(Chapter 6)**; (b) the analysis of the results of a quasi experimental research design evaluating the attendance rate and the training outcome of two different groups of students **(Chapter 7)**; and (c) the performance and the subjective assessment of users, who have used the GOFT Training Materials and traditional stepwise approach for the acquisition of different computer functions. **(Chapter 8)**. The studied hypothesis, the methodology, the results and the discussion of the findings of each research design are discussed.

The last section of the report provides an overall discussion of the findings in relation to the goals and objectives of the study, analyses the derived conclusions and outlines future recommendations.

Aims and Objectives

This study supported the assumption that one of the major reasons for the reported high rate of initial dropouts at the different computer training projects for people with mental health problems was the lack of a suitable training model. The study highlighted the need for the creation of a methodology for the development of effective computer training model which fosters goal directed learning, will have a medium difficulty level; provides realistic practice opportunities and respects the needs of the novice, adult user with mental health problems.

Thus, the main objective of this study was to implement the derived methodology in the creation of specific Training Materials, which are effective in developing computer skills, personal satisfaction and self confidence in adult, novice users with mental health problems.

The aim of the research part of this study was to investigate whether the GOFT Computer Training Materials will have a different effect on the outcome of computer training of adult novice users with mental health problems.

The set hypotheses of the study were that:

1. The users of the GOFT Training materials will show different ways of using the materials during the training to fit their personal learning preferences and needs.
2. The attendance rate of students with mental health problems trained with the GOFT Computer Training Model will be significantly higher than that of students trained with other methods.
3. The number of students with mental health problems that will finish the initial three month training at the Speedwell Information Technology Project will be significantly higher for those students trained with the GOFT Training Materials than other students trained with traditional methods.
4. The number of students with mental health problems that will continue their computer training after 6 and 9 months will be significantly higher for those students who were initially trained with the GOFT Training Materials than for other students trained with traditional methods.

5. Performance of computer functions mastered with the GOFT Training Materials will be significantly higher than that of functions mastered with traditional, long, stepwise procedures.

6. The GOFT Computer Training Model will be rated significantly higher than traditional stepwise approaches by the same users in ten subjective parameters measuring: (a) the materials; (b) the user's control, satisfaction, confidence and mastery; and (c) the fostering of goal directed, problem solving approach.

Research & Findings

The GOFT Training Materials have been used as a training method at the Speedwell Information Technology Project. The project was designed to provide people with mental health problems the opportunity to acquire skills in computer technology.

The gathered observational data supported qualitative changes in the overall training process when the GOFT Training Materials were used. The students spent more time working with the computer, worked more independently, and were better able to transfer their learning to new tasks when they were using the GOFT Training Materials. In addition, the students themselves referred to the different ways they were using the GOFT training Materials to fit their individual learning style, their interests or personality.

The results of two different groups of novice users with mental health problems, revealed a significant improvement in the attendance rate of the 34 users trained with the GOFT Training Materials, compared to the 36 users trained with traditional methods. The number of students finishing their three month initial training at the Speedwell Information Technology Project was significantly higher for the group that was trained with the GOFT Training Materials. In addition a significantly higher number of students continued their computer training after a period of 6 and 12 months.

The comparative results in the performance of the same 12 users who utilised both the GOFT Training Materials and a traditional stepwise approach to learn different computer functions during the same training period showed a significantly higher score when they were using the GOFT Training Materials. All users for those functions trained with the developed training materials demonstrated an independent use of the mastered functions in new applications.

Finally, a comparative qualitative assessment by the 12 users exhibited a significantly higher score in terms of: understandability, fitness, task relevancy, organisation, personal effect, user's control, confidence, mastery and problem solving process for the GOFT Training Materials compared to stepwise approaches. In addition the negative scores given to the traditional materials in the aspects of organisation, relevancy, user's affect, user's control, and support of goal directed learning reveals some differentiating features among the developed and the traditional materials.

These findings supported the position of this study that the development of specialised training materials that implement a comprehensive methodology of design, and construction propositions derived from relevant theoretical background can improve the outcome of computer training programs for people with mental health problems.

THEORETICAL BACKGROUND

1. HUMAN FACTORS ASSOCIATED WITH HUMAN COMPUTER INTERACTION.

The theoretical background most pertinent for the study of the human-computer-interaction is provided by the information-processing psychology, whose aim is to describe how people are driven by "goals", make up "plans", "interpret" their environment, and adjust their conceptions as a result of "feedback" from their actions. (Miller, Galanter & Pribram, 1960)

Psychology has been keen on finding general simple principles to describe human functioning. The Stimulus-Response (S-R) principle proposed by the behaviouristic tradition, remains useful for the description of the kind of behaviour which can be regarded as "responses" to "stimuli", but another principle has to be used to capture the human-computer-interaction process.

Miller,Galanter & Pribram (1960) introduced the "test-operate-test-exit" (TOTE) principle in order to capture the essential parts of human goal-directed behaviour on which the human-computer-interaction is based. According to this principle an action is generated as long as the test condition indicates that the set goal has not been reached. The TOTE principle concerns complex cognitive processes like learning and problem solving as well as mental operations such as attending, memorising, and reading comprehension. Since the TOTE process is based on such processes it can be assumed that the human computer interaction is affected by the same factors and limitations relevant to cognitive performance in general.

According to Baecker and Buxton (1987a,b) the examination of those cognitive processes is essential for the determination of the processing resources available to the user for handling the cognitive demands of the task. Balancing the available processing resources of the user with the critical resources required for the user to perform a task or execute a process is instrumental in determining the user's performance.

It was considered necessary for the construction of the materials to study and analyse the principles governing the structure and efficiency of those basic operations as well as of those complex cognitive processes affecting the human-computer interaction . Special emphasis will be given to highlighting their implications for the acquisition of computer skills and for the creation of effective training materials for the novice user.

1.1 Basic Processes affecting the HCI.

The Model Human Processor employs a set of three inter-connected subsystems - perceptual, cognitive and motor, each consisting of memories and processors. Associated with each subsystem are four key parameters memory capacity, decay, re-presentation and processing cycle (Card, Moran, & Newell, 1983)

The processes relevant to the Human-computer Interaction can be organised in six different categories and include those processes which concern: (a) the activation status of the internal environment, the organism; (b) the ability of the organism to attend to external stimuli; (c) the characteristics of the sensory organs and motor aspects involved in carrying out motor performance; (d) the possibility of keeping knowledge in active use in working memory; (e) the knowledge stored in long-term memory; and (f) the language comprehension.

1.1.1 Arousal of the Organism

It is widely accepted that the degree of arousal of the organism affects all types of performance. This relation was first expressed by the Yerkes-Dodson law (1908) whose main assumption supports, that performance is optimal "when arousal is neither too low nor too high" , or " when a person's body or mind is stretched to its limits in a voluntary effort to accomplish something difficult and worthwhile" (Csikszentmihalyi, 1990).

The Yerkes-Dodson law has not only been the subject of much debate, it has also inspired a lot of research which indicated that: (a) sleepiness, monotony and low motivation alone or together will lead to low arousal ; (b) arousal will affect the amount of effort which the person may expend on a task; and (c) task characteristics and the person's judgement of control and capabilities will affect their willingness to devote energy to a particular task (Ghani, 1991, Ghani & Deshpande, 1994).

The major implication of the Yerkes-Dodson law for the human computer interaction outlines the need to carefully consider what will happen when a novice user encounters a computer system. It is probable that their first impressions of the system will determine both the setting of goals and the manner in which the user will approach the system. Perception of the task challenge and the sense of being in control will affect the amount of effort the user is willing to spend on accomplishing the tasks (Ghani 1991).

The training should therefore provide an optimum level of challenge to every skill level. If the challenge is too high, the user will feel lack of control over the environment and will become anxious and frustrated. If the challenge is too low, then the users lose interest (Csikszentmihalyi, 1990). In addition, training must include tasks that will foster the users sense of control and of feeling competent and self-determined (Ghani & Al-Meer, 1989). Thus, keeping an optimal complexity flow across training will increase the likelihood of the users to continue their effort to master the system.

1.1.2 Selective attention

Human attention is subjected to certain restrictions in terms of how many stimuli or tasks can be performed concurrently and which aspects of a task can be considered simultaneously. Selective attention comes into play when two or more different stimuli are impinging simultaneously on our senses and the person has to decide which to attend to.

Selective attention is necessary for two different reasons (Kahneman, 1973). One is related to the structural limitations of the visual, motor and auditory systems of performing two similar tasks concurrently. The second is related to general processing limitations, which are in turn related to the amount of effort the person can and is willing to expend for the completion of a certain task.

Early in acquisition, only a small amount of the available information can be attended to, while later on, the performer can accomplish the task easily and apparently has capacity to spare. Performance decrements are anticipated with secondary loads or distractors in early phase of acquisition. These decrements will be increasingly diminished in later stages. (Nissen & Bullemer, 1987) and with sufficient and consistent practice, two complex tasks verbal or non-verbal can be performed simultaneously (Shiffrin & Dumais, 1981; Parkin & Rosso, 1990).

Some investigators (Schneider & Fisk, 1983; Schneider & Shiffrin, 1977; Shiffrin & Dumais, 1981, Damasio, 1989) have proposed a two process theory of attention to account for these changes. At first, processing is controlled: that is, it uses general processing capacities, but it is slow, effortful, generally serial, under intentional control and involves awareness. With practice, apparently effortless performance results from automatic processing, which is fast, parallel, obligatory, does not require awareness and has low demands on the processing capacity (Fisher, Duffy, Young & Pollatsek, 1988; Fisher & Tanner, 1992). These two process theories have been criticised for the lack of consistency of the definition they give (Phillips & Hughes, 1988), and for the notion that the presence of automatic processing is inferred from the performance that it is invoked to describe (Allport, 1980).

The attention spent on the completion of a task is related not only to the level of task acquisition but also to the task's difficulty and familiarity and to the person's motivation and psychological state. Integrative processes of novel, perceptual-motor stimuli require full attentional allocation which may not as crucial for familiar verbal stimuli (Verdolini-Marston, Balota, 1994).

Furthermore, it has been suggested that people under stress tend to reduce the number of cues to which they can attend in a situation (Easterbrook, 1959). It has been found that people who are anxious, find it difficult to concentrate on a task. A possible explanation is that anxiety itself or the monitoring of the anxiety inducing stimuli requires processing effort which leaves a smaller proportion of attention capacity available for task relevant processing.

Attention capacity can be increased through attention training that involves the increase in attention-attraction strength of consistently trained target stimuli and the decrease in the attention-attraction strength of non trained or distractor stimuli (Shiffrin & Czerwinski, 1988). Attention training entails the preferential response to certain stimuli which once is encoded, its associated response will automatically be activated (Rogers, 1992). The consistency in training and practice opportunities has been found to be crucial in fostering the selective attention to certain stimuli (Fisher & Tanner, 1992).

The various aspects of selective attention are very important when it comes to performing tasks with the aid of computers. Computers require the acquaintance not only with new stimuli but also the use of perceptual-motor processes in a new environment. Each task consists of two subtasks: the task itself and the handling of the computer. If both these tasks require attention and share the same processing resources performance in one or both is likely to suffer since attention must be divided among the subtasks (Navon, 1984). This will be particularly noticeable if the computer tasks share the same processing resources (Navon, 1984), have to be performed under stress or if those concerned are anxious while they are working. Thus, it is important to carefully analyze and measure both the demands of the actual task itself and also of using the system and learning the computer's procedures so that a novice learner will not become overloaded, during training. This is particularly important when the user has no previous experience of the actual tasks and is prone to become anxious.

1.1.3 Sensory - Motor Characteristics

The characteristics of the sensory and motor organs can be regarded as representing the "bioware" restrictions on the human system. Human cognitive performance cannot go beyond these restrictions, however some technical restrictions of computer systems conflict with them. In such cases the users have to work at the limit of their capacities and they have to expect both stress and errors. The Human-computer interaction is generally based on the screen output given by the computer and the motor input via the keyboard or mouse provided by the user.

Card, Moran & Newell (1983) studied the quantitative characteristics of vision, visual search and motor performance using data from the performance of different subjects under different circumstances. They determined that three aspects of vision are especially important to consider.

The first aspect concerns the minimum duration required for a stimuli to be perceived as distinct. The detection time of visual stimuli indicates that two stimuli presented successively within a period of time less than 50-200 msec will be perceived as one continuous stimulus.

The second factor relates to the decay rate in sensory memory, meaning that the interval between various pieces of information that are to be integrated should be as short as 90 to 1000 msec in order to prevent the loss of the sensory trace of one piece before the next arrives.

The third factor deals with the amount of information retained immediately after presentation. The amount of processed information retained depends on the rate of information given and the demand for meaning in the material presented. So long as the material is novel and cannot be interpreted, the limited sensory memory will provide the only way of retaining information.

Screen reading often requires active visual search. Visual search is a complex task and performance at the novice level is determined by: the degree to which the user understands task instructions; the speed with which can encode the memory-set item; the speed of assessing and matching the items presented in the display with the desired one; and finally the motor respond speed (Ackerman, 1988).

In the case of human computer interaction it has been found that reading from a screen is often less efficient than reading from a paper, mainly due to: (a) bad quality of the writing on the screen; (b) the presentation of text on the computer screen and the rate of change; and (c) the segmented formation of the visual images.

In addition warnings and help are provided outside the visual focus field of the user and they may pass undetected by the user unless they are able to attract the user's attention or the instruction materials assist the user to actively look for them. Training materials must enhance the meaning of those warnings in order to enhance the possibility that they will be registered in the user's memory by making them meaningful and relevant to the situation.

Every movement performed consists of a series of discrete micromovements, each requiring about 70 (30-100) msec. Performance checks cannot be made on every micromovement, since feedback from action to perception takes 200-500 msec. Rapid actions such as those involved in typing have to take place in an automated sequence of actions, in which feedback loops must be incorporated.

Skilled typists find frustrating the utilisation of the function keys, since they are located outside the conventional keyboard movement range, disturbing the trained position of the fingers on the keyboard leading to mistakes which usually go undetected until they look at the screen.

Keyboard keys are sensitive to the time of pressing and combination function keys require the co-ordination of two hands, presenting a problem with people with poor hand co-ordination, or slow motor skills. Such dexterity difficulties do result in mistakes that confuse the users especially when they don't know what to expect and therefore cannot detect errors.

Direct manipulation devices like pointing, clicking and dragging require a mean performance time of around 200msec per movement (Jackson & Roske-Hofstrand, 1989). Mackenzie, Sellen & Buxton (1991) found a substantial variance between pointing and dragging times of 100 to 300msec respectively. The speed advantage of pointing can be interpreted by the reduced cognitive processing requirements and the relative cost of inaccuracy in the two processes. Unlike pointing, dragging requires a control movement of the cursor which has direction, a constrained path and a temporal duration. Recovery from small errors in pointing requires the simple repositioning of the cursor in contrast to dragging that necessitates the repetition of the entire procedure (Gillan, Holden, Adam, Rudsill, & Magee, 1992)

1.1.4. Working Memory

Working memory is a convenient concept for denoting the information which is being attended to at the present. Information in working memory lasts only for a short period estimated to be up to 34 seconds for one chunk (Melton 1963), and with half the information being lost after about 5 seconds for three chunks (Murdock 1961).

The short-term memory model proposed by Miller (1956) has become particularly well known in the human interface literature but there are several limitations to that model. Miller proposed that human short-term memory capacity resides in a discrete buffer that contains 7 (+_)2 items. However, there is much experimental evidence that does not support this single buffer model (Broadbent 1975, Monsell 1981). For example, the number of items that a person can recall decreases as the complexity of the items increases (Simon 1974). While theorists continue to agree that the capacity of short-term memory is limited, the discrete-buffer model of short-term memory has been replaced by models in which memory resources are dynamically allocated (Moray, 1967). According to these models, performance may be affected by the ways in which active processes share resources (Norman & Bodrow 1975) and the sequence in which the information is presented

(Simon 1974). While these resource allocation models do fit the experimental models more readily, their predictive power is low and some of their applications also have been questioned. (Duncan 1980, Moray 1977).

Baddeley (1981) has used the term working memory functionally to include additional components of the human limited-capacity short-term storage system, which includes items for skilled tasks such as reading to provide a larger capacity. Chase and Ericsson (1981) have used the term working memory to include rapid accessing mechanisms in long-term memory, termed effective working memory, proving that through extensive practice, people can enormously increase their effective working memory capacity.

Working memory will impose a limit on the processing capacity of the novice computer user once a goal has to be achieved, once something new is to be learnt and once information in the outside world which requires conscious attention has to be taken into account . More specifically, the user will have to: (a) remember the identity and usage of the relevant functions to the current situation; (b) think through and hierarchically arrange a set of goals; (c) keep track of the current set of actions; and (d) assess the state of the computer in order to determine which operations are possible. It is not surprising, therefore, that novice users of a computer system will perceive their own working memory capacity as being painfully small. They have to process each new item separately, because they have not yet formed any "chunks" in long-term memory related to the handling of the system (Baddeley, 1986).

One way of reducing the load on the working memory is to guide those new to the system through the required procedure by letting them make successive choices through a sequence of menus or set of goals. However, the advantage of menus is quickly lost, if the menu offers too many alternatives, and the novice user is at risk of "losing the track".

The limitations of working memory is probably the most important factor to be considered in trying to achieve a "user-friendly" system and "easy to learn" instructional materials (Katajima, 1989). The strain on working memory for the total novice user can be estimated by counting each goal and subgoal as a "chunk". To these chunks should then be added the methods for achieving the goals and subgoals. If the initial tasks to be performed by the user with the system can then be described within the limits of working memory, the user will then find the system easy to handle. As part of the process becomes automatic then other "chunks" of new information can be added without overloading the working memory.

Furthermore, when the novice user is also learning the structure of the computer applications themselves it is then necessary also to consider the complexity and difficulty of the task itself so that an estimate of the load on the user's working memory can be made (Sheridan, 1980).

1.1.5 Long term Memory.

Longterm memory refers to all information that is potentially available to a person. The conclusions drawn from different learning and memory studies supported the view that longterm memory contains two different types of knowledge the declarative and the procedural knowledge (Squire, 1986).

Declarative knowledge refers to the knowledge of "knowing what" and is represented in the shape of abstract propositions, which describe a concept in terms of its relation to other concepts. Since the possible relationships between concepts are indefinite, a number of principles have been suggested to explain the manner in which declarative knowledge is organised in the longterm memory. Such processes include the "chunking" of information, mentioned in Miller's (1956) paper and the models employing semantic networks which represent the associations and relationships between single items in memory (Tulving 1972). .

Chunking refers to the process of considering a concept as "prototypical", storing the information related to this concept and then relating other concepts to the prototype (Rosch & Llyod, 1978). The chunking of information in long-term memory provides an explanation of our ability to process complex information and of the development of expertise in one field.

However, in the literature on human interaction with computers, models that employ associative networks or "schemata" for organising recurring regularities (Rumelhart & Ortory, 1977) are becoming increasingly common. Many specific schema models have been proposed, varying in the areas in which they are applied. The scripts are related to complex real-world scenarios (Shank & Adelson, 1977); and the frames are related to the relationship of visually perceived objects (Minsky, 1975), and to the psychological validity attributed to objects and events (Anderson, 1981). These higher-order schemata are essential not only in handling everyday situations but also in understanding what other people tell us.

As the field of human computer interaction becomes more concerned with the mental organisation of complex material, schema models have been applied to command languages (Thomas & Carroll, 1981), to learning about programming (Mayer, 1981) and to learning how to use text editors (Mayer,1976). Protocols of subjects who were attempting to learn editor commands showed a tendency to integrate new commands with prior schemata of organised knowledge.

Procedural knowledge embraces actions rather than propositions. People find difficulty in expressing their procedural knowledge of motor skills, of language, and of social skills, because the procedures used become automatic once expertise is developed.

Researchers express the procedural knowledge of an action by a sequence of "production-rules" of the following type; "IF situation is X, THEN action is Y". This way of expressing a procedure calls for the mechanism of comparing the current task situation with the "IF" clauses related to the set of production rules stored in the long term memory.

The usage of procedural knowledge becomes more complicated when different "productions rules" are available with the same "IF" clauses. According to Anderson (1983) there are five principles which will influence the production rule that will be selected. These principles include: (a) the degree of match, referring to the possibility that only part of the "IF" clause can be matched to the current situation; (b) the strength of the production rule, meaning the frequency with which a production rule has been effectively used; (c) the data refractoriness, implying that the same production rule cannot be used more than once with the same data; (d) the specificity principle, suggesting that more specific production rules are chosen before more general ones, provided that both apply to the same situation; and (e) the principle of "goal dominance" denoting that a production rule that is consistent with the current goal will take precedence over all other potentially applicable production rules, even though these might be stronger or more specific.

Procedural knowledge can be organised in two essentially different ways. The one is related to the production system, in which a number of simple production rules are organised to form a single procedure with more steps, as in the case of adding numbers, reading, writing, and using a word processor. The second organisational principle stems from the declarative part of the production rule, according to which the production system selected will depend on the semantic associations generated by the situation.

Semantic networks are commonly used to describe how people present information in memory (Anderson, 1983). They consists of nodes connected by links. The nodes represent concepts or images and the links the relationships between the nodes. Two kinds of semantic networks and their interconnections are important to human-computer interaction (Chechile, Eggleston, Fleischman, & Sasseville, 1989). The world-knowledge network that represents the user's general knowledge of the problem domain and a display-knowledge network that presents the user's knowledge that is specific to the display. The user's performance with a novice display is determined by the number of nodes in display-knowledge network, the number of interconnection with the world-knowledge network and the number of critical attentional clusters of information (Gugerty, 1993).

The difference between declarative and procedural knowledge should be considered both in designing and in making instructions for computer systems (Parkin, Reid, & Russo, 1990). Declarative knowledge is needed in the teaching of new concepts, but is a slow type of knowledge to use when action is required. Procedural knowledge can be applied more quickly, for the execution of simple automated procedures. Systems instructions should thus be designed to facilitate the acquisition of procedural knowledge, by providing an organised sequence of actions.

Furthermore, since most packages provide a number of different procedures for accomplishing a task, instructions must also highlight under which conditions the procedure is most efficient; to prevent the generalisation of one procedure to all situations at the expense of efficiency.

At the same time, for the optimal use of the system the user will require some declarative knowledge. This will allow the comparison of the efficiency of different methods applied in different situations, the use of help menus; and the application of the procedures to new tasks sharing similar conditions.

1.1.6 Language Comprehension

Language comprehension can be analyzed in three stages: (a) perception, which concerns the translation from sound or vision to a word representation; (b) parsing, which involves the transformation from word to a meaning representation; and (c) utilisation, meaning the way the person will put the meaning of a message to use.

Adults tend not to have any limits to their reading capacity in relation to physiological or perceptual factors. Rather they are limited by the extent of their general language,comprehension abilities (Anderson, 1980), by the text complexity, that determines the duration of fixation, number of fixations, and number of regressions when reading, and by their level of motivation. Increasing the awareness and motivation of the purpose of reading improves reading comprehension, as in the case of the PQ4R (Preview, Questions, Read, Reflect, Recite & Review) method (Thomas & Robinson, 1972).

In addition, it has been found that world knowledge influences concept formation by narrowing down possible hypothesis during learning (Wisniewski & Medin, 1991), by helping the formulation of a particular rule to tie together separate features (Pazzani, 1991), by constructing a novel concept from known constituents and by determining the organization of concepts in memory (Murphy, 1988). Murphy and Allopenna, (1994) argued that some amount of world knowledge is necessary for any concept learning to occur and can aid in later concept performance tasks. Even computational models of concept learning with no previous knowledge do not start with a true tabula rasa but rather have inputs that are selected and filtered by their investors (Murphy, 1993).

Furthermore, concept learning in the real world that takes place in a knowledge rich environment, is faster and more efficient than artificial concept learning experiments (Murphy & Wisniewski, 1989). Computer concepts are learned and used, at least by the novice user, in the new and artificial environment of the computer interaction.

Language comprehension of computer manuals and training materials will be limited by the fact that computer terms present a new language terminology. As such the novice user's ability to understand the meaning of the terms and to utilise that meaning in applications will be greatly reduced. Furthermore, since adult users will read computer instructions at the same rate as they approach any reading task, they find their comprehension of the materials upsettingly low.

It is therefore, essential that computer training materials encourage the users to become aware of the purpose of their reading, foster the connection of the artificial perceived situation of computers with the applications of the real world and provide a chance for them to recite and review the meaning of the newly acquired terms by incorporating the PQ4R presentation methods. Using methods to increase language comprehension becomes even more crucial for those users with low general language comprehension abilities.

1.2 Complex Processes affecting the HCI

Although all skills involve mental as well as sensory-motor components, cognitive skills may be distinguished from sensory-motor skills by the nature of the task. Cognitive tasks are considered to require more effort from the person who does not know how to perform the task. Thus, problem solving can be regarded as the process through which a cognitive task is performed and learnt before becoming a cognitive skill. (Card, Moran & Newell, 1983)

Problem solving occurs when there is a goal to be reached, when the method for reaching the goal is not yet known, and when attempts to reach the goal are being made. This definition distinguishes problem solving from routine performance, when the method is known; from free association, when there is no explicit goal; and from wishful thinking, which implies no concrete effort to achieve a goal.

Norman's (1984) decomposition of the mental activities performed during the human computer interaction process corresponds with Fitts & Posner's (1967) definition of skilled activities. According to them, skilled performance is organised; is goal directed; and generally uses feedback for error detection and correction. It was considered important to investigate here the major theories of skill acquisition, the processes affecting problem solving, and the attainment of goal-directed behaviours, giving particular emphasis to their implications for the acquisition of computer skills.

1.2.1 Skill Acquisition Theories.

Although there are several approaches to the study of the cognitive processes involved in problem solving and skill acquisition (Thomas & Carroll 1979), the production-system models, which assert that when a given state is achieved in the short-term memory, a certain action will be triggered, are the most widely used (Newell & Simons, 1972).

The early production systems were first applied to highly constrained tasks such as cryptarithmetic and the "Towers of Hanoi" problem (Hayes & Simon 1974). However recent work has applied variations of the models to describe human interactions with computers in programming (Brooks 1977), editing (Card et all 1980), reading (Just & Carpenter 1980), speech perception (Newell 1980), text composition (Hayes & Flower 1980) and fault diagnosis (Rouse, Rouse, & Pelegrino 1980). The main such production system models will be further described.

Anderson's ACT Theory:

Anderson (1982) has provided a framework for understanding observations made by Fitts (1964) on the development of skill. Fitts outlined three main stages: (a) the cognitive stage , in which the learner makes an initial approximation of the skill, based upon background knowledge, observation or instruction; (b) the associative stage, in which performance is refined through the elimination of errors; and (c) the autonomous stage, in which skilled performance is well established.

Anderson bases his framework on his Adaptive Control of Thought (ACT) production system whose function is based on three qualitatively different types of memory. The declarative memory contains factual information in a propositional network. The procedural memory, contains the steps required to accomplish tasks in production. Finally, the working memory is responsible for the transfer of information between declarative and procedural memory and for the intake and rehearsal of information from the environment.

Anderson's theory has two main stages, the declarative and the procedural stage as well as a transitional phase of conversion of facts into procedures through the process of knowledge compilation.

In the declarative stage, knowledge about how to perform a skill is assembled from declarative memory and from instructions or guidance, and passed into working memory. These declarative encodings are accessed step by step. This procedure is performed under conscious control and is subject to capacity limits of the learner. This declarative knowledge is then turned into productions through general problem-solving procedures (Anderson 1982) like the use of analogy with a similar problem (Rumelhart & McClelland, 1986) or working backwards from a solution (Larkin, McDermott, Simon & Simon 1981).

According to Anderson (1983), this transition is accomplished by the knowledge compilation process, which is composed of : (a) the proceduralisation process, which creates specific productions that eliminate retrieval of information from long-term memory by building that information into rules, thus reducing the amount of long-term information that needs to be maintained in the working memory; (b) the composition process, which combines successive productions into a single, abbreviated process with the same final effect; and (c) the tuning of productions stage which is achieved through the processes of generalisation, discrimination, and strengthening. Generalisation requires that the learner formulates rules which capture what two problems and their solutions have in common, so that the rule can be applied in similar problems. Discrimination means that the solver imposes restrictions on productions that are too general by adding conditions which restrict the range of applicability. Strengthening produces speed up in the performance of simple tasks and algorithmic improvements in the application of complex tasks, through repeated practice.

Anderson's view (1983) that declarative knowledge was a prerequisite to procedural knowledge has been criticized (Willingham , Nissen, & Bullemer, 1989). Results from patients with amnesia (Squire & Frambach, 1990), and subjects who succesfully manipulated a rule based system without consciously stating the rules (Broadbent, 1989; Berry & Broadbent,1984) suggest that declarative knowledge can be acquired without going through the procedural stage.

In response to these criticisms the conception of the relationship between declarative and procedural knowledge has been modified in the new version of ACT called ACT-R (Adaptive Control of Thought - Rational)(Anderson,1993). The emphasis has shifted from declarative memory of instruction to learning from examples' analogy as is evidenced by students (in mathematics, science and computer programming), who made heavy reference to examples in their initial attempts to solve problems in these domains (Pirolli, 1991; Pirolli & Recker, 1994).

In the ACT-R conception of the transition from declarative to procedural knowledge is that the student learns from a declarative representation of the example without the requirement that the presentation be permanent and retrievable from the longterm memory. Students look up examples in resource books and keep them active in working memory during the analogy process.

Anderson & Fincham (1994) supported that there is a gradual shift from an example-based processing to rule based processing and that with practice on the procedural-rule task subjects extract a declarative representation of the rule and compile a production to embody it (Novick & Holyoak, 1991) . But, in order for the user to be able to complete other examples through analogy it is necessary to have being able to extract and state the rules used to solve the first example (Novick & Holyoak, 1991). Further research is required to study the applicability of the ACT-R model for the learning of computer packages by novice users with no previous experience in this domain.

According to Anderson's theory, in order for a training method to be efficient in promoting learning it must: meet the need for practice opportunities; facilitate the processes of generalisation, discrimination and strengthening; consider the capacity limits of the learner's working memory; and foster the production of rule-based processing. Since the novice computer learner has to rely heavily on the information given in the instructions of the training materials it is necessary to consider carefully that the amount of new information will not exceed the capacity of the working memory. In addition, steps of actions must be organised in a manner that will facilitate the transformation of individual actions to a compound goal directed routines. Also, instructions must provide the necessary information for the learner to be able to discriminate under which conditions the learned rules can be generalised and used by analogy. Finally, it is useful to include examples which incorporate the procedural rules used for their completion so that the learners can use them to complete other applications through the process of analogy.

Hunt & Lansman' s Production Activation Model:

Hunt & Lansman (1986) produce a production model which attempts to integrate findings on changes in the use of attentional resources over skill acquisition with those on problem solving. They proposed that productions can be triggered either by spreading activation between them or by matching their condition with information in working memory, which acts as a blackboard for the transfer of information between production or its acquisition from the environment. Controlled processing involves the use of working memory. Initially a match is made between information in the environment and the conditions of a production rule in long-term memory. When a match is found, the condition is transferred to working memory, then the production is enacted. Automatic processes takes place via the spread of activation between productions.

Hunt's & Lansman's production model highlights the significance of working memory as the main way that novel information is processed. It is therefore, necessary to present new information in such quantities so, as not to exceed the capacity of working memory. In addition, the tendency of the learner to match the computer situation with information of already existing production rules from previous experiences must be considered, to prevent novice users from forming misleading assumptions and conclusions.

Larkin's ABLE model:

The model of acquisition proposed by Larkin (1981) is focused on characterising the minimal knowledge a learner might acquire from a textbook and then to propose means by which practice might facilitate the application of that knowledge to solve problems. The computer-implemented model, ABLE, consists of BARELY ABLE, the novice model, which becomes MORE ABLE, the expert simulation, by developing its knowledge structure as it works through different problems.

Whenever a principle is successfully applied, a production is stored in the long-term memory with a condition linking the principle and the situation it was applied in and an action which incorporates knowledge that can be generated by that principle. Ackerman (1988, 1990) extended this model to incorporate the relationship of abilities and practice. He argued the importance of abilities will be shifted from general intelligence, to perceptual speed to psychomotor ability with the increase of skill acquisition.

The model implies that the procedure for finding the correct equation and the desired quantity becomes automated after execution of the initial production, but this proposition is seldom the case. Furthermore the model cannot link a series of productions into one and is inadequate in explaining the relation between the focus on a goal and the knowledge acquisition. (Sweller Mawer & Ward 1983).

This model highlights the significance of practice for the formulation of a knowledge structure which will then be applied to solve new situations. Furthermore, since learning is based on the link between the correct action and the desired outcome, materials must try to maximise the link between goal and action as well as to provide all the necessary information for the user to be able to expect the correct outcome after each action is performed. It is important to foster the habit of verification after each action and also to provide the information needed to minimise random attempts which will result in false outcomes which the user can not ameliorate or evaluate.

1.2.2 Problem Solving Approaches

In order to investigate the processes and strategies used in problem-solving situations, a number of think aloud protocols used by people when solving standard production system problems like the Tower of Hanoi puzzle (Anzai & Simon, 1979) were analyzed. In each attempt to solve the problem four kinds of processes were recognised: applying the current strategy, gathering information that would later be used to modify the strategy, using information gathered in previous episodes and deciding when to terminate a solution attempt.

The processes were modelled in a production system which, while it did not model the learning process, elaborated on the processes the learner may use to acquire or transform strategies. According to this model, strategy develops through the transformation process; that is new strategies are dependent only on the strategies that immediately preceded them. The success of transferring the problem solving strategy to analogous problems depends on the memory quality from the previous episode (Lovett, Anderson, 1994). In practice, this would suggest that a learner who employs a relatively ineffective strategy early on is likely to be handicapped, not just initially, but over a considerable part of the learning (Hammond & Barnard, 1984).

At a second stage of the model's application, an adaptive production system was built, with the goal of examining the process by which people develop more efficient strategies to solve problems. Developing more efficient strategies depended on learning to avoid bad moves, and on acquiring a goal-recursion strategy to formulate goals according to the conditions and characteristics of the present state of the problem.

From the analysis of wordprocessing tasks, which were learned by doing Waern (1989) reported marked differences from those of the Tower of Hanoi tasks. The wordprocessing learners did not acquire much search knowledge even after 20 repeated tasks, whereas the learner in the Tower of Hanoi had already found some strategies after only four attempts to solve the prescribed task. A number of reasons for this have been suggested: (a) the differences in the details of the different kinds of tasks, may have inhibited the learner from benefiting from the general similarities; (b) the learner was not in full control of the situation, having to attend to new and unexpected developments in order to get the information to increase their search knowledge; and (c) in real life learning by doing means learning to understand the presentation of the problem space and to simultaneously search for the accomplishment of a well defined end goal.

There are two main aspects to the thinking involved to solve a problem: (a) the problem has to be properly defined; and (b) the different paths from start to goal have to be found. Since these two distinct stages of the problem solving process have specific implications for the human computer interaction they will be further examined below.

Representation of the Problem.

"Gestalt" psychologists have determined a number of issues in problem solving tasks, rendering the representation of the task difficult. First, the formulation of the problem is often such that the representation most readily arrived at is not adequate to the problem. This means that the problem must be represented in a different way in order to fit the structural features and requirements of the task. Secondly, the "implicit restrictions" embodied in a task requires the need to "restructure" the ordinary way of perceiving it.

In a computer situation the system offers one or more problem spaces, in the shape of permitted operations and concepts, with which the system operates. The user constructs a problem space by selecting a sub-set of task at hand. The search implies combining the chosen operations in some way so as to achieve the goal. Furthermore, a computer system allows the use of several methods to achieve the same goal, so learning involves choosing the "most efficient" method of approach.

The only information the first time user has, for the definition of the characteristics of the problem space and the possible system strategies, is provided by the available documentation and manuals. The user has to be able to remember and understand the available information in order to be able to apply it when working with the system. From a study of people learning to use a wordprocessing system given a minimal set of instructions and so having to rely on learning by doing Waern (1985) identified four different stages; (a) the "playing around" stage during which the user investigated new functions; (b) attending to the unexpected result of their actions; (c) reflecting on what has been observed and relating the conclusion to the problem space; and (d) forming a general model of how the system works.

In order to be able to complete those steps the new user must be confident and able enough to handle unexpected outcomes without getting frustrated. When learning a system applications must be given in such sequence so as to foster the user's experimentation with new approaches but also the formation of a structure of a model. Finally, cues promoting review and reflection can facilitate the generation of relations between actions and the formulation of general rules.

Search Problems

For a user to be able to choose an efficient way of solving a particular task requires the development of the concept of Heuristics (Newell & Simon, 1972), which represents a way of searching the problem space without guaranteeing that a correct solution will be found. In the situation of the novice user, who has little heuristic knowledge, the solution can be found through trial and error. The efficiency of such a trial and error method depends on how systematic the user is; and on the user's ability to remember which actions were not effective and to repeat those most efficient. Thus, materials which provide the necessary initial heuristic knowledge to the novice user can be of great help.

Search problems require the examination of all possible situations which can be derived by the application of possible actions on the initial situation (Newell & Simon 1972). Each situation can be regarded as a "Knowledge state", which includes all information relevant to the problem at a particular state. New knowledge states are then derived by using the available "operations". Search problems become difficult when they necessitate the overview of several possibilities which exceed the working memory capacity. In order, to deal with such situations people tend to use heuristics, meaning short-cut ways to search among possibilities, or to redefine the problem in a way that will reduce the problem space.

Problem solving efficiency is based on the solver's: (a) ability to represent goals in the way that steps of actions can apply; (b) wealth of knowledge in the specific domain problem solving strategies which can be used to meet the demands of the applications ; (c) strategy of approaching a problem solving task; and (d) capability of assessing the correctness of the outcome. Increasing the availability of relevant knowledge can facilitate problem solving and conversely by increasing the availability of irrelevant information can inhibit problem solving abilities (Anderson, 1981).

The efficient utilisation of problem solving skills in computer applications is greatly hindered in the case of novice users by their limited knowledge of how computers operate. They have to rely on previous knowledge from other areas or on the usage of any available information. As a consequence, they tend to represent the problem in ways inapplicable to computer operations or to get confused by the fact that they cannot distinguish relevant from irrelevant information. It is therefore, essential that users should be encouraged to utilise their problem solving skills only once they have developed a model of how computers operate; or they are given only the necessary information that could guide their problem solving.

Another feature of computers that make the application of problem solving strategies troublesome is the difficulty the users' face in evaluating the outcome of their actions. The users must know what to expect of every single action and evaluate the outcome of every action they make during a procedure. Knowledge of the correct result of each action of the procedure and of the end goal is therefore essential to the user.

1.2.3 Goal-Directed Behaviour

Almost all human behaviour can be characterised in terms of goals and plans. The traditional view of plan use is one in which people think about their goal, develop a plan and then execute the plan without additional thought (Suchman, 1987). The importance of goals and plans to human behaviour is an important insight in cognitive psychology (Miller, Galanter, & Pribram, 1960). The goal-plan approach has been especially important and well developed in the study of story understanding.

A crucial part of understanding or writing stories is using our knowledge of goals and plans to make inferences that link story statements into memory representations comprised of goals and plans (Shank & Adelson, 1977; Black 1984; Black, Wilkes-Gibbs, & Gibbs, 1982). Evidence supporting this statement comes from results showing that readers retain story information in memory in the order called for a plan rather than in the order presented in the story (Bower, Black, & Turner, 1979).

Furthermore, it was found that when readers make goal-plan inferences linking story statements, the stories are more coherent and better remembered (Black & Bower 1979). For readers to be able to detect the plan of the story they have to read two stories embodying the same plan in different contexts (Gick & Holyoak, 1983). Nevertheless, goal and plan formation in understanding stories cannot be readily applied to computer understanding since it involves recognising variations on already familiar plans rather than considering and interpreting new unforseen circumstances (Agre & Chapman, 1990).

The use of plans in the context of users interaction with the system have a strong element of improvisation; the users continually reevaluate and reconsider what to do now, utilizing resources from the immediate surroundings. Plans provide the resources and the assistance to allow users to interpret the situation and the uncertainties that arise and to help figure out how the plan may be made to fit to the current situation (Agre, 1990)

Goal plan analysis has been applied to study expert use of text editors (Card, Moran, & Newell, 1980) and also to study how novice users learn to use such systems and become expert with them (Kay & Black, 1985). Robertson & Black (1983) indicated that novice users: a) formulate basic plans and pause at the plans' boundaries to evaluate the results of the action and to determine the next step; and b) combine elementary plans to make more complex ones.

Kay and Black (1985, 1986) have been able to trace out the plan acquisition process by having users with various levels of experience in text editing systems, to rate how similar pairs of systems commands are. They found that the basis for such similarity judgments shifted dramatically from one experience level to another, and that this method could be used to map out the knowledge representation, as users become more experienced. By combining their results with those of Robertson & Black they concluded that learning to use a text editing system progressed through four phases, with distinct characteristics and requirements of the learner.

Phase one represents the completely novice user, who has no experience in using a text editor. At this stage of learning, users have preconceptions about the concepts, terminology and commands to be used in text editing, but those preconceptions in most situations do not apply. Therefore, users in this phase are confronted with the task of overcoming a bias toward interpreting the commands in terms of their previous knowledge associations.

To accomplish this task and achieve any level of expertise, the previously existing knowledge representations must be reorganised to accommodate the acquisition of accurate text editing knowledge.

Initial text editing knowledge can be acquired from a manual, a class, self teaching or any combination of these. Regardless of the method, the main goal is to overcome the prior knowledge bias that exists for the text editing commands. This means learning: (a) the goals relevant to text editing; and (b) the commands that can be used to accomplish these goals. The first part of the learning process takes place as soon as the user begins to use the system's commands. Knowledge of general goals allows for the generation of high-level goal structures. The organisation of this knowledge is based upon only the "result" of the commands and not the procedure that leads to this result. Because of this narrow focus, the users do not possess the knowledge to: (a) develop more complex structures, such as plans; (b) to discriminate between commands which are linked to the same goals as for instance PUT, INSERT, & REPLACE commands which are conceptualised as similar because they can add text.

An efficient computer training model must provide the necessary information for the novices to be able to understand the general goals involved and the individual commands and operations that are related to these goals. During this initial state of the learning process instead of the user being introduced to numerous commands and their definitions and leading on to a trial-and-error learning approach, the user is provided with the correct command in the correct situation that leads to the desired goal. Thus novices start to conceptualise the commands with the goals they accomplish.

Once the users have acquired the basic editing commands and goals, they develop the ability to form plans by combining the actions that were organised separately in a sequence of actions. This realisation leads to a reorganisation of the knowledge presented to accommodate the command sequences or plans that are used to accomplish the goals. Instead of clustering the PUT, INSERT and REPLACE commands together, PICK and PUT commands are used together to accomplish the goal of moving a text.

The GOMS model with its organisation of operations in goals and sub goals provides the conception of command knowledge according to a sequence-oriented or goal-plan fashion.

Phase four of the Kay & Black model accounts for the user's ability to accomplish more advanced tasks by being able to: (a) transform simple plans into more compound plans to accomplish major goals; and (b) develop rules for selecting the best plan to achieve a given goal in a given situation. In this phase there is a change in the one to one association between goal and plan to one goal to several plans correspondence. In addition, the evolution of compound plans resulted in the decrease of (a) pausing time between simple plans; (b) time taken to initiate a compound plan; and (c) time required to assess the conditions and to select the most efficient plan was diminished (Robetson & Black, 1983).

In order to ensure in this knowledge phase that the correct plan is chosen from a set of applicable plans, the conditions or selection rules that must be met for the applicability of the specific plan must be given to the user. Thus, at this level of expertise, goals are linked to plans using the conditions under which these plans are invoked. The GOMS model assures the selection of the most efficient plan for the achievement of the goal by providing the set of rules which will connect each specific plan to its goal.

Training must provide the structure and the necessary information to the novice user to meet the demands of different goal plan development phases.

2. HUMAN COMPUTER INTERACTION FOR THE ADULT, NOVICE LEARNER

A number of researchers have indicated that software packages were often under-utilised by both novice and more experienced users and that novice users often face common difficulties, when they learn computer applications (Clement, 1984; Davis, 1983; Lang, Lang & Auld, 1981). The acquisition of computer skills presents a different learning situation not only due to the fact that the learners are adults, who are experts at particular tasks and who want to continue being experts in computers as well, but also, due to the peculiarities of the computer features themselves (Halpin, McGullough, 1986).

In this chapter the main suggested sources of the common problems that adult, novice users face when mastering a computer system will be investigated, giving particular emphasis to their implications for the design of efficient training materials. In addition, the effectiveness of different models of computer training instructions will be discussed and the objectives of an efficient training model will be highlighted.

2.1 Issues related to the computer user.

2.1.1 The Ways Adult Users Prefer to Learn

Research on how novice, adult users prefer to learn computers, by using the think aloud approach (Nisbett & Ross, 1980, Ericsson & Simons, 1980) revealed similar results in findings from studies examining the style to approach learning by adults (Carroll & Mark, 1985; Jarvis, 1983; Knowles, 1980). Adult novice users utilise three different approaches to acquire computer knowledge. They learn by doing, thinking and knowing because they desire to "learn with energy and intelligence" (Jarvis, 1983), to be active and in control of their learning. Due to the unique nature of the human computer interaction, each of those methods imposes specific limitations on the learner.

Most adult learners prefer to learn by trying things out rather than reading about how to do them. Learning by doing involves the definition of the characteristics or the nature of the problem space, as well as learning how to search efficiently to discover an effective solution.

Traditional training materials tend to provide expository materials or long stepwise procedures in order to capitalise on the desire of the user to learn by doing. Such designs lead the user to "jump the gun", meaning to try out the operations before reading the instructions and to "be easily sidetracked" with no available way of recovering. Most importantly, with such methods the overall orientation towards accomplishing a meaningful task had been sub diverted by the narrower orientation, that of following a sequence of instructions. It is important, therefore, to organise training materials according to modules with respect to real tasks (Carroll, 1982; Carroll & Mark, 1987). This implies that by typing a letter the user will learn to perform different sub tasks like moving the cursor, saving the letter etc.

Furthermore, the adult users desire to learn by thinking, by being active in trying to make sense out of their experience with the system or the program. More specifically they are trying to develop hypotheses about why the system operates as it does. These quests after meaning are triggered by the user's personal agenda of goals and the encountered discrepancies which will necessitate the finding of solutions for the new problems.

In the effort to learn by thinking the novice user has to construct a rationale for why computers operate as they do, by relying on their limited previous knowledge, which cannot support the effective utilisation of their deductive or inductive reasoning capacities. So novice users have to rely on reasoning through abduction. Reasoning through abduction focuses only on the confirming evidence and overlooks potential discrepancies that cannot be explained by the assumed explanation (Nisbett & Ross, 1980). Concepts that violate one's knowledge are harder to learn and situations that do not apply to the expected assumptions tend to be neglected (Murphy & Wisniewski, 1989). So novice users tend to reach erroneous conclusions.

In addition adult novice users set a personal agenda of goals which they actively try to reach but they are hampered by not knowing the appropriate problem space, the domain of the possible actions and which interpretations can be considered as relevant.

Novice users, tend to use their capacity to learn by knowing, meaning the use of their reasoning and problem solving skills by spontaneously referring to their substantive knowledge from other domains in the exploration of computers. Many times, they have to rely on a superficial resemblance between goals and feasible operations leading to failure, because previous knowledge usually is not helpful in defining the "problem space", in deciphering what is relevant to the particular goal, in interpreting results and in formulating goal directed actions (Tulving, 1972).

Many of the novices' errors are caused by deficient analogical thinking, which usually occurs when some knowledge in a source domain is activated in response to a search description and the novice user is not able to take note of the constraints in the target domain which do not exist in the source domain (Dewier, & Karnas, 1991).

Novice's comprehension of an introductory manual explaining the text editing tasks was found to be hindered by the incompatible use of the office analogy (Halsz, Moran, 1982); by the creation of a deficient model of the computer, such as confusing two different programs; by the inability to induce regularities in functions and command language; and by inadequate understanding of how different steps in combination carried out the task (Clement, 1984).

A further analysis of the nature of the novices' errors showed that up to 60% were due to erroneous use of the typewriter analogy (Douglas & Moran, 1983), and that 92% of the inefficient commands used were associated with the fact that inefficient commands were more congruent with the users' prior knowledge of typewriting (Allwood & Eliasson, 1987). It is important that training materials do prohibit the transference of the deficient analogical thinking by highlighting the differences between their previous experiences and the computer interaction and by clearly marking the inconsistent features between computers and type-writers (Carroll & Thomas,1982 , Dewier & Karnas, 1991).

Finally, when performance reach a high level of accuracy makes the learners to think that they know it all. This attitude discourage the acquisition of more efficient procedures and potentially important new information (Krueger, & Rothbart, 1990).

These three preferred learning styles affect the ability of the novice user to follow the instructions in the manual, which is one of the major ways of learning computer operations. Users encounter difficulties due to: (a) their tendency "to try out" procedures before finishing reading all the instructions; (b) their reluctance to follow instructions that contradict what they believe to be appropriate; and (c) their simple oversight like skipping or repeating a step.

In addition, the complexity of learning a basic skill from an instruction book, must be considered in the design of the training materials. Highlighting and separating the basic elements of the process; translating the operations into actions and keys, coordinating the multiple sources of information (manual, display, screen, memory, keyboard etc) and evaluating the outcome of each action, will be helpful to many users and prevent them from becoming overloaded. Finally, the training materials must encourage the integration of the separate actions to more complex procedures and the appropriate transference to other situations.

2.1.2 Misconceptions about Computers

Most novice computer users are people who want to use computers in order to perform certain tasks (Eason, 1976). For such task-tool relationships the user expect to find computers easy to use and learn (Eason 1974), and they are not willing to undergo extensive training (James, 1981). Such expectations, contradict the actual experience of novice users with computers, making them feel "stupid, frustrated and intimidated by the machine", leading them to consider quitting.

Text processing skills are influenced by positive or negative transference. Text processing builds on typing skills but some ideas are violated by most word processors, like the CARRIAGE RETURN, causing a considerable number of physical execution or inefficient commands errors (Allwood & Eliasson, 1987). The learner has to alter their skilled typing procedures to accommodate those differences.

The novice user's desire to limit the amount of time and effort expended on using a computer system in combination with their minimal previous knowledge, necessitates the development of effective training models and guidance methods.

2.1.3 Psychological Factors.

Psychological factors may affect the manner in which novice users interact with the computer. Attitude and anxiety have been shown to affect learning and computer interaction (Shneiderman, 1979). It has been demonstrated that novice users with negative attitudes toward computers tend to learn more slowly, to make more mistakes, and to exaggerate small problems, thus affecting their motivation to work with the computer (Eason & Damodaran, 1981).

Previous experience with office work, motivational anticipations, and expectations about power and control in work related settings, and educational status will influence the user's approach to computer learning and the way of reacting to difficulties (Parasuraman, Igbaria, 1990). When encountering difficulties, typists tend to conclude that the fault is their own and that they are too stupid to understand, due to their belief that they are powerless and hence expect to be victimised (Arndt, Feltes & Hanak,1983). Users with high need for achievement are characterised by a desire to find solutions to problems, a tendency to set moderately difficult achievement goals, a strong orientation towards task completion and high commitment to decision making and success (Hollenbeck, Williams & Klein, 1989).

Furthermore, the novice user's perception of computers as mysterious displays of communication procedures and programs, which can only be understood by computer experts enhances the anxiety level of novice users (Parasuraman, Igbaria, 1990) especially those who have a low tolerance for ambiguity and perceive unpredictable situations as threatening. Involvement and satisfaction with computer systems was found to be higher for users who were tolerant of ambiguity and high need for achievement (Hawk, 1993).

2.1.4 Individual Differences

Computers lack the capacity to respond flexibly to the characteristics and the needs of the user. Card, Moran & Newell (1983) studied a number of user variables of importance in user-computer interaction but no direct relation between the different characteristics of the computer system and the individual attributes can be made (Van der Veer, Tauber Waern, Van Muylwijk, 1985, Egan, 1988).

Difficulty in learning line and screen based editors was closely related to the age (Charness & Bieman-Copland, 1992), the spatial memory abilities (Gomez, Egan, Wheeler, Sharma & Gruchacz 1983) and visual search (Fisk & Rogers, 1991; Rogers, 1992). Eventhough the impact of those abilities decrease with consistent practice and skill acquisition (Ackerman, 1987) nevertheless performance of older people remains lower (Rogers, Fisk, & Hertzog, 1994). Older people have more difficulty than younger people in learning text editing (Czaja, Hammond, Blascovich, & Swede, 1989) due to the decline of spatial skills and memory ability (Egan & Gomez, 1985). Such individual differences in the rate of mastering computer functions highlight the importance of pretraining and of training materials with variable pacing.

Differences in the effectiveness of learning methods have been noted between high-middle and low aptitude trainees (Dean & Whitlock, 1988). Generally speaking, the higher aptitude learner learns most efficiently when structure is minimized. Such students tend to be oriented towards learning by themselves and they are sufficiently successful in mastery computer skills without built-in feedback and other motivational devices, because they provide their own. For this type of learner, computer assistance may be most effective in describing objectives, indicating the location of resources for learning and providing assessment, when the learner is ready for it.

Lower aptitude trainees, on the other hand, need a complete structure comprising shortish sequences in which there is a high rate of repetition, the use of simple language, and the provision of extensive practice opportunities. Such learners do appreciate contact with an instructor.

Tendency towards reflective or impulsive behaviour may well have implications for programming and for approaches to learning in computer situations. A reflective individual will think upon the problem more and will evaluate more alternatives than an impulsive person, making fewer mistakes but also taking a much longer time to solve even simple problems. Impulsiveness, on the other hand, may be a hindrance to some computer tasks leading to mistakes.

Personality dimensions like introversion and extroversion, which are related to the user's level of, sociability and stress tolerance (Eysenck 1967,1977), will greatly influence the way a novice user will react to computer messages. Extroverted people are expected to have a higher tolerance of stress and to be more able to accept and handle "threatening " error messages of a computer system. In addition, the fear of failure will cause certain individuals to under achieve or give up computer work when faced with difficulties.

Computer involvement is likely to be an unfamiliar, demanding and anxiety evoking experience for many users (Parasuraman, & Igbaria, 1990). Parkes (1984) suggests that internal control users may experience less distress since they have developed more effective coping mechanisms. On the contrary the external control users are more likely to experience feelings of helplessness, dissatisfaction and anxiety under conditions of high job demands (Perrewe, 1986).

Removing the competition aspects in computer work, providing more help facilities, instructions, and guidance, strengthening the self confidence of the novice users and supporting their understanding of the benefits for their own jobs will be helpful for people with fear of failure and negative attitudes towards computers (Pilgrim, 1990). Especially in regard to novice users, it is important that training ensures a positive experience and the feeling of completing something in every session.

According to Shneiderman (1980) computer training must be designed so that: (a) instructions are clear, phrased in familiar terms and easy to follow; (b) training begins with simple tasks that will enable learners to be successful and gain confidence; (c) messages are clear and non-threatening; and (d) through their work with computers learners should feel a sense of closure or finishing a task that leads to a sense of relief and accomplishment..

2.2 Issues related to the computer features.

2.2.1 The Computer Language

One difficulty encountered by the novice user is that computer language is usually abbreviated, coded and terse (Stewart, 1976), and as computer language becomes further removed from the natural language, it becomes more difficult for the novice user to handle (Kennedy, 1975). Computer jargon requires the novice users to learn and memorise the various command definitions in addition to their functions.

Users regardless of their training or experience with computers found easier to use natural language when interacting with computers (Capindale, & Crawford, 1990). Despite the benefits of the use of natural language, the users must state their queries in terms that the system can understand and the systems must have a large vocabulary to accommodate for the different ways users express themselves (Jarke, & Vassiliou, 1985).

A number of ways have been found which seem to facilitate novice users in handling computer language like: teaching the operational definition of a computer command first, and then their functional meaning; presenting computer messages in both the coded form and a complete explanation; and providing command prompts to improve the novice user's memory capacity (Scapin, 1981). Furthermore, the feedback provided by the system is an important feature in teaching users about computer language limitations, in reminding users about application-specific terminology , and in responding to user's actions (Slator, Anderson, & Conley, 1986).

2.2.2 The computer interface

One way to make the novice user to feel at ease with the computer is to improve the user computer interface (Thomas, 1981) by designing interfaces which are easy to use and which enable the user to successfully perform their tasks without great difficulty and hard work (Sneeringer, 1978, Edmonds, 1981).

The abstraction level that the user works at is related to the relationship of user's task to the interface language (Hutchins, Hollan, & Norman, 1986) and the qualitative feeling of the manipulated interface objects (Lee, 1991).

There are two types of interpretation difficulties in user system communication. The semantic distance concerns the distance between the level at which a person thinks of a task and the level of description required by the interface language either at the input or the output stage language (Norman, 1986). The articulatory distance is the distance between the semantics of the interface and the physical form of their expression (Taylor, 1988). Computer interfaces are using a variety of conceptual, logical even physical structures that have implications for human memory and cognition (Treu, 1992).

There are two types of engagement available in computer interfaces. The direct manipulation involves browsing, pointing, and doing operations on images and is characterized by the sensation of being directly engaged with the semantic objects of user's goals and intentions (Ziegler & Fahnrich, 1988). The descriptive manipulation involves querying, naming and describing sorts of operations on symbols and acts as an intermediary between the user and the things said (Suchman, 1987).

Many interfaces operate through menu selection, fill-in-the-blank and a parametric mode (Schneiderman, 1980). The menu selection interface provides the user with a set of numbered choices on the screen to select from and conforms to the same laws that govern information retrieval categories and object names (Nielsen, 1989).

Different studies have investigated the effects of an alphabetic to a functional or conceptual organization. Alphabetic organizations were found to reduce search time in early trials, but performance becoming equal with functional organization as the user gained more knowledge of the organizational structure of the system (Smelcer & Walker, 1993). Furthermore, functional structure menus were more effective when users could not generate the exact command name; when users have generated a functional or conceptual relationship among the commands; and when users must use many different applications or applications combining different programs (Gentner, 1989, McDonald & Schvaneveldt, 1988).

Even though menu interface model requires minimal or no training, an obvious advantage for the novice user, nevertheless the user faces difficulties in: (a) exiting from the menu sequence, (b) returning to previous menus; (c) accessing help frames; and (d) understanding the meaning and the differences of the given choices (Mehlenbacher, Duffy, Palmer, 1989).

In the fill-in the-blank interface model the user has to give a phrase, word or number response to a line of text and in the parametric model the user has to respond to a prepared line of text with a specific format with a yes or no answer. To be able to use these interface models the novice user must have previous training with the package to know which is the correct response, and also must actively search for the messages, which are usually presented at the edges of the computer screen.

In order to enhance the successful usage of those interface models it is necessary that the novice user is given the necessary information to understand the used language, the possible choices of actions and their results, prompts to foster their active search for computer messages and cues to prevent misinterpretations.

2.2.3 The Help Facilities.

Help facilities in general did not seem to be very effective in enhancing the performance of the novice users in any systematic way (Kreigh, Pesot, & Halcomb, 1990). Novice users find help facilities complicated due to their difficulty in understanding the utilised jargon language, in describing what their problem was and in matching their goal with the provided help categories.

The importance of flexible help facilities, which can provide the necessary semantic knowledge: which can enable the users to control how much information they need; and which can take into account the context of the help requested have being investigated (Scheiderman, 1980; Tagg, 1981). They concluded that available on line-help facilities must be supplemented with additional attributes including the following: (a) usage flexibility; (b) educative help, organised to provide interpretive definition, descriptive explanation of how the command can be used and reason giving explanation of why things are done; and c) grading explanations according to the complexity of the command and the user's previous knowledge (Gwei & Foxley, 1990). In addition help facilities must also be combined with computer-assisted learning packages to ensure that the novice user understood the help messages and to provide assistance and information on the specific problem the user was facing (Maquire, 1982; Tagg, 1981).

A number of "intelligent" help systems have been developed and designed around an embedded model of the user. The most sophisticated of them is the intentional models which attempt to represent the user's knowledge of the system on the basis of the users actions and initiate unsolicited advice to the user (Gilbert, 1987). Since, even users with considerable experience may not have the metaknowledge of the system to generate appropriate queries (Briggs, 1990) such systems could prove invaluable. However, such systems are based upon the assumption that performance can be taken as a reliable index of knowledge about the task which is not always valid (Gilbert, 1987; Berry & Broadebent, 1988).

2.2.4 The errors made.

There are two categories of errors associated with computer interaction (Norman 1983a). Mistakes include errors of faulty decision making or problem solving due to misunderstanding, misinterpreting or misdiagnosing the system's state leading to wrong intentions. Slips are attributed to the unintentional activation or uncontrollable activation of actions or the false triggering of or failure to trigger correctly selected actions (Norman, 1983b).

Eventhough, every action evokes some response from the computer, this response is difficult to interpret by the novice user, due to: (a) the poor available feedback; (b) the difficulty of discriminating between different operations with the same result; (c) the fact that often undetected errors cause others to occur; and (d) the different sets of function keys that control the same operation when the system is at a different state.

Furthermore, working with the computer entails a restricted freedom to a correct sequence of actions. Working in one's head or on a paper the learner is free to go back to an earlier step and make corrections called by Van Lehn (1983) "backup repairs". The computer user may wish to back up, but cannot do so because the user's actions have changed the computer's state in a way that it may not be easy to reverse.

It is therefore important than computer systems and training materials do provide user-recovery options that will help users to deal with the effects of errors, to detect errors immediately and understand the error made (Lewis & Norman 1986, Monk 1986) and to inform the user, when a procedure may not be appropriate or what it would happen before the operation is carried on (Carroll & McKendree, 1987). In addition, it would also be helpful for the novice user that the training materials identify the set of function keys with different utilities and do-undo functions.

2.2.5 The computer's alien culture.

Computing is not just something new; it is also something strange since its spatial and temporarily characteristics, controllability, and nature of feedback are unlike those of other technologies (Sproull, Kiesler, Zubrow, 1984). The initial interaction between a novice and a new culture inevitably produces reality shock for the novice.

Reality shock is composed of: (a) changes, which refer to objective differences from the learner's prior situation; (b) contrasts, which are differences in what is subjectively salient from that in the novice's former situation; and (c) surprises, which comprise unexpected differences between expectations and reality (Louis, 1980). Considering the reality shock is important not only because it signals that prior instrumental behaviours are no longer appropriate and that new ones must be learned, but also because it determines the psychological impact of the first experiences in the new culture.

Reality shock in an alien culture leads the learner to experience confusion amounting to a feeling of loss of control due to the lack of previous information (Carver & Scheier, 1981). Novices try to re-establish control (Bandura, 1977, Carver & Scheier, 1982) by actions and/or mental activity. If, the control attempts are successful, the individual is able to learn the values and skills necessary in their new role. If on the other hand, attempts are not successful, anger or withdrawal results not only in precluding positive learning and cultural inclusion, but also in fostering a negative self-image. (Carver, Balney & Scheier, 1979).

2.3 Computer Training Models

A number of computer training models with different features have been created, utilised and studied for the purpose of defining those characteristics most suitable to foster computer mastery for the novice learner.

Frese, et al. (1988) compared the effectiveness of three training methods for a wordprocessing system : a) a sequential programme, which taught low level skills and which did not help the user to actively develop a mental model; b) a hierarchical method, which provided an explicit and integrated conceptual model of the system to the user; and c) a program in which the users were asked to develop hypothesis on the functioning of the software and to use an active and exploratory approach.

Sequential training methods that partition an action into small low-level sequences which are taught and practised separately and then pieced together were found to encourage the learning of the commands by heart. Such training methods do not foster a coherent conceptualisation of the functions and the way in which each function relates to the whole system (Norman, 1983; Grief, 1986).

Frese et al. (1988) found that the use of hypotheses and goals in the beginning of the training emphasises the development of some explicit cognitive preconceptions of the system, so that the newly learned materials will be integrated into those preconceptions. Training programs which encourage exploration and active development of an integrated mental model from the beginning of the training lead to a better performance in terms of recall, learning, performance and satisfaction.

Passive sequential learning is fostered by materials which include step-by-step instructions for every keystroke to be used, with no explanation of why a certain command had to be used. The chances of errors are minimised as long as the learner followed the instructions without making any mistake in pressing the function key or in step sequence.

A number of studies showed that the most efficient training materials were those which encouraged and supported learning by exploration. When users knew the task they wished to perform then a non-elaborated version of instructional text produced a better performance than an elaborated version. Carroll, Mack, Lewis, Grischowsky & Robertson (1985) found that "brief exploration" cards were more effective than a commercial manual in training people to use a wordprocessor. More specifically, the users trained with guided exploration techniques accomplished more tasks, made fewer errors, were better in recognising mistakes, more often utilised the information provided on the screen and were more active in using the system.

In a related work Carroll, Smith-Kerker, Ford, & Mazur, (1986) showed that a very brief training manual called the Minimal manual, enabled new users to accomplish basic wordprocessing tasks more quickly than those who used the commercial manual. The important distinguishing features of this manual are its orientation towards typical goals and its support for error recognition and recovery (Carroll, 1984).

This minimalist philosophy lead to the creation of training materials that are minimal and that involve user interfaces (Singley, Carroll & Albert, 1991). Among these innovations are the training wheel interface (Carroll & Carrithers, 1984) in which the system allows the user only one possible action and the "scenario machine" (Carroll & Kay,1988) in which the computer responds to the user actions that are not on the prescribed path.

The positive results of these techniques confirm that active learning which involves interaction with the target machine and problem solving tasks, is more effective than reading instruction manuals or copying example solutions (Charney & Reder,1986).

Furthermore, Black, Carroll & McGuigan (1987) found that novice users created a more complete mental model of computer system when they were trained with instruction manuals which required inference of some information, than materials with complete and explicit information.

Charney, Reder & Kusbit (1990) investigated the benefits of acquiring spreadsheet skills through learner initiated versus trainer's supplied goals and within the latter condition, active practice at selecting and applying procedures versus copying examples. They have concluded that learning by problem solving, with given goals, was the most effective training method for novice users.

Kerr and Payne (1994) studied the instructional efficacy of animated demonstrations within active and passive learning contexts of teaching basic spreadsheet skills. Results indicated a clear superiority of the active, problem solving training approach with animated demonstrations providing a useful introduction to complex interfaces.

Training by lecturing and classroom teaching involves presenting students with relatively high level representations which may be understood but which are difficult to convert into behaviour. However, it is possible for the learner with hands-on experience to fail to transfer the specific learning to other similar situations. It is important, therefore, that training presents the learner with a range of tasks and highlights the similarities among them (Diapper, Johnson, 1989).

Comparison of the effectiveness of theoretical augmented training, which incorporates both the fundamental principles of system operation with procedural aspects, with simple procedural training revealed controversial results depending primarily on the nature, complexity level and predictability of the tasks (Dayton, Gethys & Unvein, 1990).

Allwood and Kalen (1993) studied the deficiencies of a training system designed to teach novice users to use a patient administrative system. The most important difficulties included: (a) very little conceptual information about the system and its structure; (b) the lack of practice tasks, and in particular, lack of realistic and work context relevant tasks; and (c) no guided exploration or written instructions.

A number of studies have examined the effectiveness of self-directed learning and have shown that only the most experienced users had a suitable mental task description available to them, that they relied upon visible components of the task to cue their inquiry and that there was a dissociation between their ability to perform a task and their awareness of the procedural knowledge required to complete it (Briggs, 1988; Briggs 1990; Carroll, & Rosson, 1987).

In 1980's the application of artificial intelligence to the design of computer-based tutoring systems resulted in the development of two types of sophisticated tutoring systems (Nwana, 1990). The simulation based tutoring system which provides an exploratory learning environment, for students to learn by doing, in a computer controlled environment and the intelligence tutoring systems which provides the student with structured lessons controlled by the computer itself.

A comparative evaluation of human versus computer based instructions in learning spreadsheet (Hicks, Hicks & Sen, 1991) indicated controversial results. No difference between the two methods was found in terms of the operational and instructional learning of the system. However, at the comprehension learning level human instruction appeared to be superior to the computer tutoring system. So, computer based tutorials could be used effectively as an introduction materials to the software and human instructors should primarily concentrate on problem solving skills and comprehension enhancement (Hicks et al., 1991).

As a consequence, Milech, Kisner, Roy & Waters (1993) proposed the development of a hybrid system which would conduct much of the training by allowing students to explore a simulated environment. This system should be designed to: (a) provide immediate feedback of the simulation according to the level of expert knowledge; (b) use students actions to create a student's model by identifying needs and difficulties; (c) adjust lessons to address student's needs and induce optimal knowledge; (d) perform actual tasks in realistic environment; and (e) expose students to novel problems (Kirwan, 1990).

For the development of effective training it is important to take into consideration the following aspects of psychology: knowing how to give effective advices and instructions to promote learning; knowing the nature and complexity of the tasks to be accomplished; and knowing what kind of person receives and uses the advice (Carroll & Aaronson, 1988, Carroll & Mckendree, 1987).

An efficient training design must have the necessary structure and materials to encourage the learner: to focus their attention; to inform them of feasible objectives; to stimulate recall of the prerequisite learning; to present stimulus material; to provide "learning guidance"; to elicit the performance; to give feedback; to assess performance; and to enhance retention (Dean & Whitlock,1988). The complexity of the interface and the user's need to learn by experimenting with and exploring the system are two major factors, which must be carefully considered in the design and the organisation of the training (Mack Lewis & Carroll 1987, Card, Moran & Newell, 1983, Schneiderman 1980, Carroll & Mack 1983).

Furthermore, the psychological implications of training procedures must also be examined. It is imperative that training does not antagonise the trainee and that by the end of each training session the trainee must have a more positive attitude toward computers (Kennedy, 1975). Training must include a user supportive, non challenging instructions (Morris, 1994) to help reduce or prevent the situations in which the trainee will feel helpless when using the computer system. The user's sense of control of the system is instrumental in building their confidence in their ability to use the computer system.

Finally, the training must respect the need of privacy, which is particularly important to the adult learner, who tends to be more inhibited and only use computers when there are no other people around (James, 1981).

3. COMPUTER TRAINING IN MENTAL HEALTH REHABILITATION

3.1. Vocational Rehabilitation in Mental Health.

Over the last thirty years knowledge about the treatment, the needs and capabilities of individuals suffering form mental illness, has resulted in a steadily increasing movement away from the exclusive use of institutional care to an emphasis on the development of community based facilities and programs that assist people to live in the least restrictive environments (Anthony & Blanch, 1989). This movement towards congregated care as an alternative to hospitalization created the dilemma of whether psychosocial rehabilitation services for individuals with psychiatric disabilities must be focused only on the promotion of longer stays in the community or must also concentrate on the improvement of clients' skills and competencies (Solomon, Gordon & Davis, 1984; Liberman, & Eckman, 1989). It has been found that treatments aimed at symptom amelioration alone have little effect on strengthening a person's capacity for independent community living (Morris & Edwards, 1984).

The majority (90-100%) of the longterm mentally ill persons receive medication therapy, with intensive psychotherapy to has fallen into desuetude (Spaniol & Zipple, 1988). Literature review on the effectiveness of different treatments supported the use of long-term supportive psychotherapy and behavioral techniques, combined with the minimum amount of medication needed (Conte & Plutching, 1986; Rimmerman, Finn, Schnee, & Klein, 1991). Supportive psychotherapy is designed to help the person to learn basic problem-solving and work skills and to handle day to day practical issues and relationships. Wong, Woolsey, & Gallegos, (1987), suggested that behavioral techniques, like the token reinforcement and token economy programs , were most effective in reducing hallucinations and delusions, in decreasing aggressive and disturbing behaviours, in increasing ADL skills and social integration activities, in enhancing social skills, self-care, recreational activities and vocational skills (Rimmerman, & Al., 1991,).

A sensible program of vocational training and rehabilitation for people with mental illness must be specifically designed to prepare them for the environment in which they will eventually function, rather than simply to prepare them to achieve good levels of functioning during rehabilitation (Watts & Bennett, 1983). Therefore, both personal predispositions and environmental influences must be considered for the creation of a sensible rehabilitation plan. Among the various aspects of the environment that need to be considered are whether it provides an outlet for the skills and capacities of the person involved, whether it avoids stressful exacerbation of potential dysfunctions by providing whatever shelter is needed and whether it provides the level of support needed for the person to function at his or her best level (Bennett, 1978).

Rehabilitation must ensure and foster the transition process from patient, to student, to worker. There are three important variables to be considered in this transition process, the person's competence, the environmental or task demands and their discrepancy. (Seppalainen, 1990). Competence refers to the individual's cognitive, emotional, educational and physical abilities and how they can be actualised to perform life activities or work tasks. Environmental or task demands incorporate the needed competencies for the individual to perform successfully. Discrepancy includes the difference between one environment or functioning level and the next, as well as, the difference between the abilities of the person and the requirements of the task.

The degree of discrepancy may influence the person's ability, not only, to transfer acquired skills and behaviours in different situations as in their home or in open employment, but most importantly, their prospects of advancement. Psychiatric rehabilitation must consist of a series of small steps, which must be just within the person's present capacity, and the result at each step must determine whether is possible to move on to the next (Wing 1989).

Rehabilitation must provide a hierarchy of work experiences and training options, to encourage the person to get to the top, but also must include different outlets at every level of the hierarchy (Goldberg,Schooler, Hogarty, Roper, 1977). The person must be given options to choose a realistic work or training activity and support to create the formation of goals according to their residual abilities and to perceive the progress made and the future possibilities (Agacinski, & Stern, 1984). The persons' perception and understanding of where they stand and the possible directions in which they can move, helps them to readjust their attitudes and behaviours and to enhance their motivation. The experience of progress and success in acquiring new skills, after months or years of nothing than failure, is expected to bring about a stable increase of self-confidence and self-esteem.

Rehabilitation of people with mental illness can be grouped under medical, vocational and social aspects (Pradad, Bhagat, &

Padankatti, 1991) to provide for their widespread lack of functional behaviours, work habits and vocationally demanded skills (Farkas, Rogers & Thurer 1987). Vocational factors are important in the rehabilitation process of psychiatrically disabled people, since work problems and unemployment interferes with recovery from mental illness and occasionally contributes to its onset (Coviensky, & Buckley, 1986). Occupation confers a sense of mastery, through performance of social roles, bring social status and contacts (Shepherd, 1984). Sustained unemployment among psychiatric patients have been reported as high as 70% (Thornicroft & Bebbington, 1989). The relationship between psychiatric illness and the capacity to work is not precise or predictable (Anthony & Jansen, 1984). Specific psychiatric symptoms were found to be related to work performance like primary symptoms of delusions and hallucinations, as well as, secondary effects of emotional withdrawal and conceptual dis-organisation, but the stability of these correlations over the course of rehabilitation needs further study (Massel, Liberman, Mintz, Jacobs, Rush, Giannini, & Zarate, 1990). A broader range of more differentiated measures, such as productivity level, responses to work place stressors, and the ability to arrive at work on time and remain on the job, is required in order to evaluate the work capacity of people with mental illness (Summerfield & Lipsedge, 1990).

In addition, social factors like unemployment and discrimination mutually keep people with mental illness history out of work (Midgley, 1990), but discrimination would be less destructive if there were fewer applicants. There is evidence to suggest that training people with disabilities in skills that are in demand, like computer technology, is instrumental in reducing the discrimination effect (Midgley, & Floyd, 1988). Effective vocational rehabilitation requires that skills must be fitted to both the individual and to the employment market. The acquisition of computer skills seem to provide people with mental illness a valuable work asset.

3.2 Computers in Mental health rehabilitation.

The labour market has been greatly influenced by technological developments. Computer technology in working life influences the content of ordinary work and provides new forms of employment for people with special needs.

A survey of information technology training in Great Britain for people with special needs revealed that only 16 per cent of the provided projects addressed people with various kinds of psychiatric disorders (Floyd, Cornes, & Boeckenfoerde, 1993). Furthermore, training to people with history of psychiatric illness were found to be catered for by hospital-linked providers in a segregated form and by Employment Departments and small voluntary organisations, where they accounted for one third of all trainees (Cornes, Floyd, & Boeckenfoerde, 1993).

Computer technology in mental health services are used in a diversity of settings with different objectives. The computers are used as tools in therapy, in Rehabilitation, in sheltered employment and employment training settings (Evans, 1993).

The computers as tools in therapy are mainly used by psychiatric occupational therapists, in the form of games (Evans, 1989), cognitive retraining (Gillan, Gregory & Fogas, 1991), open-computer activity groups (Roberts, 1986). The computers in therapy were used with the aim to stimulate, motivate, increase concentration, attention span, enhance cognitive abilities and also to encourage social interaction, improve social skills and self esteem. Evans, 1993);

The computers in Rehabilitation Units, both in hospital units and in community, were used to teach and prepare work-oriented tasks, like CV's and application letter writing. Computers are also used in innovative programmes of systemic vocational rehabilitation which have intergraded assessment, training, work experience, vocational counselling and placement (Watt, 1984, Folkes, 1988). Furthermore, the use of computers also provided work opportunities in sheltered workshops settings (Evans, 1989).

Employment Training Projects provided training opportunities in computer technology with the scope of increasing the employ-ability of people recovering from mental illness (Summerfield & Lispedge, 1987, Jofre, 1988).

There is a great potential for use of the computer in all aspects of mental health work. The computer's popularity with patients and clients must be partially due to the prestige and status associated with it. Computers can provide an open learning environment where people could choose between a wide range of software to pursue as far as they feel able, when they feel able. Work on a computer has proved to be a valuable means of invoking feelings of personal potential and fostering self esteem and self-confidence. The potential of computer-related activities lies not only in well-designed systems and software but also in its imaginative integration into the therapeutic or training environment. It is important that computer training meets the needs and potentials of the people with an history of mental health problems to ensure the positive effects of computer technology on the social and vocational integration of people with mental illness.

3.3 Characteristics of the user with Mental illness.

A common characteristic of most mental health rehabilitation programs is the diversity of their clients in terms of the psychiatric diagnosis as well as of their personal history and background. Most computer rehabilitation programs address people after the acute symptoms of psychiatric illnesses like schizophrenia, depression, neurosis, personality disorders as well as dependencies. Nevertheless, most people still have a variety of psychiatric complains, which persist over a long period after the acute symptoms.

Those secondary psychiatric disorders influence the overall functioning of the person in two very relevant for rehabilitation and skill acquisition domains, the cognitive and the socio-emotional.(Seyfried, 1991). The cognitive domain includes perception, concentration, memory, and problem solving abilities (Foulds, Dixon, 1962). The socio-emotional domain is concerned with the client's motivation, interest, self-confidence and social skills and interpersonal problem-solving.

Productivity, the ability to cope with stress and pressure, the necessity of ongoing medical treatment with its side effects and the fluctuations in motivation are found to be the major barriers to training and vocational integration of people with mental illness (Webb, 1990). Nevertheless, each psychiatric disorder presents an array of different difficulties and vulnerabilities which must be taken into consideration, to ensure a positive training or rehabilitation outcome and to minimise the chances of relapse. Since schizophrenia, depression and obsessional disorders represented the majority of the people participating at the Speedwell Information Technology project and in this study a brief account of the particular difficulties associated with these conditions will be given below.

People recovering from schizophrenia may display difficulties in all stages of information-processing, like in selecting relevant and reject irrelevant stimuli, maintaining focused attention and flexible shifting of attention, as well as in recognising, identifying, interpreting and storing stimuli, drawing deductive and analogous conclusions or in maintaining a response hierarchy (Brenner, 1989)

The ability to process information in an adequate, stable and organised manner is necessary but not a sufficient condition for adequate behaviour. The self image, the emotional state, the motivational level, the judgement of one's own abilities, the sense of control, the level of involvement, and the outcome expectancy also determine the manner people will react and perform in different situations (Carver & Scheier, 1983; Zubin, 1987; Brenner, 1989).

People with schizophrenia, due to their lower stress tolerance, are more vulnerable to break down with acute psychotic or lower order symptoms when they are experiencing stressful events. More specifically three kinds of environmental factors have been identified, to precipitate a breakdown. The first, consists of events that have emotional impact on the person like threatening unpleasant and depressing events, as well as exciting or positive situations. (Brown & Birley, 1970).

The second factor, arises from close personal relationships, particularly those that are critical, dominating and intrusive, which occur at about 40% of families at the time of relapse (Brown, Birley & Wing, 1972, Vaughn & Leff, 1976). The third type of precipitating factors include iatrogenic reasons like when a patient is put under too much pressure in a rehabilitation program or is being discharged prematurely (Goldberg, Schooler, Hogarty & Roper, 1977; Stevens, 1973).

Therefore, the person recovering from schizophrenia has to walk on a tightrope between two kinds of dangerous environments (Wing, 1989). On the one hand too little stimulation tends to increase symptoms like social withdrawal, passivity, inertia and lack of initiative. On the other hand over stimulation or when impossible demands are made to the person there is a high probability of a break down leading to the manifestation of the cognitive disorder in productive symptoms or behaviours. An ordered, structured and emotionally neutral environment with demands which make the best use of real assets and skills without amplifying the impairment is required for the effective rehabilitation of people with schizophrenia (Wing & Brown, 1970; Herz & Melville, 1980; Wing, 1989).

In the case of the depressed client Miller's (1975) review of the objective measures of psychological performance outlined two common impairments. One is associated with difficulties in concentration and the other with retardation of performance. Difficulties in concentration are prominent among the complaints of depressed people and was found to correlate with reported distractibility and slow mentation rate (Giambra & Traynor, 1978). Furthermore, it is likely that the memory deficit associated with depression (Henry, Weingartner & Murphy, 1973) is secondary to a basic problem in concentration and registration. The registration deficit can be associated with the tendency to process information at an acoustic rather than a semantic level (Mueller, 1976); and with the difficulty in sustaining concentration for the required span of time.

Retardation of performance both in intellectual and motor speed is another performance deficit in depression (Miller, 1973) associated with lack of motivation or cognitive interference. A number of studies indicated that performance speed can be improved when cognitive methods are used to reduce interference from distracting thoughts and worrying (Wine, 1978) and when maladaptive and redundant self-talk is replaced with talk directing attention back to the problem and the method to tackle it effectively (Meichenbaum, 1977).

In addition to those cognitive deficits, there is evidence that in depressed people the subjective sense of impairment is greater than the objective reduction in the level of performance (Weissman & Paykel, 1974). Similarly, Altman & Wittenborn (1980) found that recovered depressives still had poor self esteem, an unhappy outlook, a feeling of helplessness, and low confidence. They are more likely to become totally demoralised by their failures, greatly affecting their self esteem (Flippo & Lewinsohn, 1971) and future expectations (Wener & Rehm, 1975).

Seligman (1975) had described the sense of 'learned hopelessness' a characteristic of depression in which people begin to feel hopeless about all attempts to solve problems. Fresh achievements are needed to offset the experience of repeated failure (Teasdale, 1978) and to restore a sense of mastery. Costello (1972) has pointed out that people with limited skills are particularly vulnerable, because they do not have the skills or the resources to create alternatives. Therefore it is important for rehabilitation not only to provide the opportunities for the development of new skills, but also to introduce skills in a gradual manner in order to ensure the feelings of mastery, success and satisfaction.

On the other hand the obsessional personality has been described by Sandlers and Harazi (1960) as:

> 'an exceedingly systematic, methodological and thorough person, who likes a well ordered mode of life, is consistent, punctual and meticulous in his use of words. He dislikes half done tasks, and finds interruptions irksome. He pays much attention to detail and has a strong aversion to dirt.'

Due to those characteristics a job or a task in which it is necessary to respond to unexpected events is highly stressful for obsessional people. In addition their work capacity is greatly hindered by their slow speed of performance due to their tendency of collecting additional and repeated information well beyond the point that it is necessary, when taking a decision; and due to their habit of checking over their work more frequently (Volans, 1976).

Furthermore, another factor that may impair their performance is their difficulty in dividing attention between different things. Unless they are consciously aware of what they are doing, they cannot feel sure that they have done the task correctly. As such they cannot perform the familiar tasks automatically at an unconscious level. Consistent training and practice has been proven to be effective in improving their capacity for divided attention (Spelke, Hirst & Neisser 1976).

The different needs and expectations imposed by the nature of the disability highlighted the need of materials that can be independently and flexibly used by each learner to ensure mastery, to foster self confidence and to reduce the risk of relapse.

4. TASK ANALYSIS MODELS OF HUMAN COMPUTER INTERACTION.

The analysis of tasks is a fundamental and important process in many areas of applied behavioral science. Task analysis offers modes for exploring relationships between the properties of systems and user performance. Traditionally, the analyst takes a description of the cues that should be perceived and the actions that should be performed, and maps these into behavioral units (Miller, 1962), but working with computers presents novel problems. Successful task execution now depends critically on the user's knowledge of the system and the optimisation of the user's conceptual rather than perceptual motor skills (Wilson, Barnard, Green, Maclean, 1988). As a consequence, a number of human-computer interaction researchers have built analytical models of the user, which simulated the cognitive processes and the task knowledge of the user in ways to estimate the usability of the interface (Butler, Bennett, Polson, & Karat, 1989; Gugerty, 1993).

A number of task analysis models have been developed with the aim of describing knowledge-intensive tasks in human computer interaction by addressing different aspects, in differing degrees of detail. A number of task-analysis models incorporating the knowledge requirements of the human computer interaction process will be analyzed below. The main focus of the chapter will be first to outline the general goals, structure and properties of the most utilised models and then to highlight their contribution in understanding and in facilitating the acquisition of human computer interaction skills.

4.1 The task strategies approach.

Miller (1973) created a descriptive and analytic terminology to represent the generalised-information processing functions of a highly skilled operator. For the purpose of analysis " a task consists of goal directed transactions controlled by one or more 'programs' that guide the operations by a human operator of a described set of tools through a set of completely or partially predicted environmental states" (Miller 1973, p 11).

A task is described in terms of 25 task functions which refer to cognitive actions (e.g. detect, transmit, plan) or entities (e.g. a message, a goal image). A complete list is given in Fleishman & Quaintance (1984) who had also added one more function to account for motivational goals. The analysis requires four stages: (a) describing the task or domain content; (b) identifying key aspects of the environment (e.g. goals and stressors); (c) identifying what needs to be learned; and (d) naming the task functions.

The model captures most aspects of the user-centred dynamics of a task with particular emphasis on the explicit incorporation of the user's goals and the processing of information. The main limitation of this approach is the lack of tools which can be used by an analyst to achieve the three first stages of the analysis. Furthermore, the user of this method must have a background in psychology in order to be able to analyze the tasks and to select the appropriate functions.

4.2 Task Analysis for Knowledge based Descriptions (TAKD)

Task analysis for knowledge based descriptions (Johnson, Diaper, Long, 1984; Johnson 1985) aims to make explicit the knowledge requirements for a particular world task. The principle objective of TAKD is to produce a specification of the knowledge required to use a system or the knowledge that the system would have to include to perform a task. As such, the TAKD has been used to design a syllabus for teaching information technology skills (Johnson et. al., 1984, Diaper & Johnson, 1989), and for the generation of designs for computer programs (Johnson, 1985)

The task is characterised by domain specific knowledge. TAKD involves four main stages: (a) the generation of a task description; (b) the identification of required knowledge in terms of objects and actions; (c) the classification of these into generic actions and objects; and (d) the expression of the task in knowledge-representation grammar (KRG).

The authors stress the use of as many sources of information as possible in the first stage of the analysis, including structured interviews, direct observations of real and structured tasks and the analysis of protocols collected during and after completion of the task by trainees, instructors and experienced users. At the first stage, the task analysis contains a range of disparate information about objects and behaviours of specific real tasks with no common representational format.

At the second stage, two lists that detail, independently, all the particular behaviours performed in the tasks and all the objects related to those behaviours called specific objects and specific actions are created. At the third stage, the specific lists are translated into 14 generic actions and 22 generic objects from a generic syllabus structure. Finally, generic actions are related to generic objects with the use of specific Knowledge Representation Grammar (KRG), statements.

TAKD has certain weaknesses in identifying the so-called generic actions and objects and in combining them into a knowledge representation grammar. The recombination of these items into KRG statements is very difficult as they overlap in scope, their structural relationships are not made explicit by the simple dictionary structure, and the grammar used in one situation may not be appropriate in another. For the non specialist, therefore TAKD is not likely to be usable.

A further development of the TAKD model is the Task Knowledge Structure (TKS) (Johnson & Johnson, 1991), which is a task analysis process "that represents the knowledge people possess about tasks" (Johnson, 1992; p.156). The principle of TKS decomposition contains two target areas, the decomposition of goals into subgoals and their control relations which show how the goals and subgoals are related for execution; and the analysis of the work domain objects according to a "taxonomic subsrusture" , which identifies object properties and attributes, goals and plans.

4.3 Command Language Grammar (CLG)

The Command Language Grammar was originated by Moran (1978; 1981) as a design tool to " separate out the conceptual model of the system from its command language and to show the relationship between them" (Moran 1978, p. 5) by hierarchically decomposing a system's function into its objects, methods and operations. CGL has been used as a design tool to develop the structure of computer programs (Moran, 1981), and as a method for evaluating interfaces (Davis, 1983), for which it was only moderately successful.

The CLG model consists of three components: (a) the Task level, which describes the user's major intention; (b) the Semantic and Syntactic levels, which focus on the objects and actions the user employs to accomplish the task; and (c) the Interaction level, which contains the sequences of physical actions. The Semantic Level contains a conceptual model composed of objects and operations that may be performed on them and semantic model containing the methods for accomplishing the tasks of the previous level. The Syntactic level describes the command language structure, discriminating between commands, arguments, descriptions and command contexts. The Interaction level is subdivided to the Spatial Layout level, where the physical layout of the output/input devises are specified, and the Device Level, where the remaining physical features are defined.

The important feature of CLG is that its several levels of description are designed to correspond to the levels of representation held by the users. CLG maintains that users need not represent all knowledge at all levels - some knowledge will be held as procedures whilst other knowledge will be declaratively represented. Furthermore, CLG implies that users can efficiently operate with only the methods from one level. However, users who operate only in the interactional level, without a higher representation of the system's methods, will be at a loss when something goes wrong. Conversely, users may know their objectives, having the semantic representation, but may not know what commands to use if they are lacking the semantic method representation.

CGL offers a symbolic notation and a grammar for describing knowledge which permits the relationships between knowledge to be expressed. The limitation on the use of the model is in the identification of knowledge aspects to be represented, and in the lack of available mechanisms to select which knowledge exists at which level.

4.4 External - Internal Task Mapping Analysis (ETIT)

The purpose of the External-Internal Task Mapping Analysis (Moran, 1983) is to assess the complexity of learning a system for a naive user and the potential transfer of knowledge from one system to another.

ETIT assumes that the difficulty found in using and especially learning a system, for the user with complete or nil knowledge of the system, depends on the complexity of the relationship between the external task space of the task itself and the internal task space of the system. In order to define the external task space Roberts and Moran (1983) reduced the 212 tasks which text editors can potentially perform to 37 universal tasks. Each editing task was then further analyzed according to eight editing functions and five types of text entities. The internal task space for a display editor (Moran 1983) may have only one entity and three functions. Finally, a set of ten rules were defined in order to map from the external to the internal task space.

ETIT model presumes that the complexity and the number of those mapping rules reflect the complexity in using a particular system; and that the number of common rules between different systems reflects the transference of learning from one system to another.

The main limitation of the model is the development of a representation of tasks in the real world as an external task space in a way of reflecting the user's conceptual model of the task. This representation becomes even more complex if the ways a conceptual model changes according to the user's increased general knowledge.

4.5 Task Action Grammar (TAG)

Task-Action Grammar (Payne & Green, 1986, 1989) attempts to model the user's knowledge of the mapping from tasks to actions and to predict learnability by capturing all the generalities that the user may be aware of. TAG has been used (Payne, 1984) to describe the languages used in several experiments (Carroll, 1982) and its predictions are consistent with the experimental findings. It has also been used to describe various systems such as MacDraw & Multiplan (Green, Schiele & Payne, 1988).

An analysis of a computer version of a task into a TAG requires its decomposition into "simple tasks". A simple task is "any task the user can routinely perform" or which can be accomplished with no problem solving component or control structure; A simple task may represent a very simple structure for the novice user or may be compiled into larger groupings for the more experienced user (Anderson 1983).

TAG offers two mechanisms for capturing the generalities within command languages. First, simple tasks may be defined as having the features of another simple task, but with one or more of the specific elements being different. For example " move cursor one character down" has the same features as "move cursor one character up" but with the "direction" specifically set to "down". The second mechanism allows TAG to capture different forms of general semantic knowledge in separate rules, by expressing the notion on which a command language is based in the natural language of the user.

Even though TAG claims to be a "cognitive competence" model, it does not explicitly account for any dynamics of the user's representation or processing. User goals can only be equated with "simple tasks" but there is no mechanism for combining "simple tasks" , no precise definition of what a "simple task" is, or how a system's language can be segmented. Finally, there is no attempt to capture higher goals or motivations.

Another issue of concern in the use of the TAG model is that the analyst must re-code an ideal representation of a computer interface dialogue into a task dictionary and rule schemata. This encoding relies on the analyst's intuition and observation leading to difficulties in comparing different interfaces.

4.6 The GOMS Family; the Keystroke Model.

The purpose of the GOMS (Goal-Operation-Method-Selection rule) analysis (Card, Moran & Newell, 1980, 1983) is to generate useful engineering models to predict the time to complete tasks. Different members of the GOMS family incorporate different grains of analysis for the description of observed behaviour. Since the GOMS model itself will be further described in a later chapter, only the keystroke model will be outlined here.

The Keystroke Level model is based on the GOMS model but its role is purely to predict "the time an expert user will take to execute the task using the system, providing the method is used without errors" (Card et al 1983, p 260). The user's task is divided into "unit tasks", whose time of execution is the sum time of three different components: an "acquisition time" (computed at 1.8"); a performance time which is the sum of the times needed to execute the keystrokes in the commands (depending on the user's typing speed); and the times for mental operations (computed at 1.4" for each "cognitive unit").

The Keystroke Level model assumes that expert performance is error free and that the shortest sequence of commands is used by the expert user to perform a task. Although evidence suggests that experts don't always use the technique that is either fastest (Maclean, Barnard & Wilson, 1985) or has fewest keystrokes (Embley & Nagy, 1982); and that major errors occupied between 4% to 22% of the testing time (Roberts and Moran, 1982); or that the average time spent correcting errors was 20.1% of the total time (Allen & Sczerbo, 1983), the Keystroke Level model appears to generate fairly good predictions. The model is reported as being accurate to a standard error of 21% over a variety of tasks and systems (Card et al., 1983) and that an adjustment of the model's predictions by a factor of 1.4 is necessary to fit true performance (Roberts & Moran, 1982).

The Keystroke Level model is a concise engineering formula which is predictive of approximate performance times. The main limitation of the model is the lack of a concise definition of the "unit-task" and "cognitive unit", mainly due to the model's focus on the system's representation rather than representing cognitive units derived from cognitive theory.

4.7 The User - Device Model

Kieras & Polson, (1985) present a two component approach to assess the effects of transfer of knowledge from one system to another, the complexity of devices, learning and performance times and error frequencies. The description of a device and a task using this model offers the opportunity for running computer simulations of task performance, as in the case of the IBM Display - writer, which appears to predict learning rate with some accuracy (Polson & Kieras, 1985).

The first component is a production system model of the user's how-to-do-it knowledge of system use, based on the GOMS representation. The user's goal structure is derived using the mechanisms of GOMS, with the addition that active goals are represented in working memory. In this model, one measure of complexity is the depth of goal stack during operation and the other measure is the number of productions required to represent a method of achieving a task.

The second component constituent of the approach is a Generalised Transition Network (GTN) model of the device, that is the computer interface, showing the system's possible states, the possible actions the user can take in that state, and a connection to the next state that will result from that action.

Production rules are assumed to be single units that are learnt on an "all or none" basis, and rules already learnt from one "task" or "method" can be incorporated when a new one is learnt. If two methods have some production rules in common, learning one method will make it easier to learn another.

The Generalised Transition Network, presents what information is on the screen at any time, permitting the evaluation of the consistency of the system's prompts, and thus it can offer a way of assessing the perceptual and attentional aspects of the interaction.

In order for this model to be used, the analyst would have to encode a system specification into two formats, which are complex to use, and cumbersome to construct and maintain.

4.8 Information Structure Description Model.

Wilson, Barnard & MacLean (1985) used task analysis to classify user errors, so that the knowledge elements or "information structures" supporting actual users' performance could be derived. A second purpose was to describe long-term transitions in learning as knowledge structures evolve.

This approach makes use of two levels of task description. One level describes the overall process of controlling a dialogue sequence in terms of attempts to satisfy task goals. The other specifies particular "information structures" or "meta-information structures" that make up the knowledge called upon to achieve those goals.

The process of controlling a dialogue sequence is described as a simple goal structure, consisting of a major goal which is subdivided into individual goals approximately equivalent to individual editing instructions. For each goal, an attempt-test cycle is generated during which the user specifies the goal, establishes a command context, performs a command specific procedure and then terminates the command sequence.

The technique has been described for a single system, and much of its application is heuristic rather than formalised. Its major drawback is the time and effort required to assign individual user actions to the possible aspects of the fully specified attempt-test cycle.

4.9 Decomposition of Mental Activity.

Norman (1984, 1986) describes an analysis based upon the decomposition of a task into its different mental activities in order to understand the cognitive consequences of design features.

The user approaches a system with a set of goals to achieve, yet these goals must be realised through physical actions at the terminal. This gap between the goal formation and action is what Norman calls "the gulf of execution". Bridging this gulf requires: forming an intention to act; specifying an appropriate action sequence; and executing that action sequence.

Once an action sequence has been executed, there is a corresponding "gulf of evaluation" because the user must relate the system's response to the original goal. This is accomplished by three complementary activities: perceiving the physical properties of the present system state; interpreting them; and evaluating those interpretations in relation to the original goal.

Taking these stages together with the initial formation of a goal defines seven stages of mental activity which correspond to the those stages defined by the action theory. It should be underlined that in real tasks the stages need not necessarily occur in strict order and some may even be omitted. The value of the model is to represent the interaction between the user's psychological needs and the requirements imposed by the system's characteristics. As such, different aspects of system design support or hinder different stages of the activity. Furthermore, experience and training do influence the facility with which each stage will be performed.

At present; the technique is best viewed as a tool to describe thought rather than a rigorous form of task analysis. The technique clearly requires a working knowledge of cognitive skills and capabilities relevant to the tasks and systems being analyzed. Although not as explicit as some other analyses, it does provide a way of representing what the user might actually doing. In this respect, specialists in human factors found this approach more valuable than other more formal models (Whiteside & Wixon, 1987).

4.10 Cognitive Task Analysis Model (CTA).

Cognitive Task Analysis (Barnard, 1987) focuses on the nature of mental activity rather than on tasks themselves based on the theoretical assumption that decomposition of cognitive resources can be used to describe mental activity associated with dialogue tasks.

Following the Interactive Cognitive Subsystems (ICS) approach to human information processing (Barnard, 1985) it is assumed that the cognitive system is divided into subsystems, each of which processes information in a particular mental code, and contains translation processes that can record its input into codes used by other subsystems. Sensory subsystems generate codes that can be processed by representational subsystems, which in turn handle higher level descriptions of linguistic and visual structure, as well as defining the meaning and its implications. Effector subsystems can translate the representational codes into codes controlling particular effectors (e.g. hands, speech, musculature).

The description of mental activity contains four components: (a) the configuration of processes, which describes the set of processes required to accomplish a given phase of cognitive activity; (b) the procedural knowledge, which outlines the properties of each individual process within the configuration; (c) the record contents, which specifies the properties of memory records that are likely to be assessed during the task execution; and (d) the dynamic control, which describes the flow of information among processes.

The complete four component description makes up a cognitive task model and the attributes of such models are used to predict user behaviour at novice, intermediate and expert levels. The complexity of dynamic control required by a task is, thus, assumed to relate to overall ease of learning and performance. The important feature of this analysis is that knowledge is described in an approximate form in a way that relates directly to mental codes and to features of the use of the knowledge. It seeks to represent the use of knowledge in performance rather than presenting a formalism for representing the structure of required system knowledge.

CTA can be used in two ways by different analysts. One class of analysts needs to analyze tasks in detail and establish the principles which interrelate the four components of the task model (Barnard, 1987). This type of analysis requires a specialist in the cognitive sciences who has a detailed working knowledge of the model-building process. The products of this class of usage are principles of cognitive task modelling: mapping from those principles to particular classes of application or system; and mapping into properties of user behaviour; resulting in the formation of an expert system. (Barnard, Wilson, & MacLean, 1987).

The second class of analyst is the user of the resulting expert system. They simply need to be in a position to answer the particular queries for information that the expert system needs in order to build the model (Barnard et al., 1987).

4.11 Conclusion

The techniques of task analysis summarised in this chapter cannot be considered simply as rivals, since they differ in the starting points they consider for their analysis, in their focus, their output, and their usability to the non-specialists. There is no best technique. As Olson (1987) has pointed out, we have fragments of the kinds of representations required to meet the full needs of researchers and practitioners.

The main shortcomings of present techniques include the lack of: (a) the representation of cognitive strategies and individual differences to account for the different learning styles among individuals as well as differences in various cognitive abilities (Gomez et al, 1983, Green et al, 1988); (b) the examinination of the user-motivation and attitudes which greatly influence the effect and the use of information technology (Olson, 1987); (c) the prediction of users tendency to trade off extra physical action for reduced mental effort (Staggers, & Norcio, 1993); (d) the assessment of reliability and validity; and (e) the description of required analytical skills needed by the user to be able to effectively utilise the technique.

Regardless, of those shortcomings and the lack of one universal model of task analysis of the human-computer-interaction, a number of assumptions and findings from the application of those models provide some useful concepts to consider for the study of computer skill acquisition.

METHODOLOGY & DEVELOPMENT OF GOFT TRAINING MATERIALS

The position contemplated in this research is that in order for computer training materials to be effective in fostering computer skills and self confidence must consider and implement the relevant theories concerning the human computer interaction and the acquisition of skills.

The construction of the training methodology of this study was based on the theoretical assumptions related to: a) the cognitive processes relevant to computer skills acquisition; b) the learning style and the needs of adult users; c) the amelioration of the expected problems and difficulties associated with the characteristics of the user and the design features of the computer interface. In addition, the capacities and needs of the novice, adult users with mental health problems for the acquisition of computer command-based skills were considered and incorporated in the construction of the training materials.

The scope of the first part of this chapter will be to elaborate on the methodology used for the development of the training materials. More specifically, the basic theoretical premises observed in the construction and use of the training materials, the guidelines followed for the format, organisation and content of the training will be described. The methodology of development, the formulation of theoretical premises and the guidelines for the construction which may assist in the construction of future training materials are presented in the Supplement I.

The second part will present the actual Goal-directed, Optimal Complexity, Flexible, Task Oriented (GOFT) Training Materials developed and used in this research. Particular emphasis will be given on the description of the incorporated models for the design of materials, as well as, on the objectives, structure organization and development of the actual training materials used for the computer skill acquisition of people with mental health problems.

5.1 Methodology of training construction.

The main objective for the development of training materials was to promote and facilitate the computer user interaction in such a systematic manner, as to enhance the acquisition of computer skills and the promotion of mastery and expertise of the user.

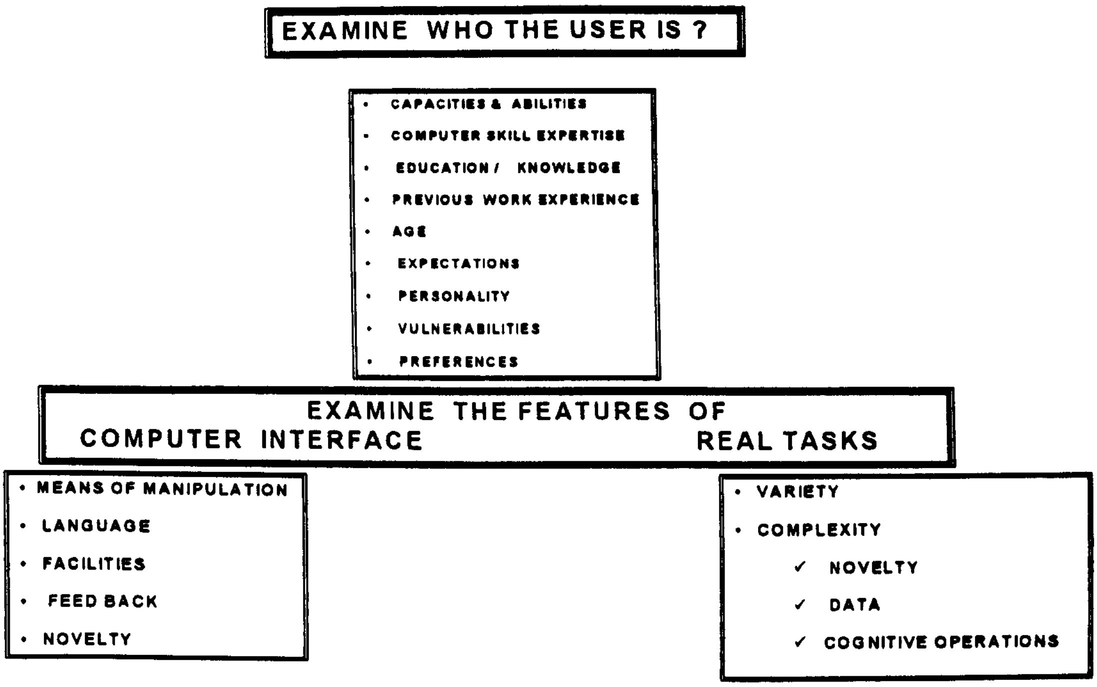
More specifically, the training materials were designed to meet the goals of:

1. bridging the gap between the abilities and knowledge of the users and the demands of the interface systems for the successful completion of tasks and the enhancement of motivation;
2. providing a systematic structure of instructions and practice opportunities to foster the acquisition of computer skills and the confidence to transfer those skills in other tasks and working situations.

The consideration of different issues affecting the human computer interaction is instrumental in facilitating the accomplishment of computer tasks, in predicting difficulties and in ameliorating possible mistakes. Training materials must bridge the difference between the users' capacities, knowledge, characteristics and expectations and the computer's demands, unique features, and permitted processes. The bridging of this interaction is not static but depends on the characteristics and expertise of the user as well as on the features of the computer interface and the complexity of the applications.

The initial inquiries in the design of the training materials are to: a) examine WHO IS THE USER; and b) to weigh the features and demands of the specific computer interface system and the tasks designed to accomplish. In regard to the users, the relevant information in terms of expertise, of education, of previous work experience, of age, of expectations and of personality characteristics must be considered. In terms of the interface's features the means of input and output communication between the user and the system, the computer's language and feedback, the novelty of the system and complexity of the performed applications must be examined. An overview of the studied features of the user computer interaction is given in figure 5.1.

Fig 5.1 : User and Interface system features to be examined for the construction of training materials



Furthermore, in order for training materials to be effective in promoting skill acquisition, mastery and transference of learning to other situations, they must also consider the way the users desire to learn, the requirements for the development of skills and expertise, the prerequisites of problem solving and goal directed learning. This information is of particular importance when computer interaction is a novel experience and the user is an adult with previous knowledge and areas of expertise, and preconceptions about computers, who wants to be in control of the computer interaction.

The present training materials were designed with the objective to take into consideration: a) the characteristics and needs of the adult, novice users from different educational and vocational backgrounds with mental health problems; b) the demands of command based commercial computer packages and the complexity of their task applications; and c) the goals of the computer training rehabilitation program of enhancing computer skills, motivation, self esteem, and confidence. An overview of those specific features affecting the development of the current training materials is presented in figure 5.2.

FIG 5.2. : User's & Interface system's characteristics for the development of the current GOFT Materials.

• THE USERS OF THE DEVELOPED MATERIALS

USER'S CHARACTERISTICS

✓ AGE
- FROM 18 TO 55

✓ N OVICE IN EXPERIENCE

✓ ABILITIES
- LOW ATTENTION, CONCENTRATION,
- REDUCED STAMINA
- SLOW MOTOR -PERCEPTUAL SKILLS
- REDUCED WORKING MEMORY
- LOW PROBLEM SOLVING ABILITIES
- LOW LITERACY & NUMERICAL SKILLS

✓ PERSONALITY
- LOW FRUSTRATION TOLERANCE
- FLUCTUATION IN MOTIVATION
- LOW SELF ESTEEM & CONFIDENCE
- EASILY DISCOURAGED
- PRESERVE CONTROL & PRIVACY

USER'S BACKGROUND

- LOW SOCIO-ECONOMIIC
- MINORITY GROUPS

✓ EDUCATION :
- UNIVERSITY DEGREES (12%)
- HIGH SCHOOL (76%)
- DROPPED HIGH SCHOOL (12%)

✓ WORK EXPERIENCE: :
- NO WORK (25%)
- OFFICE WORK (30%)
- OTHER WORK (45%)

5.1.1. Theoretical Premises of Construction.

The overview of the theoretical background of the mentioned areas of concern lead to the formulation of a number of different basic premises affecting the construction of the training materials in terms of format, context, organization and means of utilisation. Training materials must try to accomplish the following propositions.

1. Sustain an optimal complexity and challenge across training.

In the construction of materials the task characteristics and the users' judgment of capabilities that determines their willingness to devote energy in acquiring new skills (Ghani, 1991; Ghani & Deshphande, 1994) as well as their desire to be active and in control of their learning (Jarvis, 1983) must be considered.

Training materials must be organised in such a way as to preserve an optimum level of challenge, that is neither too high nor too low, across the different skill levels, training sessions and applications (Csikszentimihalyi 1990). An optimal complexity flow will foster arousal of the user and an optimal level of challenge and motivation (Ghani, 1991) decreasing the anxiety and the chances of relapse in users with mental health problems (Wing, 1989).

2. Ensure a positive and meaningful learning experience from the beginning of the training.

A positive impression and experience is important in determining the effort spent (Ghani & Deshpande, 1994) and in reducing negative attitudes and anxiety (Parasuraman & Igbaria, 1990). Positive result of initial attempts will influence the transference of skills to analogous tasks (Lovett, Anderson 1994) and will greatly affect subsequent learning (Hammond & Barnard, 1984).

In addition training materials must be organised so that they facilitate the accomplishment of real tasks (Carroll, 1982; Carroll & Mark 1987) in each training session, thus enhancing the user's sense of competence, relevancy and self determination. (Ghani & Almeer, 1989).

Successful completion of computer tasks will reduce the reality shock of the user enhancing the chances for the novice user to acquire new skills and reducing the probability of negative behavioral reactions and withdrawal from training (Carver, et. al., 1979; Carver & Scheier, 1977).

Training sessions that provide a sense of closure and accomplishment are considered important to sustain the motivation, to decrease anxiety and to promote self confidence in people with mental health problems (Wing, 1989; Kennedy,1975).

3. Balance the user's capacity with the task demands.

Balancing the available processing abilities of the user with the demands of the task is crucial in determining the user's performance and learning potential (Baecker & Buxton, 1987a,b). Balancing the demands of the tasks with the resources of the users is a very crucial aspect for the prevention of relapse and the progress of people with mental health problems (Seppalainen, 1990; Bennett, 1978).

4. Consider the processing capacity of the novice user.

In the construction of the training sessions the capacity of the user to handle novel information and the limitations of selective attention (Kahneman, 1973, Scheider & Fisk, 1983), working memory (Hunt & Lansman, 1986; Katajima, 1989), motor capacity, and visual perception and visual search abilities (Card, Moran, & Newell, 1983; Ackerman, 1988) must be considered in order to avoid the overloading of the cognitive capacities of the user.

More specifically, the capacity of working memory to handle up to 7+-2 chunks of new information (Miller, 1956 Morray, 1977; Baddeley, 1986), the difficulty of selective memory to handle two, novice tasks simultaneously (Shiffrin & Dumais, 1981; Parkin & Rosso, 1990) must be taken into account in the construction of the training materials.

In addition the demands of the computer language comprehension on the cognitive resources of the user, due to the lack of previous world knowledge (Wisniewskin, & Medin, 1991; Pazzani, 1991) must be examined.

5. Consider the demands of the computer interface.

The training materials must consider the communication demands of the computer system on the user, in terms of the semantic distance of the interface commands with natural language (Anderson, 1980), the structure of the interface in terms of conceptual, logical and physical patterns (Treu,1992), the constraints on the visual and motor processes imposed by the computer interface (Card et.al 1983) and the qualitative feeling of system manipulation. (Lee, 1991, Hutchins, et al. 1986, Norman, 1986, Taylor 1988).

In addition the novelty and the requirements of the display knowledge network of the specific operation, in connection with the acquired world-knowledge network of the computer model and their inter-connections will define the demands of the system on the processing capacities of the user (Chechile et al, 1989; Gugerty, 1993). As such, in the construction of training materials must be considered and incorporated, not only, the processing or manipulating demands imposed by the interface or the specific application, but also the sufficient information and knowledge for efficient performance.

These constraints of performance and learning are particularly important, when the users face visual search, concentration, motor coordination, attentional and cognitive difficulties (Gomez et al. 1983; Broga & Neufeld, 1981; Brenner 1989; Seyfried, 1991, Wing 1989).

6. Consider the dual nature of Computer training.

The complexity of Computer training is determined by two aspects: a) the complication and novelty of the computer operations; and b) the complexity, difficulty and previous experience demands for the accomplishment of real tasks with the use of the computer. This dual estimation is necessary in the estimation of loads and distractors of selective attention (Nissen & Bullemer, 1987), the demands on the working memory (Sheridan, 1980) and the effective allocation of the user's processing resources (Novan, 1984) .

In addition, the examination of the cognitive complexity of the real tasks is useful in determining the additional information required to the user to be able to understand the task and to apply the computer procedures. The provision of explanatory information is necessary to enhance task understanding for novice users with no previous knowledge or experience of office work and low educational background as well as to prevent the transference of inappropriate solutions and conclusions from previous experience with office tasks.

7. Consider the changes in the processing capacity and information needs of the user with computer skill expertise.

Practice and skill acquisition reduce the constraints of the computer task demands, on the users processing capacities and affect the quality of the required information needed by the user for the development of expertise (Anderson, 1982, Rasmussen, 1983).

The training materials should consider the shift from controlled to automatic processing with practice and skill acquisition by utilising the user's: a) spare ability to simultaneously attend to two complex tasks (Shiffrin & Dumais, 1981; Parkin & Rosso, 1990, Damasio, 1989, Fisher et al., 1988; Fisher & Tanner, 1992); b) increased capacity of selective attention and working memory to handle more complex information (Fisher, et al, 1988); c) required capacitiies from that of general intelligence to motor abilities (Ackerman, 1988, 1990).

In addition, training materials should provide the adequate and sufficient information to facilitate the knowledge reorganization and the development of a coherent and correct model of computer operation (Pazzani, 1991; Murphy 1988; Murphy & Allopenna, 1994), by enhancing the conversion of declarative concept association to procedural processes (Rosch & Lloyd, 1978), by fostering the composition of successive steps into a single procedure, (Anderson, 1983, Kay & Black, 1985 1986), and by tuning of procedures through the processes of generalisation, discrimination and strengthening (Lee, 1991).

8. Provide practice opportunities.

Practice opportunities are considered important for the acquisition of skills and the development of expert performance in Anderson's (1993) ACT R* and Larkin's (1981) ABLE model.

Consistent practice of commands are important (Fisher & Tanner, 1992) in increasing the attention attraction of specific stimuli (Shiffrin & Czerwinski, 1988); in decreasing the attention attraction to other present stimuli and in enhancing the automatic activation of a response (Rogers, 1992). The provision of practice opportunities foster learning by analogy which is an important prerequisite for skill acquisition (Anderson, 1993 Pirrolli, 1991; Pirrolli & Recker, 1994) and a desirable way for adult users to approach new learning.

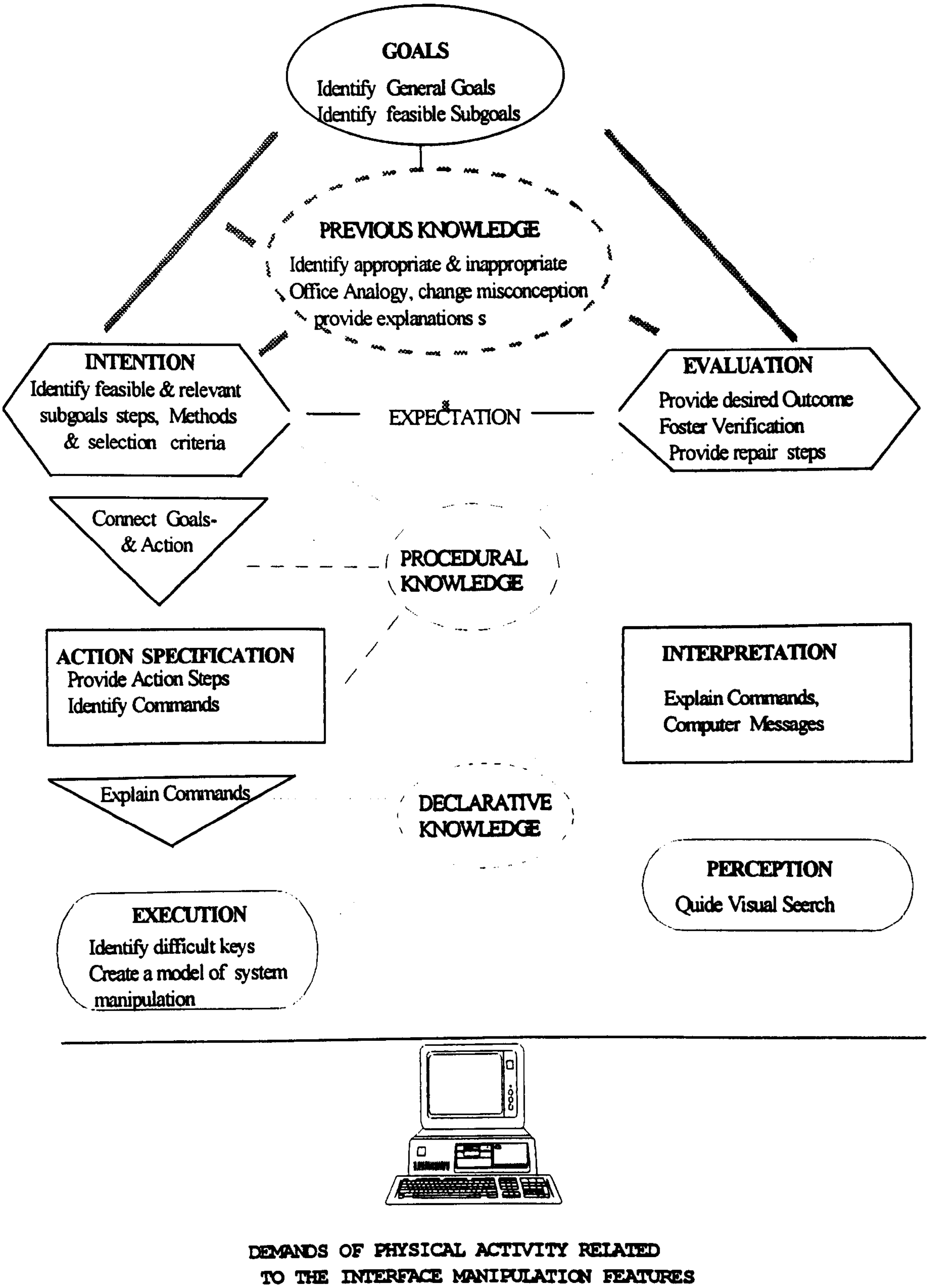
Training materials must incorporate relevant practice opportunities of the functions in the accomplishment of real tasks from real world. Real tasks from real world improve language comprehension (Murphy & Wisniewski, 1989), foster the user's motivation (Eason 1974), sense of competence and self determination (Ghani & Almeer, 1989), and enhance the chances of transference of the acquired skills to real work and everyday life situations (Carroll & Mack, 1987). The transference of knowledge and confidence gained in the computer training to other work, educational or daily living environments is of great importance for the rehabilitation of people with mental health problems (Wong et, al., 1987; Watts & Bennett, 1983).

9. Promote goal directed and problem solving learning.

The training materials must provide the necessary structure and information to promote goal directed learning and the use of the adult users' tendency to learn by doing and problem solving (Waern, 1985). Training materials must be organised according to the user's desire to use the computer to perform tasks than to undergo extensive training with no relevance to real work tasks.

For this purpose training materials should assist the user in: a) defining attainable goals to each computer situation (Kreigh et, al., 1990); b) combining goal and actions (Kay & Black, 1985, 1986; Robertson & Black, 1983); c) guiding the user through the required procedures (Larkin, 1981) and the permitted operations (Dewier, Karnas; 1991); d) linking actions with the desired outcome (Larkin, 1981); e) fostering the verification and interpretation of results (Norman 1983, Waern, 1985); and f) providing the discriminatory conditions for the selection of the most efficient plan (Anzai & Simon, 1979; Kay & Black, 1985, 1986; Anderson 1983). The necessary objectives that the training materials must incorporate to meet the demands of Norman's (1986) goal directed cycle of human computer interaction and their relation of to the previous, declarative and procedural knowledge is presented in figure 5.3. The consideration of those five steps coupled with the evaluation of the effects of transfering previous knowledge is necessary for the effective application of goal directed learning and the user's problem solving abilities in the new domain of computer skills.

FIGURE 5.3. Cycle of human-computer interaction activities (from Norman, 1986) its relation to previous, declarative and procedural knowledge and implications for the objectives and construction of effective training materials .



10. Promote the effective use of learning by knowing.

Adult novice computer users tend to rely on their previous knowledge and experience from other contexts for the assimilation of the new computer concepts, for the formulation of goals and rules, for the implementation of plan of actions, and for the development of a computer model (Suchman, 1987).

The training materials must assist the novice user in overcoming bias and preconceptions that hinder the mastery of new concepts or solutions that violate previous knowledge (Murphy & Wisniewski, 1989; Nisbett & Ross, 1980) and result in misleading interpretations. Training must incorporate the necessary declarative knowledge in teaching and interpreting new concepts, commands and computer messages (Slator, et al., 1986; Schneiderman,1980, Parkin et.al., 1990)

The training materials should advice the users of the common errors caused by the deficient application of the office and typewriter analogy to the computer situation (Clement, 1984; Moran & Douglas, 1983; Dewier and Karnas, 1991; Allwood & Eliasson, 1987) and provide the possible recovery options to such common mistakes (Lewis & Norman, 1986; Monk, 1986). Furthermore, training must support the user to formulate procedural rules to tie concepts together (Pazzani, 1991) for the creation of a consistent model of computers or of specific computer features like the use of help facilities and menus (Mehlenbacher, 1989).

11. Consider the individual needs and preferences of the users.

Individual differences of users in terms of age, abilities, background, knowledge, skill and personality has been found to affect the human computer interaction and computer skill acquisition (Egan, 1988). The age of the user (Charness et al., 1992; Rogers et.al., 1994; Czaja et. al., 1989;) differences in spatial memory abilities (Gomez et al, 1983; Egan & Gomez, 1985); in aptitude level and cognitive abilities (Dean & Whitlock, 1988 Seyfried, 1991); in previous experience with office work and educational background (Parasuraman, Igbaria, 1990) should be taken into consideration in the structure and the method of training.

In addition personality characteristics like anxiety perception and attitudes towards computers (Shneiderman, 1979; Eason & Damodaran, 1981); expectations about power and internal or external control, (Parasuraman, & Igbaria 1990); tendency towards reflective or impulsive behaviour introversion & extroversion, (Parasuraman Igbaria, 1990; Parkes, 1984; Perrewe, 1986); self esteem and tendency to feel helpless and victimised (Arndt et al., 1983); orientation towards success (Hollenbeck, et. al., 1989); tolerance to ambiguity and reaction to unpredictable results (Hawk, 1993) will determine the way the users will react to the computer interaction and to the different training styles. Materials that provide a structure in the training process, that allow the user to determine the speed of their progress and to evaluate mastery, that preserve the user's privacy and deminish competition are useful in accommodating the different learning needs and preferences of user.

The basic theoretical propositions on which the development of the training materials was based and their derived guidelines used for the construction of materials are presented in the Construction Methodology Manual in the Supplement I.

5.1.2. Guidelines of Construction

From the described basic theoretical premises a number of specific guidelines were derived and applied in the construction and development of the training materials. The guidelines used will be presented here according to their role in the constuction of the training materials in the following categories: format, contents, difficulty estimation, organisation, and administration of the training materials. Examples of the implementation of those guidelines in the construction of the actual materials will be presented in the Appendix I.

Format Guidelines

The format of the training materials must incorporate the necessary procedural knowledge for the user to be able to perform the computer operations (example 1) :

1. Define goals and subgoals in a way that actions can be taken.
2. Define intermediate and end goals
3. Combine goals and commands.
4. Outline permitted operations
5. Guide the user through the required procedures

6. Outline different methods

7. Provide the discriminatory conditions under which a method is most efficient.

8. Allow the user to make choices through structured sequence of actions and goals.

9. Present information to assess outcome of actions.

10. Enhance the process of checking after each action (example 2).

11. Facilitate visual search (example 2)

12. Provide recovery options (Example 3)

Content

The training materials must incorporate and provide the following information:

1. Provide the declarative information for the understanding of computer commands and messages (example 4).
2. Direct the user to use the instruction set (example 5).
3. Provide explanations to avoid misinterpretations (example 6).
4. Identify incompatible use of office analogy and typewriters (example 7).
5. Highlight Do-Undo and combination keys that require both hands coordination (example 8).
7. Materials must provide practice opportunities (example 9).
8. Materials must support the accomplishment of meaningful tasks from the beginning of the training (example 9).

9. Materials must provide meaningful real practice opportunities (example 10).
10. Focus attention to new information (example 11).
11. Include strategies to enhance the learning of new terms by Preview, read, reflect, recite & review (example 12).
12. Include cues to enhance the chances of reflecting upon the mastery of new functions (example 13).

Guidelines for the Estimation of difficulty

For the estimation of the difficulty for the application of novel instructions in the accomplishment of real tasks:

1. Consider each goal-action as a chunk.
2. Consider each method selection as a chunk
3. Count new chunk units.
4. Consider novelty and cognitive complexity of applications.
5. Combine the novel goal-actions, method-selection units with the difficulty of the task (example 14).

Organisation Guidelines

Materials must preserve an optimal complexity level across training sessions and across application tasks.

1. Start with simple operations whose complexity will increase with practice and mastery .
2. Start with low in cognitive complexity practice applications (example 15).

3. Increase cognitive complexity of tasks with the mastery of computer functions.
4. Increase number of goal-action steps with practice.
5. Organise materials to foster the composition of successive steps into a single procedure (example 16).
6. Provide sufficient practice opportunities according to the difficulty of the procedure and the complexity and variety of real tasks.
7. Differentiate between the computer operation instructiona and their application to the accomplishment of real tasks.
8. Create a operation models of different features of the learned package like use the menus or help facilities (example 17).

Training administration Guidelines

1. User's must be active and in control of their learning
2. Ensure a positive first experience (example 21).
3. Remove competition aspects.
4. Provide structure and hierarchy.
5. Enhance feeling of control
6. Foster problem solving & Goal directed learning.
7. Insure the feeling of completion in each session
9. Permit flexibility to progress at own speed

5.2 Implemented Theoretical Models

For the development of the training materials, three different models of analysis were used for the structure and organization of the Training Materials. The GOMS model for the design of the Training Materials' format (Card, Moran & Newell, 1983; Carroll & Mark, 1982; Carroll et al, 1987), the Cognitive Complexity Model (CCT) of Polson (1987) Kieras and Polson, (1985) for the estimation of the complexity of the different computer functions in terms of their degree of novelty, and a modified version of the Cognitive map analysis (Feuerstein, 1979) for the evaluation of the cognitive difficulty of the realistic applications.

These three theoretical models will be further described in terms of their assumptions, structure and applications.

5.2.1 The GOMS Model.

The GOMS model applies a theory of humans as symbolic processors to tasks that require human-computer interaction. The GOMS model has been developed by Card et al, (1983) with the purpose of describing the content and structure of the necessary knowledge for the acquisition and mastery of different computer skills.

The GOMS model characterises the users' knowledge as a collection of hierarchically organised methods and associated goal structures that give a sequence to methods and operations. The GOMS model describes both general knowledge of how the task is to be decomposed as well as specific information on how to execute methods required to complete a task in a given environment with a specific package. Finally, the GOMS model assumes that the accomplishment of a task involves the execution of a sequence of different easy to assimilate sub-tasks.

In the GOMS model the user's cognitive structure is represented by four components: Goals, Operators, Methods, and Selection Rules (acronym GOMS).

A Goal is a symbolic structure that defines the desired outcome to be achieved and determines the possible methods by which this may be accomplished.

Operators consist of those perceptual, motor or cognitive acts whose execution is necessary to change the user's mental state or the task environment for the accomplishment of the desired goal state.

Methods generate a sequence of operations which have internally organised goal structures that accomplish specific goals or sub-goals.

Selection Rules specify the appropriate conditions for executing a method to effectively accomplish a goal in a given context. The rules are presented in the form of IF-THEN statements which provide the necessary information for selecting the most appropriate method.

The GOMS analysis model has been extensively used in different studies investigating the acquisition of computer skills of different text editors (Bovair,Kieras, Polson, 1990), editors for tables and graphics (Vossen, Sitter, & Ziegler, 1987), telephone operator workstations (John, 1990) operating system commands (Jones, Mitchell, & Rubin, 1990), help systems (Elketron & Palmiter, 1991), spreadsheet and databases (Olson & Nilsen, 1988).

The GOMS model has been found to be 80% accurate in predicting the number of actions and 35% accurate in predicting the time needed to complete a task (Card, Morgan, & Newell, 1980, 1983; Koubek, Salvendy, Dunsmore, Lebold, 1989). GOMS analysis has been used to model many tasks in a diversity of domains (Olson & Olson, 1990) extending to the modelling, predicting and explaining performance in real world tasks (Gray, John, Atwood, 1993) and in highly interactive and complex computer tasks (Arend, 1991; John, Vera, Newell, 1994).

Furthermore, the GOMS analysis model was found to be the most effective way to foster learning and skill acquisition (Salvendy 1987); to predict errors attributed to working memory (Olson & Olson,1990), to estimate execution time (Lee, Polson, Bailey, 1989) and use frequencies of help functions (Metzler, Ollenschlager, & Wandke, 1991). Elketron & Palmiter (1989, 1991) used the hierarchical goal and subgoal model of GOMS to redesign a menu-based hypercard help system. With this system users were more consistent, browsed through fewer cards, retrieved information faster and rated the help system better on subjective evaluation. In addition GOMS model-based manual resulted in shorter learning time and fewer errors than original or improved manuals (Gong, & Elektron, 1990).

The GOMS model have been criticized for its assumption of context independence, meaning that the methods people use change over tasks and time, and of error-free performance which is not true even for the experts (Whiteside & Wixon, 1987). But, the empirical findings of Lerch, Mantei and Olson, (1989) suggests that GOMS can predict errors and that models of existing interfaces can provide plausible explanations and predictions for a wide variety of human-computer task operations (Olson, & Olson, 1990).

5.2.2 The CCT Model

The Cognitive Complexity Task framework (CCT) has been developed with the purpose of determining the difficulties in acquisition, transfer and retention of skills necessary to perform the task using a given application. (Kieras, 1985; Kieras & Polson, 1985) This attempt to formalise knowledge as a production system is theoretically motivated by the architecture proposed for different human-information processing systems (Kieras 1985, Anderson 1983).

The CCT production model takes into consideration three basic components: (a) the rules, which describe the knowledge needed to perform a task; (b) the working memory, which contains a representation of a user's immediate goals, the intermediate results generated from the execution of a method, and the external behaviour of the system (conditions) that specify when a physical action or cognitive operation should be performed; and (c) an interpreter, which controls the execution of the rules by the alteration between the recognize and act modes.

At the beginning of each cycle, the interpreter, in the recognize mode, matches the conditions of all rules against the contents of working memory, and the appropriate rule triggers an action. The action includes a physical and cognitive operation as well as the addition and deletion of goals which with the changes in the environment will change back the production system to the recognize mode. As is evident, the CCT model emphasises the importance of the working memory which is a crucial factor in estimating the efficiency of the user in acquiring new skills before reaching the level of mastery and expertise (Anderson, 1981).

Polson & Kieras, (1985), Polson, (1987) & other researchers have shown that production system models based on the original CCT model were able to make successful quantitative predictions for training time, transfer performance and productivity.

Kieras & Bovair, (1986), Polson & Kieras, (1985) Polson, Muncher, & Engelbeck, (1986) tested successfully the assumptions that the amount of time required to learn a task is a linear function of the number of new rules that must be learned in order to successfully execute the task and that execution time for a task is the sum of the execution times of the rules that fire in order to complete the task.

Lee, Polson and Bailey (1989) varied the order in which subjects learned the procedures and measured learning time. Regression analysis showed that, for all training orders, the time to learn a new procedure was 77% consistent with the number of the new productions. In addition error rates of spreadsheet users was found to be positively correlated with working memory loads which consisted of the number of new goals for the task.

Furthermore, they supported the idea that the common methods used to achieve the same goals, even when these goals occurred in different task contexts, once learned, are always incorporated into the presentation of a new task at little or no cost in training time (Kieras & Bovair, 1986; Polson & Kieras, 1985a,). Three or four to one reductions in training and menu selection time were observed when tasks were organised so that they supported transference of common rules among operations and applications (Lane, Naper, Bastell, Naman, 1993) .

5.2.3 Cognitive Task Analysis of Applications.

For the construction of the GOFT Training Materials it was considered necessary to have a model to evaluate the complexity of the different realistic applications that a user can encounter when using a specific computer package. Such an analysis of applications was of particular importance, since the training materials were developed for users with limited experience and knowledge of real office applications and with previous educational limitations and cognitive deficiencies.

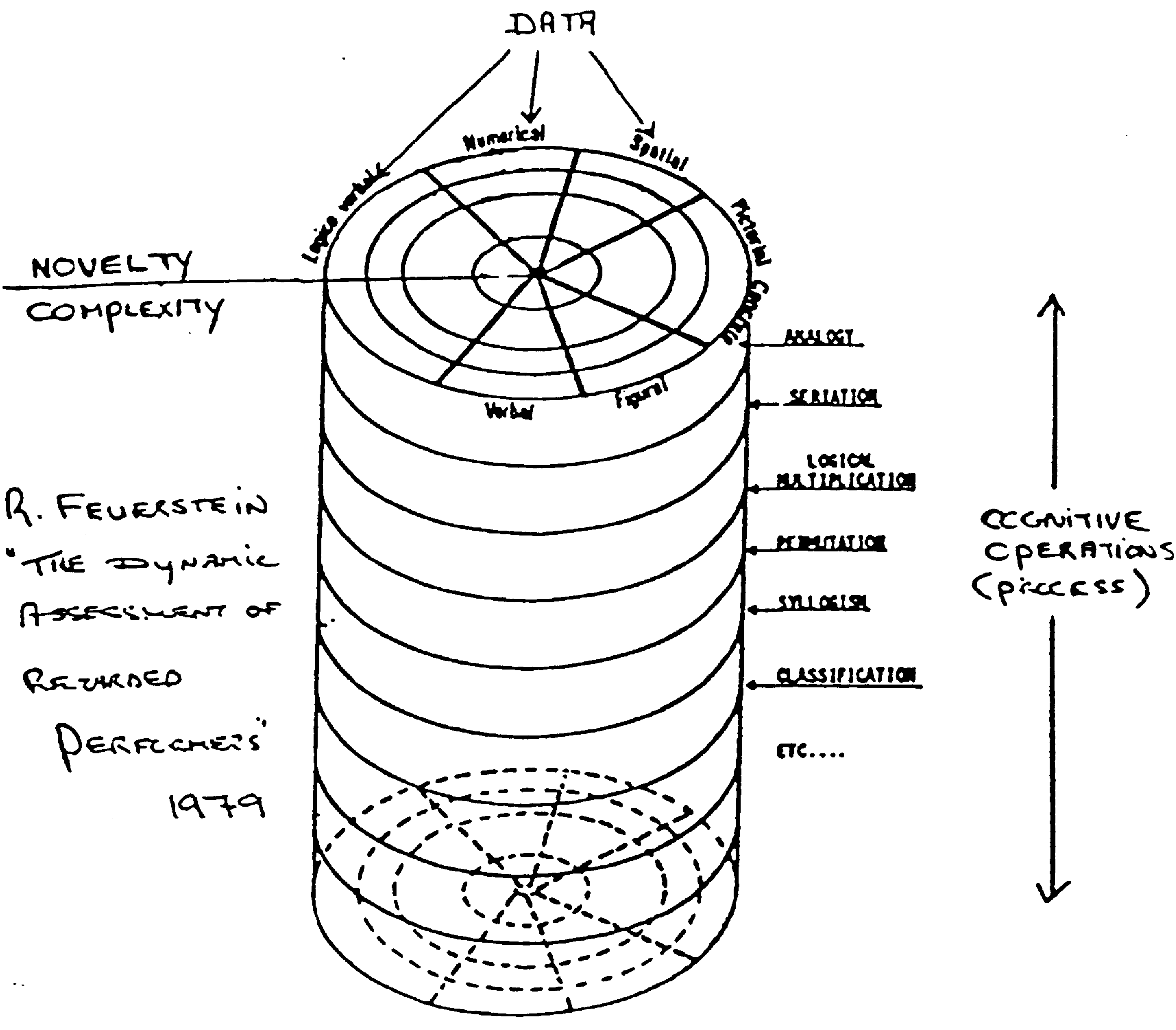
The theoretical framework of the analysis model was based on Feuerstein's (1979) Cognitive Map Analysis which has been extensively used in predicting difficulties and deficiencies as well as the need for cognitive training of children, adolescents and adults with learning deficits due to cognitive, emotional or environmental factors. The Cognitive Map Analysis described a task in terms of seven different parameters; the content, operations, modality, phase, level of complexity, level of abstraction and level of efficiency. From those parameters, the three dimensions presented in Fig.5.4, namely the content, operation, and modality were considered particularly important for the complexity analysis of real office tasks.

The content refers to the subject matter of the application. Content is an area of cognitive functioning in which people differ greatly, with differences determined directly by experiential, educational and cultural background. If an application is attempted with content that is so difficult that it absorbs all the attention of the user, the learner may be left with little or no capacity to focus on the mastery of the computer operation. Furthermore, the nature of the content will determine what further explanations will be required so that the user can fully understand the applications.

Operations are the internalised actions in terms of which we elaborate upon information, which has been derived from internal or external sources. Operations may range from the simple identification and recognition of objects, to more complex activities such as their classification, seriation, and logical manipulation. Furthermore, operations may be applied to existing information or may require the generation of new data, as in syllogistic, analogical or inferential reasoning.

Figure 5.4 Feuerstein Model of Cognitive Demands (Feuerstein, 1979)

Dynamic Assessment: A New Approach



LPAD model.

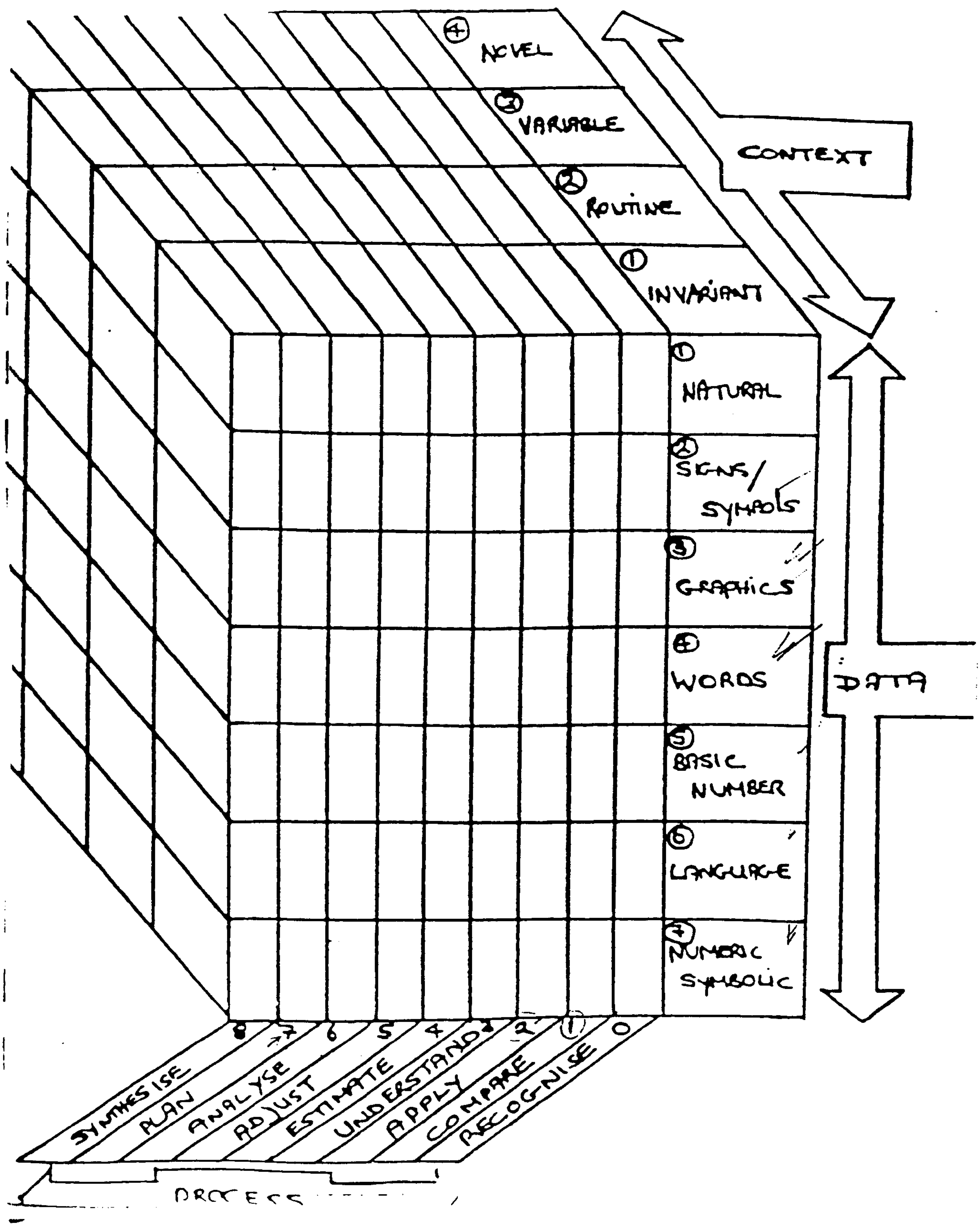
The modality concerns the language in which information is presented. The means of presentation may range from pictorial and verbal to numerical and symbolic. The modality of the task is an important factor to consider in order to correctly evaluate the abilities of the users if they encounter difficulties.

The estimation of the cognitive complexity of the realistic applications for the construction of the Training Materials was based on the modified version of the cognitive map analysis, developed by McAnaney & Duffy (1988) for the analysis of the cognitive demands of using a microcomputer. For their analysis, they described a task according to its context (variability); to the nature of the Data (numbers, language, numeric symbols) and to the required cognitive processes (operations) as presented in Fig. 5.5

The main difference from Feuerstein's cognitive map analysis is in the definitions of the considered levels of cognitive processes. The considered operations range from recognition and comparison, through adjustment and estimation to synthesis and evaluation. These ten processes cover the range of most activities which were encountered in a office work setting including those using technology, as defined by the Dictionary of Occupations classifications and Blooms taxonomy (1965).

This task and cognitive demands analysis was useful in broadening the range of computer skills taught to trainees with mild mental handicap, and in evaluating the software in terms of complexity for the users (McAnaney & Duffy, 1988).

Figure 5.5: Revised Model of Cognitive Demands Analysis. (McAnaney, Duffy,1988)



5.2.4 Implementation of the Models

The GOMS model provided the basic model for the design of the structure of the instructions. The distinct separation of goals, actions, methods and conditions promoted an independent goal-directed way of approaching new computer functions and an easy way to identify the number of goal-action steps required to accomplish the specific computer function. Furthermore, it provided a consistent format of instructions which the user could easily learn to use efficiently.

The Cognitive Complexity Model provided the rules to estimate the complexity of each new function by evaluating the novelty of each sub-goal-action step for the new user, and by considering the different methods available for the accomplishment of the specific function and the associated conditions for their selection. The Cognitive Complexity Model gave the guidelines for the hierarchical organisation and introduction of the different functions so as to foster the transference of identical goal-steps from one operation to another and to determine the number of novel goal-action sets to insure that up to a maximum of seven novel steps are introduced at each session.

The Cognitive Analysis Model was used for the evaluation of the difficulty level of the realistic applications the user will encounter when using a specific computer package or function. Available realistic applications were evaluated according to the three parameters mentioned and relevant exercises of different difficulty levels were included and arranged according to their cognitive difficulty in each session.

Finally, a combination of the Cognitive Complexity Model and the Cognitive Analysis Model was utilised to determine the number of exercises and their sequence in each application session to ensure the mastery of the relevant function and its implementation in realistic applications.

5.3 Objectives of the Training Materials

The Training Materials have been developed with the aim of enabling the user to learn the computer applications in an independent and goal-directed manner and to gain the required confidence to implement the mastered functions in real applications. The new training model was designed to meet the following distinct goals:

(a) to support the user in taking an active, independent and goal-directed approach in learning the computer package;

(b) to enhance the user's use of inferential and problem solving abilities;

(c) to provide a structure in the training process which would permit the users to learn at their own pace;

(d) to supply a sufficient number of realistic applications to allow the user to implement and master the functions;

(e) to provide a variety of realistic applications and so build up the user's confidence in using the mastered functions in other real situations; and

(f) to establish a constant, average level of difficulty across all tasks, to prevent overloading and to enhance motivation to reaching mastery.

To meet those objectives the Training Materials are composed of two distinct parts, the instructional and the application part whose design was based on a specially devised difficulty analysis model.

The goals, structure, and examples of each part in addition to the structure and implementation of the devised difficulty analysis model will be further elaborated.

5.4 Structure of the GOFT Training Materials

5.4.1 Instructional Part

The instructional part of the Training Materials take the form of goal-action steps on how to execute the different functions of a computer package. Instructions are constructed with the purpose of:

(a) being presented in a goal directed manner to highlight the rational for taking a specific action or pressing a specific key;

(b) having a concise and concrete structure which the students can easily learn to use efficiently;

(c) gradually introducing computer terminology;

(d) providing all the necessary information for the user to make active decisions about which is the most efficient method to use;

(e) reinforcing user computer interaction by providing the needed information to evaluate the feedback given on the screen;

(f) fostering a complete, active problem solving approach; like setting the goal, deciding the method, performing the action, and evaluating the outcome; and

(g) having a hierarchical organisation in introducing computer functions, to enhance transference and to reduce the degree of novelty.

Each set of goal lists provides all the necessary information so that the user will be able to know what the desired goal is at every step of the process, how this can be accomplished, and how to evaluate the outcome. More specifically, each goal list set of instructions includes:

Main goals, which indicate the desired end result of the procedure;

Goals and Subgoals, which break a long procedure into distinct goals or subgoals, composed to up to three actions;

Actions, which include the use of function keys;

Verifications, which indicate where the expected change is located and what should be the outcome of each action, encouraging the user to verify the feedback given on the screen;

Methods, which provide the different, possible ways of approaching a task; and

Conditions, which outline the parameters under which the described method would have been more efficient.

Different visual cues are used in the format of the goal lists to help the user to distinguish between the different aspects of the instructions. More specifically the Main Goal is presented in capital/ bold letters at the centre of the line. Goals are written in bold letters on separate lines with their subgoals indicated by two stars (**). Each action is indicated by the symbol Act and two dashes (Act --). Verifications are located on the left side of the page with the desired outcome of the action underlined. Finally, the different methods are presented in bold letters with their conditions in brackets and in an underlined form. The structure, style and special feature of different goal lists are presented in the Supplement II Part.

5.4.2 The Application Part

The application part is divided into different sessions composed of a number of different exercises according to the difficulty level of each session. The intention is to ensure mastery of the functions and experience with the different realistic applications.

The application parts have been created to satisfy the following goals:

(a) to enable the user to complete at least two applications in every training session;

(b) to require the user to carry out a complete "computer working process", from loading a package to saving, printing, exiting the program and closing the computer;

(c) to give enough practice opportunities to ensure mastery of the relevant functions;

(d) to provide a variety of different applications, whose complexity meets the demands of the tasks in real work situations and whose organisation, according to their difficulty level, ensures success of completion even for the most complex ones;

(e) to promote a sense of self-esteem and confidence in handling other real work tasks;

(f) to predict areas of difficulties to provide the necessary information and explanations to encourage understanding and to prevent failure; and

(g) to create a structure in the training process which can be followed independently by the different users at rates suitable to their abilities.

Each application session is composed of:

an Introductory part, which highlights the new functions which will be introduced in the session, in order to focus the user's attention on them;

a set of applications which includes a number of different exercises for the user to work on in order to master the new functions introduced in the session; and to get acquainted with the different available realistic applications;

an explanatory part, which is incorporated in most exercises, especially those with mathematical formulas, in order to ensure that all users regardless of their previous educational background can understand the applications;

a rehearsal part, which summarises the new functions that must have been mastered in the session providing an opportunity for the user to rehearse them and to evaluate their mastery;

a result part, which provides the correct final version of each application, which is important especially for those applications composed of mathematical formulas;

an estimation value, composed of three different numbers, is given at each session and exercise reflecting its difficulty level value. The first number depicts the novelty degree of the functions and the other two the cognitive complexity value of the applications according to the nature of the data, and required cognitive operations.

Examples of the application sessions of the Wordperfect 5.1 computer package are presented in the Supplement II Part B.

Each session is composed of a different number of applications depending on the Complexity level of the procedures and the difficulty of the Cognitive demands of applications available in real work environments. The estimation of the difficulty level of each session, and the ways employed to keep an average, easy to manage complexity level across applications will be elaborated in the next chapter.

5.5 The Difficulty Evaluation Model

A very important characteristic of the Training Materials is the consideration given to the organisation of the instructions and the design of the application sessions, so that they have a constant, easy-to-master difficulty level during the whole training process. This is established by the utilisation of a new difficulty evaluation model.

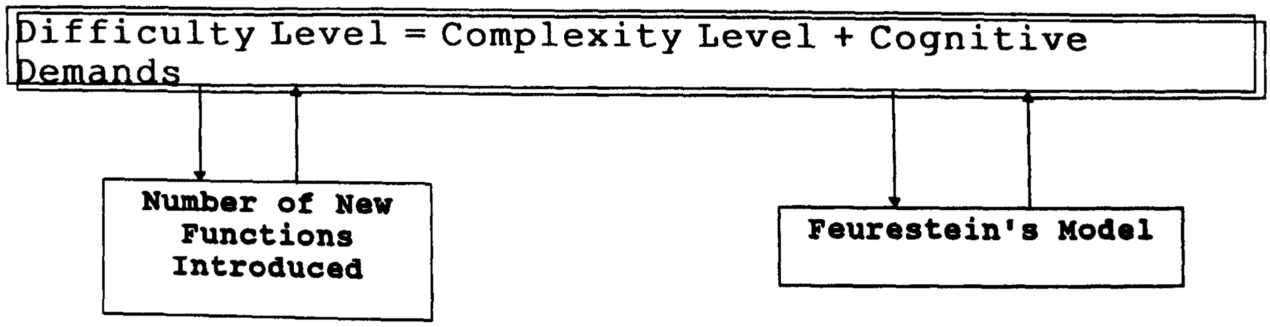
The difficulty level is defined as the sum of the complexity level of the computer function and the cognitive demands imposed by the nature of the realistic applications. The estimation formula of the difficulty level of each application is presented in Fig. 5.6.

The complexity level of the different computer functions is estimated by the number of the newly introduced goal set

Figure 5.6.

Estimation formula of the Difficulty Level of applications.

Calculation of Difficulty LEVEL



operations in each set of instructions, as defined by the CCT model. The cognitive demands of the applications are evaluated according to the modified cognitive map analysis model of McAnaney (1988),in terms of two parameters and the nature of the data, and the cognitive operations that the user has to rely on, in order to accomplish a specific application. The consideration of the nature of data is particularly relevant for the spreadsheet packages since it will determine the requirement for additional explanations to ensure the understanding of the mathematical formulas and their applications in other life tasks; like balancing a cheque book, or comprehending a given graphic presentation.

The difficulty level determines three main factors in the design of the GOFT Training Materials, the hierarchical organisation of the goal lists in the instructional part, the arrangement of the exercises in the application sessions and finally the number of required exercises in each session to ensure mastery and the user's confidence to handle real work tasks.

Goal lists are organised so that even the most complex functions have a relatively low complexity level because the user has already mastered most of the sub-procedures in previous sessions as can be illustrated in the goal lists presented in Figures 5.7 and 5.8. Note that in the goal list of Figure 5.8 four out of the ten goal action sets are identical with those in the previous goal list of Figure 5.7. Thus, the complexity level is reduced from 10 to 6.

Furthermore, goal lists with identical subprocedures are arranged so that their sequence fosters transference of learning and provides additional practise opportunities to insure mastery. For example procedure of blocking part of text has been first practised in low complexity level goal lists of less than 6 goal action steps as adjusting text, and emphasising typed text.

Figure 5.7: Goal list of adjusting more than two lines of typed text to the centre of the line. Total Complexity Level is equal with **6**. The complexity level of defining a BLOCK of text is **4**.

MAIN GOAL: ADJUST TEXT TO THE CENTRE

{level of compl.6}

Method 3 (Adjust to the centre more than one line of typed text)

Goal: **Define a block of text** **{l.c.4}**

** Sub Goal: **Specify the beginning of the block**

Act --- Move cursor

** Sub Goal: **Load Block Commands**

Act --- Press **Alt F4**

Verify:On the right "block on" is flashing.

** Sub Goal: **Specify the wanted block of text**

Act.--- Move cursor at the end of the text

Verify: that all the wanted text is highlighted?

Goal: **Centre Block**

Act--- Press **Shift F6.**

Verify: On the right. Prompt: Just Centre? No (yes)

Act--- **Confirm** Press **Y**

Verify: That the specified block is centred?

Figure 5.8: Goal list of moving a non specifiable text. Complexity level of **6** because the complexity level of blocking a part of text is reduced from **4** to **1**. Total number of goal-action steps is **10**.

MAIN GOAL: MOVE TEXT
{level of compl. 6}

Method 2 (More than one sentences, paragraphs, tables/columns)

Goal: **Define a block of text** **{1.c.1}**
** Sub Goal: **Specify the beginning of the block**
Act --- Move cursor
** Sub Goal: **Load Block Commands**
Act --- Press **Alt F4**
Verify:On the right "block on" is flashing.
** Sub Goal: **Specify the wanted block of text**
Act.--- Move cursor at the end of the text
Verify: that all the wanted text is highlighted?
(alt F4; procedure) **{c.1}**
Verify: All the wanted text is highlighted?

Goal: **Load Moving functions**
Act --- Press **Ctrl F4**.
Verify:Bot/Rig **Move: 1** Block, **2** Tabular Column, **3** Triangle.

Goal: **Goal: Specify text type**.
Act --- Press **1** for block of text
Verify:**1 Move; 2** Copy;**3 Delete; 4 Append;0**

Goal: Move text
** Sub Goal: **Select Move function**
Act --- To **Move** Press **1**
Verify: The specified text disappears, "Move cursor Press **RETURN**"
** Sub Goal: **Specify Place to move the text to:**
Act --- Move Cursor
** Sub Goal: **Transfer text**
Act --- Press **RETURN**
Verify: that the text appears at the wanted place.

****

A second area in which the difficulty level is used is in the arrangement of the exercises in each application session. Exercises are sequenced according to their cognitive demands from simpler to more complex as indicated by the last number of the estimation value. The initial exercises of each application session have a low cognitive complexity level, in terms of the nature of the data and the required cognitive operation, to balance for the difficulty imposed by the complexity level of the computer functions due to the novelty of the operation.

For example the first exercise (exercise 10) of the third session, has a high complexity level of computer procedures but requires a low, cognitive demands operation. The difficulty level of the exercise is 6-2 meaning the user has to apply a computer procedure with at least six goal-action steps. In comparison the last exercise of the third session (exercise 13) requires the user to analyze and plan to arrange the given information in a letter format. So the difficulty level is 3-6. The overall difficulty value of each exercise remains in the range of a total of 7 to 10 across the different practice applications and training sessions.

Finally, the overall difficulty level of each application session determines the number of exercises required to be included to ensure the mastery of functions and the enhancement of the user's confidence to handle real work situations.

5.6 The Developed GOFT Training Materials.

The GOFT training Materials were developed to meet the training demands of the introductory phase at the Speedwell Information Technology Project. The main purpose of the introductory phase was to familiarise the novice user with computers and to introduce different commercial computer packages.

More specifically the developed GOFT Training Materials covered the initial training of the WordPerfect 5.0 wordprocessing package, and the SuperCalc.5.1 spreadsheet package. For each computer package an Introductory summary, an instructional manual and an application part was developed and distributed to every student for training in those computer packages.

The instructional manual of WP 5.0 was composed of 55 different goal lists covering the topics of typing, editing, formatting, correcting, and printing text as well as file management. The Application part was divided into 9 different sessions and included 40 different exercises for the mastery of different wordprocessing operations.

The instructional manual for the training of SuperCalc 5, was composed of 20 different goal lists covering the use of the package, the creation of a Spreadsheet, the entering of data and the use of formulas, the modification of cells, the formatting and editing and the manipulation of data. The application part included 7 sessions and 30 different exercises.

Additional GOFT Training Materials covering the training in two advanced functions, the creation and editing of Tables and the typing of text in column format,of the WordPerfect 5.0 were developed to meet the demands of the comparative research part of this study.

The pilot version of the Training Materials was developed and used by the students enrolled at the Speedwell Information Technology Project in June 1990.

From the comments of those users the following modifications in the materials were introduced: a) the different distinguishing characteristic for each component of the goal lists was added; b) tables with simple keystrokes were introduced; c) the difficulty level estimation was incorporated in another manual for the trainer; d) different reminders in the rehearsal part were added to facilitate the mastery and to prompt the users to evaluate their confidence in using the functions in other tasks.

RESEARCH DESIGNS & FINDINGS

The efficiency of the new training module to meet the needs of the novice computer user with mental health problems have been evaluated by three different approaches.

1. Observational data were kept to highlight the qualitative differences in the training process with the GOFT Training Materials as perceived by the users themselves.

2. A quasi experimental research design was conducted to evaluate the relationship between the Training Module and increases in the attendance rate and reductions in the number of drop out students at the different stages of their computer training program.

3. An experimental research study was carried out to evaluate the effectiveness of the GOFT Training Materials to promote learning, and confidence as well as the user's level of satisfaction with them compared with traditional long stepwise training methods.

A detailed description of the purpose and hypothesis, the variables, the methodology, the obtained results and the derived conclusion of each utilised research approach will be presented in the next three chapters.

6. OBSERVATIONAL APPROACH.

The observational data were gathered in order to provide a basis to evaluate the effect of the training materials on the qualitative aspects of the daily training process and to report the different ways the materials were used by each trainee to fit their personal needs.

A daily log of verbal comments concerning the GOFT Training Materials in addition to a record of the different ways the training materials were used by the users, was kept by the experimenter during two training sessions at Speedwell. A brief comparative account of the differences in the overall training nature due to the different training method used will be given and a description of some personal examples, elaborating the different ways the new materials were used by each user, will be reported.

6.1 Overall Training Process Observations

The general structure and disposition of the training sessions at the Speedwell Information Technology Project remained unchanged regardless of the applied training methods. More specifically, each training session lasted for three hours with a 15 minute coffee break in the middle. The students had their own computer and training materials. They worked independently at their own pace but assistance was always available from a trainer. The training sessions were characterised by a relaxed attitude, which allowed the students to work at the pace they desired, and to take as many breaks as they wanted. In general, the trainers did not intervene to persuade the students to start or to continue with their training.

The different training materials qualitatively affected the overall training sessions. A notable increase in the time the students spent working with the computer was evident when the GOFT Training Materials were used. More specifically, they tended to start their work earlier, to observe their coffee break time and to finish with the end of the training session.

Another difference between the training sessions was that with the GOFT Training Materials most students came into the training session with a prepared set of goals to accomplish that day. As a consequence, they required less friendly encouragement by the trainers to start and to continue with their work.

Furthermore, the GOFT Training Materials provided a structure to their training, which they could follow independently at their own pace. For some students, this structure gave them a sense of control over their work and a freedom from the instructors, which they enjoyed. For others, who were reluctant to ask for work, the structure of the materials provided the necessary incentive to continue.

There was a indicative change in the responses students gave to the question, "What have you learned today?" When traditional training materials were used the typical answer was the number of the completed exercise or session. They could not distinguish the real purpose of their work which was the mastery of specific computer functions. In contrast, with the GOFT Training Materials, most students tended to refer to the specific new computer functions, like "moving text" or "copying spreadsheet cells" they had mastered or to the new components introduced in the different applications like "balancing a chequebook or creating a storage database".

In addition, students trained with the GOFT Training Materials were more willing and able to tackle new applications. They were more able to specify where they encountered a difficulty or when they did not know the function necessary to accomplish a new given task. They were more efficient in utilising the help given by the computer package and in experimenting with new functions. Furthermore, they were more able to deal with unwanted results by taking corrective actions and by remaining calm.

Finally, they were more keen to share and discuss their progress and accomplishments as well as some of their difficulties with other fellow students and the instructors during coffee breaks. This social talk of progress was extremely important for the beginning of social contacts and the promotion of personal self esteem.

6.2. Case Histories.

Student 1.

A black student with a diagnosis of schizophrenia, who was studying at college at the time of the onset of the illness. He was very proud of his mathematical background and wanted to protect his image of a man and of a smart university student. He wanted to be in control and he had a major problem in relating to the "figures of authority" like the instructors. As a consequence he had difficulty in accepting instructions from the staff whom he constantly challenged at the beginning of the program.

The materials gave him a sense of independence since he could control the speed of his learning but also the structure to help him to focus on a specific task. He used to program his work in advance, by specifying which applications he would finish in each session. Furthermore, the gradually increased difficulty of the applications provided the necessary challenges to keep him motivated, without being too complex to be threatening to his image. After the completion of each package, he used to rehearse the mastered functions, and wanted to keep the instruction part to refer back to it, in the future.

Student 2.

A young, black woman, from a low socioeconomic and educational background, with a diagnosis of schizophrenia. She had enrolled on the program in the past but quitted early. She had a very low image of herself and she used to become easily confused. She had a childish behaviour and she used to "shout" for assistance with each presented difficulty and so disturbing her fellow students.

According to her, the materials were very helpful in terms of the gradual difficulty of the applications, and the provided explanation part, especially in the spreadsheet program. She worked very persistently to understand the meaning and the structure of the different office task applications. Once she understood the applications, she created her own personal projects, whose accomplishment gave her a sense of independence and personal satisfaction. One day, she came to the program happy to announce that "for the first time she had understood how to read her bank statement and to balance her chequebook".

Furthermore, the structure of the instructions was helpful in gradually promoting her problem solving skills and helping her to feel more confident in herself to deal with everyday problems. Gradually, she learned to control her impulsivity, and to ask for assistance after she had thought through where she had a difficulty.

She completed the Speedwell program and continued her training at the ITeC program. She started to enrol in special programs promoting literacy and numeracy skills. She was preparing to sit for the typing exams.

Student 3.

A middle-aged woman with a diagnosis of depression. She was extremely nervous when encountering something new and afraid of the computer, regardless of her previous experience in typing and office work. She had very low self confidence and had difficulty in evaluating her progress.

She used to test her knowledge of the computer functions by using the rehearsal part and by selectively repeating previous exercises without the use of the instructions. The structure of the materials in different sessions provided a concrete way for her to see her progress. Every time she finished a session, she verbally reported her sense of pride in her accomplishment. In addition, she found the explanation part of the applications very helpful in providing her with the necessary information to overcome her fear of mathematics and to be able to understand and apply the spreadsheet formulas. Furthermore, she enjoyed the fact that she could control the rate of her work according to her mood, and she did not felt the overpressure to keep up with the rate of the other students. She was very proud of herself that she was able to learn new things at her age.

She continued her training at the ITeC program, where she was able to refresh her office skills, to continue her computer training, and to consider sitting for the exams.

Student 4.

A smart young man, who dropped out of college with a diagnosis of depression. He was very punctual in his attendance and hard working but very withdrawn.

For him, the most interesting feature of the materials was " the freedom given to him" to select which method to use at each application. He worked very systematically to understand the differences between the various methods used to accomplish each specific goal, in order to be able to select the most efficient one. He wanted to have all the required information in order to reach a decision and which he then tested.

The choice of methods provided a topic to start a conversation with the trainers and later with his fellow trainees, enabling him to create some relationships in the program.

He continued his training at ITeC.

Student 5.

A 50 year-old black man, who worked as a bus driver with a diagnosis of schizophrenia. He had no previous experience with office work and he was very hesitant to believe that he would be able to learn to use the computer.

According to him the most important features of the GOFT Training Materials were: (a) the explanation part of the applications which fostered his understanding; (b) the organisation of the applications whose gradual increasing difficulty facilitated his mastery; and (c) the freedom to work independently without having to compete with the other students. He followed every step of the instructions for each application and he felt a big sense of accomplishment every time he completed a session.

He completed the Speedwell program and continued his training at the ITeC.

6.3 Discussion

The data collected from personal observation revealed qualitative differences in the use of the GOFT training Materials for learning computer functions by these users who wanted to fit it to their individual learning needs and their personal preferences. This freedom of differential use allowed each user not only to make their training more meaningful and desirable but also to control their rate of progress according to their personal capacities.

The increase which was revealed in the time users spent working with the computer and the decrease in their need for personal encouragement and assistance provided positive indications that the GOFT training Materials were instrumental in promoting the interest in computers, in eliminating stress and failure, and in encouraging independent learning.

7. RESEARCH DESIGN I.

7.1 Purpose & Hypotheses

This study was conducted in order to examine whether novice computer users with a history of mental health trained with the GOFT Training Materials showed a significant difference in their attendance rate and training outcome compared with other who were trained with other commercial training materials at the Speedwell Information Technology Centre ?

More specifically , in this research the following hypotheses have been examined :

(a) students trained with the new training materials were expected to show a higher attendance rate than those students trained with other commercial packages;

(b) a higher number of students trained with the new training materials was expected to finish the Speedwell Information Technology Program and to continue to the Outset ITeC Computer Program;

(c) a higher number of students trained with the new training materials were expected to continue at the Outset ITeC Computer Program after three and nine months.

7.2 Variables

Independent Variables

The independent variables in this study were the different training methods used for teaching computer skills.

The control group used the MacMillan training Method and the User's Manual Guide in addition to a number of exercises which had been created at the Speedwell Information Technology Project.

The experimental group was trained with the GOFT Training Materials. This training package included the Introductory Section, the Instructional Part, and the Application Part.

Dependent Variables

In this research the following dependent variables have been examined:

(a) the attendance rate of each student which was kept in the daily attendance record sheet;

(b) the number of students who completed the three first months of training at the Speedwell Information Technology Project;

(c) the number of students who continued their training at the Outset ITeC program after three months; and

(d) the number of students who completed their one-year training.

7.3 Method

7.3.1 Subjects

The subjects of this study were the students enroled in the Speedwell Information Technology Project. This project was composed of a three months introductory phase held at the Speedwell Day Hospital and a nine month training at the Itec program. All students had a history of mental illness, which resulted in repeated hospitalisations. There were no discriminatory criteria for selection, in terms of age, race, socioeconomic status, vocational and educational background. The only imposed criteria were that all students had to be residents in the Lewisham area, that they had to be without work for at least one year, and that they had expressed an interest in learning to use computers to increase their employable skills.

The control group consisted of 36 subjects. They were the students who had completed the first three months of their training at the Speedwell Information Technology Project (SITP) from November 1989 to July 1990. All these students were trained with traditional training materials. The subjects were trained in six different groups of six students each. Of these 20 were men and 16 women. 18 (50%) came from ethnic minority groups. The age range varied from 18 to 55 years with 7 (20%) being under the age of 25 and 2 (5%) being over 50. In terms of educational status, 2 (5%) had obtained A University Degree, 4 (10%) had passed the qualification exams, 4 (10%) had dropped out of High school, and 26 (80%) left school without taking exams before the onset of their illness and their enrolment in SITP. 7 (20%) had no previous work experience, 12 had office work experience and 17 had worked in other fields.

The experimental group consisted of 34 subjects. They were the students who had completed their initial three month training at the Speedwell Information Technology Project from August 1990 to July 1991. They were trained using the GOFT Training Materials. They were divided into six different groups. Of those 18 (52%) were men and 16 (48%) were women. 12 (40%) came from different ethnic minority groups. The age range varied from 19 to 55 with 7 (20%) being under the age of 25 and 2 (6%) being over 50. In terms of educational status, 1 (3%) had obtained a University degree, 3 (9%) had passed the O level qualification exams, 26 (76%) finished school without taking exams and 4 (12%) had dropped out of High school 9 (25%) had no previous work experience, 10 (30%) had worked in office related jobs and 15 (45%) had worked in other fields unrelated to the work in an office.

The chi square analysis revealed no significant difference among the two groups in term of gender (x^2=0.05, df=1, p>0.05), age,(x^2=0.02, df=2, p>0.05), work (x^2=0.02, df=2, p>0.05), and educational status (x^2=0.34, df=2, p>0.05).

7.3.2 Procedure

The training was provided in two concurrent groups of around 6 trainees each. The whole training program lasted one year and had two distinct phases, the introductory and the ITeC Phase.

The Introductory/Speedwell phase lasted for three months. The training was conducted in a separate room at the Speedwell

Day Hospital. Each group received two training sessions every week. Each session lasted for 3 hours (10:00am to 1:00pm and 1:30 to 4:30) with a 15 minute coffee break in the middle. In addition two practice sessions were available to all students, every week. The main goals of the Introductory phase were: (a) to introduce the trainees to various computer applications; (b) to encourage them to acquire keyboard skills; (c) to reduce their anxiety; and (d) to foster their self esteem and confidence. Only during the Introductory phase at Speedwell, do the two groups differ in their instructional methods with the study group being trained with the GOFT Training Materials.

The control group was introduced to a variety of computer applications which included wordprocessing, database, graphic, spreadsheet, drawing, and Desk Top Publishing packages. Emphasis was given also to the acquisition of keyboard skills with the use of a Typing Tutor Program. Each student worked independently. The training material, which were available for the trainees included the User Manuals, the MacMillan Training Method, the Book " WordPerfect 5.1 Step by Step" and sets of training materials created by a previous instructor. Assistance was available, when needed, from two trainers and a psychology student. The experimenter participated as a trainer at the last two control groups, which were trained from May to July 1990.

The experimental group was mainly trained in three applications, wordprocessing (WP5.0), spreadsheet (SuperCalc,4); and DBase IIIPlus. All trainees had been briefly introduced to Drawing and Desk Top Publishing packages. The Typing tutor was mainly used during the practice sessions or when the trainees wanted to relax. Each student worked independently but assistance was available from two trainers and a psychology student. Each student was given the Introductory, the Instructional, and the Application Part of each package they were trained in. The experimenter participated as a trainer in the first four study groups. Another trainer substituted the experimenter at the last two study groups.

The ITeC phase of the program was identical for both the control and the study group. The Lewisham Outset ITeC program was responsible for the training of the students for the other nine months. The trainees attended two three hour training sessions per week with the possibility of attending another two practice sessions at the Speedwell Day Hospital. The main goal of the ITeC phase was to prepare the students for the RSA and City and Guilds exams on various applications. The training during that phase was identical for both the control and the experimental group.

7.3.3 Measurements

The attendance data was recorded on the daily attendance sheet, which was completed by one of the trainers every day. For the six study groups the attendance records have been kept in a computerised database. For the analysis of the data, the subjects have been classified, according to their attendance record, in the following three categories:

Perfect Attendance: Absent for up to 3 training sessions, during the 3 month training period at Speedwell. The students had a valid reason for being absent and had informed the program of the reason of their absence.

Regular Attendance: Absent from 4 to 10 training sessions during the 3-month training period at the Speedwell. The student had a valid reason for being absent and kept a contact with the centre.

Occasional Attendance: Absent for more than 10 training sessions during the 3 month training period at Speedwell. The attendance of those students was sporadic with no reported valid reason.

The number of students participating at the Speedwell Information Technology Project was recorded, for each group, at the following time periods:

Stage 1. At the beginning of the project;

Stage 2. After three months (which coincides with completion of the program at the Speedwell);

Stage 3. After six months (three months at the ITeC;

Stage 4. After nine months at ITeC.

The data concerning the 4 control groups were collected from the attendance records available at the project. The data for the last two control groups and the 4 study groups has been collected by the experimenter. The data for the last two study groups has been collected for the experimenter by one of the other trainers.

7.4 Results & Discussion

7.4.1 Participants

Table 7.I summarizes all the Demographic and Background information of the participants.

Chi square analysis of the control and study group revealed no significant difference in terms of sex (x^2=0.05,df=1,p>0.05), age (x^2=0.02,df=2,p>0.05), education (x^2=0.34,df=3,p>0.05) and work experience (x^2=0.02,df=2,p>0.05).

TABLE 7.I Demographic Data of the Control & study group participants

DEMOGRAPHIC DATA	CONTROL GROUP N= 36		STUDY GROUP N = 34		CHI SQUARE ANALYSIS
	No	%	No	%	P
SEX					x^2 = 0.05
Male	20	55.60%	18	52%	df=1
Female	16	44.40%	16	48%	p > 0.05
AGE					
18 - 25	7	19%	7	20%	x^2 = 0.02
26 - 49	27	76%	25	74%	df = 2
50 & up	2	5%	2	6%	p > 0.05
EDUCATION					
University	6	15%	4	20%	x^2 = 0.34
H.S. No Exams	26	80%	26	76%	df = 2
Dropped H.S.	4	5%	4	12%	p > 0.05
PREVIOUS WORK					
No Work Exp.	7	20%	9	25%	x^2 = 0.02
Office Work	12	33%	10	30%	df = 2
Other Work	17	47%	15	45%	p > 0.05

7.4.2 Attendance Rate.

The number of students who exhibited a perfect attendance rate during their three-month Speedwell training was significantly higher for the group trained with the GOFT Training Materials (n=15, 44.12%) compared to the control group (n=4, 11.11%). Also the number of students in the group trained with the GOFT Training Materials who had a perfect attendance rate (n=15,44.12%) was higher than those with regular attendance (n=11, 32.35%) and significantly higher than those with occasional attendance (n=3,8.82%).

On the contrary, a higher number of students in the group trained with traditional materials exhibited an occasional attendance rate (n=7, 19.44%) than a perfect (n=4, 11.11) or regular (n=6, 16.67%) attendance rate. The analytical distribution of the students according to their attendance rate and training method group is being presented in Table 7.II.

Chi square analysis revealed an overall significant difference between the two groups in regard to the three, different attendance rate classifications of those students completing the three-month Speedwell training program (x^2=6.77,df=2,p<0.05). The level of significant difference between the two groups for all students, including those who quitted, was found to be even higher (x^2=17.56,df=3,p<0.005).

Table 7.II : Distribution, percentage & Chi-square Analysis according to different rates for GOFT and traditional training materials.

ATTENDANCE	CONTROL GROUP		STUDY GROUP	
	N	%	N	%
PERFECT	4	11.11	15	44.12
REGULAR	6	16.67	11	32.35
OCCASIONAL	7	19.44	3	8.82
QUITTED	19	52.78	5	14.71
TOTAL	36		34	
CHI SQUARE TEST	ANALYSIS RESULTS			
Between Groups & the four attendance of all participants	$x^2 = 17.56$, df = 3, $p < 0.005$			
Between Groups & the attendance of remaining students	$x^2 = 6.77$, df = 2, $p < 0.05$			

7.4.3 Participation.

At every stage of the Speedwell Information Technology Project, namely the three, six and twelve month periods a higher number of students was participating from the group trained with the GOFT Training Materials than the control group. More specifically, 29 from 34 students trained with the GOFT Training Materials completed the three introductory months of training at Speedwell in comparison with 17 from 36 students trained with traditional materials for the same length of time. From the group trained with the GOFT Training Materials, 18 and 15 continued after three and nine months of training at the ITeC Program compared to 10 and 8 from the group trained with traditional materials. An analytical account of the number of participants from the control and the study group at the different phases of the project is shown in Figure 7.1. In addition the number of dropout students of both groups at the different stages of the program is depicted in figure 7.2. A summary of the number of students and drop outs at different stages of the project for both groups is given in Table 7.III.

Chi square analysis revealed an overall significant difference between the two groups (x^2=17.56,df=3,$p<0.005$) in regard to the number of participants in the different stages of the Speedwell Information Technology Project.

Figure 7.1 : Chart of Percentage Difference Between Study and Control at Different Stages

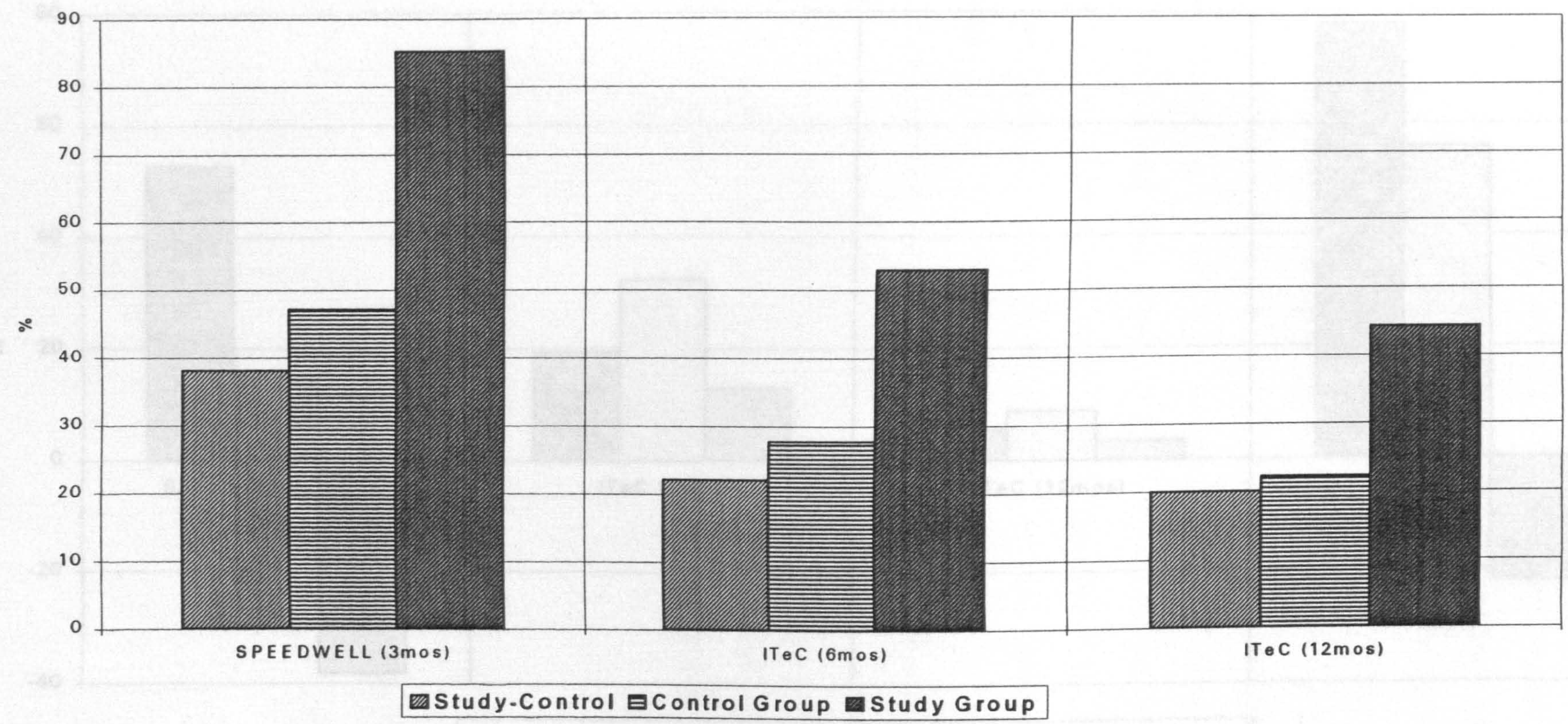
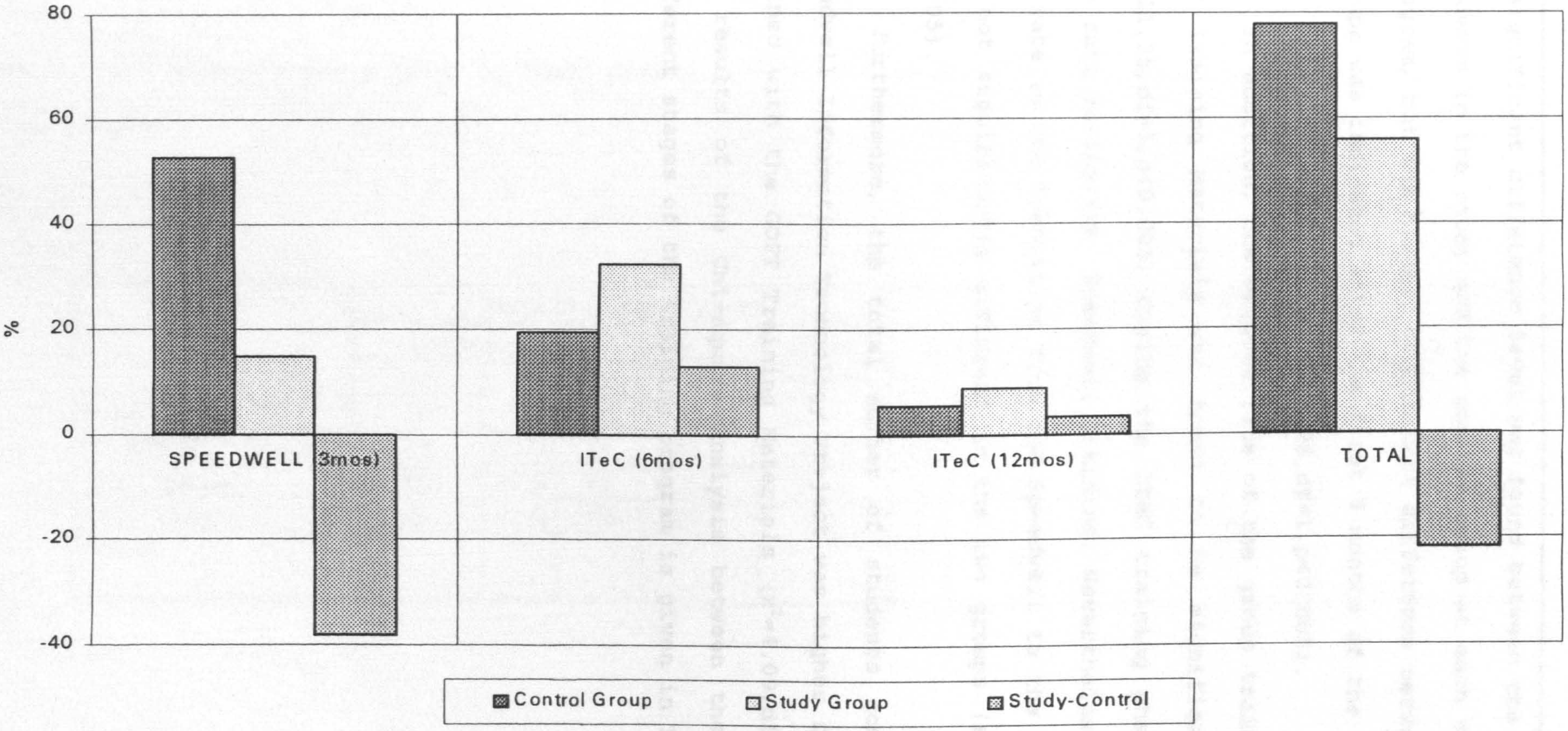


Figure 7.2 Chart of Drop Out Percentages and their Difference between Study and Control Group at Diferent stages of the Program



A significant difference level was found between the number of students in the study and the control group at each stage of the program, but the highest significant difference between the two groups was indicated after the first 3 months of the training at Speedwell (x^2=11.25,df=1,p<0.005).

In addition, the dropout rate of the group trained with the GOFT Training Materials was found to be significantly higher (x^2=11.25,df=1,p<0.005) during the ITeC training phase than the drop rate during the Speedwell training. Nevertheless, the drop-out rate in the transition from the Speedwell to the ITeC Program was not significantly different in the two groups (x^2=0.2, df=1, p>0.05).

Furthermore, the total number of students completing the Speedwell Information Technology Project was higher for the group trained with the GOFT Training Materials (x^2=4.09,df=1,p<0.005). The results of the Chi-square Analysis between the groups and different stages of the training program is given in Table 7.IV.

TABLE 7.III : Number & percentages of Participants & Drop outs of he study & Control group at different stages of the program

	Number of Participants					NUMBER OF DROP OUT				
	Control		Study		Differ.	Control		Study		Differ
	No	%	No	%	Stud-Con %	No	%	No	%	Stud-Con %
STARTED	36	100	34	100						
SPEEDWELL (3mos)	17	47.2	29	85.3	38.1	19	52.8	5	14.7	-38.1
ITeC (6mos)	10	27.8	18	53	22.2	7	19.4	11	32.3	12.9
ITeC (12mos)	8	22.2	15	44.2	20	2	5.5	3	8.8	3.3
TOTAL						28	77.8	19	55.8	-22

Table 7. IV : Chi-square analysis results between groups and the number of participants and drop outs at different stages of the program.

Description of Chi-Square Analysis	**Drop Out Numbers**			**Results & Significance Levels**
	CONTROL	STUDY	CON-STUD	
Number of Participants & Drop outs between groups from start to finishing Speedwell (3 mos).	19	5	14	$x^2 = 11.25$, df=1, $p<0.005$
Number of participants and Drop-outs between groups from finishing Speedwell (3 mos) & continuing at ITeC after 3 mos. (6 mos)	7	11	-4	$x^2=4.61$, df=1, $p< 0.005$
Number of Participants and Drop outs between groups from three months at ITeC and the end of the program (12mos).	2	3	-1	$x^2=.20$, df=1, $p> 0.005$
Number of Participants and Drop outs between groups from start at Spedwell to the end of the program	28	19	9	$x^2=4.09$, df=1, $p< 0.005$
Number of Participants and Drop outs of the study group between the Speedwell and the ITeC				$x^2=4.46$, df=1, $p< 0.005$

7.5 Discussion

The obtained results from this Quasi experimental design supported the main stated hypothesis that the GOFT Training Materials will be more effective in improving the attendance rate and training outcome of the novice computer users with mental health problems.

The significantly higher number of students showing a perfect attendance during the first three introductory months of the project supported the assumption that the GOFT Training Materials were more efficient in promoting the student's self motivation and control over their training. In addition the significantly reduced number of students with occasional attendance indicated a significant change in the motivation of the students to learn as much as possible.

The significantly increased number of students participating in the project after the completion of the first three months supported the assumption that the new training materials were efficient in reducing the initial stress and frustration caused by the encountered difficulties or the lack of control over their interaction with the computers.

The structure of the materials and the manageable complexity level of each application seem to have been instrumental in reducing the incidence of relapse. The

In addition, the significantly higher number of students completing their twelve-month training at the Speedwell Information Technology Project when the GOFT Training Materials were used for the first three months of training, denoted the significance of an initial positive experience with computers for the continuation of computer training for the novice users.

The increased number of students quitting the project with the change of training during the ITeC phase further supported the significant role of specially designed training methods to meet the needs and preferences of adult novice users with mental health problems. The construction propositions supported in this study for the development of effective training materials as well as the results of the subjective evaluation of the developed and traditional training materials may provide some explanations for the high dropout rate at the ITeC project, as will be discussed further in the Chapter 9.

8 EXPERIMENTAL RESEARCH DESIGN.

8.1 Purpose & Hypothesis

This research was designed to evaluate whether the GOFT Training Materials were rated higher than traditional long stepwise procedures in terms of their effectiveness to foster mastery of new functions, of the user's level of satisfaction with the training materials, and of promoting a problem solving approach in learning new functions?

More specifically in this research the following hypotheses have been examined:

(a) a significant higher performance score was expected for those functions in which students were trained with the GOFT Training Materials than with traditional long stepwise approaches;

(b) a significant higher score in terms of the user's level of satisfaction was expected for the GOFT training materials than for long stepwise procedures;

(c) a significant higher score reflecting the promotion of a problem-solving approach was expected for the GOFT training materials than for traditional long stepwise procedures;

(d) a significant higher score depicting the user's level of confidence in using the mastered function was expected for the GOFT training Materials than for the traditional long stepwise procedures.

8.2 Variables

Independent Variables

The independent variables reflected the two different training methods used to master two different advance functions of wordperfect. These different training methods were the GOFT training Materials and the long stepwise approach of the MacMillan method.

Dependent Variables

The dependent variables were the level of performance and the results from the completion of a questionnaire measuring the level of the user's satisfaction, the promotion of problem solving approach, and the user's confidence in using the mastered functions. A detailed description of those measures will be given in the methodology part.

8.3 Method

8.3.1 Subjects

The subjects were 12 trainees who were students at the Speedwell Information Technology Project and voluntarily participated in this research. Six were males and six females; with an age mean of 32 years.

All subjects have completed their initial three month training at the Speedwell project and were continuing their training at the ITeC program. All students have already mastered the elementary functions of the WordPerfect Package. Four students had no previous experience working with the GOFT

Training Materials, but all twelve had been trained with the control training method.

8.3.2 Procedure

Each subject participated in six training sessions of 3 hours each. Four training sessions were devoted to the training of two advanced Word Perfect procedures, namely tables and column formation. Equal training time, of two sessions, was given to each subject to master the specific procedures with the GOFT Training Materials or the MacMillan Method. An additional training session was also given for the evaluation of the mastered function and the completion of the questionnaire. The evaluation was conducted after the completion of the training sessions of each function.

All subjects worked independently using the respective training materials. Help was available from an experimenter when that was absolutely necessary. All subjects were informed of the time constraints of the training sessions but were free to regulate their work. All students had a 15-minute break at the middle of each session.

All subjects worked with both training methods, but they were separated in two different training subgroups according to the following parameters:

Subgroup I. the subjects were trained in Wp 5.0 package, first to create tables using the GOFT Training Materials, and then to format text in Columns using the MacMillan method.

Subgroup II. the subjects were trained in Wp 5.0 package first, to create tables using the MacMillan method, and then to format text in Columns with the GOFT Training Materials.

In the analysis of the performance data an additional category was examined reflecting the previous experience of the subjects with the GOFT Training Materials. The group with **No previous experience** with the GOFT Training Materials, which consisted of 4 subjects, and the group **with previous experience** with the GOFT Training Materials, which had 8 subjects.

After the completion of the two training sessions each subject was given a similar task to complete during the third session. Each subject had 1 hour 30 minutes to complete the task. The subjects were encouraged not to rely on the materials to complete the task, unless it was absolutely necessary. After the completion of the task each subject completed the performance scale and the document evaluation questionnaire for the training method used to learn the procedure.

8.3.3 Measurements

All measurements were taken after the completion of the two training sessions for the mastery of each function. These measurements included a performance rating and a questionnaire.

Performance Rating

An overall performance rating reflecting the students' competence to use the functions they have mastered was given by one of the trainers. The performance rate consisted of a five step scale according to the following parameters.

Score 5: the subject was able to finish a new example using the most efficient method quickly, without errors and with no assistance from the materials or the experimenter.

Score 4: the subject was able to finish a new example with no assistance but without using the most efficient methods, or after some exploration (trial & error efforts).

Score 3: the subject was able to finish a new example by referring back to the training materials.

Score 2: the subject was able to finish a new example by referring back to the training materials and by using guidance from the experimenter.

Score 1: the subject was not able to finish the new example of the relevant functions.

<u>The Questionnaire:</u>

A 48 item questionnaire was developed to measure the user's evaluation of the training materials in terms of their structure, of their efficiency in fostering a problem solving approach and of their effect on the user's confidence. More specifically:

25 items, corresponding to the five different dimensions users tend to use to evaluate computer documentation, were selected from the questionnaire developed by Guillemette (1989). These dimensions included the systematic arrangement, personal affect, understandability, task relevance, and fitness.

12 items were developed to evaluate the material's efficiency to support a problem solving approach. These items reflected every step of the problem solving process, the goal formation, the selection of method, the action, and the verification of the outcome.

15 items were included to evaluate the user's confidence with the acquired skills, the user's feelings of control and mastery and their preferences.

Each question had a seven point scale ranging from strongly agree (3), agree (2), slightly agree (1), neutral(0), slightly disagree (-1), disagree (-2) and strongly disagree (-3). A sample of the questionnaire is included in the Appendix II.

8.4 Results.

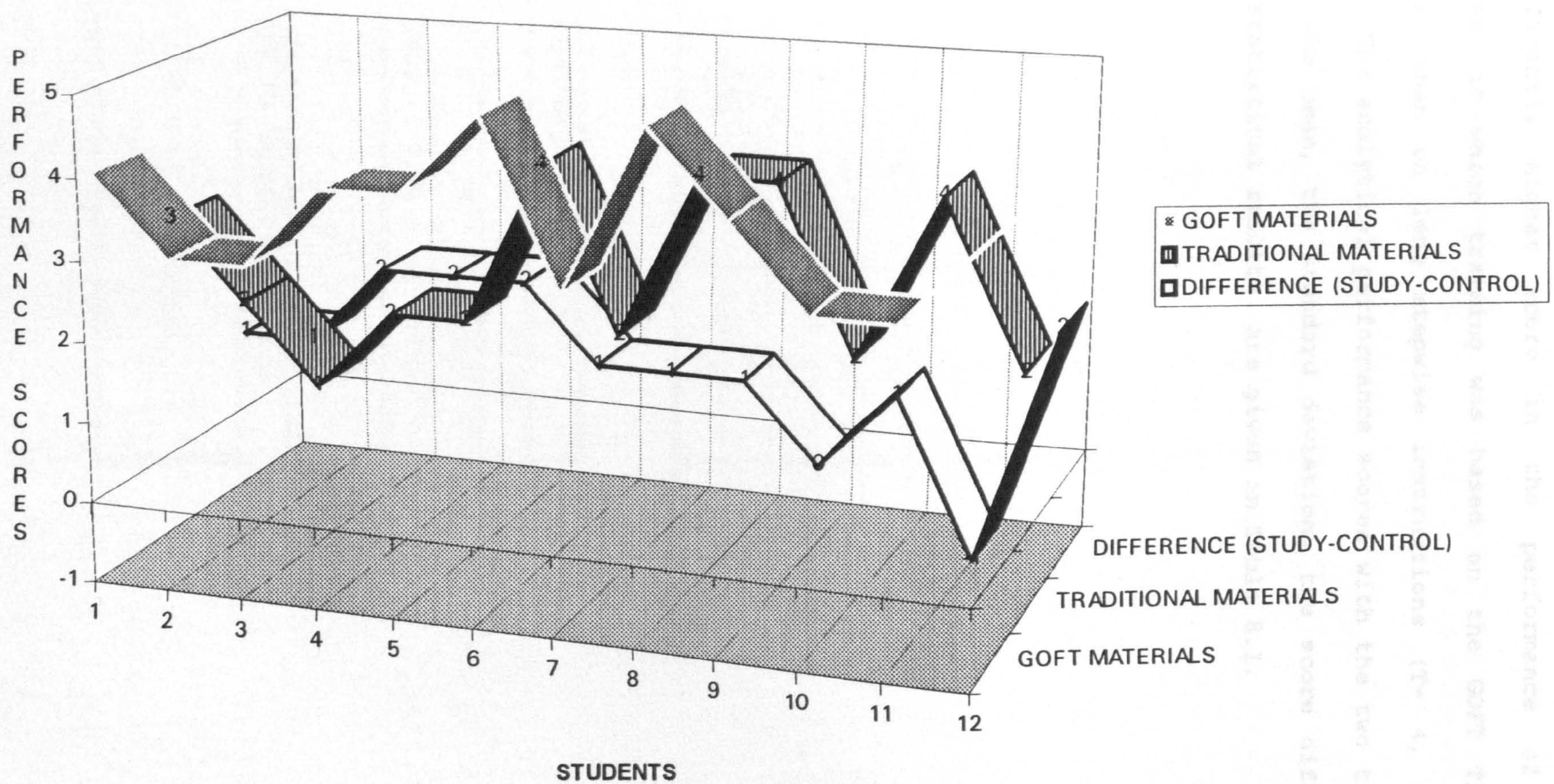
8.4.1 Demographic Data.

No significant difference was found between the participants in this study and the other trainees at the Speedwell Information Technology program in terms of sex, age, minority status, educational and vocational background.

8.4.2 Performance Score Rate

The performance score of all subjects was found to be 13 points higher in the procedures trained with the GOFT Training Materials compared to the procedures trained with the MacMillan method. In one subject only, performance with the GOFT Training Materials had dropped one point (from 4 to 3) and in another had remained the same. The most significant improvement was revealed in those subjects who had a low performance score of 1 or 2 with the MacMillan approach. Furthermore, all performance scores obtained with the use of the GOFT Training Materials were 3 and above. The performance scores of both training materials are presented in figure 8.1.

Fig. 8.1 Performance Scores of GOFT & Traditional Materials & Their Difference



The Wilcoxon Matched Pair Signed Rank Test analysis revealed a significantly higher score in the performance of those procedures, in which training was based on the GOFT Training Materials, than on long stepwise instructions ($T= 4$, df 11, $p<0.005$). The analytical performance scores with the two training methods, the mean, the standard deviation, the score difference and the statistical results are given in Table 8.I.

TABLE 8.I ; Performance Scores of Each student for both training methods, their score difference, summative & he Wilcoxon Pair Signed Rank Test Results.

Performance			
Students	Study Group	Control Group	Difference
1	4	3	1
2	3	2	1
3	3	1	2
4	4	2	2
5	4	2	2
6	5	4	1
7	3	2	1
8	5	4	1
9	4	4	0
10	3	2	1
11	3	4	-1
12	4	2	2

SUMMATIVE RESULTS		
Total	45.00	32.00
Average	3.75	2.67
Standard Dev	0.75	1.07

WILCOXON SIGNED RANK TEST
T- = 4, df 11, $p < 0.005$

8.4.3 Questionnaire Results.

An overall significantly higher score was given in the evaluation of the GOFT Training Materials compared to the traditional stepwise approach by the same users. In addition a higher score was given for the GOFT Training Materials in each of the ten measured parameters. The summarised results of the score range, mean and standard deviation of each of the studied parameter and the difference of scores of the two training methods are given in Tables 8.II, 8.III. The mean distribution of the studied parameters for the two groups are presented in figures 8.1 & 8.2. The analytical scores of the 12 participants and their difference at the measured parameters for the two training methods are included in the Appendix **IV**.

The Wilcoxon Matched Pair signed Rank Test analysis revealed an overall significant difference between the scores given by the same users to the two training methods. More specifically, a level of significance of $p< 0.005$ was found in all parameters except in those reflecting fitness and understandability, in which the significance level was $0.01> p > 0.025$. A summary Wilcoxon Matched Pair Signed Rank Test is presented in Table 8.IV

In addition, a analysis of the frequencies of the positive, neutral (0) and negative overall rating of the different parameters of the subjective questionnaire showed that the developed Training Materials had only 5 neutral and 6 negative responses in comparison to 25 neutral and 93 negative responses for the traditional materials. A chi square analysis of those findings revealed: a) a significant difference of $0.05 >p<0.025$ for personal affect, and organisation ($x^2=6.07$, df=2, $0.05 > p <$

0.025 $x^2=6.01$, df=2, $0.05 > p < 0.025$) respectively; b) a non significant difference of $p< 0.05$ for the parameters of Understandability and fitness; c) a significant difference of $0.025 > p > 0.01$ for the parameters of User's Control and Outcome Assessment; and d) a significant difference of $0.005 > p$ for the parameters of Task Relevancy, Confidence, Mastery, Preference, of the overall Total Goal Directed Approach and it's components of Goals, Actions, and Methods Support. The distribution of positive, neutral and negative responses of each parameter for both training methods and the results of Chi-Square Analysis are presented in Tables 8.V & 8.VI.

8.4.4 Subgroup Analysis of Variance

The two by two analysis of variance showed a no significant difference in the performance rates and the scores of the measured parameters between the different subgroups. There was no difference in the scores in regard to the mastered function, the sequence of training method and the user's previous experience with the GOFT Training Materials.

TABLE 8.II: Summary results of nine parameters from Questionnaire's data for both training materials.

QUESTIONNAIRE'S PARAMETERS	Study Group N= 12			Control Group N= 12		
	Average	Standard Deviation	Range	Average	Standard Deviation	Range
Understandability Max 12 Min -12	5.5	2.61	-1 8	2.83	2.04	-1 5
Fitness Max 15 Min -15	6.33	2.66	1 12	4.1	3.42	-2 7
Task Relevancy max 12 min -12	5.83	2.94	-1 11	-0.75	1.88	-4 2
Organisation max 21 min 21	8.92	3.33	3 14	2.17	2.87	-3 7
Personal Effect max 18 min -18	10.17	4.43	0 15	-1.75	3.03	-4 7
User's Control max 21 min -21	12.33	4.33	2 17	-1	3.72	-8 4
Confidence max 12 min -12	5.77	1.62	1 7	-0.92	2.06	-5 2
Mastery max 18 min -18	8.58	2.87	4 12	2.92	2.53	-6 2
Preference max 3 min -3	1.9	1.32	-2 3	-0.4	1.19	-2 2
Total Score max 144 min -144	72.88	20.53	18 97	-8.42	14.04	-27 17

TABLE 8.III: Summary esults of the four, goal directed parameters of the Questionaire's data for both training methods

	N= 12			N= 12		
	Average	Standard Deviation	Range	Average	Standard Deviation	Range
Setting Goals	7	3,37	0 11	-4.67	2.29	-8 0
Selecting Methods	4.08	1.93	0 8	-3.67	1.03	-5 -2
Action Steps	4.33	1.93	-3 7	-0.92	1.99	-4 3
Assessing Outcome	3.33	2.53	-1 7	-4.57	1.59	-7 -2
Total Problem Solving	16.42	6.4	5 25	-13.7	13.3	-18 -7

Fig. 8.2 Chart of mean Scores for GOFT & Traditional materials on nine Questionnaire parameters.

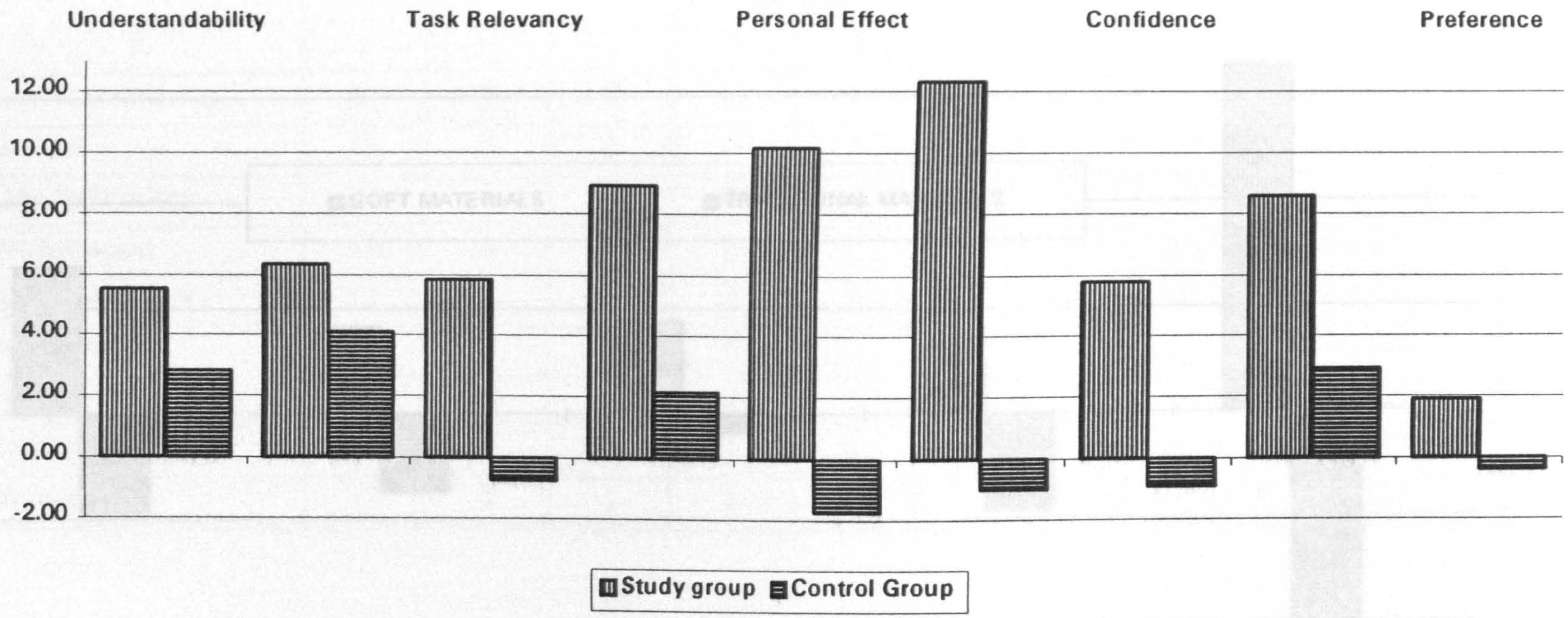


Fig. 8.3 : Chart of Means for GOFT & Traditional materials on the four goal directed parameters of the Questionnaire.

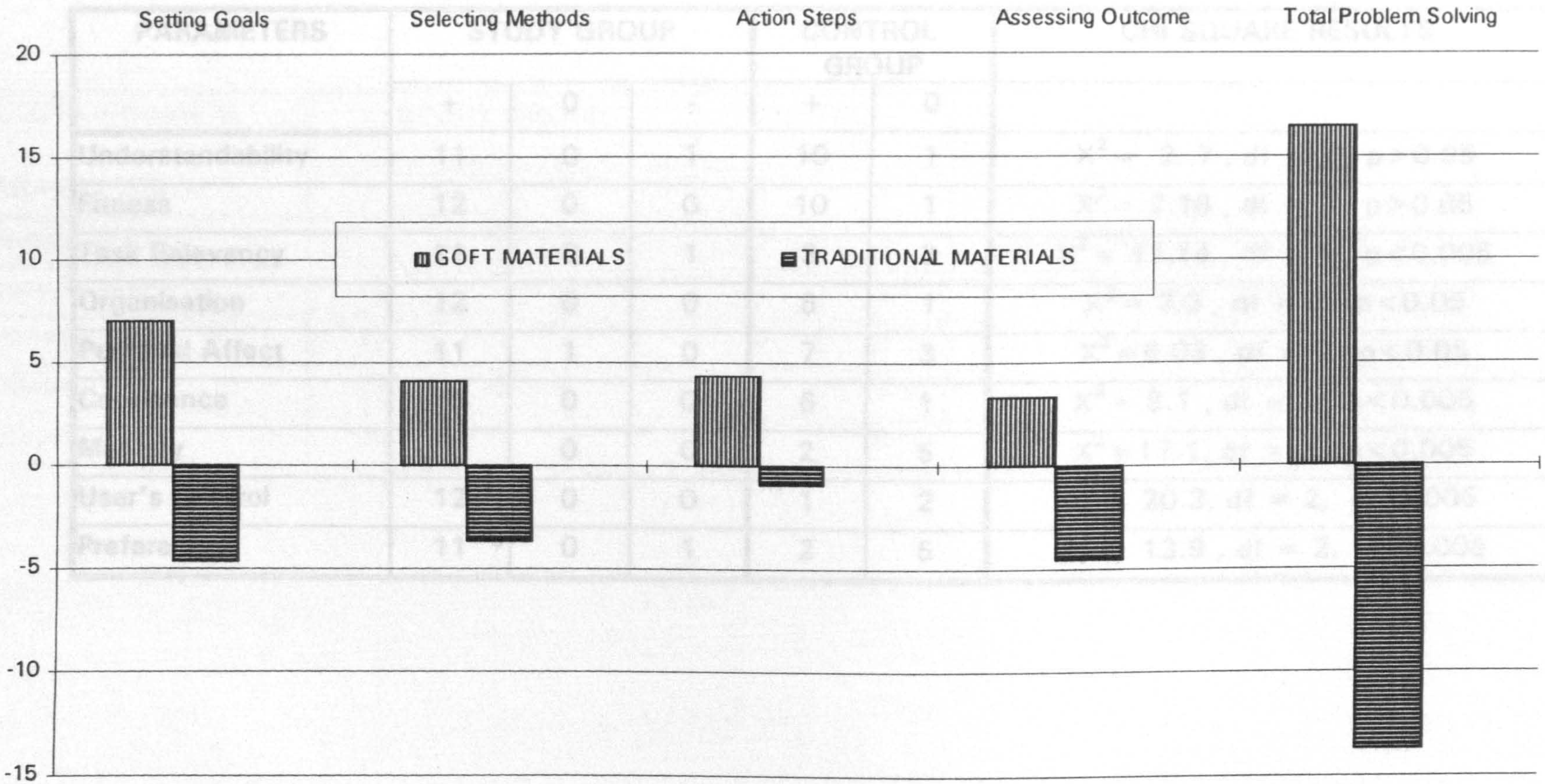


TABLE 8.IV: Distribution of negative, neutral & positive scores of the nine Questionnaire's parameters of both training materials & the Chi-square Analysis results.

PARAMETERS	STUDY GROUP			CONTROL GROUP		CHI SQUARE RESULTS
	+	0	-	+	0	
Understandability	11	0	1	10	1	$X^2 =$ 2..7 , df = 2, $p>0.05$
Fitness	12	0	0	10	1	$X^2 = 2.18$, df = 2, $p>0.05$
Task Relevancy	11	0	1	3	3	$X^2 = 11.14$, df = 2, $p<0.005$
Organisation	12	0	0	8	1	$X^2 = 7.3$, df = 2, $p<0.05$
Personal Affect	11	1	0	7	3	$X^2 = 6.03$, df = 2, $p<0.05$
Confidence	12	0	0	6	1	$X^2 = 8.1$, df = 2, $p<0.005$
Mastery	12	0	0	2	5	$X^2 = 17.1$, df = 2, $p<0.005$
User's Control	12	0	0	1	2	$X^2 = 20.3$, df = 2, $p<0.005$
Preference	11	0	1	2	5	$X^2 = 13.9$, df = 2, $p<0.005$

TABLE 8. V: Distribution of negative, neutral & positive scores of the four, goal directed Questionnaire's parameters of both training materials & the Chi-square Analysis results

QUESTIONNAIRE'S PARAMETERS	STUDY GROUP			CONTROL GROUP		CHI SQUARE RESULTS
	+	0	-	+	0	
Problem Solving	12	0	0	0	0	$X^2 = 24$, $df = 2$, $p<0.005$
Goals Setting	12	0	0	0	1	$X^2 = 22$, $df = 2$, $p<0.005$
Methods	11	1	0	0	0	$X^2 = 23.45$, $df = 2$, $p<0.005$
Actions	11	0	1	4	1	$X^2 = 13.87$, $df = 2$, $p<0.005$
Outcome	9	1	2	0	0	$X^2 = 15.2$, $df = 2$, $p<0.005$

TABLE 8.VI: Results of Wilcoxon Pair Signed Rank Test of the Questionnaire's scores between training materials

PARAMETERS	WILCOXON SIGNED RANK TEST
Understandability	T= -7.5, df=10, 0.01 > 0.025 p >
Fitness	T= -5.5, df=11, 0.01 0.025 > p >
Task Relevancy	T= -2, df = 12, p < 0.005
Organisation	T= -3, df = 12 p < 0.005
Personal Affect	T= 0, df = 12, p < 0.005
Confidence	T= -1, df = 12 p < 0.005
Mastery	T= 0, df =12 p < 0.005
User's Control	T= 0, df = 12 p < 0.005
Preference	T= -1, df = 12, p < 0.005
Problem Solving	T = 0, df = 12, p < 0.005
Goals Setting	T = 0, df = 12, p < 0.005
Methods	T = 0, df = 12, p < 0.005
Actions	T = 0, df = 12, p < 0.005
Outcome	T=-2, df = 12, p < 0.005

8.5 Discussion

The results obtained by the use of the GOFT Training Materials in an experimentally, controlled learning situation supported their superiority not only in terms of the user's exhibited performance but also in terms of user's subjective and qualitative evaluation. Those supportive results were evident regardless of the user's previous experience with the GOFT Training Materials, reflecting the easiness of transition from other training procedures to that of the GOFT Training Materials.

The performance from the use of functions mastered with the GOFT Training Materials to other tasks revealed that: a) all twelve users were independently able to transfer to new tasks; b) two were able to independently select and use the most efficient ways to accomplish the desired outcome; and c) all users completed the task independently without external assistance . On the contrary, the performance for functions mastered with the traditional methods showed that: a) only five users were able to independently transfer the use of functions to other applications; b) 6 required some assistance to complete the task; c) one was unable to finish the task; and d) users did not selected the most efficient ways to reach the desired outcome. The performance outcome supported the research assumption that the GOFT Training Materials would be more effective in promoting the mastery and efficient application of functions in different applications and in increasing the users independence in approaching computer tasks.

The subjective evaluation of the two used training methods by each user in terms of satisfaction, promotion of an independent problem solving approach and sense of confidence in the mastered functions reflected a significantly higher rate for the GOFT Training Materials. The results obtained by the questionnaire suggested the accomplishment of the objectives of systematic arrangement, understandability, personal affect, task relevance and fitness, which were set for the construction of the instructional and the application part of the GOFT Training Materials.

The GOFT Training Materials received a very high score in contrast to the very low scores of the long stepwise procedures, in all those features necessary to foster and sustain an independent, problem solving approach in the mastery of computer functions. These results advocated the accomplishment of one of the major stated objectives for the construction of the GOFT Training Materials that of providing the necessary information and structure to support an active goal directed, problem solving approach to computer training.

Furthermore, both the performance score as well as the score reflecting confidence and mastery supported the higher efficiency of the GOFT Training Materials to prepare the novice user not only to transfer the use of mastered function to other tasks but also to use computers in real work settings.

The significant differences between the developed and the traditional training in terms of the positive, neutral and negative overall rating in the parameters of Organisation, Task Relevancy, User's Control, Personal Affect, Confidence, Mastery and in the Support of a Goal Directed Problem Solving approach denoted qualitative differences in the construction of the materials. These results differentiate the developed materials from traditional training, support the accomplishment of the construction proposition that promote the development of effective materials and provide some explanation for the differences between the developed and the traditional materials in fostering attendance, participation and performance .

DISCUSSION & CONCLUSIONS

9.1 Discussion.

The position contemplated in this research is that in order for computer training materials to be effective in fostering computer skill acquisition and confidence in performing tasks with computers must meet the demands of the interface design and the needs and preferences of adult novice user with mental health problems. For this purpose, from the examination of the relevant theories, a methodology for the development of computer training materials have been generated, basic propositions of construction have been derived, and their specific guidelines have been incorporated in the format, context, structure organisation and administration of the developed training materials.

The developed Training Materials have been used and evaluated at the Speedwell Information Technology Project by 34 adult, novice computer users with mental health problems rendering positive results.

The observational data, the comparative analysis of the training outcome of two different groups as well as the evaluation of the performance of the same novice users in two different tasks mastered with the developed and traditional training materials supported the efficiency of the former. The results showed that the GOFT Training Materials did have a positive effect in terms of the following objective measurements:

1. significant decrease in the number of drop outs during the introductory phase;
2. significant increase in the number of participants in the consequent three stages (three, six and twelve months) of the Speedwell Information Technology Project;

3. significantly higher attendance rate;
4. significant improvement in the performance of similar tasks using the mastered computer operations.

In addition, the GOFT Training Materials were rated higher by the users in terms of their subjective evaluation and personal satisfaction in using the materials compared to a traditional long stepwise approach. More specifically the GOFT Training Materials were rated higher in the following parameters:

- Understandability, Fitness, Task Relevancy, Organisation;
- Personal effect
- User's Control
- Confidence and mastery
- Goal Directed & Problem solving Learning.

The high positive ratings given by the users in the above parameters of their subjective evaluation, coupled with the observational data demonstrated that the developed materials had indeed met the basic propositions, which they had designed to satisfy.

Furthermore, the significant difference between the high frequency of positive scores given to the developed training materials in contrast to the high frequency of negative scores of traditional training materials in the parameters of Task relevancy, Organisation, User's Control, Confidence, Mastery and Goal directed learning approach confirmed the differences in the rational and structure between the developed and the traditional training materials.

It can be assumed that the significant improvement not only in the performance, confidence and motivation but also in the increase of attendance rate and the number of participants completing their computer training program evidenced with the use of the developed training materials can be attributed to a great extend to the theoretical premises and guidelines on which the developed materials are based. How these basic propositions of the developed materials are supported by the obtained results, differentiate the developed from the traditional training materials, and how they may affect the overall outcome of the computer training of people with mental health problems will be examined.

In the development of the training materials special care was given to ensure that novice users will have a positive and meaningful interaction with the computer even from the first session. They were organised as to support the user in completing a simple real task, in changing faulty preconceptions about computers or operations, in reducing the anxiety caused by the alien nature of the interaction. The significantly higher number of participants trained with the developed training materials finishing the three first months of the SIPT project suggests that the developed materials are effective in reducing the anxiety and the chances of a strenuous beginning that handicaps learning for a considerable time many times leading to an early withdrawal from training (Hammond & Barnard, 1984, Lispedge et al, 1990, Summerfield, Lispedge, & O'Flynn, 1993).

The GOFT Training Materials were designed to allow the users to progress according to their capacities, residual abilities, aptitudes, and psychological states. The flexible nature of the training process permitted the highly differentiated group of the SIPT users to work, learn and progress together at different rates, and to preserve their privacy, their self confidence and feeling of control (Jarvis 1983) as was evidenced from the observational data and the results of the questionnaire. The issue of individuality and variability among the user's is a focal point to consider in the development of training materials (Lee, 1991) which become even more crucial, when training is directed to people with mental health problems (Goldberg, 1974, Seyfried, 1991). This flexibility in using the developed training materials and the elimination of competitive aspects is important in reducing the anxiety of trying to keep up or the feelings of disappointment of being left behind. Thus, the chances of withdrawal from training, of behavioral problems or even of a relapse are reduced and the number of participants willing to continue the computer training program is increased.

The developed training materials were constructed with the objective to maintain an average difficulty and an optimal challenge level across computer training instructions and their realistic applications. To meet this objective: a) the dual processing demands of the computer interface operations and their associated real applications were evaluated; b) the cognitive abilities and personality characteristics of the adult novice users with mental health problems were examined; c) the changes in the user's capacities with the development of computer skill acquisition were taken into consideration; and d) a formula to estimate the difficulty of the computer operations and the real tasks in term of complexity, novelty and cognitive demands was derived.

The significantly increased attendance rate and number of participants finishing the three-month training period can be attributed to the assumption that the developed training materials were effective in maintaining a balanced optimal challenge that prevented the overloading of the novice user's capacity and also sustained the user's motivation. The higher positive subjective ratings given by the users to the developed training materials in the parameters of Organisation, Fitness and Personal affect supported their efficiency in accomplishing the average challenge objective of their construction. In addition the negative scores of traditional materials in terms Organisation and Personal affect further indicated constructional differences between the developed and the traditional training materials.

The differences in flexibility and in preserving an optimal complexity level across training revealed between the developed and the traditional training materials may explain the high drop out rate of participants at the ITeC phase after the successful completion of their three months training at Speedwell.

The requirement of evaluating the demands of specific system operations and applications in terms of complexity, novelty and cognitive demands, by using a difficulty estimation formula similar to that of the present materials, is considered to be necessary for the development of effective training materials. But for determining the optimal difficulty level of each training session and the needed number of practice opportunities the processing capacities, the specific needs and characteristics of the particular group of users must be consider. Thus the effectiveness of the developed materials to meet the needs of other group of users with special needs or other interface systems must be examines and the necessary modifications in materials to satisfy the construction premises must be incorporated.

The developed training materials integrated in their structure real tasks that provided the necessary practice opportunities for the mastery of the computer procedures and the recognition of the relevancy of the training with real work. The real tasks were included in a different section of the materials in order to help the user to formulate the operational rules from the instructional part, which were then actively applied in the accomplishment of the real tasks at the application section. The use of real tasks was supposed to provide the opportunity to the user to learn by analogy, to enhance transference of learning to other situations, to foster the confidence of the user to accomplish other tasks and to help the user to associate the relevancy of the training to the use of computers to perform office tasks. The reality of the above assumptions was evidenced by the higher positive scores of the developed training materials and the negative scores of the traditional training materials in the parameters of relevancy, mastery, confidence of the subjective questionnaire. In addition the higher performance rate in the functions learned with the developed training materials, the increased attendance rate and daily work time spent using the computers further advocated the importance of incorporating real tasks from real world to practice the rather artificial computer procedures.

The developed training materials provided all the relevant information to the user to create effective goal-action sets, the hierarchy to combine simple plans to create more complex ones and the choices to enhance the processes of generalisation and discrimination, that promote expert performance (Kay & Black, 1985). In addition, the materials gave the user the necessary information to detect errors (Nisbett & Ross, 1980) by outlining what they must expect and where to look for the feedback as well as the conditions under which the method is the most effective (Card, Moran & Newell, 1983). In addition the developed materials provided, not only, the necessary procedural and declarative knowledge for the adult user to be able to learn "by doing" or "by knowing", but also, notifications for the common errors made in the transference of the non applicable aspects of the office analogy to computer tasks (Douglas & Moran, 1983 ; Clement , 1984, Allwood, 1986; Allwood & Eliasson, 1987).

In the subjective evaluation, the developed training materials received a very high score not only in the fostering and supporting of a goal-directed problem solving approach in their learning but also in each and every part of that process (Anderson, 1983, Waern, 1985; Newell & Simon, 1972; Norman 1986). More specifically the modified version of the GOMS format of the developed Training Materials were found to be effective in directing the user in the formation of the relevant goals, in the provision of available and permitted actions for the goal's achievement, in giving the appropriate information to select the most efficient method of reaching the goal, and also in guiding the evaluation of the outcome of each action by highlighting the desired result. These positive results of the GOMS format were also supported by the findings of other studies (Olson, & Olson, 1990, John, Vera, Newell, 1994; Arend, 1991) The GOFT Training Materials were judged by the users to be able to support a goal directed learning approach as described by in a situation where previous experience and knowledge can not be applied (Sproull, Kiesler, Zubrow, 1984). The support of a complete goal-problem solving learning approach evidenced in the developed training materials was found to be a profound differentiating feature from the traditional training materials.

The developed training materials had implemented the derived methodology and guidelines of construction in order to meet the demands of a command based interface systems and the needs and characteristics of adult, novice users with mental health problems enrolled at the SITP. The application of the developed materials to the specific population reflected positive results in promoting attendance, in reducing the number of drop-outs, in enhancing mastery and in meeting their proposed objectives of construction. The validity of the results, the applicability of the methodology and the theoretical propositions for the development of effective training materials as well as the generalisability of the different construction guidelines to other training situations will be examined in the critical review.

9.2 Critical Review

9.2.1 Validity of research results

The developed materials have been designed to meet the needs of people with mental health problems in the course of the completion of their vocational computer training program at SITP. Therefore, the use of materials and the design of the research had to be incorporated in the objectives and structure of the overall training at SITP . As such, only a quasi experimental research design of assessing the effects of the developed training materials in the attendance rate and the participation at the different stages of the program was possible.

The study group trained with the developed materials and the control group trained with traditional methods had been enrolled at SITP at different time periods. The structure, objectives and nature of the training were similar for both groups. In addition, the two studied groups did not differ in personal, socioeconomic, educational and diagnostic parameters. Nevertheless, no control was possible over other circumstantial aspects during the different training periods of the two studied groups that may had affected the participation or the attendance rate at the program of the enrolled students.

The controlled research study that was designed to compare the effectiveness and the users' subjective evaluation of using both the developed with traditional training materials had a small number of users for the assessment of the GOFT Training Materials and required the use of non-parametric statistics.

In addition, a factor analysis that could have estimated the differential importance of the characteristics of materials in the promotion of effective performance and personal satisfaction, required the use of materials by more subjects.

9.2.2. Transferability of Construction Propositions

The construction guidelines and propositions for the development of effective training materials were based on the theoretical background reflecting the relevant to the computer interaction capacities of the adult user, the ways adult users approach learning, the theories of skill acquisition and the needs and characteristics of the novice users. From those theories of the adult user's abilities, needs and preferences a number of pervasive characteristics of the training materials are derived. These premises include the flexible nature of use, the need to preserve an average level of difficulty and challenge across training, the support of goal directed learning with no need of previous experience, the provision of practice opportunities relevant to the objectives of the users, the promotion of a successful user computer interaction, and the enhancement of the transference of skills to other situations.

One of the basic assumptions for the construction of effective training materials is the need to balance the capacities of the users and the demands of the interface as they change across the training. This important, universal assumption necessitates the differentiation of the training materials to meet the particular needs of specific groups of users and the demands of the different interface systems.

Generalisability to Other User's characteristics.

The developed training materials for the purpose of this study are specially designed to meet the needs and preferences of adult, novice users with mental health problems. More specifically the developed materials were designed to meet the needs of users who have certain problems in terms of reduced stamina, ability to sustain attention and concentration and limited working memory capacity, are vulnerable to stressful situations, have an unstable performance and motivation, have low confidence, self esteem and frustration tolerance level and desire to be in control of their learning and to preserve their privacy.

The format and context of the training materials as well as the nature of the learning process address the learning needs of ADULT users who want to be active, to keep their privacy and the control of their learning, who desire to learn in a goal directed way and to use their problem solving capacities, and who desire to be practical than theoretical (Carroll, et al., 1985;. These preferences do not meet the training conditions the young users are accustomed to have an instructor for guidance, help, supervision, reward and evaluation of mastery (Diaper & Johnson,1989). Therefore, the efficiency of structure of the developed materials to promote computer mastery over traditional instructional methods for young users must be examined.

Eventhough, the developed training materials consider a number of common issues concerning the training of adult, novice users with special needs, nevertheless it is needed to reexamine the specific abilities, difficulties and preferences of each particular group and to modify the training materials accordingly. In addition the changes of the interface features and demands must be reevaluated for the construction of effective training materials. A brief speculation of the necessary modifications of the training materials for their application to other interface systems and to users with different special needs will be examined below.

Generalisability to Other Interface Systems.

The theoretical background examining the demands and characteristics of computer interfaces concerned the command or text menu based computer models, for which the specific developed materials were designed. Due to the growing increase in the use of the window interfaces, a brief account of the implementation of the proposed methodology for the construction of effective training materials in meeting the demands and features of the window environment will be discussed.

First the theoretical features of icons implementation and the direct manipulation performance, which are integral parts of the windows environment (Benbasat & Todd, 1993) and their implications for the novice user's performance must be examined. Then, the propositions and guidelines for the construction of efficient materials must be modified according to the new demands of the system on the processing capacity of user, to the system's characteristics and expected difficulties.

For the estimation of the demands of the window interface on the user's capacity the following areas must be examined: a) the textual and pictorial information differences in term of the cognitive effort associated with making inferences (Larkin & Simon, 1987), in recalling, recognising and categorising information (Muter & Mayson, 1986); b) the "resource pool" model attention which suggests, that the use of perceptual resources for iconic inferences spare the cognitive capacities for the demands of the primary tasks (Navon, 1984); c) the issues, positive and negative, associated with the use of familiar objects from which inferences about the system are made (Muter & Johns, 1985); d) the workload of direct manipulation that requires the use of a spatial pointing device and of the visual spatial resources of the user (Barnard & Grudin, 1988); and e) the novice user's attitudes towards the sensation of being directly engaged with the semantic object's of the user's goals and intentions (Hutchins, et. al, 1986).

The windows, feature of partitioning the display into a number of virtual screens is extremely useful as an extention of the user's memory (Miyata & Norman, 1986), provides the ability of concurrent activities, minimises the mental effort but increases the demands of physical skills and visual search (Eberieh, Korfmacher & Streitz, 1992).

The advantage of the pictures is related to the user's ease of remembering functions on the basis of recognition (Streitz, Spijkers, van Duren, 1987); of relating previous experience in understanding the meaning of the pictures for what they stand for by the use of metaphors (Gittens, 1986); of simultaneously viewing the different components of the performed task (Cypher, 1986); and of reducing errors due to the elimination of syntax and command language errors, and the immediate perception of the results of their action (Morgan, Morris & Gibbs, 1991).

For the design of materials, the increased demands of the windows interface on the physical abilities in terms of precision and dexterity, (Witten & Greenberg, 1984), on the visual search capacities, on the spatial memory, and the visual recognition abilities of the user (Gillan et al, 1992), must be evaluated. These demands of physical abilities and precision many times greatly differentiate the capacity of users with special needs to manipulate the system (Morris, 1994), leading to feelings of frustration and disappointment (Ulich, Rauterberg, Moll, Greutmann, & Strohm, 1991).

In addition, the training materials must incorporate declarative information to ensure: that icons convey the desired meaning without invoking other connotations (Ziegler, & Fahnrich, 1988); that ambiguity in the meaning of the icons is alleviated (Lodding, 1992) and that the inappropriate metaphors for the development of the user's model of the interface are designated (Halasz & Moran, 1982).

The propositions of the developed training materials reflecting the user's approach to learning, the process of skill acquisition, and the adult, novice user's preferences in learning by doing and inferring can be applied in the construction of the training materials for the window interface. In addition, the goal directed format of instructions, the provision of real task opportunities for practice, the flexible nature of the materials used, the need of preserving an optimal challenge level across training are some of the features of the developed training materials that can be implemented in the construction of materials for windows.

But for the modification of the GOFT training materials to meet the demands of the window interface the physical dexterity abilities, and the visual perception, search, inferencing, memory and recognition capacities of the users must be reevaluated to ensure that the users will not get overwhelmed.

9.2.3 Applicability of the Methodology of construction.

The methodology and guidelines for the construction of effective training materials, that have been derived in this study, were applied and incorporated in the construction of additional training materials.

The developed training materials have been incorporated as the training method at the Speedwell Information Technology Project (Summerfield, et al. 1993). Additional training materials have been developed, covering more advanced operations of WP 5.0, D Base III+, SuperCalc 5.0 and DrawPerfect. The materials have been constructed by other trainers, following the same methodology and guidelines of construction. The main critisism of the other training materials developers concerned the numerical value of the difficulty estimation formula. They have suggested that trainers found more useful to know the value of the complexity of the computer applications and the data, context and cognitive operations, instead of a numerical value, required for the accomplishment of the specific task. In addition, the significant difference in the drop out rate between the Speedwell and the ITeC program resulted in reconsidering their cooperation and in increasing the training period spent at the Speedwell project.

The same methodology and guidelines have been used for the design of computer training materials for people with physical handicaps at the Vocational Training Centre of ELEPAP in Greece. For the development of those training materials the particular needs of those users, like their dexterity and hand coordination deficits, visual search difficulties, lack of previous experience with office work, greater difficulty with the use and comprehension of the English interface command language, were some of the different issues that had to be considered and incorporated in the training materials. To meet these needs some of the changes in the developed training materials were:

the addition of a section which identified the difficult keys, in terms of dexterity or coordination, and provided repair options of how to interprete and correct such mistakes;

the provision of a brief dictionary of the English words and their meaning;

the identification of possible misinterpretation or confusion due to language differences like the typing of "N" that stands for No in English interfaces and for Yes in Greek language;

the reduction of the complexity demands to 5 new steps in order to incorporate the increased demands of typing on the physical capacities of the user, the language difficulties and the lack of previous experience; and

the decrease of the typing length of the real practice tasks, in order to give to the user the same opportunities to practice the operations in each session period and not to overwhelm them with the typing time demands of the tasks.

The materials were used for the mastery of WP5.1 and DrawPerfect by three special students and as training materials during practice sessions for the students of secretarial training. An increase in the time spent for practice, in the confidence in accomplishing similar tasks and in the fostering of a problem solving approach to learning was evident with the use of the GOFT training materials.

In addition the identification of the physical and perceptual demands of the interfaces was also helpful to the Occupational Therapist to provide extra training or aids to users with certain handicaps.

The derived methodology and construction guidelines were implemented in the design of special Training materials for the training of partially blind users, on specific applications of commercial packages with the use of a screen reading device. In the organisation of those training materials a modification in the difficulty estimation formula was made to incorporate the complexity and novelty of the reading program in addition to the operations of the package and the task applications themselves.

Furthermore, the format of the instructions that supported goal directed learning, the provision of practice opportunities, the application of the difficulty formula for the estimation of the complexity of tasks were also used in the construction of the training for other office machines like the photocopier, or electrical appliances like the microwave or laundry machines with positive results.

9.3 Conclusion.

The increasing importance of computer skills for the work market and the prestige associated with computers for people with special needs has enhanced the incorporation of computer training in many vocational training programs. The assumption supported in this study is that for computer training to foster skills and confidence of novice users with special needs computer training materials must a) be flexible; b) bridge the demands of the system and the capacities of the user; c) facilitate a goal directed interaction and the evaluation of results; d) consider the preferences, needs, attitudes of the users; and f) foster the acquisition of computer skills and the user's confidence.

The methodology and construction guidelines, which were derived from the relevant to human-computer interaction process and skill acquisition theories, were implemented to the development of training materials for people with mental health problems. The positive results of the use of the developed materials in terms of attendance rate, of number of users continuing their training, of performing similar tasks, of reported sense of mastery and confidence, as well as, of promoting goal directed learning supported the importance of the proposed construction propositions for the development of effective training materials for adult, novice users with mental health problems.

For the generalisation of the effectiveness of the derived methodology and propositions to the development of effective training materials directed to meet the special needs of different groups of users and the demands of different interface systems further research must be directed in:

The further evaluation of the GOFT training materials to more adult novice users with mental health and similar special needs at other settings;

The application of the construction guidelines to the development of modified GOFT training materials and their evaluation to different user groups and interfaces;

The comparative study of the application of the training materials to different groups and interfaces for the identification of the universal versus the specific construction criteria; and

A factor analysis study for the determination of the necessary & sufficient characteristics and their relevancy to the effectiveness of training materials to promote computer skills and confidence.

In addition, the parts of the contruction methodology of effective GOFT training materials concerning the demands of the system on the user's capacity and the user's needs and characteristics can provide useful quidelines for the selection of the most appropriate interface systems for different groups of user's with special needs abilities. In addition, it can provide the required criteria for the selection of those users that will be able to handle the computer demands, acquire new skills and promote their confidence and self esteem.

APPENDIXES

Appendix I : Examples of Construction Guidelines from GOFT Training Materials

Appendix II : Questionnaire Sample

Appendix III : Analytical Scores of the Examined Questionnaire Parameters

APPENDIX I :

EXAMPLES OF CONSTRUCTION GUIDELINES

FROM GOFT TRAINING MATERIALS

EXAMPLE 1.

Each set of instructions define a MAIN GOAL which includes Methods and Goals. The Goals, that contain more than three actions steps or decision points are devided into Subgoals. Goals and Subgoals are connected to Actions. Different methods are provided with their selection criteria for the user to choose from.

MAIN GOAL: ADJUST TEXT TO THE RIGHT

Method 1: (Adjust text to the right while typing)

Goal: **Load Flash right function**

Act.--- Press **Alt F6**

Verify: cursor will move at the end of the line

--- Type text

Verify: text will move from right to left

Method 2 (Adjust an already typed line to the right)

Goal: **Specify line.**

Act --- Move cursor at the beginning of the line

Goal: **Load Flash Right function.**

Act --- Press **Alt F6 together**

Verify: that the text moved to the right side of line.

Goal: **Adjust text**

Act --- Move the cursor to the end of line

--- Press **RETURN** to change line.

Method 3 (Adjust to the right more than one line of typed text)

Goal: **Define a block of text**

** Sub Goal: **Specify the beginning of the block**

Act --- Move cursor

** Sub Goal: **Load Block Commands**

Act --- Press **Alt F4**

Verify: On the right "block on" is flashing.

** Sub Goal: **Specify the wanted block of text**

Act.--- Move cursor at the end of the text

Verify: that all the wanted text is highlighted?

Goal: **Flash Block to the Right**

Act--- Press **Alt F6.**

Verify: On the right, Prompt: Just Right? No (yes)

Act--- **Confirm** Press **Y**

Verify: That the specified block had moved to the right?

EXAMPLE 2

Particular emphasis is given in the instructional materials to foster evaluation of outcome after each action by including a verification step.

Act--- Press **Alt F6.**

Verify: On the right, Prompt: Just Right? No (yes)

EXAMPLE 3.

A recovery option example that is included in the instructional part of the WordPerfect 5.0. It directs the users to find the reasons that have prevented the load of WP, to select the appropriate recovery method and to follow the appropriate procedure for recovery.

NOTE: If WP IS NOT LOADED

Act --- Check message at the bottom left of the screen.

Method 1 When the mesage is (Failure Drive A:)

** Sub Goal: **Check disk/ and disk drive**

Act --- check that disk is in the drive

--- check that disk door is closed

** Sub Goal: **Load Program**

Act --- type 1.

Verify: A blank screen with the menu on the top and the cursor line at the bottom

" Doc 1 Pg 1 Ln 1" Pos 1

Method 2 When the message is

(are other copies of Wordperfect currently running? Y/ **N**)

Act --- Press **N**

Verify: Old backup file exists. **1** Rename,**2** Delete

--- Press **2**

Verify the **Document screen is on**

EXAMPLE 4.

Declarative information incorporated in the training materials includes:

a) **explanation of computer notations** like;

Pg : Shows the page of the document the cursor is set.

b) **structural information** like;

The **WP** screen consists of:

a **blank** screen where text will be typed

The cursor, a blinking bash, which indicates the position in the text a change will occur;

c) **the meaning of computer functions** like;

F10 = save file.

Shift F7 = Print

d) **explain the meaning of computer messages,**

Replace B:\Text1 No (Yes)? = to change the file of drive B, with the name Text 1. No or Yes?

Respond by typing

N if you DO NOT want to change it

or **Y** if you want to carry on.

e) **relevant information to understand the demands of the tasks** that a user with no previous experience with office task may need in order to succesfullt complete the task to form good working habits and to understand issues like formulas etc.

A Bank statement includes:

The **date** of the transanction.

The **Credit** money deposited in the account

The **Debit** money taken out form the account

The **balance** the money in the account after each transanction.

The **Forward Balance** money in the account from the previous statement period.

The **Last balance** money in the account the date of the statement.

The account's balance must be automatically estimated whenever a transaction is carried on.

The **Balance Formula = Previous Balance + Credit Debit.**

EXAMPLE 5.

In the introductory part of the each Application session the users are directed to follow the instruction quidelines of the computer operations relevant for the accomplishment of task.

SESSION III.

Follow the steps Provided in the Goal lists of Flash Text to the Right. Refer back to the goal lists of Type Text, Make simple corrections, Save, Print & Exit.

EXAMPLE 6.

Emphasis was given in the instructional materials to prevent misinterpretation of unexpected results.

NOTE: Every time you save a file with the same name only the latest save version is kept in your disc. When you are **REPLACING** a document, you actually erase the previous copy and keep in your records only the latest version.

NOTE: To move to a new line Press **RETURN.** To move to the next line of typed text **USE DOWN ARROW.** The down arrow will no move to the next line unless the line has been defined. Blank lines can be defined by pressing **RETURN.**

EXAMPLE 7

Instruction materials identify the cases in which the office analogy is often applied with negative results.

Goal : **Type text**

Act --- Type text, using the Keyboard.

NOTE --- **DO NOT Press RETURN:** at the end of the line.

Verify: Text is being typed and the cursor has moved to the next line.

EXAMPLE 8.

In the instructions the DO-UNDO keys and keys that require motor coordination of both hands are identified.

Goal : **Highlight text**

Act --- Press F6 .

Verify: the Cursors Pos is: Highlighted.

NOTE: If you Press F6 for longer time then Normal letters will reappear.

Goal : **Print Text**

Act --- Press **Shift & F7** keys simultaneously.

NOTE: If it is difficult, first press **Shift** and Keep it pressed while pressing the **F7** key.

EXAMPLE 10

The computer procedures are mastered through the accomplishment of a variety of practice opportunities. The users has to select the appropriate operations to execute for the performance of the tasks. Meaningful applications are accomplished from the first session.

SESSION I

EXERCISE 1.

Type, Save and Print the following Paragraph and then clear the screen.

They think they speak English in America, but it is often a different type of English from what people speak in England. In America, if you ask someone where the lift was, they would not understand : in America it is called an elevator. If you suggested a game of draughts, you would get a blank look; it is called checkers. Gammon is bacon; the bonnet of a car is a hood. Want some chips? They are called French Fried potatoes. A drawing pin is called a thumbstick. Want to play naughts and crosses? It is called tick-tack-toe. Let's face it. It is almost a different language spoken there.

EXAMPLE 11

Practice opportunities included a variety of real tasks associated with the mastered package.

Practice applications included tasks like:

"type a letter",
"type References",
" type a newspaper's column",
"create a shopping bill",
"create a bank statement",
" create a storage database",
" create a ordering database",
" create a travel plan brochure".

EXAMPLE 12

Every session included introductory directions to focus attention on the new information, a chance to review mastered operations, to recite the new function commands and to reflect upon mastered learning.

SESSION III.

This session is designed to provide practice on how to :

Flash Text to the Right
Type more complex Text
Make Simple Corrections in Typed Text

This session will also provide further practice opportunities on how to Load WP, Save, Print, and Exit WP.

Use the directions given in quidelines of Flashing text to the right at the Instructional Part.

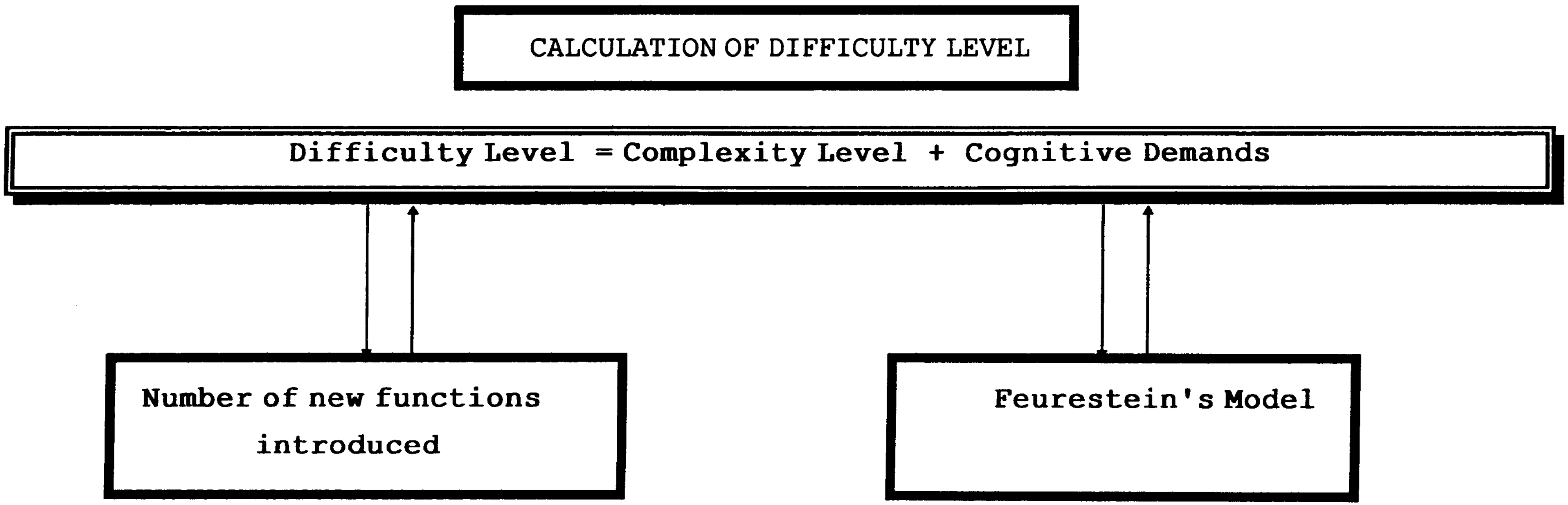
Finishing Session I you must have mastered how to:

Load the Wordperfect Package ..... WP
Type simple Text
Save the Typed Document.......... F10
Print a typed Document .... SHIFT F7
Clear the Screen .... F7, N, N.
Exit WP .... F7, N, Y.

You can now continue to the next session or work on more tasks.

EXAMPLE 13.

A difficulty estimation formula has been derived for the creation of the training materials which incorporated the novelty and difficulty of computer operations, and the novelty, context and cognitive operations of the tasks to be accomplished.



EXAMPLE 14

The interplay between the complexity of the computer operation and the cognitive demands of the different tasks included in a training session is depicted in the following table.

SESSION/EXERCISE ADJUST CENTRE	**COMPLEXITY LEVEL** **TOTAL = NEW OLD**	**DATA**	**OPERATIONS**
SESSION IV	8 = 4 + 4	TEXT	APPLY
EX. 14	6 = 2 + 4	TEXT	APPLY - UNDERSTAND
EX. 15	5 = 1 + 4	TEXT	APPLY - ADJUST
EX. 16	3	TEXT	APPLY - ADJUST
EX. 17	4 = 4 + 0	TEXT	ADJUST
EX. 18	3	TEXT	PLAN
EX. 19	5 = 3 + 2	TEXT	ESTIMATE
EX. 20	4 = 2 + 2	TEXT	APPLY - ESTIMATE

EXAMPLE 15

Materials are organised to foster the composition of successive steps into a single procedure as can be seen in the following example. The procedure of blocking text has already been used in Adjusting and Emphasizing text and is now used again for moving or copying text.

MAIN GOAL: MOVE TEXT

Method 2 (More than one sentences, paragraphs, tables/columns)

Goal: **Specify Block of text.**

Act --- (follow **the alt F4;** procedure)

Verify: All the wanted text is highlighted?

Goal: **Load Moving functions**

Act --- Press **Ctrl F4.**

Verify:Bot/Rig **Move:** 1 Block, 2 Tabulal Column, 3 Triangle.

Goal: **Goal: Specify text type.**

Act --- Press 1 for block of text

Verify:1 Move; 2 Copy;3 Delete; 4 Append;0

Goal: **Move text**

** Sub Goal: **Select Move function**

Act --- To **Move** Press **1**

Verify: The specified text disappears, "Move cursor Press **RETURN**"

** Sub Goal: **Specify Place to move the text to:**

Act --- Move Cursor

** Sub Goal: **Transfer text**

Act --- Press **RETURN**

Verify: that the text appears at the wanted place.

<u>**EXAMPLE 16**</u>

Create a model of the functions and operations of different features of the computer package.

WORDPERFECT HELP FACILITIES

The wordperfect program has two different on the screen Help facilities **the alphabetical order** and **the summary help table.**
The new user who has not formed a categorical organisation of the different functions will find the **alphabetical order** easier to use. In addition the **alphabetical order** provides the user with all the required actions to accomplish the desired goal.

MAIN GOAL : USE WP HELP FACILITIES

Method 1. <u>(Alphabetical order)</u>

Goal: **Activate the alphabetical help facility.**
Act --- Press **F3**
Verify: a screen with the help options appears at the bottom right: <u>Selection 0</u>

Goal: **Select Goal**
Act --- Type **the first letter**
Verify: the screen changes to:
<u>Features Wordperfect Key Keystrokes</u>
For every feature the above information is given.

Goal: **More information for the function.**
Act --- Press the function key.
Verify: <u>Information appears on the screen.</u>

Goal: **Activate the desired features**
Sub goal: **Exit Help**
Act --- Press **Enter**
Verify: working screen is on.

Sub Goal: **Load features**

Act --- Press the desired **function keys.**

Method 2 (Use the help table option)

Goal: **Activate Table Option**

Act --- Press two times **F3**

Verify: A table with the 10 function keys and their combinations will appear:

Only the function Key, alt + Function Key

Shift + Function Key, Control + Function Key.

Goal: **More information for the function.**

Act --- Press the function key.

Verify: Information appears on the screen.

Goal: **Activate the desired features**

Sub goal: **Exit Help**

Act --- Press **Enter**

Verify: working screen is on.

Sub Goal: **Load features**

Act --- Press the desired **function keys.**

APPENDIIX II:

QUESTIONNAIRE SAMPLE

The following questionnaire is designed to investigate YOUR OPINION about the training materials used at Speedwell.

INDICATE HOW STRONGLY YOU AGREE OR DISAGREE WITH EACH STATEMENT BY <u>CROSSING THE APPROPRIATE NUMBER</u>:

<u>REMEMBER:</u> THERE ARE NO RIGHT OR WRONG ANSWERS.

3 to the left : STRONGLY AGREE
2 to the left : AGREE
1 to the left : SLIGHTLY AGREE

3 to the right : STRONGLY DISAGREE
2 to the right : DISAGREE
1 to the right : SLIGHTLY DISAGREE

0 : CANNOT DECIDE (NEUTRAL)

	Strongly Agree	Agree	Slightly Agree	Cannot Decide	Slightly Disagree	Disagree	Strongly Disagree
I found the instructions easy to read.	3	2	1	0	1	2	3
I found the instructions easy to understand	3	2	1	0	1	2	3
I found the instructions informative.	3	2	1	0	1	2	3
I found the instructions easy to apply.	3	2	1	0	1	2	3
I found the instructions relevant.	3	2	1	0	1	2	3
The instructions were helpful in breaking a task into workable steps.	3	2	1	0	1	2	3
The instructions were useful in defining goals.	3	2	1	0	1	2	3
The instructions gave clear action steps.	3	2	1	0	1	2	3
The instructions were useful in identifying errors.	3	2	1	0	1	2	3
The instructions helped me understand how the package is working.	3	2	1	0	1	2	3
The instructions provided the necessary information to choose which method is most efficient.	3	2	1	0	1	2	3
The instructions were helpful in defining WHAT to accomplish.	3	2	1	0	1	2	3
The instructions were helpful in defining HOW to accomplish the set goal.	3	2	1	0	1	2	3

	Strongly Agree	Agree	Slightly Agree	Cannot Decide	Slightly Disagree	Disagree	Strongly Disagree
The instructions provided the necessary information for me to judge the outcome of each action.	3	2	1	0	1	2	3
The instructions were helpful in deciding WHICH method is the most efficient.	3	2	1	0	1	2	3
I was able to use the instructions as I needed them.	3	2	1	0	1	2	3
To use the instructions first I had to decide What I wanted to accomplish.	3	2	1	0	1	2	3
I had to decide which was the most efficient method to handle a task.	3	2	1	0	1	2	3
I had to actively think through what I was doing in order to use the instructions.	3	2	1	0	1	2	3
I passively followed the instructions to accomplish the tasks.*	3	2	1	0	1	2	3
I preferred this model of instructions than following long stepwise set of actions.	3	2	1	0	1	2	3
From the beginning of the training I knew what I wanted to do, what method I followed, and how to judge the outcome of my actions.	3	2	1	0	1	2	3
I used the information from the instructions to fit my own learning style.	3	2	1	0	1	2	3
Instructions were useful in showing WHAT is accomplished by EACH Function.	3	2	1	0	1	2	3
I found the exercises interesting	3	2	1	0	1	2	3
I found the exercises appropriate	3	2	1	0	1	2	3
I found the exercises helpful in mastering the functions.	3	2	1	0	1	2	3
I found the exercises meaningful	3	2	1	0	1	2	3
The exercises reflected real office task.	3	2	1	0	1	2	3
I found the exercises boring.	3	2	1	0	1	2	3

	Strongly Agree	Agree	Slightly Agree	Cannot Decide	Slightly Disagree	Disagree	Strongly Disagree
The exercises were organised.	3	2 ✗	1	0	1	2	3
The exercises were ordered according to their complexity.	3	2 ✗	1	0	1	2	3
The exercises were consistent.	3 ✗	2	1	0	1	2	3
The exercises were concise.	3	2 ✗	1	0	1	2	3
The exercises provided enough practice opportunities to master the functions.	3 ✗	2	1	0	1	2	3
I found the difficulty level of each exercise manageable.	3	2 ✗	1	0	1	2	3
Completing an exercise I felt a sense of accomplishment.	3	2 ✗	1	0	1	2	3
Finishing a session, I felt confident to use the mastered functions in other applications.	3	2 ✗	1	0	1	2	3
The exercises provided a structure in the training.	3	2 ✗	1	0	1	2	3
I felt in control of the speed of my learning.	3	2 ✗	1	0	1	2	3
I felt that the exercises prepared me to handle real work tasks.	3	2 ✗	1	0	1	2	3
I found the exercises challenging.	3	2 ✗	1	0	1	2	3
The training materials gave me the opportunity to learn at my own speed.	3 ✗	2	1	0	1	2	3
The materials clearly stated the goals to be accomplished at each stage of the training.	3 ✗	2	1	0	1	2	3
I found the exercises neither too easy nor too difficult	3	2 ✗	1	0	1	2	3
The materials allowed me to judge whether or not I have achieved the training goals.	3 ✗	2	1	0	1	2	3
The materials provided plenty of opportunity to rehearse previously learned functions.	3	2 ✗	1	0	1	2	3
I found the materials confusing*	3	2	1	0	1	2 ✗	3
I found the materials flexible to be used in different contexts.	3	2	1 ✗	0	1	2	3

The following questionnaire is designed to show **HOW CONFIDENT YOU FEEL** about your computer skills and yourself.

INDICATE HOW STRONGLY YOU AGREE OR DISAGREE WITH EACH STATEMENT BY <u>CROSSING THE APPROPRIATE NUMBER</u>:

<u>REMEMBER:</u> THERE ARE NO RIGHT OR WRONG ANSWERS.

3 to the left : STRONGLY AGREE
2 to the left : AGREE
1 to the left : SLIGHTLY AGREE

3 to the right : STRONGLY DISAGREE
2 to the right : DISAGREE
1 to the right : SLIGHTLY DISAGREE

0 : CANNOT DECIDE (NEUTRAL)

	Strongly Agree	Agree	Slightly Agree	Cannot Decide	Slightly Disagree	Disagree	Strongly Disagree
I feel confident to use the functions I learned in a real work situation.	3	~~2~~	1	0	1	2	3
I feel confident to be able to use a computer in a real job situation.	3	~~2~~	1	0	1	2	3
I feel confident that I will be able to learn other packages if I try.	3	~~2~~	1	0	1	2	3
I feel confident to be able to handle a job requiring wordprocessing skills.	~~3~~	2	1	0	1	2	3
I feel confident to be able to handle a job using spreadsheets.	3	~~2~~	1	0	1	2	3
I feel more confident in interacting with the computer.	3	~~2~~	1	0	1	2	3
I feel more able to use the feedback or help provided by the computer.	~~3~~	2	1	0	1	2	3
I tried to experiment with new functions by myself.	3	~~2~~	1	0	1	2	3
I feel more relaxed when I am working with the computers.	3	2	~~1~~	0	1	2	3
I feel more in control when I am working with the computers.	3	~~2~~	1	0	1	2	3
I feel more able to understand computer jargon.	3	~~2~~	1	0	1	2	3

	Strongly Agree	Agree	Slightly Agree	Cannot Decide	Slightly Disagree	Disagree	Strongly Disagree
I try to solve problems by myself before I ask for assistance.	3	2	X	0	1	2	3
I feel satisfied with my progress	3	X	1	0	1	2	3
I feel confident to follow a carreer using computers.	3	2	X	0	1	2	3
I feel confident to be able to pass the computer qualification exams.	3	X	1	0	1	2	3
I feel more confident in my abilities.	3	X	1	0	1	2	3
I feel eager to continue with my computer training.	3	X	1	0	1	2	3
I feel more confident in handling new situations in my everyday life.	3	2	X	0	1	2	3
I feel more confident in my problem solving skills.	3	X	1	0	1	2	3
I feel more relaxed to try out new activities.	3	2	X	0	1	2	3
I feel more in control of my progress.	3	X	1	0	1	2	3
I believe that if I will make the effort I will succeed.	3	X	1	0	1	2	3
I feel that I have a number of good qualities	3	2	X	0	1	2	3
I feel that I am able to do things as well as most other people.	3	2	X	0	1	2	3
I feel I do have much to be proud of.	3	X	1	0	1	2	3
On the whole I feel satisfied with myself	3	X	1	0	1	2	3
I feel I can make decisions for myself	3	2	X	0	1	2	3
I feel optimistic for the future.	3	2	X	0	1	2	3
I feel in control of my life.	3	X	1	0	1	2	3

APPENDIX III:

ANALYTICAL SCORES OF THE EXAMINED QUESTIONNAIRE PARAMETERS

	Understandability			Fitness			Task Relevancy		
	Study Group	Control Group	Difference	Study Group	Control Group	Difference	Study Group	Control Group	Difference
1	5	5	0	7	1	6	6	-2	8
2	5	5	0	4	4	0	6	1	5
3	8	1	7	8	7	1	6	2	4
4	6	4	2	3	2	1	5	-1	6
5	8	2	6	12	5	7	11	-3	14
6	3	5	-2	7	0	7	6	-3	9
7	7	4	3	7	6	1	5	0	5
8	6	0	6	8	4	4	8	-1	9
9	7	3	4	6	2	4	7	0	7
10	-1	4	-5	1	7	-6	-2	2	-4
11	4	-1	5	6	5	1	4	0	4
12	8	2	6	7	-2	9	8	-4	12
Total	66	34		76	41		70	-9	
Average	5.5	2.83		6.33	3.42		5.83	-0.75	
Standard Deviation	2.61	2.04		2.77	2.84		3.07	1.96	

STUDENTS	Organization			Personal Effect			Confidence		
	Study Group	Control Group	Difference	Study Group	Control Group	Difference	Study Group	Control Group	Difference
1	11	2	9	9	-2	11	6	-2	8
2	11	1	10	11	2	9	6	0	6
3	14	5	9	9	4	5	5	-2	7
4	10	-1	11	13	-4	17	6	-4	10
5	13	2	11	5	0	5	5	-5	10
6	3	-3	6	0	0	0	7	0	7
7	5	6	-1	14	5	9	5	2	3
8	11	3	8	15	0	15	6	0	6
9	8	5	3	15	4	11	5	0	5
10	6	7	-1	8	7	1	1	2	-1
11	5	-1	6	8	4	4	3	0	3
12	10	0	10	15	1	14	7	-2	9
Total	107	26		122	21		62	-11	
Average	8.92	2.17		10.17	1.75		5.17	-0.92	
Standard Deviaton	3.48	3.13		4.63	3.17		1.70	2.15	

STUDENTS	Mastery			Users Control			Preference		
	Study Group	Control Group	Difference	Study Group	Control Group	Difference	Study Group	Control Group	Difference
1	9	0	9	11	-8	19	2	0	2
2	10	-4	14	15	2	13	1	2	-1
3	13	-6	19	7	-6	13	3	-1	4
4	9	-6	15	14	-5	19	3	-2	5
5	10	-5	15	11	-4	15	3	-2	5
6	4	-5	9	10	-2	12	3	-1	4
7	9	-2	11	16	2	14	2	0	2
8	11	-2	13	17	1	16	2	0	2
9	7	-5	12	17	2	15	2	0	2
10	5	2	3	2	2	0	-2	1	-3
11	4	0	4	12	4	8	2	0	2
12	12	-2	14	16	0	16	2	-2	4
Total	103	-35		148	-12		23	-5	
Average	8.58	-2.92		12.33	-1.00		1.92	-0.42	
Standard Deviaton	3.00	2.64		4.52	3.88		1.38	1.24	

STUDENTS	Problem Solving			Goal			Method		
	Study Group	Control Group	Difference	Study Group	Control Group	Difference	Study Group	Control Group	Difference
1	20	-10	30	7	0	7	5	-5	10
2	16	-7	23	6	-3	9	3	-2	5
3	18	-11	29	5	-5	10	5	-3	8
4	13	-16	29	9	-6	15	0	-5	5
5	24	-18	42	11	-5	16	4	-4	8
6	10	-14	24	2	-7	9	4	-4	8
7	25	-18	43	7	-8	15	8	-2	10
8	24	-15	39	11	-7	18	6	-4	10
9	13	-12	25	9	-5	14	2	-3	5
10	5	-15	20	0	-5	5	4	-4	8
11	8	-11	19	6	-1	7	3	-3	6
12	21	-17	38	11	-4	15	5	-5	10
Total	197	-164		84	-56		49	-44	
Average	16.42	-13.67		7.00	-4.67		4.08	-3.67	
Standard Deviaton	6.68	3.47		3.52	2.39		2.02	1.07	

STUDENTS	Actions			Errors			Total Questioner		
	Study Group	Control Group	Difference	Study Group	Control Group	Difference	Study Group	Control Group	Difference
1	4	1	3	5	-5	10	76	-14	90
2	5	3	2	3	-2	5	75	8	67
3	4	-1	5	5	-2	7	79	-8	87
4	6	-4	10	3	-6	9	71	-27	98
5	7	-4	11	6	-6	12	89	-26	115
6	3	0	3	0	-4	4	61	-20	81
7	7	-1	8	8	-7	15	87	4	83
8	5	-2	7	7	-5	12	97	-10	107
9	4	1	3	3	-4	7	72	2	70
10	-3	-1	-2	-3	-4	1	78	17	61
11	3	-2	5	-1	-5	4	50	-1	51
12	7	-1	8	4	-7	11	90	-26	116
Total	52	-11		40	-57		925	-101	
Average	4.33	-0.92		3.33	-4.75		77.08	-8.42	
Standard Deviaton	2.74	2.02		3.28	1.66		13.03	14.66	

REFERENCES

Ackerman, P.L. (1987). Individual differences in skill learning. An integration of psychometric and information processing perspectives. **Psychological Bulletin, 102.** 3-27.

Ackerman, P.L. (1988). Determinants of individual differences during skill acquisition: Cognitive abilities ad information processing. **Journal of experimental Psychology: General, 117** 288-318.

Ackerman, P.L. (1990). A correlational analysis of skill specificity: Learning, abilities and individual differences. **Journal of experimental Psychology: Learning, Memory, Cognition, 16.** 883-901.

Agacinski K., & Stern D. (1984). A two track programme enhances therapeutic gains for chronically ill in a day hospital population. **Occupational Therapy in Mental Health 4,** 15-22.

Agre, P.E. (1990). Plans and situated actions. **Artificial Intelligence 43,3** 369-384.

Agre, P.E. & Chapman, D. (1990). What are plans for?. In P.Maes (Ed.), **New structures of autonomous agents: Task-level decomposition and emergent functionality.** Cambridge, MA:MIT Press.

Allen R.B., & Scerbo, M.W. (1983). Details of command-language keystrokes. **ACM Transactions on Office Information Systems.** 1, pp 159 - 178.

Allport, D.A. (1980).Attention and performance. In G.L. Claxton (ed.). **Cognitive Psychology : New Directions.** London: Routledge.

Allwood, C.M. (1986) Novices on the Computer: A review of the literature. **International Journal of Man Machine Studies** 25, 633-658.

Allwood, M.C. & Eliasson, M. (1987) Analogy and other difficulties in novices' very first text editing. **International Journal of Man Machine Studies,** 27, 1-22.

Allwood, M.C. & Kalen T.(1993) Usercompetence and other usability aspects when introducing a patient administrative system: a case study. **Interacting with Computers 5,2** pp 167-191.

Altman, J.H., & Wittenborn, J.R. (1980). Depression-prone personality in women. **Journal of Abnormal Psychology, 89,** 303-308.

Anderson, J.R. (1980) Acquisition of cognitive skill. **Psychological Review, 89** 369-406.

Anderson, J.R. (1981) **Cognitive Skills and their Acquisition.** Hillside NJ: Lawrence Erlbaum Associates.

Anderson, J.R. (1982). Acquisition of cognitive skill. **Psychological Review,** 8 369-406.

Anderson, J.R. (1983) **The Architecture of Cognition.** Mass: Harvard University Press.

Anderson, J.R. (1985). **Cognitive Psychology and its Implications, Second ed.** New York: W.H.Freeman.

Anderson, J.R. (1993). **Rules of the mind.** Hillsdale, NJ: Erlbaum.

Anderson, J.R., & Fincham, J.M. (1994) Acquisition of procedural skills from examples. **Journal of experimental psychology: Learning, Memory, Cognition. 20, 6.** pp. 1322-1340.

Anderson, J.R., Greeno, J.G., Kline, P.J., & Neves, D.M. (1981). Acquisition of problem solving skill. In J.R. Anderson (ed.), **Cognitive Skills in their Acquisition.** Hillsdale, NJ: Erlbaum.

Anderson, J.R ., & Schooler, L.J.(1991). Reflections of the environment in memory. **Psychological Science, 2,** pp396-408.

Anthony W.A., & Blanch, A. (1989). Research on community support services: What have we learned? **Psychosocial Rehabilitation, 12.** 55-81.

Anthony, W.A. & Jansen, M.A. (1984). Predicting the vocational capacity of the chronically mentally ill: Research and policy implications. **American Psychologist 39,** 537-544.

Anzai, Y. & Simon, H.A. (1979). The theory of learning by doing. **Psychological Review,** 86, 124-140.

Arend, U. (1991). Analysing complex tasks with a GOMS model. In MJ Tauber & D. Ackermann (eds.,) **Mental Models and Computer Interaction.** N.Holland: Elsevier Science Publishers.

Arndt, S., Feltes, J., & Hanak,J. (1983). Secretarial attitudes towards word processors as a function of familiarity and locus of control. **Behaviour and Information Technology,** 2, 17-22.

Baddeley, A.D. (1986). **Working Memory.(Oxford psychological series No 11).** Oxford England:Clarendon Press.

Baecker R.M., & Buxton W.A. (1987) Models of computer user and usage. In R.M., Baecker & W.A. Buxton (eds) **Readings in Human-Computer-Interaction: A Multidisciplinary Approach.** California: Morgan Kaufmann Publ.Inc., pp 175-178.

Baecker R.M., & Buxton W.A. (1987a) Cognition and Human Information Processing. In R.M., Baecker & W.A. Buxton (eds) **Readings in Human-Computer-Interaction: A Multi disciplinary Approach.**California:Morgan Kaufmann Publ.Inc., pp 207-217.

Bandura, A. (1977). Self efficacy: Towards a unifying theory of behaviour change. **Psychological Review, 84.** 191-215.

Barnard, P.J. (1985) Interfacing cognitive subsystems: a psycholinguistic approach to short term memory. In A. Ellis (ed.) **Progress in the Psychology of Language Vol II** Hillsdale, N.J.: Lawrence Erlbaum Associates, pp.197-258.

Barnard, P.J. (1987) Cognitive resources and the learning of human dialogues. In J.M. Carroll (ed.). **Interface Thought: Cognitive Aspects of Human-Computer Interaction.** Cambridge, Mass.: MIT Press, pp. 112-158.

Barnard, P.J., & Grudin, J. (1988) Command names. In M Hellander (ed), **Handbook of human-computer Interaction.** Amsterdam: North Holland.

Barnard, P.J., Wilson, M.D., & Maclean, A. (1987) Approximate Modelling of Cognitive Activity: towards an expert design aid. In **Proceedings of CHI + GI 1987)** Toronto April 5-9), New York: ACM, pp 21-26.

Benbasat, I., & Todd, P. (1993). An experimental investigation of interface design alternatives: icon vs. text and direct manipulation vs menus. **International Journal of Man-Machine Studies 38.** 369-402.

Bennett, D.H. (1978). Social forms of psychiatric treatment. In Wing, ed., **Schizophrenia: Towards a New Synthesis.** London, Academic Press.

Berry, D.C., & Broadbent, D.E. (1984). On the relationship between task performanceand associated verbalizable knowledge. **Quarterly Journal of Experimental Psychology, 36A,** pp 209-231.

Berry, D.C., & Broadbent, D.E. (1988). Interactive tasks and the implicit-explicit distinction. **British Journal of psychology, 79** 2-17.

Black, J. B. (1984). **Understanding and Remembering Stories.** San Fransisco: Freeman.

Black, J. B. (1986). **Work as Therapy and Rehabilitation for the Mentally ill.** New York: Alto Health & Rehabilitation Services.

Black, J.B. & Bower, G.H. (1979). Episodes as chunks in narrative memory. **Journal of Verbal learning and Verbal behaviour,** 18, 309-318.

Black, J.B., Carroll, J.M., & Mc Guigan, S.M. (1987). What kind of minimal instruction manual is most effective. In J.M. Carroll & P. Tanner, Eds. **Human factors in Computing Systems**

and Graphics Interfaces: CHI+GI 1987 Proceedings. pp 159-162. New York: Association for Computing Machinery.

Black, J.B. & Moran, T. (1982) Learning and remembering command names. Human Factors in Computer Systems,Proceedings. March 15-17, Gaithersburg. MD, 8-11.

Black, J.B., Wilkes-Gibbs, D., & Gibbs, R. (1982) What writers need to know that they don't know they need to know. In M Nystrand (Ed.)**What Writers Know,** New York:Academic Press.

Bovair, S., Kieras, D.E.,& Polson, P.G., (1990). The acquisition and performance of text-editing skill: A cognitive complexity analysis. **Human-Computer Interaction, 3.** 1-48.

Bower, G.H. Black, J.B. & Turner, T.J.(1979) Scripts in memory for text. **Cognitive Psychology,** 11, 177-220.

Brenner, H.D. (1989). The treatment of basic psychological dysfunctions from a systemic point of view. **British Journal of Psychiatry, 155, supl. 5.** 74-83.

Briggs, P. (1988). What we know and what we need to know: the user model versus the user's model in human-computer interaction. **Behaviour and Information Technology, 7,** 433-442.

Briggs, P. (1990). Do they know what they are doing? An evaluation of word processor users' implicit and explicit task-relevant knowledge, and its role in self directed learning. **International Journal of Man Machine Studies, 32** 385-398

Broadbent, D.E. (1975). The magic number seven after fifteen years. In A. Kennedy & A. Wilkes (eds.). **In studies in long-term memory.** New York: Wiley, pp 3-18.

Broadbent, D.E. (1989). Lasting representations and temporary processes. In H.L. Roesdiger,III & F.I.M.Craik (eds.),**Varieties of memory and consciousness: Essays in honour of Endel Tulving.** Hillsdale, NJ:Erlbaum. pp 214-228.

Brooks, R.E. (1977). Towards a theory of cognitive processes in computer programming. **International Journal of Man Machine Studies 9** 737.

Brown, G. W. & Birley, J.L.T. (1970) Social precipitant of severe psychiatric disorders. In E.H. Hare & J.K. Wing(eds). **Psychiatric Epidemiology.** London: Oxford University Press.

Brown, G.W., Birley, J.L.T. & Wing, J.K. (1972). Influences of family life on the course of schizophrenic disorders: A replication. **British Journal of Psychiatric, 121,** 241-258

Butler, K., Bennett, J., Polson, P., & Karat, J. (1989). Report on the workshop of analytical models. **SIGCHI Bulletin, 20** 63-79.

Capindale R. A., & Crawford, R.G. (1990). Using natural language with casual users. **International Journal of Man-machine Studies, 32.** 341-362.

Card, S.K., Moran, T.P., & Newell, A. (1980). Computer text editing: An information processing analysis of a routine cognitive skill. **Cognitive Psychology,** 12, 32-74.

Card, S.K., Moran, T.P., & Newell, A. (1983). **The psychology of Human - Computer - Interaction.** Hillsdale, NJ.: Lawrence Erlbaum Associates.

Carroll, J.M. (1982). Learning using and designing command paradigms. **Human Learning,** 1, pp.31-62.

Carroll, J.M. (1984). Minimalist Training. **Datamation,** November 1, 1984, 125-136.

Carroll, J.M. (1985). Metaphor, Computing Systems, and Active Learning. **International Journal of Man-Machine Studies 22.** pp 39-57.

Carroll, J.M. (1987) **Interfacing Thought. Cognitive aspects of Human Computer Interaction.** Cambridge Ms: Bradford Books, MIT Press.

Carroll, J.M. & Aaronson, A.P. (1988). Learning by doing with simulated intelligent help . **Communications of the ACM, 31** (9), 1046-1079.

Carroll, J.M. & Carrithers, C. (1984). Blocking learner error states in a training wheels system. **Human Factors 26,** 377-389.

Carroll, J.M & Kay, D.S.(1988). Prompting, feedback & error correction in the design of a scenario machine. **Inter, J. Man-Machine Studies 28** pp 11-27.

Carroll, J.M., & Mack, R.L. (1982) Learning to use a word processor by guided exploration. Presented at the Psychonomic Society Conf. Minneapolis, Minn. Nov. 11-13.

Carroll, J.M., & Mack, R.L. (1983). Actively Learning to use a Wordprocessor. In W. Cooper (Ed.). **Cognitive Aspects of Skilled Typewriting** New York: Springer Verlag.

Carroll, J.M., & Mack, R.L. (1985) Metaphor, Computing Systems and Active Learning. **International Journal of Man-Machine Studies 22** 39-57.

Carroll, J.M., & Mack, R.L. (1987). Learning to Use a Word Processor: By Doing, by Thinking, and by Knowing. In R.M., Baecker & W.A. Buxton (eds) **Readings in Human-Computer-Interaction: A Multidisciplinary Approach.** California:Morgan Kaufmann Publ.Inc.,

Carroll, J.M., Mack, R.L. Lewis, C.H., Grischowsky, N.L.,& Robertson, S.R. (1985) Exploring a word processor.**Human Computer Interaction 1** 283-307.

Carroll, J.M. & McKendree, J. (1987). Interface design issues for advice-giving expert systems. **Communications of the ACM, 30,1,** 14-31.

Carroll, J.M., & Thomas, J.C. (1982) Metaphor and cognitive representations of computing systems. **IEEE Transactions on Systems, Man, and Cybernetics,** 12, 107-116.

Carroll, J.M. & Rosson, M.B.(1987) The paradox of the active user. In J. M. Carroll Eds. **Interfacing Thought. Cognitive aspects of Human Computer Interaction.** Cambridge Ms: Bradford Books, MIT Press.

Carroll, C.S., Smith-Kerker, P.L., Ford, J.R., & Mazur, S.A.(1986). **The Minimal Manual.** IBM RC 11637.

Carver, C.S., Balney, P.H., & Scheier, M.F. (1979). Reassertion and giving up: The interactive role of self-directed attention and outcome expectancy. **Journal of Personality and Social Psychology. 37.** pp 1859-1870.

Carver, C.S., & Scheier, M.F. (1981) **Attention and self-regulation: A control-theory approach to human behaviour.** New York: Springer-Verlag.

Carver, C.S., & Scheier, M.F. (1982). Control theory: A useful conceptual framework for personality-social, clinical, and health psychology. **Psychological Bulletin, 92** pp. 540-572.

Carver, C.S., & Scheier, M.F. (1983). A control model of normal behavior and implications for problem in self-management. **In P.C. Kendall (ed.,) Advances in Cognitive-Behavioral Research and Therapy, Vol 2. New York: Academic Press.**

Charney, D.H., Reder, L.M.(1986). Designing interactive tutorials for computer users'. **Human-Compute Interaction 2,** pp 297-342.

Charney, D.H., Reder, L.M. & Kusbit, G.W. (1990). Goal setting and procedure selection in acquiring computer skills: a compa-rison of tutorials, problem solving & learner exploration . **Cognition and Instruction 7,4,** pp 323-342.

Chase, E.G., & Ericsson, K.A.(1981) Skilled memory. In J.R.Anderson, ed., **Cognitive Skills and their acquisition.** Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Chechile, R.A., Eggleston, R.g., Fleischman, R.N., & Sasseville, A.M. (1989). Modelling of cognitive content of displays. **Human Factors, 31** 31-43.

Clement,D. (1984) Empirical Guidelines and a Model for Writing computer documentation. In **Interact'84. First IFIP in Human-Computer-Interaction.** Amsterdam: Elsevier Science Publishers.

Conte, H.R., & Plutchnik, R. (1986). Controlled research in supportive psychotherapy. **Psychiatric Annals, 16.** 530-533.

Cornes, P., Floyd, M., & Boeckenfoerde, G. (1993). Information technology training in Great Britain. In M. Floyd (ed.,) **Information Technology Training for People with Disabilities.** London: Rehabilitation Resource Centre. 11-26

Costello, C.G. (1972) Loss of reinforcers or loss of reinforcer effectiveness. **Behaviour Therapy, 3** 240-247.

Coviensky, M., & Buckley, V.C. (1986). Day activities programming: Serving the severely impaired chronic client. **Occupational Therapy in Mental Health, 4.** 15-22.

Csikszentmihalyi, M. (1990). Flow: The psychology of optimal experience. New York: Harper & Row.

Cypher, A. (1986) The structure of user's activities. In D.A. Norman & S.W. Draper (Eds.), **User centered system design: New**

Perspectives in human-computer interaction. Hillsdale, NJ:Erlbaum, pp 243-263.

Czaja, S.J., Hammond, K, Blascovich, J.J., & Swede, H. (1989). Age related differences in learning to use a text-editing system. **Behaviour and Information Technology, Vol 8, No 4,** pp 309-319.

Damasio, A.R. (1989) Time-locked multiregional retroactivation: A systems-level proposal for the neural substrates of recall and recognition. **Cognition, 33,** 25-62.

Davis, R.(1983). Task analysis and user errors: a methodology of assessing interactions. **International Journal of Man-Machine Studies,** 19, pp. 561-574.

Dayton T.,Gethys C.F. Unvein J.T. (1990). Thepretical training and problem detection in a computerised database retrieval task. **International Journal of Man-Machine Studies, Vol 34,** 619-638.

Dean, C. & Whitlock, Q. (1988) **A Handbook of Computer Based Training Second edition.** London: Kogan Page.

Dewier, A., & Karnas, G. (1991). Level of experience in text-editing: The role of mental representations on performance. In M.J. Tauber & D. Ackerman (Eds.) **Mental Models and Human**

Computer Interaction, 2. North-Holland: Elsevier Science Publishers B.V.

Diapper, D. & Johnson P (1989) . Task analysis for knowledge descriptions: theory and application in training. In J Long & A. Whitefield (eds) **Cognitive Ergonomics and Human Computer Interaction.** Cambridge: Cambridge University Press. pp 191-224

Dictionary of Occupational Titles.(1977) U.S. Department of Labour, U.S. Government Printing Office, Washington, D.C.

Douglas, S.A. & Moran, T.P. (1983). Learning text editors semantics by analogy. **Proceedings CHI'83. Human Factors in Computing Systems.** New York: ACM.

Duncan, J., (1980). The demonstration of capacity limitation. **Cognitive Psychology, 12** 75.

Eason, K.D. (1974). The manager as a computer user. **Applied Ergonomics** 5 (1), 9-14.

Eason, K.D. (1976) Understanding the naive computer user.**The Computer Journal**. 19(1), 3-7.

Eason, K.D., & Damodaran,L. (1981).The needs of the commercial user. In M.J. Coombs & J.L. Alty (eds.)**Computing Skills and the Users Interface.** New York: Academic Press.

Easterbrook, J.A. (1959). The effect of emotion on cue utilization and the organisation of behaviour. **Psychological Review, 66**, 183-201.

Eberleh, E., Korfmacher, W., & Streiltz, N. (1992). Thinking or Acting? Mental workload and subjective preferences for a command code and direct manipulation interaction style. **International Journal of Human-Computer Interaction. 4,2.** 105-122.

Edmonds, E.A. (1981) Adaptive man-computer interfaces. In M.J. Coombs & J.L. Alty (eds.)**Computing Skills and the Users Interface.** New York: Academic Press.

Egan, D.E. (1988). Individual differences in human-computer interaction. In M. Helander (Ed.), **Handbook of human computer interaction.** Amsterdam: North-Holland. 543-568.

Egan, D.E. & Gomez, L.M. (1985). Assaying, isolating and accommodating individual differences in learning a complex skill. **Individual differences in Cognition, Vol 2,** 173-217.

Elketron, J. & Palmiter, S. (1991) Designing help systems using a GOMS model: an information retrieval evaluation. **Human Factors, 33,** 185-204.

Embley, D.W. & Nagy, G. (1982). Can we expect to improve text editing performance? In **Human Factors in Computer Systems.** (Gaithersburg), New York: ACM, pp. 152-156.

Ericsson, K.A. & Simon, H.A. (1980). Verbal protocols as data. **Psychological Review.** 87, 215-251.

Evans G. (1989) Computers in Mental Health. **Westmininster Association for Mental Health.** February.

Evans G. (1990) **Computers in Mental Health.** London: Portugal Prints.

Evans G. (1993) Micros in Mental Health. In M. Floyd (ed.,) **Information Technology Training for People with Disabilities.** London: Rehabilitation Resource Centre. 27-35.

Eysenck, M.W. (1967) **The biological basis of personality.** Springfield, III,: American lecture series.

Eysenck, M.W. (1977) **Human Memory: Theory, Research, and Individual Differences.** Oxford: Pergamon Press.

Farkas, M.D., Rogers, E.S.,& Thurer, S. (1987). Rehabilitation outcome of long-term psychiatric patients left behind by deinsti- tutionalization. **Hospital and Community Psychiatry 38,** 864-870.

Feuerstein, R (1979). **The Learning Potential Assessment Device, Theory, Instruments and Techniques.** Baltimore: University Park Press.

Fisher, D.L., Duffy, S.A., Young, C. & Pollatsek, A. (1988). Understanding the central processing limit in consistent-mapping visual search tasks. **Journal of Experimental Psychology: Human Perception and Performance, 14,** 253-266.

Fisher, D.L., & Tanner, N.S. (1992). Optimal symbol selection: A semi-automated procedure. **Human Factors, 34.** 79-96.

Fisk, A.D., & RogersG, W.A. (1991). Toward an understanding of age related memory and visual search effects. **Journal of Experimental Psychology: General, 120,** 131-149.

Fitts, P.M. (1964) Perceptual motor skills learning. In A.W. Melton (ed.), **Categories of Human Learning.** New York : Academic Press.

Fitts, P.M. & Posner, M.I. (1967) **Human Performance** Belmont, CA: Brooks Cole.

Fleishman, E.A. & Quaintance, M.K.(1984) **Taxonomies of Human Performance.** San Diego, Calif.: Academic Press.

Flippo, J.R & Lewinsohn, P.M.(1971) Effects of failure on the self-esteem of depressed and non-depressed subjects. **Journal of Consulting and Clinical Psychology, 36,** 151.

Floyd, M.,Cornes, P., & Boeckenfoerde, G. (1993). New technology training for people with disabilities in Great Britain. **International Journal of Rehabilitaion Research,** 39-45.

Frese, M., Albrecht, K., Altmann, A., Lang, J., Papstein, P.V. Peyerl, R., Prumner, J., Schulte-Cocking, H., Wankmuller, I., & Wendel, R. (1988) The effects of an active development of the mental model in the training process: experimental results in a Word Processing System. **Behaviour & Information Technology, Vol 7 No 3** 295-304.

Foulds, G.A., & Dixon, P. (1962) The nature of intellectual deficit in schizophrenia: III. A longitudinal study of the subgroups. **British Journal of Clinical and Social Psychology, 1,** 199-207.

Gentner, D. (1989). The mechanisms of analogical reasoning. In S Vosniadou & A Ortony (Eds.), **Similarity and Analogical reasoning.** Cambridge University Press.

Ghani, J.A. (1991). Flow in human computer interactions: Test of a model. In J Carey (Ed.), **Human factors in management information systems: An organizational perspective (Vol.3)** Norwood, NJ: Ablex.

Ghani, J.A. & Al-Meer, A.R. (1989). Effect and the end-user computing on job satisfaction: An exploratory study. **Information and Management, 17(4),** 191-195.

Ghani, J. A. & Deshpande, S.P. (1994). Task characteristics and the experience of optimal flow in Human-computer interaction. **The Journal of Psychology, 128(4),** 381-391.

Giambra, L.M. & Traynor, T.D. (1978) Depression and daydreaming: An analysis based on self-ratings. **Journal of Clinical Psychology, 34,** 14-25.

Gick, M.L., & Holyoak, K.J. (1983). Schema induction and analogical transfer. **Cognitive Psychology,** 15, 1-38.

Gilbert, G.N. (1987). Cognitive nad social models of the user. In H.J. Bullinger & B. Shackel Eds. **Human-Computer Interaction - Interact'87.** pp 165-169. Amsterdam: North Holland, Elsevier Science Publishers.

Gillan, D.J., Gregory, R.J., & Fogas, B.S. (1991). The Design of usable computer aids for cognitive rehabilitation. In **Procceedings of 1st World Congress of Technology, Vol II.** Arlington, USA: December, 361-386.

Gillan, D.J., Holden, K., Adam, S., Rubisill, M., & Magee, L. (1992). How should Fitts' Law be applied to human-computer interaction. **Interacting with Computers. Vol 4,3.** 291-313.

Gittens, D.,(1986). Icon-based human-computer interaction. **International Journal of Man-Machine Studies, 24** 519-543.

Goldberg, S.C., Schooler, N.R., Hogarty, G.E., & Roper, M. (1977). Prediction of Relapse in Schizophrenic outpatients treated with drugs and sociotherapy. **Archives of General Psychiatry, 34,** 171-184.

Gomez, L.M., Egan, D.E., Wheeler, E.A., Sharma, D.K., & Gruchacz, A.M. (1983). How interface design determines who has difficulty learning to use a text editor. **CHI'83 Conference Proceedings, Human Factors in Computer Systems.** pp 176-181.

Gong, R., & Elkerton, J. (1990). Designing minimal documentation using a GOMS model: a usability evaluation of an engineering approach. In J.C., Chew, & J. Whitside, (Eds.,) **Proc. CHI'90 Conference on Human Factors in Computing Systems.** New York: Ass. for Computing Machinery, 99-106.

Gray, W.D., John, B.E.,& Atwood, M.E.,(1993). Project Ernestine: Validating a GOMS analysis of predicting and explaining real work task performance. **Human Computer Interaction, 8.** pp 237-309.

Green, T.R.G., Schiele, F. & Payne, S.J. (1988). Formalisable models of user knowledge in HCI. In G.C. Van Der Veer, T.R.G. Green, J.M. Hoc & D.M. Murray (eds) **Working with Computers: Theory Versus Outcome,** London: Academic Press, LTD.

Grief, S., (1986). Job design and computer training. **Bulletin of the British Psychological society, 39,** pp 166-196

Gugerty P L. (1993). The use of analytical models in human-computer interface design. **International Journal of Man-Machine Studies, 38.** 625-660.

Guillemette R.A. (1988) Development and validation of na reader-based documentation measure. **International Journal of Man-Machine Studies. 30,** 551-574.

Gwei, G.M. & Foxley, E. (1990). Towards a consultive on-line help system. **International Journal of Man-machine Studies 32,** 363-383.

Halsz, F. & Moran, T.P. (1982). Analogy considered harmful. In **Human Factors of Computing Systems,** CHI'82, New York: ACM, pp. 383 -386.

Halpin, S.M., & McCullough, G. W. (1986). User computer interaction. In J. Zeidner (ed.), **Human Productivity Enhancement: Training and Human Factors in Systems Design. Vol 1.** New York: Praeger Publ. pp (235-284).

Hammond, N.V. & Barnard, P.J. (1984). Dialogue design: Characteristics of user knowledge. In A.F. Monk (ed.), **Fundamentals of Human-Computer Interaction.** London: Academic Press.

Hawk, S.R. (1993). The effects of user involvement: some personality determinants. **International Journal of Man-Machine Studies. 38,** 839-855.

Hayes, J.R. & Flower, L.S., (1980). Identifying the organization of writing processes. In L.W. Gregg & E.R Steinberg (eds) **Cognitive Processes in writing.** Hillsdale, NJ: Erlbaum, pp 167-200.

Hayes, J.R. & Simon, H.A. (1974) Understanding written problems instructions. In L.W.Gregg (ed.) **Knowledge and Cognition.** Potomac Maryland: Erlbaum pp 156-200.

Henry, G.M., Weingartner, H., & Murphy,D.L. (1973) Influence of affective states and psychoactive drugs on verbal learning and memory. **American Journal of Psychiatry, 130,** 966-971.

Herz, M.I., & Melville, C. (1980). Relapse in schizophrenia. **American Journal of Psychiatry,** 137, 801-805.

Hicks, J.O., Hicks, S.A.,& Sen, T.K. (1991). Learning spread-sheets: Human instruction Vs computer-based instruction. **Behaviour and Information Technology, 10, 6.** pp 491-500.

Hollenbeck, J.R., Williams, C.R. & Klein, H.J. (1989). An empirical examination of the antecedents of commitment to difficult goals. **Journal of Applied Psychology, 74** 18-23.

Howell, R.C. (1982). An overview of models, methods, and problems. In R.C Howell & E.A. Fleishman (eds.), **Human Performance and Productivity: Information Processing and Decision Making.** Hillsdale, N.J: Erlbaum Associates.

Hunt, E. & Lansman, M. (1986). Unifies model of attention and problem solving. **Psychological Review,** 93, 446-461.

Hutchins, E.L., Hollan, J,D., & Norman, D.A. (1986). Direct manipulation interfaces. In D.A. Norman & S.W. Draper (Eds.), **User-centered system desing: New perspectives on human-computer interaction** Hillsdale,NJ:Erlbaum. 87-124.

Jackson, J.C., & Roske-Hofstrand, R.J. (1989) " Circling: a method of mouse-based selection without button press. In K. Bice, & C Lewis (Eds.), **Proc.CHI'89. Human Factors in Computing Systems.**Austin Texas, ACM, 161-166.

James, E.B.(1981) The user interface: how we may compute. In M.J. Coombs & J.L. Alty (eds.)**Computing Skills and the Users Interface.** New York: Academic Press.

Jarke, M. & Vassiliou, Y. (1985) A framework for choosing a database query language. **ACM Computing Surveys, 17,3.** 313-340.

Jarvis D. (1983) **Adult and Continuing Education: Theory and Practice** London: Croom Helm.

Jofre, S. (1988) **Computers for Psychiatric Patients.** New Statesman/Society.

John, B.E. (1990). Extensions of GOMS analysis to expert performance requiring reception of dynamic visual and auditory information. In J.C., Chew, & J. Whitside, (Eds.,) **Proc. CHI'90 Conference on Human Factors in Computing Systems.** New York: Ass. for Computing Machinery 107-116.

John, B.E., Vera A.H., Newell, A. (1994). Towards real-time GOMS: a model of expert behaviour in highly interactive task. **Behaviour & Information Technology, 13, 4.** 255-267.

Johnson, P. (1985). Towards a task model of massaging: an example of the application of TAKD to user interface design. In P Johnson & S Cook (eds.), **People and Computers: Design and interface.** Cambridge: Cambridge University Press, pp 46-62

Johnson, P., Diaper, D.& Long, J.B. (1984). Tasks, skills & knowledge: task analysis for knowledge based descriptions. In

B. Shackel (ed.). **Human Computer Interaction - INTERACT'84.** Amsterdam: North Holland.

Jones, P.M. Mitchell, C.M. & Rubin, K.S. (1990). Validation of intent interfacing by a model-based operators associate. **International Journal of Man-Machine Studies, 33.** 177-202.

Juckson, J.C., & Roske-Hofstrand, R.J. (1989). Methods of mouse based selection processes. in K. Bice & C Lewis (eds.,) **Proc. CHI'89: Human Factors in Computing Systems.** Austin Texas:ACM, 161-166.

Just, M.A. & Carpenter, P.A. (1980). A theory of reading: from eye fixation to comprehension. **Psychological Review 87.** p.p 329 345.

Kahneman, D. (1973). **Attention and effort.** Englewood Cliffs, NJ: Prentice Hall.

Katajima, M. (1989). A formal representation system for the human-computer interaction process. **International Journal of Man-Machine Studies, Vol 30, No 6.** 669-696.

Kay, D.S., & Black J.B. (1985). The evolution of knowledge representations with increasing expertise in using systems. **Proceedings of the Seventh Annual Meeting of the Cognitive Science Society,** Irvine, C.A.

Kay, D.S., & Black J.B. (1986). Knowledge transformations during the acquisition of computer expertise. CCT Report 86-92, New York, Teachers College, Columbia University.

Kennedy, T.C.S.(1975). Some behavioral factors affecting the training of naive users of an interactive computer system. **International Journal of Man Machine Studies,** 7, 817-834

Kerr M.P. & Payne S.J.(1994) Learning to use a spreadsheet by doing and by watching. **Interacting with Computers 6,1** 3-22.

Kieras, D.E. (1985) An approach to the formal Analysis of User Complexity. **International Journal of Man-Machine Studies,** 22, 365-394.

Kieras, D.E., Bovair, S. (1986). The Acquisition of Procedures from text: A production-system analysis of transfer of training. **Journal of Memory and Language,** 25, 507-524.

Kieras, D.E. & Polson, P.G. (1985). An approach to the formal analysis of user complexity. **International Journal of Man-Machine Studies,** 22, pp. 365-394.

Kirwan, B. (1990). Human reliability assessment. In J.R. Wilson & E.N. Corlett (eds.), **Evaluation of human work.** London: Taylor & Francis.

Knowles, M.S. (1980) **The Modern Practice of Adult Education; From Pedagogy to Andragogy** Chicago: Association Press.

Koubek, R.J., Salvendy, G., Dunsmore, H.E.,. & Lebold, W.K. (1989). Cognitive Issues in the Process of Software Development : Review and reappraisal. **International Journal Man-Machine Studies.** 30, 171-191

Kreigh, R.J., Pesot,J.F. & Halcomb, C.G. (1990). An evaluation of look ahead help fields of various types of menu hierarchies. **International Journal of Man-Machine Studies, 32.** 649-661

Krueger, M., & Rothbart, M. (1990). Contrast and accuracy effects in category learning. **Journal of Personality and Sociology, 59** 651-663.

Lane, D.M., Napier, A,H., Batsell, R.R, & Naman,J.L. (1993). Predicting the skilled use of hierarchical menus with the keystroke-level model. **Human - Computer Interaction, 8** 185-192.

Lang, T., Lang, K., & Auld, R. (1981) A longitudinal study of computer-user behaviour in batch environment. **International Journal Man-Machine Studies.** 14 251-268.

Larkin, J.H. (1981). Enriching formal knowledge: a model for learning to solve textbook physics problems. In J.R. Anderson (ed.) **Cognitive Skills and their acquisition.** Hillsdale, NJ: Erlbaum.

Larkin, J., McDermott,J., Simon D.P., & Simon, H.A. (1980). Expert and novice performance in solving physics problems. **Science,** 208, 135-142.

Larkin, J.H., & Simon, H.A (1987). Why a diagram is worth ten thousand words. **Cognitive Science, 11.** 65-99.

Lawler,R.W., DuBoulay,B., Hughes, M. & Macleod, H. (1986). **Cognition and Computers. Studies in Learning.** Chichester: Ellis Horwood Series in Cognitive Science.

Lee, A. (1991). User support: Considerations, features and issues. In J. Rasmussen, H.B. Andersen, & N.O. Bernsen (Eds.), **Human-computer interaction Vol3.** Hillsdale, NJ: Erlbaum. 184-228.

Lee, A.Y., Polson, P.G. & Bailey, W.A. (1989). Learning and transfer of measurement tasks. In K.Bece & C Lewis, (eds.,) **Proc. CHI'89 Conference on Human Factors in Computing Systems.** New York: Ass. for Computing Machinery, 115-120.

Lewis, C., & Norman, D. (1986). Designing for error. In D.A. Norman, & S.W. Draper (Eds.), **User-centered system design:**

New perspectives on human-computer interaction. Hillsdale, NJ: Erlbaum. 411-432.

Liberman R.P., & Eckman, T.A. (1989). Dissemination of skills training modules to psychiatric facilities. **British Journal of Psychiatry, 155, (suppl. 5),** 117-122.

Lipsedge M.,Summerfield A., Lazzari,N., Van Beeston,M. (1987) Jobs & Computers, Information Technology Training for the Long Term Day Hospital Patients. **Bulletin of the Royal College of Psychiatrists.** Vol 11.

Lodding, K.N., (1983) Icon interfacing. **IEEE Computer-Graphics and Applications.** March/April, 11-20.

Louis, M. (1980). Surprise and sense making: What newcomers experience in entering unfamiliar organizational settings. **Administrative Science Quarterly, 25.226-251.**

Lovett, M.C., & Anderson, J.R. (1994) effects of solving related proofs on memory and transferin geometry problem solving. **Journal of Experimental Psychology: Learning, Memory and Cognition, 20,2** 366-378.

Mack R.L., Lewis, C.H., & Carroll J.M. (1987) Learning to Use Word Processors:Problems and Prospects. In R.M. Baecker &

W.A. Buxton (eds) **Readings in Human-Computer-Interaction: A Multidisciplinary Approach.** California:Morgan Kaufmann Publ.Inc., 269 - 277.

MacKenzie, I.S., Sellen, A., & Buxton, W. (1991) A comparison of input devices in elemental pointing and dragging tasks. In S.P. Robertson, G.M. Olson, & J.S. Olson, (eds.,) **Proc. CHI'91: Human Factors in Computing Systems.** New Orleans: ACM, 161-166.

Maclean, A., Barnard, P.J. & Wilson, M.D. (985). Evaluating the human interface of a data entry system: user choice and performance measures yield different trade off functions. In P. Johnson & S. Cook (eds.). **People and Computers. Designing Interface.** Cambridge: Cambridge University Press pp 177-185.

Maquire, M. (1982) An evaluation of published recommendations on the design of man-computer dialogues. **International Journal of Man-Machine Studies**,16, 237-261.

Massel, K., Liberman, R.P., Mintz, J., Jacobs, H.E., Rush, T.V., Giannini, C.A., & Zarate, R. (1990). Evaluating the capacity to work of the mentally ill. **Psychiatry, Vol. 53,** 31-43.

Mayer, R.E. (1976) Some conditions of meaningful learning for computer programming: Advance organizer and subject control of frame order. **Journal of Educational Psychology 68,** pp 148-155

Mayer, R.E. (1981) The psychology of how novices learn computer programming. **Computing Surveys, 13** pp 121-128.

McAnaney D., & Duffy S.(1988).**An Analysis of the Cognitive Demands of Using a Microcomputer** Dublin: Rehabilitation Institute.

McDonald, J.E., & Schvaneveldt, R.W. (1988). The application of user knowledge to interface design. In R.Guindon (Ed.), **Cognitive Scienceand its applications to human-computer interaction.** Hillisdale, NJ:Erlbaum.

Mehlenbacher, B., Duffy, T.M.,& Palmer,J.(1989). Finding information on a menu organization to the user's goals. **Human-Computer Interaction, 4** 231-251.

Meichenbaum, D. (1977) **Cognitive and Behaviour Modification: An Integrative approach.** New York: Plenum.

Melton, A. (1963) Implications of shortterm memory for a general theory of memory. **Journal of Verbal Learning and Verbal Behaviour,** 2, 1-21.

Midgley, G. (1990). The Social Context of Vocational Rehabilitation for ex-psychiatric patients. **British Journal of Psychiatry, 156.** 272-277.

Midgley, G., & Floyd, M. (1988) **Microjob: A Computer Training Service for People with Disabilities.** London: Rehabilitation Resource Centre.

Milech, D., Kirsner, K., Roy, G., & Waters, B. (1993). Application of psychology to computer based tutoring systems. **Inter. J. of Human - Computer Interaction 5, 1.** pp 23-40.

Miller, G.A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. **Psychological Review, 63.** 81-97

Miller, G.A., Galanter, G., & Pribram, K.H. (1960) **Plans and the Structure of Behaviour,** New York, Holt, Rinehart & Winston.

Miller, R.B. (1962). Task description and analysis. In R.M. Gagn'e, (ed.). **Psychological Principles in System Development.** New York: Holt, Rinehart, & Winston.

Miller, R.B. (1967) Task taxonomy: science or technology? In W.T. Singleton, R.S. Easterby & D.C. Whitefield (eds). **The Human Operator in Complex Systems.** London: Taylor & Francis.

Miller, R.B. (1973) Development of a taxonomy of human performance: Design of a systems task vocabulary. **JSAS Catalog of Selected Documents in Psychology,** 3, pp. 29-30

Miller, W. R. (1975) Psychological deficit in depression. **Psychological Bulletin, 82,** 238 - 260.

Minsky, M. (1975) A framework for representing knowledge. In P.H. Winston (ed.), **The psychology of Computer Vision.** New York: McGraw-Hill.

Miyata, Y., & Norman, D.A. (1986) Psychological issues in support of multiple activities. In D.A. Norman & S.W. Draper (Eds.), **User-centered system design: New perspectives on human-computer interaction.** Hillsdale NJ: Erlbaum. pp. 265-284.

Monk, A. (1986).Mode errors: A user-centered analysis and some presentative measures using keying-contigent sound. **International Journal of Man-Machine studies, 24,4.** 313-327.

Monsell, S.(1981) Representation, processes, memory mechanisms : the basic components of cognition. **Journal of the American Society of Information Science, 32.** pp 378-385.

Moran, T.P. (1978) Introduction to the Command Language Grammar.**Report no:ssl-78-3.** Palo Alto Calif.: Xerox Corp.

Moran, T.P. (1981) The Command Language Grammar a representation for the user interface of interactive computer systems. **International Journal of Man-Machine Studies,** 15(1), pp. 3-50.

Moran, T.P. (1983) Getting into a system: external -internal task mapping analysis. **CHI'83 Conference in Human Factors in Computing Systems.** (Boston). New York: ACM, pp 45-4

Moray, N. (1967). Where is capacity limited? A survey and a model. **Acta Psychologica, 27** pp 84-90.

Moray, N. (1977). **Workload Measurement,** New York: Plenum.

Morgan, K., Morris, R.L. & Gibbs, S. (1991). When does a mouse becomes a rat? or ... Comparing the performance and preferences in direct manipulation and command line environment. **Computer Journal, 34,** 265-271.

Morris, D., & Edward, R.R. (1984). Intergrating psychosocial rehabilitation into the hospital psychiatric services. **Hospital & Community Psychiatry, 35.** 1017-1023.

Morris, M.J. (1994) User interface design for older adults. **Interacting with Computers, Vol 6, 4** pp 373-393.

Mueller, J.H. (1976). Anxiety and cue utilization in human learning and memory. In M. Zuckerman & C.D. Spielberger (eds.), **Anxiety: New Concepts, Methods and Application.** New York: Lawrence Erlbaum.

Murdock, B.B.,Jr. (1961). Short-term retention of single paired-associates. **Psychological Reports** 8, 280.

Murphy, G.L.(1988). Comprehending complex concepts. **Science, 12.** 529-563.

Murphy, G.L. (1993). Theories and concept formation. In F. Mechelen, J. Hampton, R. Michalski & p. Theuns (Eds.) Goals and concepts: Theoretical views and inductive analysis. London: Academic Press. 173-200

Murphy, G.L., Allopenna P.D.(1994). The locus of Knowledge effect in concept learning. **Journal of Experimental Psychology: Learning, Memory and Cognition, Vol 20 (No 4)** 904-919.

Murphy, G.L., & Wisniewski, E.J. (1989) Feature correlations in conceptual representations. In G. Tibergien (Ed) **Advances in Cognitive Science: Vol 2. Theory and applications.** Chichester: Ellis: Horwood, 23-45.

Mutter, P. & Johns E.E. (1985) Learning logographics and alphabetic codes. **Human Learning, 4,** 105-125.

Mutter, P. & Mayson, C. (1986) The role of graphics in item selection from menus. **Behavior & Information Technology, 5.** 89-95.

Navon, D., (1984). Resources: a theoretical soupstore? **Psychological Review, 91,** 216-234.

Newell, A. (1980) Reasoning, problem solving and decision processes. The problem space as a fundamental category. In R Nickerson (ed.) **Attention and Performance, Vol 8.** Hillsdale NJ: Lawrence Erlbaum Associates 54 -106.

Newell. A. & Simon, H.A. (1972) **Human Problem Solving.** Englewood Cliffs, NJ: Prentice-Hall.

Nielsen, J.(1989). **Coordinating user interfaces for consistency.** San Diego, CA: Academic.

Nisbett, R., & Ross, L.(1980). **Human inference: Strategies and Shortcomings of Social Judgment.** Engelwood Cliffs, N.J: Prentice - Hall.

Nissen, M.J. & Bullemer, P. (1987). Attentional requirements of learning: Evidence from performance measures. **Cognitive Psycho-logy, 19,** 1-32.

Norman, D.A. (1983). Some observations on Mental Models. In D. Genter & A.L. Stevens (eds.) **Mental Models**. Hillsdale N.J: Lawrence Erlbaum Associates. 7-14.

Norman, D.A. (1984). Stages and levels in Human Computer interaction. **International Journal of Man-Machine Studies.** 21, pp. 365 - 375.

Norman, D.A. (1985). Four stages of User Activities. **Human Computer Interaction - Interact'84,** 507-511.

Norman, D.A.(1986) Cognitive engineering. In D.A. Norman & S.W. Draper (eds.). **User Centred System Design.** Hillsdale, N.J.: Lawrence Erlbaum Associates, 31-62.

Norman D.A. & Bodrow, D.G.,(1975). On data -limited and resource limited processes. **Cognitive Psychology, 7** 44.

Novick, L.R., & Holyoak, K.J. (1991). Mathematical problem solving by analogy. **Journal of experimental Psychology, Learning, Memory,& Cognition, 17** pp 398-416.

Nwana, H.S. (1990). Intelligent tutoring systems: An overview. **Artificial Intelligence Review, 4.** pp 251-277.

Olson, J.R. (1987) Cognitive analysis of people's use of software. In J.M. Carroll (ed.). **Interfacing thought:**

Cognitive Aspects of Human Computer Interaction. Cambridge, Mass: MIT Press, pp. 260-293.

Olson, J.R., & Nilsen, E. (1988). Analysis of the cognition involved in spreadsheet software interaction. Human-Computer Interaction, 3, 309-350.

Olson, J.R., & Olson, G.M. (1990). The growth of cognitive modeling in human-computer interaction since GOMS. Human computer Interaction, 5, 221-265.

Parasuraman S., & Igbaria, M. (1990) An examination of gender differences in the determinants of computer anxiety and attitudes towards microcomputers among managers. Interantional Journal Man-Machine Studies, 32, pp 327-340.

Parkes, K.R.(1984). Locus of control, cognitive appraisal, and coping in stressful episodes. Journal of personality and social psychology, 46 655-668

Parkin, A.J., Reid, T.K., & Russo, R. (1990). On the differential nature of implicit and explicit memory. Memory and Cognition, 18, 507-514.

Parkin, A.J., & Rosso, R.(1990). Implicit and explicit memory and the automatic/effortful distinction. European Journal of Cognitive Psychology, 2, 71-80.

Payne, S. (1984). Task - actions grammars. In B. Shackel (ed). Human Computer Interaction - INTERACT'84. Amsterdam: North Holland, pp. 527-532.

Payne, S. & Green, T.R.G. (1986). Task action grammars: a model of the mental representation of task languages. Human Computer Interaction, 2 (2) pp.93 -133.

Payne, S. & Green, T.R.G. (1989). The structure of command language: an experiment on task-action grammar. International Journal of Man-machine Studies, 30, 213-234.

Pazzani, M.J. (1991). Influence of prior knowledge on concept acquisition: Experimental and computational results. Journal of Experimental Psychology: Learning, memory, and Cognition, 17. 416-432.

Perrewe, P.L. (1986). Locus of control and type A behavior patterns as moderator in the quantitative job demands-satisfaction/ psychological stress relationship: an experimental analysis. Journal of applied Social Psychology, 16 620-632.

Phillips, J. & Hughes, B. (1988). Internal consistency of the concept of automaticity. In A.M. Colley & J.R. Beech (eds.). **Cognition and Action in Skilled Behaviour.** Amsterdam: N. Holland.

Pilgrim, J. (1990) On the training of EDP novices on the personal computer. **International Journal Man-Machine Studies, 32,** pp 399-421.

Pirolli, P. (1991) Effects of examples and their explanations in a lesson of recursion: A production system analysis. **Cognition & Instruction, 8.** pp 207-259.

Pirolli, P.,& Recker,M.(1994). Learning strategiesand transferin the domain of programming. **Cognition & Instruction, 12.** 235-275.

Polson P.G. (1987) A quantitative theory of human-computer interaction. In J.M. Carroll (ed.), **Interfacing thought: Cognitive Aspects of Human-computer Interaction.** Cambridge, MS: Bradford Books/ MIT Press. 184-235

Polson P.G., & Kieras D.E. (1985a). A quantitative model of the learning and performance of text editing knowledge. In **Proceedings of CHI'85 Human Factors in Computing Systems.** (San Fransisco), New York: ACM, pp 207-212.

Polson, P.G., & Kieras D.E. (1985b). An approach to the formal analysis of user complexity. **International Journal of Man-Machine Studies, 22** 365-394.

Polson, P.G., Muncher, E., & Engelbeck, G. (1986). A test of common elements theory of transfer. In M. Mantei & P. Orbeton (eds.) **Proceedings CHI'86 Human Factors in Computer Systems.** New York: Association for Computing Machinery. pp 78-83

Pradad, A., Bhagat, A., & Padankatti, B.S. (1991). A community day care programme for psychiatric patients: the role of OF. **International journal of Rehabilitation Research, 14,** 163-173.

Rimmerman, A., Finn, H., Schnee, J., & Klein, I. (1991) Token reinforcement in the psychosocial rehabilitation of individuals with chronic mental illness: is it effective over time? **International Journalof Rehabilitation Research, 14.** 123-130.

Roberts, C. (1986) The use of Computers in Occupational Therapy at the Rehabilitation Unit. **A Review. British Journal of Occupational Therapy, 49** 157-160.

Roberts, T.L. & Moran, T.P. (1982). Evaluation of text editors. In **Proceedings of Human Factors in Computer Systems.** (Gaithersburg). New York: ACM, pp. 136-146.

Roberts, T.L. & Moran, T.P. (1983). The evaluation of text editors: methodology and empirical results. **Communication of the ACM,** 26 (4), pp. 265-283.

Robertson, S.P., and Black, J.B. (1983). Planning in text editing behaviour. In A. Janda (Ed.), **Human Factors in Computing Systems,** New York, North-Holland.

Rogers, W.A. (1992). Target and distractor learning in visual search: Age related differences. **Psychology and aging, 7** 526-535.

Rogers, W.A., & Fisk, A.D. (1991). Are age differences consistent-mapping visual search due to feature learning or attention training? **Psychology and Aging, 6** 542-550.

Rogers, W.A., Fisk, A.D., & Hertzog, C. (1994) Do ability-performance relationships differentiate age and practice effects in visual search? **Journal of Experimental Psychology: Learning, Memory, and Cognition. 20, 3.** 710-738.

Rosch, E. & Lloyd, B.B. (1978). **Cognition and Categorization.** Hillsdale, NJ: Lawrence Erlbaum Assoc.

Rouse , W.B., Rouse, S.H., & Pellegrino, S.J., (1980). A rule based model of human problem solving performance in fault diagnosis tasks. **IEEE. Transactions on System, Man and Cybernetics 10.** pp 366.

Rumelhart, D.E. & McClelland, J.L. (1986) **Parallel Distributed Processing: Explorations in the Microstructure of Cognition.** (Vol 1 Foundations). Cambridge, MA: MIT Press.

Rumelhart, D.E. & Ortony, A. (1977). The representation of knowledge in memory. In R.C. Anderson, R.J. Spiro & W.E. Montague (Eds.) **Schooling and the Acquisition of Knowledge.** Hillsdale, NJ: Lawrence Erlbaum Assoc.

Salvendy G. (1987). **Advances in Human Factors Ergonomics. Vol 10b.** Amsterdam: Elsevier Science Publishers B.V.

Sandler, J., & Harazi, A. (1960) The obsessional on the psychological classification of obsessional traits and symptoms. **British Journal of Medical Psychology, 33**, 113-122.

Scapin, D.L. (1981). Computer commands in restricted natural language some aspects of memory and experience. **Human Factors.** 23 (3), 365-375.

Schneider, W. & Fisk, A.D. (1983). Attention and mechanisms for skilled performance, In R.A.Magill (ed.), **Memory and Control of Action.** Amsterdam: North-Holland.

Schneider, W. & Shiffrin, R.M. (1977). Controlled and automatic information processing: I Detection, search andattention. **Psychological Review, 84** 1-66.

Seligman, M.E.P. (1975) **Helplessness.** San Fransisco: W.H. Freeman.

Seppalainen, R. (1990) Transition from rehabilitation to work. In **Proc. 5th European Regional Conference of Rehabilitation International.** Dublin, Ireland: NRB, 142-144.

Seyfried, E. (1991). Vocational assessment and evaluation for persons with psychiatric disabilities. In **Report of the seminar of the Vocational Commission, Vocational Assessment and Evaluation.** Rehabilitation International,pp 34-47.

Shank, R.C. & Adelson R.P. (1977) **Scripts, Plans, Goals and Understanding,** Hillsdale, NJ, Erlbaum.

Sheridan, T. (1980). Mental Workload. What is it? Why bother with it? **Human Factors Society Bulletin** 23, 1-2.

Shepherd, G. (1984). **Institutional Care and Rehabilitation.** London: Longman.

Shiffrin, R.M. (1988). Attention. In R.C. Atkinson, R.J. Hernstein, & R.L. Luce, (Eds.), **Steven's Handbook of Experimental Psychology: Vol. 2. Leraning and Cognition (2nd ed.,)** New York: Willey. 738-811.

Shiffrin, R.M. & Czerwinski, M.P. (1988). A model of automatic attention attraction when mapping is partially consistent. **Journal of Experimental Psychology: Learning, Memory, and Cognition, 14**,562-569.

Shiffrin, R.M. & Dumais, S.T. (1981). The development of automatism. In J.R. Anderson (ed.),**Cognitive Skills and their Acquisition.** Hillsdale, NJ:Erlbaum.

Shneiderman, B. (1979). Human factors experiments in designing interactive systems. **Computer,** 12, 9-24.

Shneiderman, B. (1980). **Software Psychology: Human Factors in Computer and Information Systems** Cambridge Massachusetts: Winthrop Publishers.

Simon, H.A. (1974) How big is a chunk? **Science 183**. pp 482.

Singley, M.K., Carroll, J.M. & Albert, S.R. (1991). Psychological design rationale for an intelligent tutoring system for small-talk. In Koenmann-Belliveau,J., Moher, T.G. & Robertson, S.P(eds). **Empirical Studies of Programmers Fourth workshop.** Ablex, pp 106-209.

Slator, B.M., Anderson , M.P., & Conley, W (1986). Pygmalion at the interface. **Communication of the ACM, 29, 7,** 599-604.

Smelcer, J.B., & Walker, N.(1993). Transfer of knowledge across computer command menus. **International Journal of Human-Computer Interaction 5(2).** 147-165.

Sneeringer, J.(1978). User interface design for text editing: a case study. **Software - Practice and Experience.** 8, 543-557.

Solomon, P., Gordon, B.H., & Davis, J.M. (1984). **Community services to Discharged Psychiatric Patients.** Springfield,IL: Charles S. Thomas.

Spaniol, L., & Zipple, A. (1988). Family and professional perceptions of family needs and coping strength. **Rehabilitation Psychology, 33.** 37-45.

Spelke, E., Hirst, W., & Neisser, U. (1976) Skills of divided attention. **Cognition, 4,** 215-230.

Sproull, L.S., Kiesler, S., & Zubrow, D. (1984) Encountering an alien culture. **Journal of Social Issues, Vol 40, No 3** pp 31-48

Squire, L.R. (1986) Mechanisms of memory. **Science, 232,** 1612-19.

Squire, L.R., & Frambach, M. (1990). Cognitive skills learning in amnesia. **Psychobiology, 18.** pp 109-117.

Staggers, N., & Norcio, A.F. (1993). Mental models: Concepts for human computer interaction research. **International Journal of Man-machine Studies, 38.** 587-605.

Stewart, T.F. (1976). Displays and the software interface. **Applied Ergonomics.** 2 (3), 137-146

Stevens, B. C. (1973) Evaluation of rehabilitation for the psychotic patients in the community. **Acta Psychiatrica Scandinavica, 49,** 169-180.

Streitz, N.A., Spijkers, W.A.C., & van Duren, L.L. (1987). From novice to expert user: A transfer of learning experiment on different interaction models. In H.J. Bullinger & B. Shackel (Eds.), **Human-computer interaction: Interact'90.** Amsterdam: North-Holland.

Suchman, L.A. (1987). **Plans and situated actions:The problem of human machine communication.** Cambridge UK: Cambridge University Press.

Summerfield, A., & Lipsedge, M. (1987) **Training in Microcomputer for Chronic Psychiatric Patients.** University of London Intercollegiate Unit on Rehabilitative Sciences. Paper presented to Microcomputers, Psychology and Medicine Workshop. CIBA Foundation.

Summerfield, A., & Lipsedge, M. (1990). Training in Microcomputing for chronic psychiatric patients. In R. West, M. Christie, & J Weinman. (eds.,) **Microcomputers, Psychology and Medicine.** London: John Wiley & Sons.

Summerfield, A., Lipsedge, M., & O'Flynn. (1993). The foundat ions and development of the Speedwell Information Technology Project. In M. Floyd (eds.), **Information Technology Training for people with disabilities.** Kingley Publ: London.

Sweller, J., Mawer, R.F., & Ward, M.R. (1983). Development of expertise in mathematical problem solving. **Journal of Experimental Psychology: General.** 112, 4, 639-661.

Tagg, S.K. (1981). The user interface of the data analysis package : some lines of development. **Internatio nal Journal of Man Machine Studies,** 14, 297-316.

Taylor, M. (1988) Layered protocols for computer human dialogue I: Principles. **International Journal of Man-Machine Studies, 28,2.** 175-218.

Teasdale, J. D. (1978) Effects of real and recalled success on learned helplessness and depression. **Journal of Abnormal Psychology, 87,** 155-164.

Thomas, E.L. & Robinson, H. A. (1972) **Improving Reading in Every Class. A source Book for Teachers.** Boston: Allyn & Bacon.

Thomas, J.C., & Carroll J.M. (1979). The psychological study of design. **Design Studies 1,** 5.

Thomas, J.C. & Carroll, J.M. (1981). Human factors in communication. **IBM Systems Journal, 20.** pp 237.

Thorndyke, P.W. & Statz, C. (1980). Individual differences in procedures for knowledge acquisition of maps. **Cognitive Psychology. 12** 137-175.

Thornicroft, G., & Bebbington, P. (1989). Deinstitutionalisation - from hospital closure to service development.**British Journal of Psychiatry, 155** 739-753.

Treu S. (1992). Interface structures: conceptual, logical and physical patterns applicable to human-computer interaction. **International Journal of Man-Machine Studies 37,** 565-593.

Tulving, AE., (1972). Episodic and semantic memory. In E. Tulving & W. Donalson (eds.). **Organization of Memory.** New York: Academic Press. pp. 381-403.

Ulich, E., Rauterberg, M., Moll, T., Greutmann, T., & Strohm, O. (1991). Task orientation and user-oriented dialogue design. **International Journal of Human-computer interaction, 3.** 117-144.

Van Der Veer, G.C., Green, T.R.G., Hoc J.M., & Murray D.M. (1988). **Working with Computers: Theory Versus Outcome,** London: Academic Press, LTD.

Van der Veer, G.C. Tauber, M.J., Waern, Y. & van Muylwijk, B. (1985). On the interaction between system and user characteristics. **Behaviour and Information Technology. 4** 289-308.

Van Lehn, K. (1983) **Human Procedural Skill Acquisition: Theory Model & Psychological Validation.** London: Academic Press, LTD.

Vaughn, C.E. & Leff, J.P. (1976). The influence of family and social factors on the course of psychiatric illness. **British Journal of Psychiatry, 129**, 125-137.

Verdolini-Marston, K., & Balota, D.A.(1994). Role of Elaborative and perceptual integrative processes in perceptual motor performance. **Journal of Experimental Psychology: Learning, memory and Cognition. 20,3.** 739-749.

Volans, P.J. (1976) Styles of decision making and probability appraisal in selected obsessional and phobic patients. **British Journal of Social and Clinical Psychology, 15**,305-317.

Vossen, P.H., Sitter, S., & Ziegler, J.E. (1987). An empirical validation of cognitive complexity theory. In H. Bullinger &

B. Shackel, (eds.,) **Human-Computer Interaction, INTERACT'87.** Amsterdam: Elsevier, N. Holland. 309-316.

Waern, Y. (1985). Learning computerized tasks as related to prior task knowledge. **International Journal of Man-Machine Studies, 22** 441-455.

Waern, Y. (1989). **Cognitive Aspect of Computer Supported Tasks.** New York: John Wiley & Sons.

Watt, P. (1984) Computers give independence to the disabled. **Infoworld, 6** 30-31

Watts F. N., Bennett D. H. (1983) **Theory and Practice of Psychiatric Rehabilitation.** Chichester: John Wiley & Sons.

Webb, M. (1990). An investigation of the vocational needs of people with a serious permanent disability. **In Proc. 5th European Regional Conference of Rehabilitation International.** Bublin, Ireland:NRB, 688-694.

Weissman, M.M. & Paykel, E.C. (1974). **The Depressed Woman: A Study of Social Relationships.** Chicago: University of Chicago Press.

Welford, A.T. (1978). Mental workload as a Function of Demand, Capacity, Strategy and Skill. **Ergonomics 21,** 151-167.

Wener, A. E., & Rehm, L. P. (1975) Depressive affect:A test of behavioral hypotheses. **Journal of Abnormal Psychology, 84,** 221-227.

Whiteside, J. & Wixon, D. (1987). Discussion: improving human-computer interaction - a quest for cognitive science. In J.M. Carroll (ed.). **Interfacing Thought: Cognitive Aspects of Human-Computer-Interaction.** Cambridge, Mass: MIT Press pp 353-365.

Willingham,D.B., Nissn, M.J., & Bullemer, P. (1989). On the development of the procedural knowledge. **Journal of Experimental Psychology: Learning, Memory, Cognition, 15,** pp. 1047-1060.

Wilson M.D., Barnard J. P., Green T.R.G., & Maclean A. (1988) Knowledge based task analysis for human Computer systems. In G.C.

Wilson, M.D., Barnard, P.J. & Maclean, A. (1985) User learning of core command sequences in a menu system. **IBM Hursley Human Factors Report HF114.** IBM United Kingdom Laboratories Ltd., Hursley Park, Winchester, UK.

Wine, J. (1978) Cognitive-attentional theory of test anxiety. In I. Sarason, (ed.), **Test Anxiety Theory, Research & Applications.** New York: Lawrence Erlbaum.

Wing, J.K. (1989). The concept of negative symptoms. **British Journal of Psychiatry** 155: Supl.7, 10-14.

Wing, J.K. & Brown, G.W. (1970). **Institutionalism and Schizophrenia.** Cambridge: Cambridge University Press.

Wisniewski, E.J., & Medin, D.L. (1991). Harpoons and long sticks. The interaction of theory and similarity in rule induction. In D.H. Fisher, M.J. PAzzani, & P. Langley (Eds.), **Concept formation Knowledge and Experience in unsupervised learning.** San Mateo, CA: Morgan Kaufman.

Wong, S.E., Woolsey, J.E., & Gallegos, E. (1987). Behaviour treatment of chronic psychiatric patients. **Journal of Social service Research, 10.** 7-35.

Yerkes, R.M. & Dodson, J.D. (1908). The relation of strength of stimulus to rapidity of habit-formation. **Journal of comparative Neurology and Psychology,** 18, 459-482.

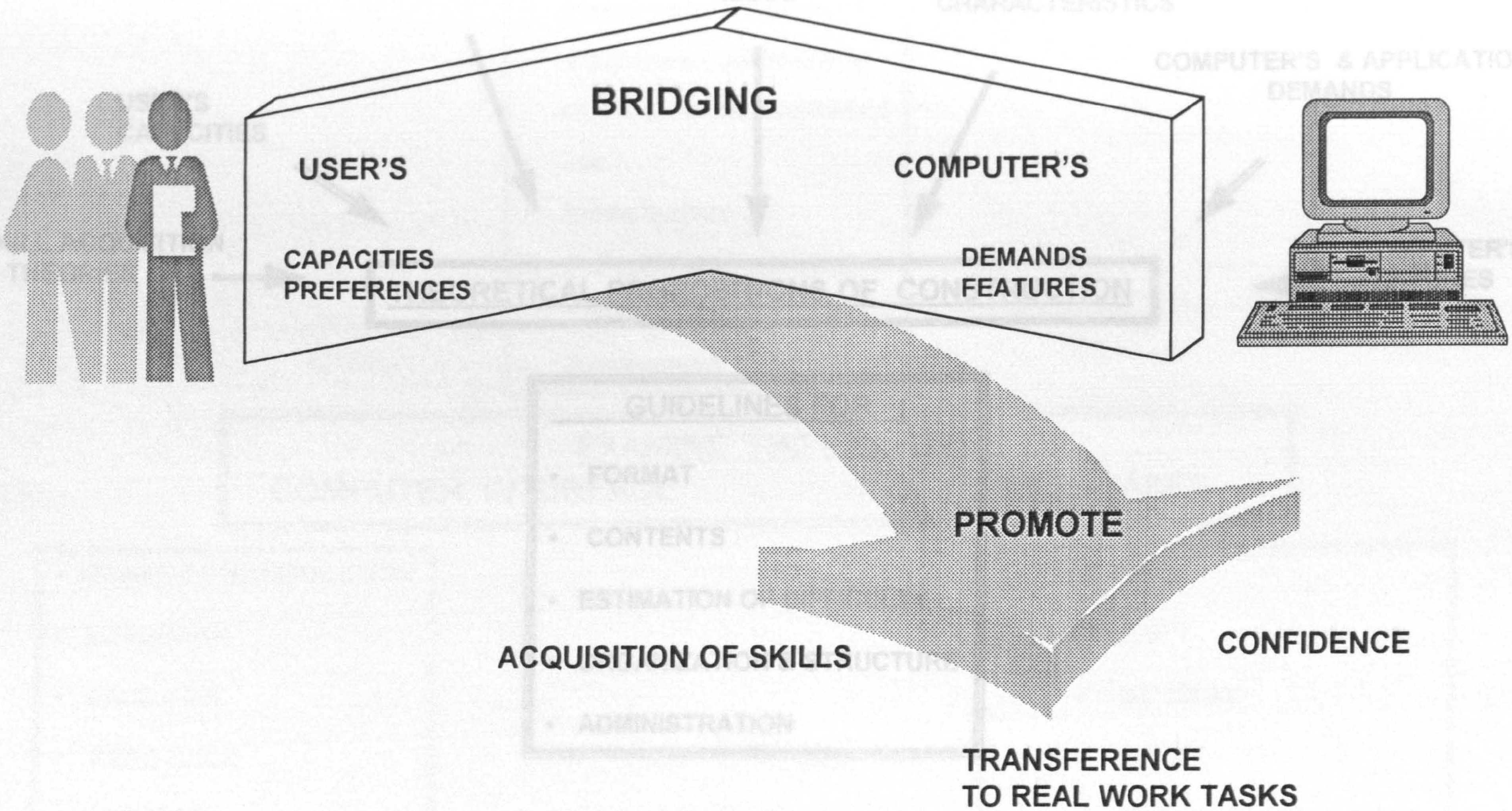
Ziegler, J.E.,& Fahnrich, K.P. (1988). Direct manipulation. In M.Helander (Ed)., **Handbook of human-computer interaction**.W Amsterdam: Holland. 123-133.

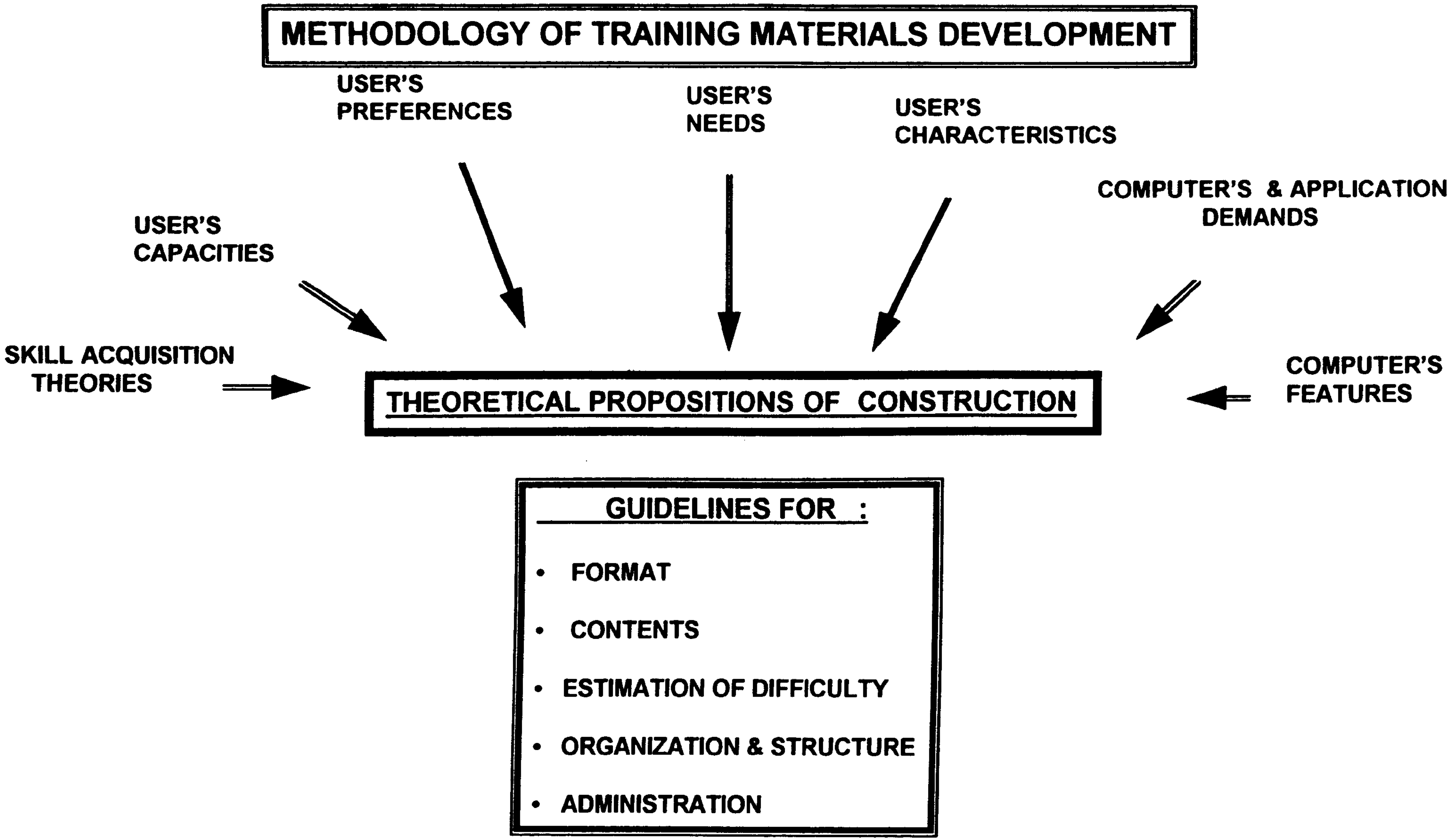
Zubin, J. (1987). Possible implications of the volnerability hypothesis of the psychosocial management of schizophrenia. In W. Boker, & H.D. Brenner (Eds.,) **Psychosocial treatment of Schizophrenia.** Toronto: Hans Huber.

APPENDIX I

CONSTRUCTION METHODOLOGY OF GOFT TRAINING MATERIALS.

OBJECTIVES OF TRAINING MATERIALS




METHODOLOGY OF TRAINING MATERIALS DEVELOPMENT
USER'S PREFERENCES
USER'S NEEDS
USER'S CHARACTERISTICS
USER'S CAPACITIES
COMPUTER'S & APPLICATION DEMANDS
SKILL ACQUISITION THEORIES
THEORETICAL PROPOSITIONS OF CONSTRUCTION
COMPUTER'S FEATURES
GUIDELINES FOR :
• FORMAT
• CONTENTS
• ESTIMATION OF DIFFICULTY
• ORGANIZATION & STRUCTURE
• ADMINISTRATION

EXAMINE WHO THE USER IS ?

- CAPACITIES & ABILITIES
- COMPUTER SKILL EXPERTISE
- EDUCATION / KNOWLEDGE
- PREVIOUS WORK EXPERIENCE
- AGE
- EXPECTATIONS
- PERSONALITY
- VULNERABILITIES
- PREFERENCES

EXAMINE THE FEATURES OF

COMPUTER INTERFACE

- MEANS OF MANIPULATION
- LANGUAGE
- FACILITIES
- FEED BACK
- NOVELTY

REAL TASKS

- VARIETY
- COMPLEXITY
  - ✓ NOVELTY
  - ✓ DATA
  - ✓ COGNITIVE OPERATIONS

• THE USERS OF THE DEVELOPED MATERIALS

USER'S CHARACTERISTICS

✓ AGE
- FROM 18 TO 55

✓ N OVICE IN EXPERIENCE

✓ ABILITIES
- LOW ATTENTION, CONCENTRATION,
- REDUCED STAMINA
- SLOW MOTOR -PERCEPTUAL SKILLS
- REDUCED WORKING MEMORY
- LOW PROBLEM SOLVING ABILITIES
- LOW LITERACY & NUMERICAL SKILLS

✓ PERSONALITY
- LOW FRUSTRATION TOLERANCE
- FLUCTUATION IN MOTIVATION
- LOW SELF ESTEEM & CONFIDENCE
- EASILY DISCOURAGED
- PRESERVE CONTROL & PRIVACY

USER'S BACKGROUND

- LOW SOCIO-ECONOMIIC
- MINORITY GROUPS

✓ EDUCATION :
- UNIVERSITY DEGREES (12%)
- HIGH SCHOOL (76%)
- DROPPED HIGH SCHOOL (12%)

✓ WORK EXPERIENCE: :
- NO WORK (25%)
- OFFICE WORK (30%)
- OTHER WORK (45%)

SUSTAIN OPTIMAL COMPLEXITY & CHALLENGE ACROSS TRAINING

- **THEORIES /REFERENCES**

- **AROUSAL & MOTIVATION:**

  Ghani, 1991, Ghani & Deshphande, 1994, Csiksentimihalyi, 1990,

- **TASK RELEVANCY**

  Carroll, 1982; Carroll & Mark, 1987 Ghani & Almeer, 1989

- **ADULT LEARNING**

  Jarvis, 1983

- **MENTAL HEALTH REHAB..**

  Wing, 1989, Kennedy, 1975 Webb, 1990, Brenner, 1989, Carver & Sheier, 1983, Zubin , 1987, Wing Brown, 1970, Herz, & Menville, 1980.

GUIDELINES OF CONSTRUCTION

- ORGANIZE MATERIALS
- ESTIMATE COMPLEXITY
- INCLUDE REAL TASKS
- PROVIDE CLOSURE & SENSE OF ACCOMPLISHMENT.
- FLEXIBLE RATE OF LEARNING

ENSURE A POSITIVE & MEANINGFUL EXPERIENCE FROM THE BEGINNING OF TRAINING

- **THEORIES / REFERENCES**
- **AROUSAL & MOTIVATION:**
  Ghani & Deshphande, 1994,
- **ANXIETY & NEGATIVE ATTITUDES**
  Parasuraman & Igbaria, 1990.
- **TRANSFERENCE OF SKILLS**
  Loft, Anderson, 1994; Hammond & Barnard, 1984
- **alien NATURE OF COMPUTERS..**
  Carver et al., 1979; Carver & Scheier, 1977

GUIDELINES OF CONSTRUCTION

- **ORGANIZE MATERIALS**
- **ESTIMATE COMPLEXITY**
- **INCLUDE REAL TASKS**
- **PROVIDE CLOSURE & SENSE OF ACCOMPLISHMENT.**
- **FLEXIBLE RATE OF LEARNING**

CONSIDER THE CAPACITY OF NOVICE USERS.

- **THEORIES / REFERENCES**

SELECTIVE ATTENTION:

Kahneman, 1973, Schneider & fisk, 1983, Schneider & Shiffrin, 1977, Shifrin & Dumais, 1981; Parkin & Rosso, 1990; Damasio, 1989; Verdolini-Marston, Balota, 1994.

WORKING MEMORY

Murdock, 1961, Miller, 1956, Melton, 1963; Moray, 1967; Norman & Bodrow, 1975; Baddeley, 1981, 1986; Katajima, 1989 .

MOTOR / PERCEPTION

Card, Moran Newell, 1983, Ackerman, 1988, Jackson & Roske, 1989; Mackenzie, Sellen, & Buxton, 1991.

LONGTERM MEMORY.

Squire, 1986, Rosch & Lloyd, 1978, Anderson, 1981, 1983; Chechile, et al., 1989; Gugerty, 1993, Parkin, Reid, & Rosso, 1990;

READING CAPACITY

Anderson, 1981, Wisniewski & Medin, 1991; Pazzani, 1991, Murphy, 1988, 1993, Murphy, Allopena, 1994,

MENTAL REHAB.

Seyfried, 1991, Brenner, 1990;1989 , Giambra et al. 1978, Volans, 1976.

GUIDELINES OF CONSTRUCTION

- ORGANIZE MATERIALS
-
- ESTIMATE COMPLEXITY
-
- INCLUDE REAL TASKS
-
- PROVIDE CLOSURE & SENSE OF ACCOMPLISHMENT.
-
- FLEXIBLE RATE OF LEARNING

CONSIDER THE DEMANDS OF THE SYSTEM..

- **THEORIES / REFERENCES**

INTERFACE LANGUAGE:

Stewart, 1976, Kennedy, 1975, Capindale & Crawford, 1990, Scapin 1981, Slator, Anderson & Conley 1986, Wisniewski & Medin, 1991; Pazzani, 1991, Murphy, 1988, 1993, Murphy, Allopena, 1994

SYSTEM MANIPULATION

Lee, 1991, Hutchins, et al, 1986, Norman, 1986, Taylor, 1988, Treu, 1992, Ziegler & Fahnrich, 1988, Suchman, 1988, Schneiderman, 1980, Nielsen, 1989, Smelcer, & Walker, 1993, Mehlenbacher, Duffy & Palmer, 1989. .

COMMON ERRORS

Norman, 1983, Van Lehn, 1983, Lewis Norman, 1986, Monk, 1986, Carroll & McKendree, 1987.

NOVELTY

Sproull, Kiesler, Zubrow, 1984, Louis, 1980, Carver & Sheier, 1981.

GUIDELINES OF CONSTRUCTION

- PROVIDE DECLARATIVE INFORMATION
- EXPLAIN COMMANDS & MESSAGES
- ESTIMATE DEMANDS ON PHYSICAL & COGNITIVE RESOURCES
- FOSTER VERIFICATION
- PROVIDE DESIRED OUTCOME
- IDENTIFY FREQUENT ERRORS DUE TO DEXTERITY DIFFICULTIES OR PRECONCEPTIONS.

CONSIDER THE DUAL NATURE OF COMPUTER INTERACTION.

- **THEORIES / REFERENCES**

SELECTIVE ATTENTION:

Kahneman, 1973, Schneider & fisk, 1983, Schneider & Shiffrin, 1977, Shifrin & Dumais, 1981; Parkin & Rosso, 1990; Damasio, 1989; Verdolini-Marston, Balota, 1994.

WORKING MEMORY

Murdock, 1961, Miller, 1956, Melton, 1963; Moray, 1967; Norman & Bodrow, 1975; Baddeley, 1981, 1986; Katajima, 1989 .

ALLOCATION OF RESOURCES

Navon, 1984,

COGNITIVE DEMANDS OF REAL TASKS

Feuerstein, 1979; McAnanney & Dyffy, 1988, Occupations Classification, Bloom, 1965

MENTAL HEALTH REHAB

Easterbrook, 1959, Giabra & Traynor, 1978,

GUIDELINES OF CONSTRUCTION

- FOR THE ESTIMATION OF DIFFICULTY CONSIDER COMPLEXITY OF COMPUTER OPERATIONS AND OF REAL TASKS.
- ORGANIZE PRACTICE TASKS ACCORDING TO COMPLEXITY
- PROVIDE SUFFICIENT PRACTICE OPPORTUNITIES
- DIFFERENTIATE MASTERY OF OPERATIONS & ACCOMPLISHMENT OF TASKS.
- PROVIDE DECLARATIVE INFORMATION FOR TASK UNDERSTANDING.

CONSIDER THE CHANGES IN THE USER'S PROCESSING CAPACITY & INFORMATION NEEDS WITH EXPERTISE.

- **THEORIES / REFERENCES**

PROCESSING CAPACITIES:

Nissen & Bullemer, 1987, Shifrin & Dumais, 1981; Parkin & Rosso, 1990; Damasio, 1989; Fisher, et.al, 1988, Fisher & Tanner, 1992, Fisher, et al, 1988, Ackerman, 1988, 1990.

INFORMATION REQUIREMENTS

Pazzani, 1991, Murphy, 1988, Murphy, Allopenna 1994, Rosch & Lloyd, 1978, Anderson, 1983, Kay & Black, 1985,1986 Willingham, et al, 1989

SKILL ACQUISITION THEORIES.

Hayes, & Simon, 1974, Anderson, 1982,, 1983,quire, 1986, Rosch & Lloyd, 1978, Anderson, 1981, 1983; Anderson, & Fincham, 1994; Novick Holloyak, Hunt & Lansman, 1986, Larkin, 1981,

GUIDELINES OF CONSTRUCTION

- PRESERVE THE OPTIMAL COMPLEXITY ACROSS TRAINING.
- ARRANGE OPERATIONS FROM SIMPLER TO MORE COMPLEX
- ORGANIZE PROCEDURES TO FACILITATE THE COMPOSITION OF SUCCESSIVE STEPS
- PROVIDE INFORMATION FOR THE CREATION OF AN OPERATION MODEL.
- PROVIDE INFORMATION AND DIFFERENT PRACTICE TASKS TO ENHANCE TRANSFERENCE.
- PROVIDE DECLARATIVE INFORMATION

PROVIDE REALISTIC PRACTICE OPPORTUNITIES

- **THEORIES / REFERENCES**

SKILL DEVELOPMENT

Anderson, 1993 , Pirrolli, 1991, Pirrolli, & Recker, 1994, Larkin, 1981,

ATTENTION TRAINING

Shiffrin & Czerwinski, 1988; Roge rs, 1992, Fisher & Tanner, 1992..

LEARNING BY DOING

Carroll, & Mack, 1985, Jarvis, 1983

IMPORTANCE OF REAL TASKS FOR

LANGUAGECOMPREHENSION Murphy & Wisniewski, 1989,

USER'S MOTIVATION Eason, 1974,1976

USER'S EXPECTATIONS James,1981

ENHANCE TRANSFERENCE TO REAL WORK

Carroll & Mack, 1987,--------

MENTAL HEALTH REHAB.

Wong et., al., 1987, Watts & Bennett, 1983

GUIDELINES OF CONSTRUCTION

- ORGANIZE MATERIALS ACCORDING TO MODULES OF REAL TASKS
- PROVIDE SUFFICIENT PRACTICE TASK OPPORTUNITIES ACCORDING TO COMPLEXITY OF OPERATIONS & VARIETY & DIFFICULTY OF REAL TASKS.
- ORGANIZE TO ENHANCE CONSISTENT PRACTICE OF OPERATIONS
- PROVIDE CLOSURE & SENSE OF ACCOMPLISHMENT IN EVERY SESSION.

PROMOTE GOAL DIRECTED & PROBLEM SOLVING LEARNING.

- **THEORIES / REFERENCES**

GOAL DIRECTED LEARNING

Waern, 1985. Suchman, 1987; Shank & Adelson, 1977; Black, 1984; Black et al. 1982; Agre & Chapman, 1990.

PROBLEM SOLVING :

Anzai & Simon, 1979 Hammond & Barnard, 1984 , Waerm, 1989.

GOAL DIRECTED STEPS

Kreigh et al., 1990; Kay Black, 1985, 1987; Larkin, 1981, Norman 1983, 1986, Waern, 1983; Agre, 1990,

COMPUTER FEATURES

Van, Lehn, 1983, Lewis & Norman, 1986, Monk, 1986, Carroll & McKendree, 1987

GOMS MODEL

Card, Moran & Newell, 1983, Carroll & MArc, 1982, Carroll et al, 1987; Bovair, Kieras & Polson, 1990, Vossen, Zitter & Ziegler, 1987; John, 1990, Elketron, Palmiter, 1991, Olson & Nilsen, 1988.

MENTAL HEALTH REHAB.

Foulds & Dixon, 1962 Brenner, 1990;1989 , Giambra et al. 1978, Volans, 1976, Meichenbaum, 1977

GUIDELINES OF CONSTRUCTION

- DEFINE ATTAINABLE GOALS.
- COMBINE GOALS & ACTIONS
- GUIDE USER THROUGH PROCEDURES
- LINK ACTION WITH DESIRED OUTCOME.
- FOSTER VERIFICATION & INTERPRETATION OF RESULTS.
- PROVIDE DISCRIMINATORY CONDITIONS FOR THE SELECTION OF EFFICIENT METHODS

PROMOTE LEARNING BY KNOWING.

- **THEORIES / REFERENCES**

LEARNING BY KNOWING:

Suchman, 1987, Jarvis, 1983; Tulving, 1972

PRECONCEPTIONS

Murphy & Wisniewski, 1989; Nisbett, & Ross, 1980,.

INTERPRETATION OF NEW CONCEPTS

Slator et al, 1986, Schneiderman, 1980; Parkin et al., 1990, Scapin, 1981

DEFICIENT OFFICE ANALOGY.

Clement, 1984, Dewier, & Karnas, 1991, Halsz 7 Moran, 1982; Douglas & Moran, 1983; Alwood & Eliasson, 1987.

ASSESSING EFFICIENCY

Krueger & Rothbart, 1990.

ALIEN NATUREOF COMPUTERS

Carver & Scheier, 1982, Louis, 1980, Spoull et al., 1984.

& MENTAL HEALTH REHAB.

Carver, Zubin, 1987; Miller, 1978; Seligman, 1975, Teasdale, 1978.

GUIDELINES OF CONSTRUCTION

- ASSIST USER IN OVERCOMING BIAS & PRECONCEPTIONS
- INCORPORATE DECLARATIVE KNOWLEDGE
- ADVICE USERS OF COMMON ERRORS & RECOVERY OPTIONS.
- PREVENT MISAPPLICATION OF OFFICE ANALOGY.
- SUPPORT THE FORMATION OF PROCEDURAL RULES
- CREATE A MODEL OF COMPUTER OPERATIONS

CONSIDER INDIVIDUAL NEEDS & CHARACTERISTICS.

- **THEORIES / REFERENCES**

AGE :

Charmess et al, 1992; Rogers et al., 1994, Czaja et al., 1989; . Egan & Gomez, 198, Gomez et al, 1983; Fisk & Rogers, 1991; Rogers 1992.

APTITUDE- ABILITIES

Dean Whitlock, 1988; Seyfried, 1991

PREVIOUS WORK EXPERIENCE

Parasuraman & Igbaria, 1990; Arndt, feltes & Hanak, 1983;

ATTITUDES TOWARDS COMPUTERS

Shneiderman, 1979; Eason Damodaran, 1981, Hollenbeck et al., 1989)

PERSONALITY CHARACTERISTICS

Parasuraman & Igbaria, 1990, Parkes, 1984, Perrewe, 1986, Arndt et al., 1983, Hawk, 1993; Eysenck, 1967, 1977, Pilgrim. 1990; .

GUIDELINES OF CONSTRUCTION

- ALLOW THE USER TO DETERMINE THE SPEED OF PROGRESS.
- PRESERVE PRIVACY
- PERMIT FLEXIBILITY IN USE
- DEMINISH COMPETITION
- PROVIDE CLOSURE & SENSE OF ACCOMPLISHMENT.
- ENHANCE FEELING OF CONTROL
- SUPPORT ACTIVE LEARNING

SUPPLEMENT II:

EXAMPLES OF GOFT TRAINING MATERIALS;

INSTRUCTIONS

APPLICATIONS

DIFFICULTY ESTIMATION

MAIN GOAL : TYPE SIMPLE TEXT.

Goal : **Type text**

Act --- Type text, using the Keyboard.

--- **DO NOT Press RETURN:** at the end of the line.

Verify: Text is being typed and the cursor has moved to the next line.

****

Goal : **Leave a blank line.**

Act --- Press **Enter.**

Verify : Cursor at the begining of the next line.

****

Goal : **Type Capital letters**

Method 1 (Capitalise Few letters)

Act --- To **Capitalise** Press **SHIFT & Letter.**

Method 2 (Capitalise Words, Sentences)

Act --- Press **Caps Lock**

Verify: at the cursor line, **Pos** is written **POS**.

--- Type text

** Sub Goal **Return to small letters**

Act --- Press **Caps Lock**

Verify: **POS** is changed back to **Pos**.

****

Goal: **Leave an empty space**

Act --- Press the **Spacebar**

Goal: **Type Symbols & Punctuation marks**

Act --- Find symbols at the Keyboard

--- (If at the lower key part) just **Press the key**

--- (if at the upper part) Press **SHIFT & the Key.**

MAIN GOAL: MOVE THE CURSOR.

GOAL: **MOVE UPWARDS.**

Act --- Press **Up Arrow key**

Verify: the cursor has moved one line up, but at the same position.

****

GOAL: **MOVE DOWNWARDS**

Method 1. (When next line is defined/text is typed below)

Act --- Press **Down Arrow key**

Verify : the cursor has moved one line down.

Method 2. (from the last line of the text)

Act --- Press **Return Key**

Verify: cursor is at a emty line, a new line is created.

****

GOAL: **MOVE TO THE RIGHT**

Method 1.

Act --- Press -> **Arrow key**

Verify: the cursor has moved one position to the right.

Method 2: (from the last letter)

Act --- Press **SpaceBar.**

****

GOAL: **MOVE TO THE LEFT**

Act --- Press <- **Arrow key.**

Verify: the cursor has moved one position to the left.

MAIN GOAL : CREATE A NEW PARAGRAPH

Method 1. (Create paragraph as text is being typed)

Goal : **Move to a New Line**

Act --- Move cursor at the end of text.

--- Press **Enter. (two times)**

Verify: Cursor at a new line.

Goal : **Indentation.**

Act --- Press **Tab** -->

Verify: Cursor has moved (5) spaces to the right.

Method 2. (Create a paragraph in a typed text)

Goal: **Move text to the next line.**

Act --- Cursor at the beginning of the text to be moved.

--- Press **Enter**

Verify: text has moved to the next line

--- Press **Tab**

Verify: Text is adjusted 5 spaces to the left.

MAIN GOAL : CHANGE AN EMPTY LINE

Goal: **Delete a Blank line**

Act --- Move cursor at the beginning of the blank line

--- To delete Press **Backspace** <-

****

Goal: **Insert line**

Act --- Move cursor at the place you want to change line.

--- Press **Enter (two times)**.

MAIN GOAL: DELETE TEXT.

Goal: **Delete Characters** (<u>one key press/character)</u>

Method 1 <u>(Cursor on the character or space to delete)</u>

Act --- Press **Del key**

Method 2 (<u>delete previous space or character)</u>

Act --- Press **<- key**

****

Goal: **Delete Word**

Method 1. <u>(Next word)</u>

Act --- Press **Ctrl Del**

Method 2. <u>(Previous word)</u>

Act --- Press **Ctrl Backspace**

****

Goal: **Delete Line**

Act --- Press **Alt End**

MAIN GOAL: MODIFY TEXT.

Method 1: (Change few letters)

Act --- Move cursor on the letter to correct

--- Type new letter

--- **Delete** old letter

Method 2: (Change Typed Text)

Act --- Move cursor at the beginning of the text to be changed

--- Press **Insert**

Verify: left bottom of the screen Insert.

--- Type NEW TEXT

Verify: As new text is typed, the old text is erased.

****

Goal: **Add (Insert) letter or Space**

Act --- Move cursor at the wanted position.

--- Type the letter or press the spacebar.

****

Goal: **Add Text.**

Act --- Move cursor to **the Place to add text.**

Act --- Type text

MAIN GOAL: SAVE FILE

Method 1: (Give a new name)

Goal: **Load saving functions**

Act --- Press **F10**

Verify: (left bottom document to be saved: Drive:\ cursor)

Goal: **Change Drive to save to**

Act --- Type **Drive name** and **:**

Goal: **Name the file**

Act --- Type a name (it can have up to 8 let . 3 let/numb.

Note (don't type spacebar or other symbols)

Verify: The name is typed at the bottom left of the screen.

--- Press **Return**

Verify: the light of the drive must blink & at left/bottom the file's name will appear.

Method 2: (Save with the same name)

Goal: **Load saving functions**

Act --- Press **F10**

Verify: (left bottom document to be saved: Drive:\ Name.)

--- Press **Enter**

Verify: **Replace (File name) Yes or No** (bottom/left)

--- Press **Y** (for Yes)

Verify: the drive's light blinks.

****

NOTE:

Every time you save a file with the same name only the latest save version is kept in your disc.

When you are **REPLACING** a document, you actually erase the previous copy and keep in your records only the latest version.

For a change to be saved you must save the file before exiting WP. When you exit the program, WP informs you whether you have saved the latest changes with the following message

(Text was not modified)

at the bottom right side of the screen.

Save a file with an appropriate code to help you remember what it is written in that file. For example:

letbank.1 meaning the document is a first letter to a bank.

wpex23 meaning the document refers to Wp exercise 23.

A name can be composed of:

Up to 8 letters or Numbers,

a .

and **three more letters or numbers.**

NOTE Do not use the spacebar or other punctuation marks.

To save the file in a Drive different from that of WP:

*** type **the drive's name with :**

for example **b:wpgl.3**

means the file WPGL.3 is saved on drive B.

MAIN GOAL: PRINT FILE.

Goal: **Prepare Printer:**

Act --- Open the Printer

Verify: Printer indicates Ready /on line

Goal **Load Printing Functions.**

Method 1. **(Use Menu)**

** Sub Goal: **Set Menu Options**

Act --- Press **Alt** key.

Verify cursor highlight the first menu option.

** Sub Goal: **Select File Options**

Act --- Highlight **File Option (use arrows)**

--- Press **Enter.**

Verify: File menu appears on the Screen.

** Sub Goal **Select printing option.**

Act --- Highlight **Print Shift F7**

--- Press **Enter**

Verify the printing menu will come on the screen.

Method 2. **(Use Function Keys)**

Act --- Press **Shift F7 (together).**

Verify the printing menu will come on the screen.

Goal: **Select Printing Options**

Act --- for **all doc.** Press **1 or F**

****

NOTE Wait for few minutes. If the printer does not start then:

Check Printer's indications : **Ready, On line.**

If there is a switch board check that it is turned to the appropriate computer.

Check the cables

MAIN GOAL: CLEAR SCREEN / EXIT FILE.

Goal: **Load Exit functions**

Act --- Load **Exit** functions by Pressing **F7**

Verify: Save document? **No Yes**

--- For **No** Press **N** (if the text was not modified; or latest changes should not be kept)

Verify: <u>To exit Wordperfect (No Yes)</u>

** Sub Goal **Save file.**

Act --- To **Save** Press **Y.**

Verify: Name file

--- Press **Enter** (for the same name)

Verify: Replace (name) No (yes)

--- Press **Y** for **Yes.**

Verify: <u>To exit Wordperfect? (No Yes)</u>

Goal: **Clear the screen**

Act --- Press **N** (do not exit WP).

Verify: blank screen & cursor line at the bottom/right

****

Goal: **Exit Wordperfect**

Act --- **To exit** Press **Y**

Verify: on the top of the screen C>:

==

SESSION III.

This session is designed to provide practice on how to :

Flush Text to the Right

Type more complex Text

Make Simple Corrections in Typed Text

Use the directions given in the Instruction Part.

==

==

EXERCISE 10.

Type, save, and print the following letter. Adjust line to the right as the text is being typed.

Buckingham Palace
The Mall
London SW1
Jan. 12th 1990

Mrs Maltilda Brown
140 Grove Park Avenue
Lewisham
London SE14

Dear Mrs Brown,

Her Majesty was most interested to hear that you had discovered a new kind of dog food on your holiday visit to the Royal Family of Hungary. We understand that this new kind of dog food is called "Dog Crunch" in English and we are sending away for some samples on your advice.

We find it very heartening to hear from our subjects who display concern about the Royal Corgis and we thank you for your kind attention. This matter will also enable us to develop new links with Hungarian Royal Family which is of such great importance after the recent momentous events there.

Her Majesty will be in touch with some information about the outcome of our "Dog Crunch" experiment and we hope that you will come to tea soon.

Yours Sincerely
H.M. The Queen.

****

EXERCISE 11.

Type, save, and print the following letter.

The Vicarage
25 High Street
Canterbury
Kent

David Anthony
Rector
St John's Parish
Auckland
New Zealand

Dear David,

I am writing to ask you if you have any vacancies in your parish at the moment. We have in our diocese one Mark Mc Williams who is looking for work in either Australia or New Zealand as he plans to emigrate soon. He has a long history of useful service in this diocese.

Perhaps you could inform me if anything suitable should come up. If you need further information please do not hesitate to contact me.

Yours Sincerely

Terence Burnley
Bishop of Canterbury

EXERCISE 12.

Type the following text.

Then Use the Block command to move the typed text to the left side of the line.

PROGRAMME

Wednesday, 20th April
Travel to Antigua.

21st April - 23rd April
Shake down cruise

24th April - 1st May
Race week

Monday, 2nd May.
Fly Home

****

EXERCISE 13.

Mr Williams Cristal wants to send a letter to Murray Palmetto Dance Studio, 345 Richmond Str., London E1 9XG. He wants to apply for the job of the dance teacher which was advertised in the East Bulletin News. He lives at 67 Lakewood str., London E1 4TR. He wrote the letter on May 12, 1990.

Type the following text in the form of a letter.

Adjust the receiver's information to the right side of the line.

Use the format of the previous letters.

Dear Sir

This letter is in reference to your ad in the East Bulletin News for someone to teach ballroom and rock dancing. The ad appeared on March 11. (@ change paragraph) Although music is not my main interest I have studied dancing in my spare time. I am not an expert in all the latest rock dances, but I can also waltz and foxtrot. Although I have never taught dancing professionally, I have shown a number of my friends how to dance everything from Bossa nova to frog. (@ Change Paragraph) I am patient and thoughtful with people who feel uncomfortable as beginners and I think you will find me a good addition to your staff. (@change paragraph). I am anxious to talk to you personally about the job. I am available for an interview at any time and can be reached either at the address above or by telephone at 555-9087. (@ change paragraph) Thank you for your time.

Finishing Session III you must have mastered how to:

Flash text to the Right side of the line... Alt F6

Use Block commands Alt F4, Use arrows

Flash already typed text (one and many lines)

Type Text in a letter form

Decide whether to continue to the next Session or practice

with more examples

Supplement II

SESSION/EXERCISE TYPE A PARAGRAPH	COMPLEXITY LEVEL TOTAL = NEW OLD	DATA	OPERATIONS
SESSION I/ DIFFICULTY	NEW GOALS OF UP TO 5 STEPS	TEXT	APPLY
EX. 1 10.1.2	10 ALL NEW/ EACH GOAL LIST NO MORE THAN 3 STEPS	TEXT	APPLY
EX. 2 8.1.2	8 SAME AS EX I.	TEXT	APPLY
EX. 3 7.1.2	7 SAME	TEXT	APPLY
EX. 4 5.1.2	5 SAME	TEXT	APPLY
EX. 5 4.1.2.	4 SAME	TEXT	APPLY

SESSION/EXERCISE MAKE CHANGES	COMPLEXITY LEVEL TOTAL = NEW OLD	DATA	OPERATIONS
SESSION II/DIFFICULTY	9 NEW UP TO 2 STEPS EACH	TEXT	APPLY - ADJUST
EX. 6 6.1.3	6 = 2 NEW + 4 OLD	TEXT	APPLY - UNDERSTAND
EX. 7 5.1.5	5 = 4 NEW + 1 OLD	TEXT	APPLY - ADJUST
EX. 8 2.1.2	2 = OLD	TEXT	APPLY
EX. 9 4.1.2	4 = OLD	TEXT	APPLY - ADJUST
EX. 5	4 SAME	TEXT	APPLY

SESSION/EXERCISE ADJUST RIGHT	COMPLEXITY LEVEL TOTAL = NEW OLD	DATA	OPERATIONS
SESSION III	NEW GOALS UP TO 6 STEPS	TEXT	APPLY
EX. 10 5.1.3	5 = 3 + 2	TEXT	APPLY - UNDERSTAND
EX. 11 4.1.3	4 = 0 + 4	TEXT	APPLY - UNDERSTAND
EX. 12 6.1.4	6 = 4 + 2	TEXT	APPLY - ADJUST
EX. 13 4.1.6	4= 0 + 4	TEXT	APPLY - PLAN
EX. 5	4 SAME	TEXT	APPLY

SESSION/EXERCISE ADJUST CENTRE	COMPLEXITY LEVEL TOTAL = NEW OLD	DATA	OPERATIONS
SESSION IV	8 = 4 + 4	TEXT	APPLY
EX. 14	6 = 2 + 4	TEXT	APPLY - UNDERSTAND
EX. 15	5 = 1 + 4	TEXT	APPLY - ADJUST
EX. 16	3	TEXT	APPLY - ADJUST
EX. 17	4 = 4 + 0	TEXT	ADJUST
EX. 18	3	TEXT	PLAN
EX. 19	5 = 3 + 2	TEXT	ESTIMATE
EX. 20	4 = 2 + 2	TEXT	APPLY - ESTIMATE

Supplement II

SESSION/EXERCISE RETRIEVE - REARRANGE	COMPLEXITY LEVEL TOTAL = NEW OLD	DATA	OPERATIONS
SESSION VI	NEW GOALS OF UP TO 5 STEPS	TEXT	APPLY
EX. 25	6 = 4 + 2	TEXT	APPLY - ADJUST
EX. 26	7 = 6 + 1	TEXT	APPLY
EX. 27	7 = 2 + 5	TEXT	APPLY
EX. 28	5 = 2 + 3	TEXT	APPLY -ADJUST
EX. 29	4 = 1 + 3	TEXT	PLAN