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**TRAINING END-USERS: THE APPLICATION OF COGNITIVE
THEORY TO LEARNING A DATABASE SOFTWARE PACKAGE**

by

ANDRÉ T. LYN, B. Sc. (Honours) - Economics

A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfilment of
the requirement for the degree of Master of Management Studies

School of Business
Carleton University
Ottawa, Ontario
June 10, 1997

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Supervisor

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June 10, 1997

This Thesis is Dedicated to My Daughter Laura Elizabeth

ABSTRACT

Several studies have investigated the impact of different types of instructional materials (i.e., training manuals) on end-user learning. There is considerable debate as to what type of materials is best. This has led to two competing schools of thoughts regarding the design of training materials: *minimalist and author-elaborated*. The *minimalist* school (e.g., Carroll, 1990) holds the view that training materials should be brief, encourage active exploration using one's own examples, and should be task oriented. In contrast, the *author-elaborated* school (e.g., Charney, Reder & Wells, 1988) holds the view that a systems approach which emphasizes concepts and procedures and using programmed exercises, results in improved learning.

The studies which have investigated the differences in the training materials had specific training materials developed and as a result, may have been subject to bias. This study evaluated the effectiveness of the minimalist and author-elaborated design of training materials, but used commercially available software manuals. A training experiment was conducted with forty-one subjects who were randomly assigned to either of the two manual types to learn Microsoft Access 2.0. A self-instructional training method was chosen.

The results of the training experiment suggest that the different manual types did not have an impact on training effectiveness, as measured by both attitudinal and knowledge outcomes. Possible reasons for these findings could be the way in which the manuals were used, or it could be due to the validity of the tests that were used to measure knowledge. Additional reasons for the findings and the implications are discussed.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 THE IMPORTANCE OF TRAINING RESEARCH

It is a commonly held axiom within information systems research that end-user training is critical to the success or failure of end-user computing (Olfman & Bostrom, 1988; Rivard & Huff, 1988; Sein, Bostrom & Olfman, 1987; Sein & Bostrom, 1989; Cheney, Mann & Amoroso, 1986; Zmud & Lind, 1985). Other studies within the information system domain have supported the claim that training is positively related to end-user success (Benson, 1983; Nelson & Cheney, 1987b; Raymond, 1988; Igbaria, 1993; Davis & Bostrom, 1993). The practitioner literature also supports the claim that training is essential to the success of organizational computing (e.g., Tannenbaum, 1990). Similarly, Turnage (1990) argues that studying end-user training is important because technological failures are often due to inadequate training rather than the technology itself.

Because training is considered important to end-user computing success, a major challenge is to provide effective training. It has been proposed that since training has a significant effect on learning (Annett, 1989), the extent of learning exhibited by trainees can be used as a key index of training effectiveness (Goldstein, 1980, 1986).

Several research models have been developed to investigate end-user training and learning. Although these models may vary in emphasis, they have focused on one or several of the following areas: the training and learning process (e.g., Bostrom, Olfman, & Sein, 1988; Compeau, 1992; Compeau & Higgins, 1995b) understanding the impact of various aspects of instructional design, including training method (e.g., Compeau & Higgins, 1995b; Davis & Bostrom, 1993; Olfman & Bostrom, 1988), design of training materials (e.g., Gong & Elkerton, 1990; Olfman & Mandviwalla, 1994; Carroll, 1990) and issues associated with social labeling (e.g., Webster, Heian & Michelman, 1990).

With respect to the research on instructional design of training materials, the focus has been on whether different ways of presenting the material and different degrees of material presented impact on learning, measured by knowledge. This has led to two competing schools of thought regarding the design of training materials: *minimalist and author-elaborated*. The *minimalist* school (e.g., Carroll, 1990) holds the view that training materials should be as brief as possible, should encourage active exploration using one's own examples, and should be task oriented. The *author-elaborated* school (e.g., Charney, Reder & Wells, 1988) holds the view that a systems approach, emphasizing concepts as well as procedures and using programmed exercises, results in improved learning.

The research findings regarding the minimalist and author-elaborated materials tend to support the superiority of the minimalist approach (e.g., Carroll, 1990, . 1994). However, the studies which have investigated the differences in the materials have relied on materials that were created specifically for the research. Two limitations arise from this approach. First, the studies may be subject to investigator bias, as the designer of the materials is usually a proponent of one or the other type material. Second, the results provide little insight about the choices faced by individuals attempting to select from pre-existing materials.

The purpose of this study, therefore, was to evaluate the effectiveness of the minimalist and author-elaborated approaches to the design of training materials, using commercially available software manuals. The software environment examined was database management systems, specifically Microsoft Access (MS Access) 2.0. This environment was chosen because it has not been subject to a high degree of investigation in the information systems literature.

A self-instructional training method was chosen for this study. This decision was based on empirical evidence that points to the growing dominance of self-training as a source of computer training (Nelson & Cheney, 1987b). This has been attributed to the high cost of providing resident expert and/or classroom service (Olfman & Bostrom, 1988). Also related to the issue of cost, is the fear expressed by organizations that "after spending

thousand of dollars training somebody in a leading edge technology they will lose him/her to some other company" (Nelson & Cheney, 1987a).

Forty-one subjects were randomly assigned to either of the two manual types to learn MS Access 2.0. They were given a learning period during which they read their respective manual and practised using the software package. This was followed by four tests to measured knowledge: a multiple choice test and three hands-on tasks. Participants were allowed to work at their own pace as well as to consult with their manual to accomplish the knowledge tests with the exception of one test (a multiple choice test) that was used to assess basic comprehension. In addition to the knowledge tests, participants completed three sets of questionnaires which were used to measure self-efficacy, usefulness, and flow. T-tests were used to examine the influence of the training method on self-efficacy, usefulness, and flow, and the influence of all these factors on tests of software knowledge.

1.2 CONTRIBUTION AND IMPORTANCE OF THIS RESEARCH

This research has several implications for both management and academia. First it helps to assess whether there is any significant difference in effectiveness between the instructional designs of the training manuals currently on the market. Second, it uses a theoretical model to examine the relationship among the most developed motivational

factors, self-efficacy, usefulness and flow, and their effect on the training method and subsequently knowledge such as learning. These have been studied individually in past research, but no studies have included all of them

Another major contribution of this study relates to the software package used in the training session. Whereas other research on software training has used spreadsheets, word processing and financial and accounting packages, this study used a database management system (DBMS) software package. Given the increasing use of database software in organizations, this is an important contribution to the training/learning research literature. Additionally, the empirical results may be compared with the empirical results of other software training research to determine if there are any identifiable trends in how people learn a software package. Thus, this study will contribute to both the theory and practice of software training.

Much of the research within this area has focused on end-user training to the neglect of end-user learning. This research focuses on both end-user training and learning by combining cognitive learning theories to examine training and learning. It decomposes learning outcomes beyond general knowledge, to include learning outcomes such as declarative knowledge, knowledge compilation, and affective outcomes. The study is further strengthened by the use of participants from the work force rather than students.

1.3 THESIS ORGANIZATION

A detailed review of the literature that deals with computer training and learning (e.g., cognitive psychology, information systems) is presented in Chapter Two. The underlining theory is cognitive theory and end-user training/learning. The research model and hypotheses for this study are presented in Chapter 3. The model is a derivative of an end-user training research model originally developed by Bostrom et al. (1988). This model looks at the training/learning process. Integral to this process are the cognitive and motivational dimensions inherent in training and learning. Chapter Four describes the research methodology, while the results of the data analysis, discussion on the research findings, limitations, research direction and conclusions are presented in Chapter Five.

CHAPTER TWO - THEORETICAL AND EMPIRICAL FOUNDATION

2.0 OVERVIEW

A detailed discussion on cognitive theory which is the theoretical foundation for this study is presented in this Chapter. The discussion focuses on the knowledge and skill outcomes which cognitive theorists identify as resulting from the acquisition of skill or knowledge. The evaluation measures associated with these outcomes are also discussed. This is followed by a presentation of a research model that drew on cognitive theory to examine the processes involved in training/learning a computer software package.

2.1 COGNITIVE THEORY

It has been proposed (Colley & Beech, 1989) that performing a computer task, for example, using a software package, requires cognitive skill. Although performing a computer task is often regarded as requiring a strong motor skill, computer interaction is in fact intensely cognitive (Card, Moran & Newell, 1983). A cognitive skill may be more aptly conceived as the translation of information into a response. This involves interpreting the information (facts) about the task(s) before executing the required procedures to achieve the desired response (Colley & Beech, 1989). This suggests that cognitive processes as well as procedures are important in the acquisition of skill or knowledge to “proficiently” use a software package.

Cognitive theory, which integrates concepts from several domains, including educational psychology, cognitive psychology, cognitive science and computer science was adopted as the theoretical foundation. Cognitive theory is concerned with what an individual learns. The emphasis is on understanding, more so than learning how to perform a task, and on the acquisition of knowledge rather than on the acquisition of a behaviour (Shuell, 1986). Cognitive theorists (e.g., Fitts, 1964; Anderson, 1982; Kraiger, Ford, & Salas, 1993) often distinguish between declarative (knowledge of facts) and procedural (knowledge of how to perform a skill) knowledge. For example, declarative knowledge refers to knowing that a database software package consists of tables, forms, queries and reports. Procedural knowledge refers to knowing how to input the relevant information in the tables, forms, do queries and prepare reports. Cognitive abilities (i.e., declarative and procedural knowledge) can be evaluated using tests of knowledge such as language (concepts) and problem-solving (procedures).

As is evident in Table 1, the identifiable stages of skill acquisition (e.g., Fitts, 1964; Anderson, 1982; Kraiger et al., 1993) may generally be categorized into: (a) cognitive or declarative, (b) associative, compilation, or skill-based and (c) autonomous or procedural. Affective outcomes have also been proposed as a stage of skill acquisition. The measures that may be used to evaluate the various stages of skill development are also presented in Table 1.

Table 1
Knowledge and Skill Outcomes

FITTS	ANDERSON	KRAIGER	MEASURES
COGNITIVE	DECLARATIVE	COGNITIVE ■ Declarative Knowledge	Multiple Choice True- False. or Free- Recall Test
ASSOCIATIVE	COMPILATION ■ PROCEDURALIZATION ■ COMPOSITION	SKILL-BASED ■ COMPILATION - Composition - Proceduralization	Targeted Behaviour Observations. Hands-on Test
AUTONOMOUS	PROCEDURAL	SKILL-BASED ■ AUTOMATICITY	
		AFFECTIVE OUTCOMES ■ Attitudinal ■ Motivational (self- efficacy, goal setting)	Self-reported Measures

Cognitive theorists generally agree that the acquisition of declarative knowledge must precede higher order development (e.g., Fitts, 1964; Anderson, 1982; Kraiger et al., 1993). However, a foundation of declarative knowledge may be a necessary, but not a sufficient condition for higher order skill development. Therefore, specifying and measuring trainees' retention of declarative knowledge is most appropriate at the initial stage of training (Kraiger et al., 1993).

There is one main difference between Anderson's (1982) skill acquisition stages and Kraiger et al.'s (1993) learning outcomes. That is, Kraiger et al., proposed that affective outcomes (attitudinal and motivational outcomes) are legitimate learning outcomes. Their reasoning was that because attitudes and motivation can affect training performance, they should be used as indicators of learning.

The stages of skill development and learning outcomes as well as the respective evaluation measures that are presented in Table 1 are explained in more detail in the next sections.

The Declarative Stage

The first or initial stage of acquiring a skill is the interpretive application of declarative knowledge (facts). This declarative stage is where the learner receives information (facts) about a skill via instruction, observation or from some other stimulus. The learner interprets these facts in order to attempt the skill. Before this happens however, the facts have to be rehearsed in working memory before attempting the procedures. This suggests that the declarative stage is intensely reliant on the mental rehearsal of the facts. For example, **F8**, which is the key stroke for underlining a word in WordPerfect 5.1, has to be memorized before it is used in the performance of a task.

Kraiger et al. (1993) argues that the acquisition of declarative knowledge can be assessed using multiple-choice, true-false or free recall tests. These tests can be fashioned into

power or speed tests. Power tests are used when recall of accuracy is important, while speed tests are used when recall speed is the focal learning outcome. It is recommended that the tests to measure declarative knowledge be given closer to the beginning of the training. This recommendation is based on two reasons. First, it allows for feedback. If knowledge gaps that may impede learning are identified, these can be used to refine subsequent stages of the training. The second, which is from a psychometric position, is that variance in trainees' declarative knowledge is more detectable at the beginning rather than at the end of the training.

The Compilation Stage

According to Anderson (1982), the stage that follows the declarative stage is essentially the compilation of declarative knowledge into a procedural form. This transition is achieved through practice, and a reduction in mental rehearsal of facts. While this does not eliminate the possibility of errors, it is expected to reduce the probability of committing errors (Anderson, 1982) resulting in a more refined performance. The compilation stage consists of two interrelated processes: proceduralization and composition. These processes bring together separate declarative statements into a coherent procedure. During proceduralization, the learner creates production rules [**IF** (condition) **THEN** (action)], which are the building blocks of domain specific skills (Anderson, 1982). For example, **IF** the task is to underline a word in a WordPerfect document. **THEN** use **F8**.

Composition involves grouping a sequence of productions into a single production that has the same effect as the sequence. For example, **IF** the task is to underline a word in a WordPerfect document that is not yet typed, **THEN** press underline (**F8**) and type the word. **IF** the word is already typed, the sequence is, block first (**F12**) **THEN** press underline (**F8**).

The transition from the declarative stage to the compilation stage indicates a progression. While this progression reflects improved execution of routine cognitive skills, perhaps what is more important, is that it demonstrates a qualitative change toward more efficient processing (Howell & Cooke, 1990). This concurs with Fitts' (1964) proposition that during the skill acquisition process, performance is accomplished in qualitatively different ways.

Kraiger et al. (1993) argue that both proceduralization and composition can be assessed using hands-on tasks. These tasks test trainees' ability to apply newly learned knowledge. It is also at compilation that trainees are able to generalize skills to situations in which they are not specifically trained and make changes (discriminate) depending on the situation. Hands-on tasks that require trainees to apply learned behaviours to a unique situation, one in which they have not been specifically trained, can be used as an overall test of knowledge compilation.

The Procedural Stage

Although the compilation and procedural stages are most appropriately considered points on a continuum instead of discrete stages, there are several characteristics at the procedural stage that are not evident at the compilation stage (Anderson, 1982; Kraiger et al., 1993).¹ For instance, it is at the procedural stage that a learner will be able to successfully perform simultaneously occurring tasks. It is also at this stage that procedures become more fluid and performance is even more refined to reflect a learned skill. This is evidenced from increased performance speed and increased resistance to interference from simultaneously occurring activities (Fitts, 1964). That is, tasks can be accomplished without conscious monitoring and tasks can be conducted concurrently. Important also, is that the learner is more competent in performing the skill by being more judicious in selecting the method of performing the task(s). This ultimately leads to increased proficiency which is only observable in the long-term. In WordPerfect 5.1 for Dos, saving and exiting an existing document, may be performed either by using: **F10 + Yes, then F7** or simply **F7**.

Anderson (1982) refers to the learning underlying this selectivity as tuning, and identifies three subprocesses of tuning. The first is called generalization. This is a process by which the production rule encompasses a wider range of applications and is extendible to novel situations. For example, generalization of the process of underlining in

¹ While the examination of this stage is beyond the scope of this study, it is presented for completeness of the literature review.

WordPerfect, might involve a recognition that the principles of underlining apply to any character formatting (bolding, italic, etc.). Thus, **IF** a sentence is already typed, **THEN** block (**F12**) and press the appropriate key.

The second subprocess is called discrimination. This is where the production rules are restricted and are only used to obtain successful results. For example, while block (**F12**) plus the appropriate function key can be generalized to several situations, there are instances where its use does not obtain successful results. In WordPerfect 5.1 for Dos, block (**F12**)+**Shift F8, 1, 6** cannot be used to reduce the line spacing of a paragraph from double space to single space.

The third subprocess is called strengthening which means that with repeated application, the more efficient rules are strengthened. For example, **Shift+F10** results in faster retrieval of a WordPerfect document if the filename is known. However, **F5, 1** (retrieve) may be more efficient if the filename is not remembered or unknown.

Affective Outcomes

Kraiger et al. (1993) extended learning outcomes beyond the acquisition of declarative and procedural knowledge to include affective outcomes. Affective outcomes which can be used as indicators of learning, are broken into attitudinal outcomes (e.g., self-awareness and changing values) and motivational outcomes (e.g., self-efficacy and goal setting). Self-report measures (e.g., use of questionnaires) can be used as a valid means

of measuring affective outcomes. Affective outcomes are discussed later in this chapter under end-user training research, but will be referred to as motivational outcomes in order to be consistent with the end-user training research literature.

2.2 END-USER TRAINING RESEARCH

A review of the Information System (IS) literature revealed a series of end-user training studies that have drawn on cognitive theory to examine the processes involved in the training/learning of a computer software package. Bostrom et al., (1988) were the first to use a cognitive framework to propose a research model of end-user learning/training.

The research model is presented as Figure 1 (taken from Bostrom, Olfman, and Sein, 1990). This research model identifies learning outcomes as knowledge and motivation to use the software, which correspond to the learning outcomes identified by cognitive learning theorists (e.g., Anderson, 1982; Kraiger et al., 1993). Knowledge can be of two types. The first is language understanding, which is knowledge of syntax (or concepts) and function of the software (Olfman & Bostrom, 1991). Language understanding corresponds to declarative knowledge (Knowledge of facts). The second type of knowledge is called problem-solving. It refers to knowledge about how to use the software to solve a particular problem. Problem-solving corresponds to both knowledge compilation and procedural knowledge. For the remainder of this study, knowledge will be used to represent understanding.

Figure 1. Training/Learning Process
(From Bostrom et. al., 1990)

In the IS literature (e.g., Bostrom et al., 1990; Compeau, 1992; Compeau & Higgins, 1995a, 1995b; Webster & Martocchio, 1992), the motivational constructs are measured by attitudes towards the software (e.g., perceived usefulness, self-efficacy, flow). Similarly, cognitive learning theory proposed the use of motivational outcomes (e.g., self-efficacy) (Kraiger et al., 1993), to measure affective learning outcomes. It should be noted that motivation and attitude to use the software/system are often used interchangeably within the IS research literature.

It has been proposed that for software training to be effective, trainees must not only have an initial knowledge of the software being learned, but also a high motivation to use the software during and after the training (Olfman et al., 1988; Sein et al., 1987). This is consistent with researchers from other domains (e.g., Noe, 1986) who argue that motivational factors are among the most efficient predictors of human performance in training. Other researchers such as Wlodkowski (1985) assert that for novices in particular, focusing on the development of appropriate motivational factors may be more important than knowledge acquisition. Keller (1983) defines motivation in terms of the magnitude and direction of behaviour. He describes it as the choices people make in terms of which experience or goals to avoid or pursue and the degree of effort that will be exerted on that choice.

Research has shown that the use of cognitively oriented variables (e.g., self-efficacy, usefulness and flow) to predict use or behaviour, produces consistent results. This has been attributed to the theoretical grounding of these variables. All three attitudinal outcomes are grounded in theory and their scale measures have exhibited strong psychometric properties.

Self-Efficacy

Self-efficacy is one of the key concepts of Social Cognitive Theory (Bandura, 1986). It is defined as beliefs about one's ability to perform a specific task (Bandura, 1977). Self-efficacy perceptions are generally believed to be task specific and are hypothesized to influence one's choice of activities, effort expended, persistence and task performance. Similarly, computer self-efficacy refers to a judgment of one's capability to use a computer to accomplish a task (Gist, Schwoerer & Rosen 1989). Self-efficacy measures may be used as a means of predicting training outcomes, as a process variable during training or as a desirable outcome of training (Tannenbaum & Yukl, 1992).

Research findings suggest that there is a positive relationship between self-efficacy beliefs and procedural knowledge. For example, Gist et al. (1989) found that pretest computer self-efficacy scores were significantly related to training outcomes. Hill, Smith and Mann (1987) studied the effect of self-efficacy on enrollment in university computer

courses. They found that computer self-efficacy was a significant predictor of both behavioural intentions and actual enrollment in computer courses. Similarly, Compeau and Higgins (1995a) and Webster and Martocchio (1990) found self-efficacy to have an impact on training outcomes.

Usefulness (Outcome Expectations)

Perceived usefulness is defined as the degree to which a person believes that using a particular system would enhance his/her job performance (Davis, 1989). Davis posits that a system that is perceived to have high usefulness is one for which the user believes in the existence of a positive use-performance relationship. This is similar to Bandura's outcome expectations concept. According to the Social Cognitive Theory, outcome expectations play an important role in determining individual's actions. That is, if individuals had a choice they would prefer to engage in behaviour with more perceived valued outcomes. Thus, it has been proposed that choice will be influenced by outcome expectations (Bandura, 1986).

Bostrom et al. (1990) and Igbaria (1990) found perceived usefulness to be positively correlated to knowledge. This finding is expected as users are more likely to adopt an application primarily because of its relevance to them, and secondarily for how easy or hard it is to get the relevant functions to work (Davis, 1989; Alavi & Henderson, 1981).

On the other hand, Compeau and Higgins (1995a) found that individuals with high outcome expectations (a similar construct to perceived usefulness) exhibited less knowledge. A possible explanation for the difference in findings is that Davis (1989) measured perceived usefulness, while Compeau and Higgins (1995a) measured knowledge.

This study will re-examine the influence of usefulness on knowledge. It will adopt the perceived usefulness construct developed by Davis (1989) to verify if this perceived usefulness measure is positively correlated with knowledge.

Flow

It has been proposed that playfulness influences the success of human-computer interactions within organizations (Webster et al., 1990; Webster & Martocchio, 1992). The theory of Flow (Csikszentmihalyi, 1975) provides a basis for understanding the exploratory interaction with computer technologies during skill acquisition. According to the theory, flow refers to those enjoyable experiences an individual gets from feeling in control of their actions (Csikszentmihalyi, 1990). In this regard, flow represents a dynamic state, a feeling that people experience when they act with total involvement (Csikszentmihalyi, 1975).

Flow is a subjective experience that characterizes the human-computer interaction as playful or as exploratory. Accordingly, flow can occur when an activity challenges an individual enough to encourage playful or exploratory behaviours without the activity being beyond the individual's ability. If the activity is not sufficiently challenging, boredom rather than flow will result. On the other hand, if the demands of the activity are greater than the skill, a state of anxiety, not flow will ensue (Csikszentmihalyi, 1975: 1990).

Researchers who have investigated the flow state within the human-computer interaction domain (e.g., Webster, Trevino & Ryan, 1993) provide evidence that flow consists of three dimensions: (a) the sense of control which the individual perceives (or exhibits) during the interaction with the technology; (b) the attention which is given to the interaction; and (c) the cognitive enjoyment that the individual gets from the interaction. The relationship between flow and training is based on the premise that involvement, or an exploratory experience, the flow state, is self-motivating since it is pleasurable and encourages repetition (Trevino & Webster, 1992). Miller (1973) has indicated that playfulness can result in positive outcomes such as learning. Webster et al. (1993) examined play using the flow construct. The results showed that employees in an accounting department who experienced the flow state while interacting with an electronic mail system increased their use of the technology. In a study comparing

employees' interactions with a spreadsheet application. it was found that flow was positively related to learning, specifically the production of higher quality output (Webster, 1989).

From the model, it can be hypothesized that learning outcomes are influenced by three factors: the software being learned, individual differences (e.g., cognitive style), and training method. The software can directly influence the design of the training method. Individual differences are inherent to each individual and it is what they bring to the training. Individual differences can impact learning outcomes directly or indirectly via interaction with the software and/or training method (Bostrom et al., 1990).

Integral to the training method is the training materials (e.g., training manuals). Software training manuals can contain several types of information, ranging from what the software is and what it can do, to how to use the software and what to do when errors occur. This information can be broadly defined as concepts and procedures (Olfman & Mandviwalla, 1994). Concepts versus procedures corresponds to declarative versus procedural knowledge.

While researchers tend to agree that some combination of concepts and procedures is needed in training manuals, there is no clear agreement on the relative quantity and

sequencing of the concepts and procedures (e.g., Carroll, 1990; Reder, Charney & Morgan, 1986). Researchers have used different names to distinguish between training manuals based on the quantity and sequencing of concepts and procedures. Examples of these training manuals include: *Application-based* (concept-based) versus *Construct-based* (task-based) *training* (Olfman & Bostrom, 1988); *Exploration-based* (task-based) versus *Instruction-based training* (concept-based) (Davis & Bostrom, 1993); *Minimalist* (task-based) versus *Systems Approach* (concept-based) (Carroll, 1990).

The Application-based method, the Instruction-based training method and the Systems approach all fall under the *Author-elaborated* School, while Construct-based, Exploration-based and Minimalist fall under the *Minimalist* School. A description of these two schools follows in the next section.

A. AUTHOR-ELABORATED INSTRUCTIONAL DESIGN

Reder, Charney & Morgan (1986) propose that elaborations (author) of text should facilitate all components of skill learning. The reasoning is that analogies can assist in acquisition of facts (declarative knowledge), while exemplification can enhance learning of procedural information. This is consistent with Gagne and Briggs (1979) who define the systems approach as focusing on comprehensiveness and logical decomposition of

skills and knowledge into components, and explicitly drilling every component. Other proponents of the author-elaborated approach propose that the addition of advanced organizers (e.g., Foss, Rosson & Smith, 1982) together with detailed examples, analogies, restatements and additional explanations (e.g., Reder & Anderson, 1980) lead to increased attention and knowledge. This implies that effectiveness increases with increased comprehensiveness and length of the manual.

The fundamental principles which guide the author-elaborated approach are that learners rely explicitly on the conceptual elaboration and programmed exercises that come with the instructional material, and that learners follow a sequence of reading and exercises through drill and practice. This approach is based on the assumption that elaborations provide several sources from which learners can draw to make association with the essential information. The advantage of elaborations is that it allows for the reconstruction of important information if it is forgotten. Thus, conceptual elaborations (which explain some of the underlying concepts about the software), programmed exercises (which take the learner through step-by-step examples) and error recognition and support (to help when things don't work) are the major features of an author-elaborated manual.

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B. MINIMALIST INSTRUCTIONAL DESIGN

The minimalist approach supports active learning by encouraging users to actually use the software being learned. It also provides explicit error-recovery information as a means of encouraging the learner to complete a task. These characteristics of the minimalist approach indicate that it diverges from the author-elaborated approach. Accordingly, Carroll (1984) argued that the drill and practice instructional approach of the author-elaborated approach impedes learning. He contends that it creates a misfit between the nature of self-instruction and the self-instruction needs of users. Persons who choose self-instruction want materials that have short and easy examples, not requiring too much reading, and provide support for error recognition and recovery. The author-elaborated manuals do not meet these needs. As the name suggests, such manuals elaborate on concepts, and provide very detailed examples which require completing several steps.

Based on the observation of trainees' response to the author-elaborated approach in learning a word processing software package, Carroll and his colleagues designed and tested a self-instructional manual that reflected a minimalist design approach. The major tenets of the minimalist approach are: (1) brevity, (2) exploration, (3) task-orientation, and (4) support for error recognition and recovery.

Brevity

This tenet is based on the principle that "less is more." Although there is evidence that more information and additional headings and explanations (Reder & Anderson, 1980) may improve attention and knowledge, too much information can be somewhat self-defeating (Carroll, 1990). First, a wide variety of information creates an opportunity for confusion. Secondly, learners tend to be daunted by the sheer volume of information, consequently they skip around and read carelessly, if at all (Wright, Creighton & Threfall, 1982). The minimalist approach (i.e. keep it simple and to the point) may allow learners to explore by starting on real tasks as soon as possible, rather than the passive approach of relying on the explicit use of elaborated instructions (Carroll, 1990).

Exploration

The minimalist design approach encourages the learner to reason and do things on his/her own. For example, incompletely specifying procedures such as cursor movements may encourage learners to explore and find the other cursor movements. By extension, the exploration principle encourages learners to create tasks that are relevant and meaningful to them: tasks that they can personalize (Carroll, Ford, Smith-Kerker & Mazer, 1988). For example, instead of detailed examples, "on your own exercises" or open-ended examples may be given. This gives learners the flexibility of creating their own

example(s). This principle is in line with the cognitive view of the learner as an active participant in the training/learning process.

Task Orientation

A task oriented design principle implies quick orientation to the software. Thus, topic chapters should be (a) brief, but with enough conceptual information to facilitate ease of understanding, and (b) organized into modules, i.e., each chapter should cover only the relevant goals and subgoals (Carroll, 1990). For example, in a chapter on "creating a table," a subgoal would be to define a table. Defining a table requires specifying the type of data for each field. Rather than just stating that there are several data types and giving only one example (e.g., text), each data type should be presented, but with a one-line explanation.

Support for Error Recognition and Recovery

By encouraging the learner to become a constructor of knowledge, to reason, explore and pursue their own goals, the cognitive view of the learner implicitly assumes that errors are inevitable. In fact, it is argued that errors are necessary in learning (Carroll, 1990). This is in contrast with the systems approach that assumes away errors since learners are expected to unerringly follow programmed exercises. Based on the proposition that errors can be productive, the minimalist approach provides specific error recovery

information. A designated symbol (e.g., a triangle) is used to indicate the error recovery information. In addition, other explicit and implicit error strategies are also used. An example of an implicit strategy is to incompletely specify the information in the training manual when the information is available on screen. An example of an explicit strategy is to specify in the manual that users consult the screen for prompts. These approaches serve to keep learners focused on and involved in the learning tasks (Carroll, 1990).

Empirical Findings

Studies which have compared the minimalist approach to the author-elaborated approach have consistently supported the minimalist viewpoint. Reder and Anderson (1980), found that subjects who used elaborated texts consistently performed worse than those who used unelaborated (summarized) texts. The similarity between the unelaborated texts and the minimalist design is primarily in terms of brevity, less to read. Carroll (1990) contrasted the minimalist manual with a commercial systems style manual in training novices to use a word processing system. The results revealed that those using the minimalist manual exhibited faster learning and greater achievement. Those that used the minimalist manual also performed better in tests of comprehension of concepts. Research by Black, Carroll and McGuigan (1987) found that a minimalist design approach that allowed learners to infer procedures, particularly from a general rule or procedure were the most effective type of instruction. Gong and Elkerton (1990) used the

concepts of Goals, Operators, Methods and Selections (GOMS) to modify a manual to reflect a minimalist manual. An experiment was conducted to compare this minimalist manual with a system style manual. It was found that those who used the minimalist manual exhibited significantly higher learning outcomes.

There are two major limitations of these studies. First, the only learning outcome that is assessed is knowledge. Therefore, it is not known if knowledge is the only outcome affected, or if other learning outcomes (i.e., attitudinal outcomes) are also affected. Second, these studies relied on specially designed materials. Since many of these materials were developed by the researchers, the question of investigator bias must be considered. Moreover, in using specifically designed materials, these studies provide little insight into the relative efficacy of commercially available materials.

Summary

The end-user training/learning research corresponds with the cognitive view of knowledge acquisition. First, both ability and motivation are recognized as important factors in learning (Keller, 1983). Second, it recognizes that training methods (e.g., training approach) differentially affects learners (Cronbach & Snow, 1977). Third, the support materials (e.g., training manuals) which usually reflect the training approach can influence learning outcomes (Wlodkowski, 1985).

A research model that is consistent with both the cognitive view of knowledge acquisition and end-user training/learning research and the associated hypotheses are presented in the next Chapter in order to evaluate training effectiveness. Specifically, the model is used to examine the influence of the training method on learning outcomes.

CHAPTER THREE - RESEARCH MODEL AND HYPOTHESES

3.0 RESEARCH MODEL

The research model for this study (Figure 2) which is a derivative of the Bostrom et al. (1990) research model, is used to examine the influence of the training method on learning outcomes. Training method is represented by the training approach or more specifically, the training manuals. Two types of training manuals differing only in the instructional design approach are compared: *minimalist* and *author-elaborated* approaches.

In order to investigate the minimalist versus the author-elaborated approach to the design of software manuals, a comprehensive definition of effectiveness was adopted. This definition is consistent with the end-user training/learning research and the literature on cognitive learning, and conceptualizes effectiveness in terms of both knowledge and attitudinal outcomes.

Attitudinal outcomes relevant to training include self-efficacy (Compeau, 1992; Compeau & Higgins, 1995a; Webster et al., 1990; Webster & Martocchio, 1993), outcome expectations or usefulness (Bostrom, Olfman & Sein, 1990; Compeau, 1992; Compeau &

Higgins, 1995a, 1995b; Davis & Bostrom, 1993; Olfman & Mandviwalla, 1994; Sein & Bostrom, 1989) and flow (Webster et al., 1990; Webster et al., 1993).

As both self-efficacy and usefulness are domain specific constructs (Bandura, 1986; Davis, 1989), the hypotheses relating to this study will focus on software specific self-efficacy and software specific usefulness. Although both computer and software self-efficacy and computer and software usefulness will be reported, it is the software construct that this study is especially interested in.

The research model also suggests that there is a relationship between prior computer experience (denoted as experience) and type of manual and prior computer experience and attitudinal outcomes (Olfman & Bostrom, 1991). Experience represents an individual difference. An individual difference represents a set of characteristics that each trainee brings to the training. Research findings indicate that trainees benefit differently from the training method depending on their individual characteristics (Sein, 1987; Cronbach & Snow, 1977). Experience refers to the previous interactions that the end-user has had with computer systems and software and will vary from individual to individual.

Figure 2 Research Model

3.1 RESEARCH HYPOTHESES

Arising from the research model presented in Figure 2, seventeen hypotheses were tested. Specifically, the training manuals are predicted to directly impact on knowledge and self-efficacy, usefulness and flow. It is also proposed that self-efficacy, usefulness and flow are correlated and they are also predicted to influence knowledge. Prior computer experience is proposed to moderate the effect of the manual as well directly influence self-efficacy, usefulness and flow. Each of these hypotheses is justified below.

3.1.1 Type of Manuals

The first set of hypotheses relate to the specific impact of the minimalist and author-elaborated manuals on knowledge. As noted earlier, the empirical results have tended to support the minimalist approach to instructional design, both in terms of declarative knowledge and the dimensions of knowledge compilation. Hence, the following hypotheses:

- H1. Subjects who use the minimalist manual should score higher on each of the knowledge tests than those who use the author-elaborated manual.**

The second set of hypotheses relate to the impact of training manual type on self-efficacy. According to Bandura (1986), efficacy perceptions develop from a gradual attainment of skill and experiences over time. Based on this proposition, it seems that the author-elaborated texts may facilitate increased self-efficacy. This would occur as users work through the step by step procedures and benefit from the detailed concepts which provide a wide range of use (including short cuts and alternative methods of achieving the same goals) of the software. Consequently, these users should develop increased software self-efficacy.

H2. Subjects who use the author-elaborated manual should have higher software self-efficacy scores than those who use the minimalist manual.

It has been shown that identifying with an activity is a powerful source of motivation that enhances learning (Carroll, 1990). This is a key contrast between the minimalist approach, which emphasizes that learners use their own (relevant) examples, compared to the elaborated manual, which provide users with examples. Using one's own example should increase users' perceived usefulness of the software resulting in increased usage and subsequently increased knowledge. Thus, the third hypothesis:

H3. Subjects who use the minimalist manual should have higher software usefulness scores than those who use the author-elaborated manual.

Several aspects of training design have been found to influence flow. Webster et al. (1990) found that labeling computer training as play resulted in higher involvement (the flow experience). Other researchers (e.g., Miller, 1973) proposed that individual's exercise and develop their skills through exploratory behaviours, and that playful interactions (the flow state), result in enhanced knowledge. Neither the minimalist nor the elaborated approaches will be labeled as play. However, one of the major design principles of the minimalist manual is to encourage higher involvement and exploratory behaviour (e.g., through the use of own examples) which in turn should lead to more playful interactions or the flow state. Thus, the fourth hypothesis is:

H4. Subjects who use the minimalist manual should have higher flow scores than those who use the author-elaborated manual.

3.1.2 Attitudinal Outcomes

Self-Efficacy

Social Cognitive Theory (Bandura, 1986) predicts that self-efficacy expectations influence knowledge. Gist et al. (1989, 1992) and Compeau and Higgins (1995a) demonstrated that individuals with high self-efficacy tend to perform better on knowledge

tests than individuals with low self-efficacy when learning a computer software package.

Hence hypothesis 5:

H5. Subjects with higher software self-efficacy will score higher than those with lower software self-efficacy on the measure of knowledge.

Social Cognitive Theory proposes that self-efficacy influences outcome expectations (Bandura, 1978). This occurs because "the outcomes one expects derive largely from judgments as to how well one can execute the requisite behaviour" (Bandura, 1978). This definition of outcome expectations correspond to the perceived usefulness construct as defined by Davis (1989). Based on a survey of Canadian managers, a significant positive relationship was found between computer self-efficacy and outcome expectations (Compeau & Higgins, 1995a, 1995b). Thus hypothesis 6:

H6. There is a positive relationship between software self-efficacy and software usefulness.

Self-efficacy judgments are purported to influence individuals' preference and enjoyment of a task. Researchers in the domain of play posit that self-efficacy is an important precursor to playfulness and by extension to the flow state (e.g., Csikszentmihalyi, 1975).

Based on five independent studies involving over 400 participants (students and employees) using various types of software (e.g., Lotus 1-2-3, Accounting software), Webster and Martocchio (1992) found a positive relationship between computer efficacy beliefs and playfulness. This research therefore proposes the following relationship between computer self-efficacy and the flow state:

H7. There is a positive relationship between software self-efficacy and flow.

Usefulness

It is natural for people to undertake activities that will result in valued outcomes. Therefore, it has been asserted that the expected consequences of one's actions will determine the activities in which individuals engage. This was demonstrated in a study (Hill et al., 1987) which examined the influence of outcome expectations on computing behaviour. Even though the study dealt with outcome expectations, by a process of association, the resultant choice stemmed from the perceived usefulness of the individual's actions. It is therefore reasonable to infer that a behaviour which is perceived to lead to favourable consequences and is enjoyable could lead to the flow state. Thus, the following hypothesis:

H8. There is a positive relationship between software usefulness and flow.

It has been proposed (Davis, 1989) that individuals are often more willing to persevere with a task if it is perceived that the results will be useful. If a task is perceived to be useful, then it encourages persistence which in turn could lead to increased task performance. Within the context of this study, task performance would be represented by the measures of knowledge compilation. This is predicted by the following hypothesis:

- H9. Subjects who perceive the software to be highly useful will score higher than those who perceive the software to be less useful on the measure of knowledge.**

Flow

There is empirical evidence supporting the proposition that flow is positively related to task performance (Webster, 1989). This is based on the premise that trainees' involvement and interest in the training is likely to encourage exploration and successful task performance. Webster (1989) found that individuals who experienced the flow state while working on a spreadsheet package significantly increased their task performance. For this study task performance is represented by the measures of knowledge compilation. Thus:

- H10. Subjects who experience a higher flow state while interacting with the software package should score higher than those who experience a lower flow state on the measure of knowledge.**

Prior Computer Experience

Bandura (1986) argues that prior experience contributes to the formation of self-efficacy and perceived usefulness judgments. Enactive mastery, or successful execution of a behaviour, is considered to be an important source of self-efficacy (Bandura, 1986). Research by Compeau and Higgins (1995a) found prior computer experience had a significant impact on self-efficacy for Lotus training, and on the knowledge of two software packages. Gist et al. (1989) also demonstrated the influence of previous experience on self-efficacy.

With respect to perceived usefulness, those who had previous successful computer experience should anticipate a similar experience from future use of the computer. By extension, if past experience with computer software packages resulted in enjoyable and cognitive interesting interaction (the flow state), then it is anticipated that a similar experience could result in the future with other computer software packages. In two experiments that examined the influence of previous spreadsheet and Lotus 1-2-3 experience, Olfman and Bostrom (1991) found that those with previous software experience performed better on tasks that measured knowledge. In one experiment, they found that in terms of motivation to use, naive users performed better using application-based (minimalist) manual. In contrast, experienced users performed better using

construct-based (author-elaborated) manual. Drawing on these occurrences, the first set of hypotheses relating to prior computer experience reads:

H11. Prior computer experience will directly influence self-efficacy.

H12. Prior computer experience will directly influence usefulness.

H13. Prior computer experience will directly influence flow.

H14. Prior computer experience will directly influence knowledge.

Researchers in the area of end-user training (e.g., Olfman & Mandviwalla, 1990; Olfman & Bostrom, 1988) have demonstrated that there is an interaction between prior computer experience and training method in predicting initial understanding of a software package. Based on their research findings they recommended that novice computer users be exposed to application-based (minimalist) training, while experienced users be provided with the construct-based (author-elaborated) approach. Still others (e.g., Charney et al., 1988) have provided empirical evidence that both novice and experienced computer users benefit from the same type of elaborations, although the experienced users performed better overall. This finding was also true for the proponents of the minimalist manual, both novice and experienced users benefited from this instructional design (Carroll, 1990).

It is still not known what is the relationship between the instructional approach and attitudinal outcomes and whether experience moderates this relationship. Therefore, the second set of hypotheses relating to prior experience reads:

- H15. Experience will moderate the influence of training method on self-efficacy.**
- H16. Experience will moderate the influence of training method on usefulness.**
- H17. Experience will moderate the influence of training on flow.**

Summary

The research model links instructional design to knowledge and attitudinal outcomes as a means of better understanding the training/learning process of a computer software package. In order to test the hypotheses derived from the model, a computer training experiment was conducted. The research methodology for the computer training experiment is presented in Chapter Four.

CHAPTER FOUR - RESEARCH METHODOLOGY

4.0 OVERVIEW

A training experiment was conducted to examine the hypotheses presented in Chapter 3. The training was held at the School of Business, Carleton University. Forty-one participants completed a one day (an average of 6 hours per participant) training course in Microsoft Access. The software was installed on four IBM compatible PCs which were located in four separate rooms. Participants were randomly assigned to one of two manual types, which respectively reflected either a minimalist or an author-elaborated instructional design approach. The research methodology is detailed below.

4.1 Measures

In this study, training/learning effectiveness was measured using: (1) knowledge outcomes, (2) attitudinal outcomes and (3) computer experience. All the measures were developed based on the literature. The measures of knowledge were specifically developed for this research based on definitions found in the literature and from previous research work. Both the attitudinal outcomes and computer experience were adopted from existing measures used in the end-user training research.

4.1.1 Knowledge

Knowledge was measured at two levels: (1) acquisition of declarative knowledge and (2) knowledge compilation measured by proceduralization, composition and an overall measure of compilation. For each of these types of knowledge, specific measures were developed for the research.

Declarative Knowledge. A multiple choice test was developed for Microsoft Access. The primary purpose of this test was to measure comprehension or language understanding by gauging participants' ability to recall specific concepts covered in the training. An example of the items in the multiple choice test is: *A collection of related records is called (a) File. (b) Field. (c) Database. (d) Data Directory.* See Appendix 1 for a complete version of the multiple choice test. The multiple choice test was scored in terms of number of correct answers. Marks were not deducted for incorrect answers.

Knowledge Compilation. Three tasks were used to measure compilation. These tasks can be classified as near and far transfer tasks. A near transfer task is similar to the task(s) performed during the practice/hands-on exercises. A far transfer task requires learners to perform commands that are not explicitly demonstrated during the training. Two near transfer tasks were used to measure knowledge compilation, one each to measure proceduralization and composition. The first near transfer task which was a test of proceduralization, required participants to create a database of scholarship recipients.

The participants were provided with the data required for the database. See Appendix 2 for the information which was provided to complete this task.

The second near transfer task which was a test of composition, required participants to make changes to the scholarship database. Some of the changes (e.g., creating a table, performing queries) were a variant of the examples covered in the manuals, and therefore required participants to determine the appropriateness of their actions. An example of a question for the test of composition was to add several fields (e.g., country of origin, last name, university and year of study) and then save as a new table (University Students). See Appendix 2 for this knowledge test.

The far transfer task was used an overall measure of compilation. This task required participants to create a mailing label using the data from the previously created scholarship recipient database. It required combining several aspects of previously learned procedures to a problem-solving situation. The participants were specifically told what the mailing label should contain (i.e., last name, first name, address including apartment number and street address, city, province and postal code). The instruction on how to create the mailing label is presented in Appendix 3. The grading scheme for each task was based on a predetermined key that was developed by the researcher in consultation with a reviewer before the commencement of the training programme. This grading scheme is presented in Appendix 4.

4.1.2 Attitudinal Outcomes

Self-efficacy. An eight item scale was used to measure self-efficacy. This scale was developed by Compeau and Higgins (1995a). Both general computer self-efficacy and software specific self-efficacy were measured before training, after training but before testing, and after testing. An example of the items that were included in the scale is "I can complete the task using the software package with only the manual as my reference." Each item was measured using "yes" and "no" responses. For the "yes" answer, confidence was rated on a 10 point scale, where 1 indicates "Not at all confident," 5 indicates "Moderately confident," and 10 indicates "Totally confident." Scores were created by averaging the 8 items. Software specific self-efficacy was used for hypothesis testing (See Appendix 5).

Usefulness. Six items were used to measure usefulness. This scale was developed by Davis (1989). Usefulness was measured for computers in general and for Access specifically before training, and after training but before testing. An example of the items that were included in the scale is, "Using this software will make my job easier." Each item was accompanied by a seven point scale, where 1 indicates "Extremely unlikely," 4 indicates "Neither likely nor unlikely," and 7 indicates "Extremely likely." Computer and software usefulness were computed by averaging the responses to the 6 items. Software specific usefulness was used for hypothesis testing (Appendix 5).

Flow. Flow was measured using an eleven item scale which asked participants to characterize themselves while using the computer. This measurement scale was developed by Webster et al. (1993). The items represent the flow outcomes which are believed to result when interacting with a software package (in this case Microsoft Access). For example, "When using Access I feel in control." Each item was measured on a 7 point scale, where 1 indicates "Strongly disagree," 4 indicates "Neither agree nor disagree," and 7 indicates "Strongly Agree." Scores were created by averaging the responses for each of the eleven items. Flow was measured for Access specifically after the training but before testing (See Appendix 6).

4.1.3 Demographics

Demographic information on the participants was collected to provide general information about the participants such as gender, age, education level, type of job (type of organization, functional area and level/position). Computer experience was also assessed. The computer experience questions ranged from use (years) of computers, frequency of use and use of MS Access to familiarity with different software, attending computer training courses and owning a computer.

Given that the research model for this study included prior (computer) experience as an individual difference variable, a specific measure of computer experience had to be

computed from the questions asked, to use in this model. In the context of computer training research, there are several variables that could be used to measure computer experience, as is evident from the Background questionnaire. Often familiarity with certain types of software or level of experience have been used to measure prior experience. Even though the participants of this study are novice users of MS Access, they have significant other computer experience. Based on this reality, "years using computers" was considered an appropriate measure of computer experience. This measure is also consistent with other IS researchers (e.g., Olfman & Mandviwalla, 1990) who investigated prior computer experience. The measure of "Years using computers" was obtained from the background questionnaire (Appendix 5).

Three questionnaires were administered in order to collect data. A background questionnaire completed prior to the training session was used to obtain information about participants' prior computer experience, perceived usefulness of computers in general and database software usefulness specifically, computer self-efficacy in general and database software self-efficacy specifically, and demographic information. At the end of the learning phase the first post-test questionnaire (Post-test1) was administered to measure computer and software usefulness, computer and software self-efficacy, and flow. The scores from the Post-test1 questionnaire were used to assess the impact of the training on attitudinal outcomes. At the end of the knowledge tests the second post-test

questionnaire (Post-test2) was administered to obtain the participants' reaction to the training and to measure computer and software self-efficacy (See Appendix 7).

4.2 TRAINING MANUALS

The materials for this study comprise several chapters of two off-the-shelf manuals, differing only in the instructional design approach. The manuals were rated to ensure that they reflected the instructional approach desired for this study. A brief discussion on the rating of the manuals is provided in the next section, however a more detailed discussion on the manual classification and selection is provided in Appendix 8. A practice disk was also included with one of the manuals (author-elaborated design). Each manual type and the relevant practice disk was placed in a binder. Three of the four knowledge tests were placed at the back of the binder. They were separated from the manual with instructions not to start until instructed to do so. The multiple-choice test was not included in the binder because participants were not allowed to use their manual to perform this task. The *Tables of Contents* of the two manuals and instructions for the knowledge tests are presented in Appendix 9.

Rating Commercial Manuals. In order to identify commercial manuals which would best reflect the minimalist and author-elaborated design approaches, a structured evaluation was conducted. Carroll (1990) and Gong and Elkerton (1990) provided

specific examples of training manuals designed to reflect the two instructional (minimalist and author-elaborated) approaches that were adopted for this study. These examples were used as a guideline to classify and choose from among existing commercial MS Access manuals those that exhibit a minimalist and author-elaborated design approach respectively.

The researcher reviewed approximately ten different commercial manuals on Microsoft Access 2. Based on this initial review, four manuals were chosen for more in depth examination to determine which exemplified the instructional designs required for this research. In the second phase of the selection process, two persons, experienced in end-user computer training, rated the four manuals. Neither of the raters was aware of the experimental focus. Each rater was given the selection criteria for classifying and selecting manuals as either minimalist or author-elaborated. The criteria were established from the literature on instructional design of manuals as well as from two other researchers who had explored training manual design based on the minimalist and author-elaborated approaches.

Each rater was asked to evaluate each manual in terms of the criteria for the minimalist and author-elaborated designs. For each manual, the rater was asked to identify the extent to which the manual matched the relevant criterion using a 1-3 scale, where 1 means "criterion completely satisfied," 2 means "criterion satisfied somewhat," and 3

means “criterion not satisfied.” A detailed description of the ratings of each of the four manuals, is provided in Appendix 8.

Of the two manuals chosen to reflect minimalist principles, **10 Minute Guide to Microsoft Access 2.0** was rated as completely satisfying all of the four criteria, while the other, **Access Quick Reference**, was rated as completely satisfactory on only the criterion of brevity. Exploration and task orientation were somewhat satisfied, and error recognition and support were not satisfied. With respect to the ratings for author-elaborated manuals, one manual, **Microsoft Access 2 for Windows Step by Step**, completely satisfied all the criteria. The other manual, **The Visual Guide to Microsoft Access** satisfied only the criterion of conceptual elaboration completely. Programmed exercises and error recognition and support were only somewhat satisfied.

The two manuals chosen **10 Minute Guide to Microsoft Access 2.0** (reflecting minimalist design) and **Microsoft Access 2 for Windows Step by Step** (reflecting author-elaborated design), were comparable in terms of functional coverage. That is, they covered the same topics and as much as possible used the same order. This ensured that the two manuals were, at least in principle, equally capable of providing instruction on the same set of basic functions (Carroll, 1990). In order to preserve this functionality, neither manual contained an index and the author-elaborated manual did not follow a strict chapter and page number sequence.

Practice-exercises were an integral part of the manuals. They provided the participants with the opportunity to become familiar with the software. The practice exercises differed between the two manual types. The minimalist manual encouraged users to use their own examples, listing only the steps required to do a task (e.g., how to create a database), while the author-elaborated manual detailed the steps through examples on how to do a task (e.g., creating a database). The practice exercise for creating a database was presented in three pages in the minimalist manual compared to 18 pages in the author-elaborated manual. An illustration of the differences between the two manuals follows.

Creating a Database is Lesson (Chapter) 3 in the manual selected to represent a minimalist design -**10 Minute Guide to Microsoft Access 2.0**- (Townsend, C., 1994). It starts with a one sentence overview of what is to be learned in the chapter. This is followed by concepts about databases and the relation to tables, forms, queries and reports. It then lists the steps for creating a database, giving a pictorial representation of what should be on the screen if procedures are properly executed. The panic button (a picture of a bomb) is used to caution or alert users against possible error. The chapter closes with how to close a database and a brief summary of what was learned and what is to be learned in the next lesson. This lesson was presented in three pages. The other lessons and respective examples follow a similar pattern to Lesson 3.

In contrast, the manual selected to represent the author-elaborated design -**Microsoft Access 2 for Windows Step by Step** - (Rainey, E., 1994), *Creating a Database* is in the Getting Ready section which is a preparation chapter. Concepts about databases are presented on the third page of this section of the manual. Two pages later, the steps for creating and opening a new database are provided. Reference is also provided for more information on creating a “brand new database.” This is then followed by instructions to open a specific database. Pictorials are used to provide a representation of what should be on the screen if the procedures are properly executed. The section continues with information for new users of Microsoft Windows, including information on using menus, toolbars, a mouse, help, cue cards. The Chapter concludes with instructions on how to quit MS Access and Windows. Before quitting MS Access, there is a note to go to Lesson 1, if you want to start working with a database. This section on “Creating a Database” was presented in 18 pages. The other lessons and respective examples are presented in about the same number of pages as this lesson.

4.3 PROCEDURES

Pretest. A pretest of the training course was conducted with 8 Masters students from the Carleton School of Business. The training course included a learning phase (reading and practice exercises), three (3) sets of questionnaires which were given at specific times during the training and four (4) knowledge tests. The intent of the pretest

was to get general feedback on the fairness of the knowledge tests, the clarity and ease of completing the questionnaires, and the average time of the training course. As a result of the pretest, a few changes were made to the knowledge tests in order to improve the clarity and fairness of the questions. No changes were required for the questionnaires. The average time of the training course was six (6) hours.

4.3.1 Recruitment of Participants

Recruitment was based on voluntary consent. Participants were drawn from government agencies (e.g., Consulting & Audit Canada, Treasury Board, Canada Post), private sector organizations (e.g., Association of Community Colleges of Canada, Esnard Consulting Inc.), Non-government Organization (e.g., CARE Canada), and academia (Carleton University). Most of the participants were identified through personal contacts within the various organizations. The participants from Carleton University responded to an advertisement that was placed in "This Week at Carleton," a campus newspaper. Posters were also placed in the School of Business. Both the posters and the advertisement indicated that a one day introductory training course in Microsoft Access was being offered free of cost to persons who were employed and who had very little or no knowledge of Microsoft Access. No restrictions were placed on computer experience.

Potential participants contacted the researcher to register for the course. They were then informed that this was a research project in partial fulfillment of a masters thesis, and the purpose of the research was to further the understanding of how people learn a computer software package. The participants were also informed that this study would use a self-training method, but they were unaware of the experimental manipulation (use of two different types of manuals). At this point they were asked to complete the Background Questionnaire.

4.3.2 The Training Program

The training program was a one day introductory training session consisting of several phases. The pre-test of the training session indicated an average training time of six hours (excluding refreshment breaks and stretching); however, to minimize stress no time limits were imposed. Participants were allowed to work at their own pace throughout the training session. Figure 3 depicts the Training Program Time Line.²

Phase 0: Registration & Background Questionnaire

Those participants who registered prior to the day of their training session were sent a registration package. The registration package consisted of: (1) Participation Information

² Even though a record of the time taken to complete the training was not maintained, both groups took about the same time to complete the training.

sheet and Consent form; (2) a background questionnaire; and (3) directions (map) to Carleton University and the designated meeting room (see Appendix 5). In accordance with the regulations on ethical treatment of research participants, the information sheet explained the purpose of the research, the general procedures of the training session and the rights of the participants. Each participant was required to complete and return the consent form and background questionnaire on the day of their training session. Participation was contingent on the completion of both.

Due primarily to time constraints, several participants did not receive the registration package prior to the day of their training session. However, all participants completed both the consent form and background questionnaire before starting the training.

Phase 1: The Learning Phase

The learning phase consisted of a reading and practice period. During this phase, participants were introduced to Microsoft Access through their manuals. They were instructed to read and practice using the software as set out in their respective manual. For example, users of the minimalist manual were encouraged to create their own examples, while users of the author-elaborated manual were given specific examples and were guided through it step-by-step. Participants worked at their own pace. Phase 1 ended when participants indicated that they were satisfied they had read and practiced using the software.

Figure 3. Training Program Time Line

Phase 2: Post-test1 Questionnaire

In phase 2, participants were asked to complete the first post-test questionnaire. This questionnaire included measures of computer and software usefulness and self-efficacy, and flow. The Post-test1 scores were used to assess the impact of the training on attitudinal outcomes. After completing this questionnaire, participants were encouraged to take a refreshment break up to a maximum duration of one hour. However, they were free to choose whether to take a break at that point, or at some other time.

Phase 3: Knowledge Tests

In phase 3 participants completed the tests required to measure knowledge. The first such test was that of declarative knowledge. Participants were given the twelve multiple choice questions to answer without the aid of their manual, since the test was one of recall and recognition. The manuals were returned to the participants at the end of this task. Approximately 15 minutes were needed to complete the test of declarative knowledge. The maximum possible score was 12.

For the hands-on tests of proceduralization, composition and the overall measure of compilation, participants were encouraged to use their manual as well as the built-in help facilities. The participants were given two tasks which were similar to those performed in the practice session (near transfer tasks). This task was a test of proceduralization. The maximum possible score was 20. The second task was a test of composition. The

maximum possible score was 12. Approximately 30 minutes each was needed to complete the test proceduralization and composition.

The final test was an overall measure of compilation. Approximately 30 minutes was needed to complete the test of compilation. The maximum possible score was 7. All four knowledge tests scores were converted to percentage to facilitate comparison.

Phase 4: Post-test2 Questionnaire

Upon indication that they had completed the knowledge tests, participants were asked to fill out the second post-test (Post-test2) questionnaire. The questionnaire had two sections. The first section asked participants to subjectively rate the training. The second section measured computer and software self-efficacy. See Appendix 7 for a sample of the questionnaire. After completing this questionnaire, participants were debriefed and thanked for their participation.

Exit Interview

An exit interview was conducted on a voluntary basis with 21 of the 41 participants. This was a face-to-face question and answer session in which the experimenter sought the participants' opinion about the training. Although some of the questions were similar to those on the post-test2 questionnaire, the intent of the exit interview was to engender a discussion with the participants and thereby to obtain more substantial answers. No

formal analysis of the interviews is presented; they were however, used as an aid in interpreting the results of the hypothesis testing (See Appendix 10 for the Exit Interview Questions and Responses).

4.4 DATA ANALYSIS

In order to test the hypotheses of the research model, several statistical tests were conducted. T-tests were used for the hypotheses (H1-H4) relating to the influence of the manual on the learning outcomes. Correlation analysis was used to test the relationships between the attitudinal outcomes (hypotheses 6, 7, 8) as well as the relationships between prior computer experience and the attitudinal outcomes (hypotheses 11-14). Correlation analysis and path analysis were used to test the influence of attitudinal outcomes on the dimensions of knowledge as outlined in, hypotheses 5, 9, and 10. Analysis of covariance (ANCOVA) was used to test the hypotheses relating to the moderating effect of prior experience on attitudinal outcomes (hypotheses 15-17). All test results are presented and discussed in Chapter Five.

CHAPTER FIVE - RESULTS

5.0 OVERVIEW

This chapter begins with a demographic description of the participants in the study, followed by a presentation of the reliability measures for the attitudinal outcomes, a discussion on the measures of knowledge and the scores for each knowledge test. The hypotheses arising from the research model are tested and the findings are presented. The chapter ends with a discussion of the findings.

5.1 PARTICIPANTS

Of the forty-five original participants who volunteered for the training course, four did not participate in the training because they misunderstood that it would be a self-training course, which means that there would be no trainer. The final sample was forty-one participants, twenty of whom were exposed to the minimalist manual and twenty-one to the author-elaborated manual.

Table 2 presents a comparison of the demographics of participants in the two groups (minimalist versus author-elaborated manual).

Table 2
Participants' Demographics

	Minimalist	Author-elaborated	Overall	χ^2	df	p - value
Gender				5.60	1	0.02
Male	8	17	25 (61%)			
Female	12	4	16 (39%)			
Education				0.47	4	0.98
College/University	10%	14%	12%			
Completed College	15%	14%	15%			
Undergraduate Degree	25%	29%	27%			
Some Graduate Work	15%	10%	12%			
Graduate Degree	35%	33%	34%			
Type of Organization				7.76	4	0.10
Government	40%	33%	37%			
Educational	25%	5%	15%			
Manufacturing	5%		2%			
Financial Services		5%	2%			
Other (Consulting Firm)	30%	57%	44%			
Organizational Level				5.60	6	0.47
Middle Mgmt/Prof'nal	55%	45%	50%			
Administrative	20%	15%	18%			
Technical	5%	15%	10%			
Executives	5%	10%	7%			
Clerical/Secretarial	10%		5%			
Other	5%	15%	10%			
Functional Area				7.44	6	0.28
Accounting & Finance	15%	20%	18%			
Information Systems	15%	20%	18%			
General Management	20%	5%	12%			
Eng'ing, Design, R& D	5%	5%	5%			
Marketing & Sales	10%		5%			
Other (Consulting)	35%	50%	42%			

Overall there were 25 (60%) men and 16 women (40%), ranging in age from 22 to 65, with a mean of 37.5 years ($t = 0.43$, $p = 0.67$). The participants were highly educated. Close to 75% had a university education. Of this amount, 27% had an undergraduate degree, 12% had completed some graduate work and 34% had a graduate degree. Half of the participants held middle management and professional positions, 22% held administrative and clerical positions, while 10% held technical positions. One participant was unemployed, and was seeking a technical position. The participants represented several functional areas, including consulting (42%) accounting and finance (18%), general management (12%), and information systems (18%). Fifteen (37%) worked with government, six (15%) in an educational organization, and eighteen (44%) worked in consulting firms.

Computer Experience

Table 3 shows a comparison of the experience of the participants in terms of overall profile by manual type, along with the χ^2 statistics.³ In terms of the overall profile, years using computers ranged from 1-31 years, with a mean of 11 years ($t = -0.63$, $p = 0.53$). Thirty-one (76%) of the participants owned a computer, while 40 (98%) had previously attended computer training courses. Four participants had used MS Access previously, their use was quite limited however.

³ Both groups were comparable on all the presented categories of computer experience. No significant differences were found between the two manual types.

The other major indicator of computer experience was the frequency of use of computers in general and frequency of use of computer to perform a variety of activities. This was based on a scale ranging from 1 (never) to 6 (daily). The results as presented in Table 4 show a mean use of computers in general of 5.9. This indicates an almost daily use of computers. Word processing was the most frequent computer activity, with a mean of 5.4, followed by electronic mail (mean = 4.6) and operating systems (mean = 4.1). Manpower scheduling (mean = 1.6) and generator and query languages (mean = 1.7) were the least common computer activities, conducted approximately once per year.

Table 3
Computer Experience

	Minimalist	Author-elaborated	Overall	χ^2	df	p - value
Own a computer				0.41	1	0.52
Yes	16	15	31 (75.6%)			
No	4	6	10 (24.4%)			
Attended Computer Training				1.46	1	0.23
Yes	19	21	40 (97.6%)			
No	1	0	1 (2.4%)			
Ever used Access				0.002	1	0.96
Yes	2	2	4 (9.8%)			
No	18	19	37 (90.2%)			

Table 4
Frequency of Use of Computers

Item	Mean ¹	Std. Dev.
Computers in general	5.9	0.40
Coding/Data Entry	4.2	1.68
Computer-based Searches	4.1	1.49
Word Processors	5.4	1.07
Computer Graphics	3.4	1.38
Electronic Mail	4.6	1.90
Statistical Packages	2.2	1.42
Desktop Publishing	2.1	1.37
Telecommunications	2.9	1.89
Operating Systems	4.2	1.79
Programming Language	2.0	1.46
Generators/Query	1.7	1.13
Financial/Accounting Packages	3.1	1.85
Manpower Scheduling	1.6	1.05
¹ 6 point scale: 1 =Never, 6 = Daily		

5.2 MEASURES

The reliability of each of the attitudinal measures was assessed using Cronbach's alpha. As is evident from Table 5 below, the reliabilities for each construct were high at each time period (Background, Post-tests1 and 2 questionnaires). The reliability of the flow

construct was also high, $\alpha = 0.83$. This indicates that the measures of all three constructs were adequate.

Table 5
Reliabilities of Attitudinal Outcomes

Item	Background Questionnaire	Post-test1	Post-test2
Self-efficacy			
Computer self-efficacy	0.85	0.89	0.91
Software self-efficacy	0.89	0.91	0.92
Usefulness			
Computer usefulness	0.94	0.93	
Software usefulness	0.97	0.94	
Flow		0.83	

Self-efficacy Scores

Repeated measures of analysis of variance (ANOVA) was performed to determine whether self-efficacy had indeed changed over the course of training. As a follow-up, the Neuman-Keuls post hoc test was performed to determine which of the software self-efficacy means were different. Significant differences were observed between the background questionnaire and the post-test1 and also between the post-test1 and post-test2 questionnaire. The results indicate that software self-efficacy changed significantly, while computer self-efficacy was unaffected (See Table 6). These results suggest that software self-efficacy was affected by training. The change in software self-efficacy is consistent with the findings of Compeau and Higgins (1992, 1995a). The lack of change

in computer self-efficacy may be attributable to the high level of computer experience in general. The mean self-efficacy scores for the Background, Post-Test1 and Post-Test2 Questionnaires are presented in Table 7.

Table 6
Repeated Measures ANOVA
of
Self-Efficacy Scores

	Sum of Squares	df	F	p - value
• Computer Self-efficacy				
Effect (Time)	3.92	2	2.32	0.105
Error	67.58	80		
• Software Self-efficacy				
Effect (Time)	19.93	2	8.31	0.001
Error	95.94	80		

Table 7
Self-efficacy Scores at Background, Post-test1, and Post-test2

	Background	Post-test1	Post-test2
• Computer Self-efficacy (F = 2.32, p = 0.105)			
Mean	6.55 ^a	6.97 ^a	6.84 ^a
Std. Dev.	1.53	1.77	1.95
• Software Self-efficacy (F = 8.31, p = 0.001)			
Mean	6.44 ^a	7.41 ^b	7.09 ^c
Std. Dev.	1.72	1.70	1.96

Superscripts (a, b, c) that are different indicate significant differences (p < 0.05) across time. Superscripts have no meaning between rows.

Usefulness Scores

The repeated measures ANOVA (Table 8) showed significant difference for the software usefulness scores across time. These results suggest that training decreased perceived software usefulness. This is opposite to prediction and possible explanations for the decline will be presented in the discussion section. General computer usefulness was again unaffected. The mean usefulness scores for both the Background and Post-Test1 Questionnaires are presented in Table 9.

Table 8
Repeated Measures ANOVA
of
USEFULNESS SCORES

	Sum of Squares	df	F	p - value
• Computer Usefulness				
Effect (Time)	0.41	1	1.28	0.265
Error	12.99	40		
• Software Usefulness				
Effect (Time)	5.55	1	5.55	0.023
Error	39.98	40		

Table 9
Usefulness Scores at Background, and Post-test I

	Background	Post-Test I
• Computer Usefulness ($F = 1.28$, $p = 0.265$)		
Mean	6.47 ^a	6.33 ^a
Std. Dev.	0.87	0.74
• Software Usefulness ($F = 5.55$, $p = 0.023$)		
Mean	6.18 ^a	5.66 ^b
Std. Dev.	1.39	1.21
Superscripts (a, b) that are different indicate significant differences ($p < 0.05$) across time. Superscripts have no meaning between rows.		

Flow Scores

Flow was measured only in the first post-test questionnaire (after the learning phase but before the learning measures). The mean flow score (on a 7 point scale, where 7 indicates high flow) for the group using the minimalist manual was 5.5 (standard deviation = 0.67) and the mean score for the group using the author-elaborated manual was 5.2 (standard deviation = 0.94).

Knowledge Tests Scores

The overall means as well as the average scores for each of the dimensions of knowledge by manual type (minimalist and author-elaborated) are presented in Table 10. Overall, participants scored highest on the test of proceduralization (82%). The second highest scores were on the test of declarative knowledge (76%), and the lowest on the tests of composition (67%) and overall compilation (69%). For the test of declarative knowledge,

the minimalist group recorded a mean of 80% compared to a mean of 72% for the author-elaborated group. Similarly, means of 83.8% (test of knowledge proceduralization), 68.2% (test of composition) and 70.3% (overall test of knowledge compilation) respectively, were recorded for the minimalist group compared to the respective means of 80.7%, 65.8%, and 68.9% for the author-elaborated group.

Table 10
Knowledge Tests Scores

	Declarative knowledge	Proced. (Task 2)	Composition (Task 3)	Compilation (Task 4)
Max. Possible Marks	12	20	12	7
Minimalist Manual				
Mean (%)	80.0	83.8	68.2	70.3
Std. Deviations	11.9	10.3	25.3	39.9
N Cases	20	20	20	20
Author-elaborated Manual				
Mean (%)	72.2	80.7	65.8	68.9
Std. Deviations	15.9	15.6	33.2	37.7
N Cases	21	21	21	21
Overall				
Mean (%)	76.0	82.2	66.7	69.6
Std. Deviations	14.5	13.2	29.2	38.2
N Cases	41	41	41	41

A Kolmogorov-Smirnov test was conducted on each of the compilation measures in keeping with the decision to use compilation as the measure of knowledge to assess the relationships in the path analysis. The Kolmogorov-Smirnov is a test of normality. The results showed that the scores for the test of proceduralization did not give a normal distribution, the scores for composition gave a normal distribution, while the overall test of compilation was not a normal distribution. The combination of all three tasks (proceduralization, composition and overall compilation) did result in a normal distribution. Based on these results, it was decided to use this measure of knowledge to assess the relationships in the path analysis.

Table 11
Learning Outcomes Means and (Standard Deviations) by Gender and Manual Type

	Minimalist Manual		Author-elaborated Manual		Total
	Male	Female	Male	Female	
Declarative	9.4 (1.3)	9.7 (1.5)	8.4 (1.9)	9.7 (1.7)	9.1 (1.7)
Proceduralization	17.1 (2.6)	16.5 (1.6)	16.1 (3.2)	16.6 (2.7)	16.4 (2.6)
Composition	8.9 (2.7)	7.7 (3.1)	7.7 (4.3)	8.6 (1.3)	8.0 (3.4)
Compilation	4.3 (3.2)	5.3 (2.4)	4.8 (2.5)	4.9 (3.3)	4.9 (2.6)
Software Self-efficacy	8.2 (1.9)	7.5 (1.3)	7.3 (1.8)	5.8 (1.3)	7.4 (1.7)
Software Usefulness	5.5 (1.0)	6.4 (1.0)	5.0 (1.2)	6.5 (0.6)	5.7 (1.2)
Flow	5.4 (0.8)	5.5 (0.6)	5.2 (1.0)	5.0 (0.9)	5.3 (0.8)

5.3 HYPOTHESIS TESTING

A. Impact of manual type (H1-H4)

Hypothesis one (H1) examines the influence of the different training manuals on four different measures of knowledge. While other studies have used broadly Near and Far

Transfer tasks to measure comprehension (knowledge), this study has separated Near and Far Transfer tasks into knowledge compilation and its components, proceduralization and composition. The remaining hypotheses are concerned with the impact of the manuals on self-efficacy, usefulness and flow, as assessed using the Post-Test1 measures. T-tests were used to determine if the scores for each of these measures differed between the minimalist and author-elaborated manuals. The results of the hypothesis testing are presented in Table 12.

The use of multiple t-tests in assessing the manual effect results in a high experimentwise Type I error rate. A Bonferroni Inequality was used to control for such results, and gives a new critical value for α of below 0.01.

Table 12
Results of Hypothesis Testing (H1 - H4)

Hypotheses	Predicted Effect	df	t	p-Value
H1. Subjects who use the minimalist manual should score higher on each of the knowledge tests than those who use the author-elaborated manual.				
A. Test of Declarative Knowledge.	M>AE	39	0.89	0.08
B. Test of Proceduralization	M>AE	39	0.36	0.47
C. Test Composition.	M>AE	39	0.14	0.77
D. Overall test of Knowledge Compilation.	M>AE	39	0.05	0.92
H2. Subjects who use the author-elaborated manual should have higher software self-efficacy than those who use the minimalist manual.	AE>M	39	0.71	0.16
H3. Subjects who use the minimalist manual should have higher software usefulness scores than those who use the author-elaborated manual.	M>AE	39	0.94	0.07
H4. Subjects who use the minimalist manual should have higher flow scores than those who use the author-elaborated manual.	M>AE	39	0.59	0.24

None of the hypotheses regarding the impact of the manual were supported by this study.

None of the measures of knowledge or the attitudinal outcomes were significantly different across the two groups. This finding contradicts previous research which found

minimalist manuals to be preferred. When the minimalist and author-elaborated manuals were chosen from among commercially available manuals, no knowledge or attitudinal differences were detected.

Power was estimated using the effect size (Δ) and observed power options for a two sample t-test (Kraemer & Thiemann, 1990). Stevens (1992, pp. 173) suggests that power of 80% is an acceptable level. Cohen (1977) has suggested a rule of thumb regarding effect size (Δ). If Δ is approximately 0.20 it is small, if δ is around 0.50 it is medium, and if $\delta > 0.80$ it is large. It should be noted that while large effect size is desirable, small and medium effect sizes are more common in social science research (Cohen, 1977).

An increase of 15% in the respective knowledge scores would be a reasonable expectation of management. Given that the author-elaborated group had the lower knowledge scores, these scores were increased by 15% to determine if the sample size was adequate. The results indicate that for a 15% increase in knowledge scores, (for Declarative knowledge and Proceduralization), a medium effect size is obtained which indicates that the current sample size of 41 is adequate to maximize power of between 50%-70% level. For the tests of knowledge composition and compilation a small effect size of approximately 20% is obtained with the current sample size of 41.

B. Relationships Between Attitudinal Outcomes (H5-H10)

The second set of hypotheses (H5 - H10) relate to the relationships among the attitudinal outcomes as well as the relationships between the attitudinal outcomes and knowledge. These relationships were tested using path analysis. One of the stated advantages of path analysis is that the correlations among the variables can be decomposed. This strengthens the interpretation of the relationships as well as the pattern of effects of one variable on another (Pedhazur, 1982).

The impact of the manual was not tested. The main reason for this decision is that since the manuals did not significantly influence knowledge there would be no gain from conducting a path analysis for this relationship.

According to cognitive theory, there is a qualitative difference in the skill acquisition process during declarative knowledge and knowledge compilation (Fitts, 1964; Anderson, 1982; Kraiger et al., 1993). Declarative knowledge is concerned with component skills, such as recalling which key(s) move the cursor between fields. Compilation on the other hand is concerned with the ability to apply learned skills, such as creating mailing labels. In recognition of this difference between declarative knowledge and compilation, it was necessary to determine a measure of knowledge to assess the relationships for the path analysis. The measures of compilation were considered to more closely reflect knowledge as this study was interested in application of knowledge of the software to

novel situations. The final measure of knowledge was the summation of the three measures of compilation (proceduralization, composition and overall compilation). These measures were weighted equally because they are related sub-processes. This measure of knowledge was only used in the path analysis. The correlation matrix for the attitudinal outcomes and the dimensions of learning including the measure of knowledge for the path analysis as well as the experience measure⁴ are presented in Table 13.

From Table 13, software self-efficacy is significantly correlated with all the dimensions of learning except for declarative knowledge. Software usefulness is significantly correlated with only declarative knowledge, while flow is significantly correlated with proceduralization and overall compilation.

Path analysis was used to test the direct, indirect and spurious effects of the hypothesized relationships. The path coefficients (represented as β) for the hypothesized relationships which are presented in Table 14, indicate the direct effect of the independent variable (attitudinal outcomes) on the dependent variable (Knowledge).

⁴ The results of experience will be discussed later in this Chapter.

Table 13
Correlation Coefficients
Between Attitudinal Outcomes, Knowledge and Experience

	1	2	3	4	5	6	7	8	9
1 Software self-efficacy	1								
2 Software usefulness	.07	1							
3 Flow	.37*	.35*	1						
4 Declarative Knowledge	.08	.39*	.18	1					
5 Proceduralization	.39*	.18	.37*	.45**	1				
6 Composition	.33*	.08	.04	.39*	.47**	1			
7 Compilation	.34*	.08	.32*	.29	.75***	.58***	1		
8 Knowledge	.41**	.13	.26	.44**	.84***	.84***	.89***	1	
9 Experience	.22	-.20	.05	.02	.10	.25	-.03	.14	1

Significance: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$; Knowledge which is the summation proceduralization, composition and compilation is included for use in the path analysis

Hypotheses 7 and 8 were supported, but hypothesis 6 was not. No significant relationship between software self-efficacy and perceived usefulness was found.

All paths were in the predicted directions.

The correlation between software self-efficacy and Knowledge (0.41) was due to the direct effect of software self-efficacy as well as several indirect effects through usefulness, flow and usefulness and flow. The direct effect of self-efficacy (0.37) was stronger than the indirect effects (0.04).

The hypothesized relations are summarized in Table 14.

The correlation between usefulness and Knowledge (0.13) was due to the direct effect of usefulness, an indirect effect through flow (0.03) and several spurious effect due to the common cause of software self-efficacy. The correlation between flow and Knowledge (0.26) was due partly to the direct effect of flow (0.096) and partly to the spurious effect due to the common causes of software self-efficacy and usefulness.

Table 14
Summary of Hypotheses (Path Coefficients)

Hypotheses	Predicted Effect	β	p-Value
H5. Subjects with higher software self-efficacy will score higher than those with lower self-efficacy on the measure of Knowledge.	SSE $\rightarrow$ Knowledge	0.369	0.01
H6. There is a positive relationship between software self-efficacy and software usefulness.	SSE $\rightarrow$ SU	0.066	0.68
H7. There is a positive relationship between software self-efficacy and flow.	SSE $\rightarrow$ Flow	0.349	0.02
H8. There is a positive relationship between software usefulness and flow.	SU $\rightarrow$ Flow	0.330	0.02
H9. Subjects who perceive the software to be highly useful will score higher than those who perceive the software to be less useful on the measure of Knowledge.	SU $\rightarrow$ Knowledge	0.072	0.41
H10. Subjects who experience the flow state while interacting with the software package should score higher than those who do not experience the flow state on the measure of Knowledge.	Flow $\rightarrow$ Knowledge	0.096	0.10
$\rightarrow$ implies relationship between two variables; β = Path coefficient			

Figure 4 illustrates the causal model for this study and the path coefficients (β 's) for each variable.

Figure 4. Causal Model

Prior Computer Experience

Research findings (e.g., Olfman & Mandviwalla, 1990) indicate that there is interaction between prior computer experience and training method in predicting initial knowledge of a software package. For this study, seven hypotheses were examined to assess the relationship between prior computer experience and the training method, and experience and knowledge. Three hypotheses were based on the premise that an influence could result from the direct influence of prior computer experience on the attitudinal outcomes (self-efficacy, usefulness and flow). Three other hypotheses predicted that experience could moderate the influence of the training method on the attitudinal outcomes, while one hypothesis tested the relationship between experience and knowledge.

The hypotheses relating to prior experience were tested using the variable “years using computers” as the measure of (computer) experience. This variable was chosen because it had been used in other end-user research to examine similar hypotheses (e.g., Olfman & Bostrom, 1988).

An analysis of covariance (ANCOVA) was conducted, with experience as the covariate and software self-efficacy, software usefulness and flow as the dependent variables, and manual type as the independent variable. The ANCOVA was not significant. The correlations between experience and the attitudinal outcomes of software self-efficacy, software usefulness and flow also were not significant (Table 15).

These results indicate that experience does not influence software efficacy, usefulness, flow or Knowledge. Nor does Experience moderate the influence of the training method on attitudinal outcomes. Possible explanations for these results will be raised the discussion section.

Table 15
Analysis of Covariance
Experience (covariate). Attitudinal Outcomes and Manual Type

	Experience			Manual Type		
	F	df	p-value	F	df	p-value
Software self-efficacy	2.06	39	.16	2.02	39	.16
Software usefulness	1.58	39	.22	3.56	39	.07
Flow	.08	39	.77	1.40	39	.24
Declarative Knowledge	.02	39	.89	3.12	39	.08
Proceduralization	.42	39	.52	.52	39	.47
Composition	2.73	39	.11	.09	39	.77
Compilation	.32	39	.86	.12	39	.91
Significance: *p < 0.05. ** p < 0.01. ***p < 0.001						

5.4 DISCUSSION

Influence of Manual Type

The data suggest that the design of the instruction manual had no impact on any of the attitudinal or knowledge outcomes of training. Regardless of whether the subjects received the minimalist or author-elaborated manual, they experienced an increase in self-efficacy, decrease in perceived usefulness, a moderate degree of flow, and achieved knowledge scores between 67 and 82% on the knowledge tests.

While these results contradict Carroll's (1984) findings, they are consistent with other studies (Bostrom et al., 1990; Olfman & Bostrom, 1991; Olfman & Mandviwalla, 1990) that compared exploration-based (referred to as minimalist in this study) and construct-based (referred to as author-elaborated in this study) manuals. Carroll (1984) found a significant difference in the level of knowledge which they attributed to the type of manual. On the other hand, the studies by Bostrom et al. (1990), Olfman and Mandviwalla (1990), and Olfman and Bostrom (1991) found no significant difference in knowledge between those who were exposed to exploration and construct-based learning materials.

The results of the knowledge tests and attitudinal measures indicate no difference between the two manual types. This may be interpreted as inconclusive results. There are a number of possible reasons for this finding. First, it is possible that the two manuals chosen did not appropriately represent the minimalist and author-elaborated principles (perhaps none of the commercially available software manuals represent these schools completely). Second, it is possible that the distinction between the minimalist and author-elaborated manuals has no practical impact on learning to use computer software, at least for experienced users.

Given the ratings of the two manuals by independent evaluators (both manuals were deemed to completely satisfy the criteria set out for each manual type), the first

explanation does not seem likely. The responses to the exit interview also lend support to the fact that the two manuals were different. Those who used the minimalist manual described it as brief, short and to the point, allowed for exploring. The users of the author-elaborated manual described it as having too much details for novices, too much information and too many exercises. These were their personal interpretations of the manuals and they are consistent with the tenets that distinguish the two manual types.

Another reason for the inconclusive results may be due to the way the manuals were used. The question is, did the subjects use their respective manuals as they were intended, that is, did those who received the author-elaborated manual read and follow the examples, and did those who received the minimalist manual read and explore? Another reason that cannot be ruled out relates to the validity of the tests that were used to measure knowledge. While every care was taken in creating the tests to ensure they measured the appropriate constructs, and the tests were reviewed by an experienced Access trainer, no formal valuation process was undertaken to ensure their predictive validity. Formal valuation of the knowledge measures as well as the examination of manual use could be areas for future research.

If it can be assumed that the participants used their manuals as expected, then it appears that for practical purposes, the distinction between instructional designs is not sufficient to impact on training outcomes. This does not mean that training materials make no

difference at all. Rather it means that considerations other than pure instructional design must be taken into account. Olfman and his colleagues (e.g., Bostrom et al., 1990; Olfman & Bostrom, 1988) found that training methods interact with user characteristics (such as learning styles) to produce unique results. Thus, perhaps, the efficacy of training materials depends on the characteristics of the learner. On the other hand, since individuals are typically the purchasers of software manuals for their use, this still results in a practical interpretation that any manual is acceptable - a user's preference for one type over the other should be the primary criterion used to select a manual.

Impact of Self-efficacy

The results regarding the impact of self-efficacy on knowledge, usefulness, and flow were mixed. There was a positive and significant relationship between self-efficacy and knowledge. This result is consistent with Compeau and Higgins (1995b) findings that individuals who have confidence in their ability to use the software package scored significantly higher than those who lacked this confidence.

On the other hand, the relationship between self-efficacy and usefulness was positive but not significant, suggesting that being confident of one's ability to use a particular software package does not necessarily mean higher perceived usefulness of it. In this case perceived usefulness relates to usefulness to accomplish specific tasks rather than ability to use the software package in of itself. Compeau and Higgins (1995b) found that

individuals who had confidence in their ability to use the computer had higher expectations of the outcome of using computers. A possible explanation for the difference in findings is that Compeau and Higgins (1995b) examined computer use in general, whereas this study examined a specific software package.

The correlation between self-efficacy and flow was also significant. This relationship is consistent with findings by researchers on play (e.g., Csikszentmihalyi, 1975) that high self-efficacy influences the flow state. Someone who is confident in their ability to use computers should be more likely to explore the software package than someone who has low self-efficacy about their ability to use computers.

Impact of Usefulness

The influence of usefulness on flow was significant. One explanation for the relationship between flow and usefulness may be that once usefulness beliefs are established, then there is the tendency to explore.

While the impact of usefulness on knowledge was positive, it was not significant, suggesting that those who perceived the software to be highly useful exhibited less knowledge. Compeau and Higgins (1995a) found that individuals with higher outcome expectations (perceived usefulness) exhibited less knowledge. A possible explanation for the finding regarding usefulness in this study could be that upon acquiring initial

knowledge (declarative knowledge) of the software, it was discerned that the MS Access may not be as useful as originally perceived prior to using it and therefore lost the interest to do the knowledge tests. Support for this explanation comes from the exit interview. Of the twenty-one persons who participated in the exit interview, only four indicated that they would definitely be using MS Access after the training.

Another explanation may be related to the time when participants completed the usefulness measures. It was observed that both computer and software usefulness scores decreased between the background and Post-test1 measures. The post-test1 scores were measured immediately after the hands-on training period. According to Olfman and Mandviwalla (1989), giving participants time to think and integrate the information about the software that they have just been trained in, may lead to more reliable usefulness scores. In a two study experiment conducted by Olfman and Mandviwalla (1989), usefulness was a surrogate for motivation to use a software package. They obtained significantly better usefulness scores when the participants were allowed to return their self-reported measures of usefulness several days after the training compared to immediately after the training. This result suggests that some time should elapse after the training before usefulness is measured.

It may also be the case that the lack of relationship between usefulness and knowledge is not critical. The theory is clear and research has shown that usefulness affects

behavioural choice (i.e., continued use) (Davis, 1989). Even though knowledge may not be affected, usefulness is still an important learning outcome in its own right. This implies that if perceived usefulness decreases due to changes in expectations, then users will not spend time doing something that is not considered useful.

Impact of Flow

Flow was not significantly correlated with knowledge. While it is unclear why this result occurred, a possible explanation could be that those who experienced the flow state were more interested in exploring the software than doing tests. The counter argument could be those who performed well on the various tests did not have the time to explore and hence experience the flow state. It could also be as posited by theory and supported by research, that flow is associated with use (Trevino & Webster, 1992, Webster et al, 1993). Thus, increased use could eventually lead to increased knowledge.

Although anxiety was not specifically measured in this research, the flow theory states that if the demands of the activity is greater than the skill level, anxiety, rather than flow will occur. The measure of flow used in this research was designed to account for these occurrences if they existed. Given that the average flow score was 5.3, it suggests that flow rather than anxiety occurred.

Influence of Prior Experience

In this study the influence of prior experience on the attitudinal outcomes (self-efficacy, usefulness and flow) was not significant.

Prior experience did not have as hypothesized, a significant impact on self-efficacy. As MS Access was a novel experience to the participants, it was anticipated that they would draw on related computer experience (e.g., spreadsheet or database) to develop their own ability. However, this did not seem to materialize. Compeau and Higgins (1995b) found that prior computer experience influenced self-efficacy of a novel software package, Lotus training. The difference between this and Compeau and Higgins (1995b) study could be as a result of the computer experience measure. This study used "years using computers" as the computer experience measure, while Compeau and Higgins used "prior computer experience", measured by performance on the previous day's tasks.

In terms of usefulness, the relationship with prior experience was unexpected, it was inversely related, $r = -0.20$, and not significant. While it is unclear why this result occurred, one explanation may be related to the time when usefulness was measured. One may have to think about the usefulness of the software package rather than relying on prior computer experience, unless there is an immediate demand for its use, for example, instruction by management to use it. Even though Compeau and Higgins (1995b) prior computer experience measure was not similar to the prior computer experience measure of this study, they found negative relationships between prior

computer experience and outcome expectations (a similar construct to perceived usefulness). The difference in time horizon of the measurement was posited as a plausible reason for the result.

The lack of relationship between prior experience and flow was also unexpected. One possible explanation for this occurrence may be that users only explored the software to determine what was new about it. As these were largely experienced users, if there was a flow state it was limited and lasted until the curiosity aspect of the flow experience was satisfied.

Prior computer experience did not moderate the effect of the manual on self-efficacy, usefulness, and flow. This result may be due to a feeling of obligation to use the manuals given the context of a training environment. Of the twenty-one persons who participated in the exit interview, 62% indicated that they used their manuals while performing the tasks for which it was allowed.

5.5 LIMITATIONS

The limitations of this study relate primarily to the sample. First, because the study used knowledge workers, rather than students, it was difficult to obtain a larger sample size. Thus, statistical power, while adequate to detect a moderate to large effect size was not

adequate to detect small effect sizes. Since small sizes correspond to a 10% or lower improvement in scores on the measures of knowledge, this limitation was not considered critical from a practical viewpoint.

Second, the distribution of subjects across experimental groups, while equivalent on most dimensions, was not even across gender. More men used the author-elaborated manual relative to the minimalist manual. The participants between the two manuals were comparable in all the categories with the exception of gender. A significant difference [$\chi^2 = 5.6$ ($p = 0.02$)] was obtained for gender (refer to Figure 2). Given this result, the differences between means of the 2 groups (minimalist and author-elaborated manual) could be attributable to three sources of variation in means: (a) due to gender; (b) due to the manual type; (c) interaction between gender and the manual type. The means and standard deviations of the knowledge and attitudinal outcomes broken down by gender and manual type are presented in Table 11. T-tests revealed no difference, suggesting that the difference between means of the manuals is not due to an interaction effect of gender. Although the results indicate that there was no interaction between manual type and gender, this limitation cannot be entirely be discounted and is worthy of further study.

A limitation regarding the measurement instrument relates to the time at which the usefulness measure was completed. It has been suggested that more reliable usefulness

scores may be obtained if it is measured some time (e.g., a day) after the training (Olfman & Mandviwalla, 1990). Since usefulness was measured immediately after the training (hands-on) period in this study, this could have reduced the reliability of the usefulness scores.

The experience profile of the sample is another limitation. The participants in this study had used computers for an average of 11 years. Thus, the findings of this study apply to experienced users, rather than novices. Given the increasing prevalence of computers in all types of organizations, a focus on experienced users in research is arguably overdue. While concern over instructional design may be warranted as the novice level, for some types of users (this study does not indicate this, but previous research has), for experienced users the concerns would appear to be less relevant.

Another limitation, although narrow, is the length of the training (1 day) session. While this time frame is consistent with other end-user training research (e.g., Sein, Bostrom & Olfman, 1987; Olfman & Bostrom, 1988; Webster, Trevino & Ryan, 1993; Reder, Charney & Morgan, 1986; Carroll, 1990), it has been proposed that a one day session is too short to adequately assess trainees' abilities.

The education background of the participants is also considered a limitation. One third of the participants had a graduate degree, while most of the remaining two thirds had

completed a undergraduate degree, and the remainder had at least some college or even a university background. The findings therefore are limited to persons of similar backgrounds.

Two strengths of this study are worthy of note. First, the use of employees rather than students answers calls to move training research out of the artificial domain of the laboratory experiment. Second, the use of commercially available software manuals results in a comparison which has current practical application. The methodology used to distinguish the software manuals can be used beyond this study to help both managers and researchers understand and evaluate training materials. Even though neither instructional design has a clear advantage, the ability to distinguish specific features (e.g., task orientation or programmed exercises) can help those selecting materials to understand their choice.

5.6 RESEARCH IMPLICATIONS

In spite of the limitations presented above, the findings of this research are consistent with research that compared the impact of different training methods on end-user training and learning (Compeau & Higgins, 1995b; Davis & Bostrom, 1993; Olfman & Bostrom, 1988). The findings are also comparable with other end-user research that focused on

factors such as self-efficacy, perceived usefulness, and flow (e.g., Compeau & Higgins, 1995a, 1995b; Olfman & Mandviwalla, 1994; Webster, Heian & Michelman, 1990).

While the results of this research provide evidence of the suitability of Cognitive theory to the understanding of the training and learning process of a computer software package, future research is necessary to address some of the limitations highlighted in this study. An extension of the research of this study could be to examine the possibility of interactions between manual type and gender. While neither this nor previous research has indicated any specific reason to expect gender interactions, this is worthy of further study.

It would also be interesting to further investigate the relationship between the level of prior computer experience and manual type on learning outcomes. Specifically, it would be useful to determine whether people with different experience levels measured by type of software experience, or years using computers would favour one type of instructional manual over another.

5.7 CONCLUSIONS

This study has provided a “real-world” comparison of two types of instructional manuals for learning to use a database management system. The results, while subject to limitations of sample size and composition and resting on the assumption that participants

interacted with their manuals as intended, indicate that neither a minimalist approach nor an author-elaborated approach to manual design has a clear advantage in promoting either knowledge of the software (measured in term both declarative knowledge and compilation) or positive attitudinal reactions (self-efficacy, usefulness and flow). Thus from a practical standpoint, concern over which type of manual to select for helping users to learn a software package does not seem justifiable. In the absence of a clear advantage to either type of manual, issues of user preference should probably dominate the selection decision.

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APPENDICES

APPENDIX 1

DECLARATIVE KNOWLEDGE MEASUREMENT (COMPREHENSION TEST)

KNOWLEDGE TEST 1**Instructions**

There are twelve multiple choice questions. You may **NOT** consult your manuals to perform this task. Please answer as many questions as you possible can.

PLEASE INDICATE TO THE RESEARCHER WHEN YOU ARE FINISHED

**MULTIPLE CHOICE QUESTIONS
FOR
ACCESS TRAINING**

Instructions

Please Do Not use your manual for this task. Circle the letter of the most appropriate response.

Q.1 What is Microsoft Access?

- (a) Spreadsheet
- (b) Accounting package
- (c) Wordprocessor
- (d) Database management system

Q.2 In Microsoft Access, database objects include:

- (a) Tables
- (b) Forms
- (c) Reports
- (d) All of the above

Q.3 A collection of related records is called a:

- (a) File
- (b) Field
- (c) Database
- (d) Data Directory

Q.4 In a relational database table, rows correspond to -----and columns to -----.

- (a) Records, Fields
- (b) Files, Records
- (c) Fields, Files
- (d) Records, Files

Q.5 A unique identifier of a record is called a

- (a) File
- (b) Property
- (c) Primary key
- (d) Field

Q.6 Wizards can be used for customising

- (a) Tables
- (b) Queries
- (c) Forms
- (d) All of the above

Q.7 In the Datasheet View you can

- (a) View the data of a table, form, or query
- (b) Change the structure of a table, form, or query
- (c) Do (a) and (b)
- (d) None of the above

Q.8 The Microsoft Access screen includes

- (a) Title Bar
- (b) Menu Bar
- (c) Tool Bar
- (d) All of the above

Q.9 To create a new database use

- (a) File menu
- (b) Open database button on the tool bar
- (c) None of the above
- (d) Either (a) or (b)

Q.10 The following series of commands let you **move** text from one field to another.

- (a) Choose **copy** then choose **paste**
- (b) Choose only **copy**
- (c) Choose **cut** then **paste**
- (d) Choose **cut** then **copy**

Q.11 To move the cursor from left to right between fields of a record. **Press**

- (a) Shift+Tab
- (b) Tab
- (c) Space bar
- (d) Pageup

Q.12 In which of the Access object(s) can you perform calculations?

- (a) Queries
- (b) Tables
- (c) Reports
- (d) All of the above

KNOWLEDGE TEST 2

Instructions

Assume that you are employed to Alpine Consultants to manage a scholarship programme funded by the Canadian International Development Agency (CIDA). This programme has been in existence for two years and has sixteen students. The scholarship recipients are from the Caribbean and are pursuing either undergraduate and graduate programmes at various universities across Canada.

1. You have decided to create a computerized database of the award recipients in order to keep track of them. You want to record personal information about each recipient (e.g., name, address, university, programme of study, telephone number). You also need to record their student number. This is a number which each recipient receives on accepting the scholarship.

In addition to the above information, it may be useful to include, country of origin, year of study and job title.

Create a table using whatever field names and types you think will allow easy access to information in the database.

2. Add data to the table.
 - a. Use the attached sheet (Award Recipients) to add data to your table
 - b. Save your table as **Recipient** (on a diskette)

PLEASE INDICATE TO THE RESEARCHER WHEN YOU ARE FINISHED

APPENDIX 2

MEASUREMENT OF COMPOSITION & PROCEDURALIZATION (NEAR TRANSFER TASKS)

KNOWLEDGE TEST 3

Instructions

In this section you will be using the table **Recipient** (the one you just created) to perform queries.

1. Create a query using the **Recipient** table.
 - a. Add the following fields, Country of Origin, Last Name, Programme of Study, Job Title, University and Year of Study.
 - b. Save as **University Students** (on a diskette).
2. Modify your query (**University Students**) by doing the following:
 - a. insert the Country of Origin field between the University and Year of Study fields
 - b. delete the Job Title column
 - c. specify a criteria for Year of Study as " ≥ 1 " (This means students who are in 2nd year)
 - d. save the query as **Study** (on a diskette)
3. Perform calculations.
 - a. Calculate total number of recipients from each country (country of origin)
 - b. save as **Country** (on a diskette).

PLEASE INDICATE TO THE RESEARCHER WHEN YOU ARE FINISHED

APPENDIX 3

MEASUREMENT OF KNOWLEDGE COMPILATION (FAR TRANSFER TASK)

KNOWLEDGE TEST 4

Instructions

In this section you will also be using the database file **Recipient**. This time you will be creating mailing labels.

1. Create a report in a mailing label format.
2. Your mailing labels should contain the following information and in the following order, including punctuation (see label appearance below):
LNAME, FNAME
ADDRESS (APT. #, STREET ADDRESS)
CITY, PROVINCE (NO ABBREVIATIONS)
POSTAL CODE

LABEL APPEARANCE
WEB, MARK 311-302 SKYLINE DRIVE OTTAWA, ONTARIO L3D 5J5

3. Sort labels by postal code
4. Select Avery 5097 or Fab 03 as the size of mailing labels
5. Choose a font and colour
6. Save the mailing label report as **Report1** (on a diskette)

PLEASE INDICATE TO THE RESEARCHER THAT YOU ARE FINISHED

THANK YOU FOR PARTICIPATING!

APPENDIX 4**GRADING SCHEME FOR EACH KNOWLEDGE TEST**

Knowledge Tests

The first knowledge test was a Multiple Choice test which was used to measure declarative knowledge. Twelve multiple choice questions were given. One mark was given for each correct answer, marks were not deducted for incorrect answers, resulting in total maximum score of 12.

Test 2 which was a test of proceduralization required participants to create a database. In order to create the database, and based on the information provided, several actions were required. Participants were also required to add data to a table. Below is a list of the required actions to create a database, to add data to a table and the respective marks that were assigned to each action:

Action	Marks
File Name	1 if created, 0 if not done
Number of Records	1 if correct, 1/2 partially correct, 0 if incorrect/unanswered
Primary Key	1 if created, 0 if not
Text Field Property	1 if created, 1/2 mark if another field type, 0 if unanswered
Create 9 Fields	1 mark for each field (9), 0 if unanswered
Add (First and Last) Name to Table	1 mark if correct, 0 if incorrect/unanswered
Add address (Apt. # & Street, City, Province, Postal Code)	1 mark for each (total 4 marks), 0 if incorrect/unanswered
Create Input Mask	2 marks if created, 0 if not

Total maximum score is 20.

Test 3 which was a test of composition consisted of three components. The first component required participants to do several queries to the Table that was created in Task 2. Using the query operation, participants were required to add 6 fields to the table. Half mark (1/2) was given for each field added, 0 if it was left unanswered or if a field that was not specified was added. One (1) mark was given for saving the query using the file name suggested.

The second component required participants to modify the previous file by doing 4 different operations including saving as a new file. One (1) mark was given for each

operation correctly performed, 0 if incorrect or unanswered. For the operation to “specify a criteria”, 1/2 mark was given if partially correct.

Component three of Test 3 required participants to do a specific type of calculation which involved three separate steps. One (1) mark was given for each step correctly performed, 0 if incorrect or unanswered. One mark was given for saving the calculation using the file name suggested.

Each component of Task 3 received a maximum score of 4, resulting in an overall total score of 12.

Test 4 which was the overall test of compilation required participants to create a report in a mailing label format. The participants were provided with a sample of the appearance of the mailing and the information that it should contain. The information required and the respective marks assigned are presented below:

Information	Marks
Last Name, First Name	1 mark if correct, 0 if incorrect/unanswered
Address (Apt. #, Street Address)	1/2 mark if correct, 0 if incorrect/unanswered
Address (City, Province)	1/2 mark if correct, 0 if incorrect/unanswered
Postal Code	1 mark if correct, 0 if incorrect/unanswered
Sort labels by Postal Code	1 mark if done correctly, 0 if incorrect/unanswered
Select specific mailing label size	1 mark if correct, 0 if incorrect/unanswered
Choose a font and a colour	1 mark if both are done, 1/2 mark if only one is done, 0 if incorrect/unanswered
Save mailing label	1 mark if done, 0 if not

Total maximum score is 7.

APPENDIX 5

REGISTRATION PACKAGE

PARTICIPANT INFORMATION

You are being asked to participate in a computer software training session. This is part of a research project undertaken in partial fulfilment of a master's thesis. The aim of this research is to further our understanding of how people learn computer software packages.

This will be a one day introductory training course in Microsoft ACCESS (for windows). A self-instructional approach using manuals is the format of this course. It will consist of a reading period, followed by a hands-on practice of ACCESS. The manuals and exercises used in this course will be yours to keep for reference.

In addition to the course material you will be asked to complete several questionnaires over the course of the training. These questionnaires relate to your use of, competence and attitude toward computers as well as some general demographic information.

Your responses will be kept in the strictest of confidence. You are free to leave unanswered any questions you find objectionable, but it is important to this research that questionnaires are answered as completely as possible. There will be a debriefing at the end of the training session to answer any questions that may arise from your participation. Results of this study will be made available to you on request. You may withdraw from the training session at any time.

If you are willing to participate in this training session, please complete the accompanying consent form.

COMPUTER SOFTWARE TRAINING**CONSENT FORM**

I have read and understood the participant information sheet and I agree to participate in this study.

Signature _____

Name (Please print) _____

Date _____

SECTION A

This section asks about your computer experience and use. For each of the following items please **CIRCLE OR FILL-IN** the response which best describes your use of computers.

Q.1 I have a good understanding of what computers can do.

1. DISAGREE
2. SOMEWHAT DISAGREE
3. NEITHER AGREE NOR DISAGREE
4. SOMEWHAT AGREE
5. AGREE

Q.2 For how many years have you been using computers?

_____ YEAR(S)

Q.3 How often do you program your own applications?

1. NEVER
2. A FEW TIMES A YEAR
3. MONTHLY
4. WEEKLY
5. DAILY

Q.4 Have you ever attended (a) computer training course(s)?

1. YES
2. NO --> Go to question 6 on page 3

- Q.5 From the list below, please indicate where you have obtained your computer training? (**CIRCLE** all that apply and **FILL IN** the percentage of training received. It should total to 100 per cent).

	PERCENT OF TRAINING RECEIVED
1. COLLEGE OR UNIVERSITY	_____ PERCENT
2. HARDWARE OR SOFTWARE VENDORS	_____ PERCENT
3. CONSULTANTS	_____ PERCENT
4. IN-HOUSE COMPANY TRAINING	_____ PERCENT
5. SELF-TRAINING (e.g., manuals)	_____ PERCENT
6. OTHER (e.g., a friend)	_____ PERCENT
TOTAL	100 PERCENT

- Q.6 Do you have a computer at home (e.g., PC; Computer Terminal; Macintosh)?

1. YES
2. NO

- Q.7 Have you ever used ACCESS?

1. NO
2. YES --> How many hours per week do you spend using ACCESS?
_____ HOURS

Q.8 The following questions ask about the frequency with which you use computers to carry out a variety of activities.

What is your frequency of:

	Never	At least once a year	Several times per year	A few times per month	A few times per week	Daily
using computers	1	2	3	4	5	6
coding or entering data	1	2	3	4	5	6
searching computer-based records	1	2	3	4	5	6
using a word processor	1	2	3	4	5	6
using computer graphics	1	2	3	4	5	6
using electronic mail	1	2	3	4	5	6
using statistical packages	1	2	3	4	5	6
using desktop publishing packages	1	2	3	4	5	6
using telecommunication packages	1	2	3	4	5	6
using operating systems	1	2	3	4	5	6
using programming languages	1	2	3	4	5	6
using generators query languages	1	2	3	4	5	6
using financial/accounting packages	1	2	3	4	5	6
using manpower scheduling packages	1	2	3	4	5	6

SECTION B

The following statements describe some of the expectations that people may have about using a computer. For each item please indicate your expectations of whether that outcome would be likely to occur by **CIRCLING** a number from 1 to 7, where 1 indicates "Extremely Unlikely," 4 indicates "Neither Likely nor Unlikely," and 7 indicates "Extremely Likely."

Using a computer...

	EXTREMELY UNLIKELY			NEITHER LIKELY NOR UNLIKELY			EXTREMELY LIKELY	DON'T KNOW
Q.9..... will enable me to work more quickly	1	2	3	4	5	6	7	8
Q.10..... will improve my performance	1	2	3	4	5	6	7	8
Q.11..... will increase my productivity	1	2	3	4	5	6	7	8
Q.12..... will increase my effectiveness.....	1	2	3	4	5	6	7	8
Q.13..... will make my work easier.....	1	2	3	4	5	6	7	8
Q.14..... will be useful or my work.....	1	2	3	4	5	6	7	8

Consider the usefulness of using ACCESS specifically. For each item please indicate your expectations of whether that outcome would be likely to occur by **CIRCLING** a number from 1 to 7, where 1 indicates "Extremely Unlikely," 4 indicates "Neither Likely nor Unlikely," and 7 indicates "Extremely Likely."

Using ACCESS...

	EXTREMELY UNLIKELY			NEITHER LIKELY NOR UNLIKELY			EXTREMELY LIKELY	DON'T KNOW
Q.15..... will enable me to work more quickly.....	1	2	3	4	5	6	7	8
Q.16..... will improve my performance.....	1	2	3	4	5	6	7	8
Q.17..... will increase my productivity.....	1	2	3	4	5	6	7	8
Q.18..... will increase my effectiveness.....	1	2	3	4	5	6	7	8
Q.19..... will make my work easier.....	1	2	3	4	5	6	7	8
Q.20..... will be useful for my work	1	2	3	4	5	6	7	8

SECTION C

This section asks about your ability to use an unfamiliar software package. For each of the following items indicate whether you could use an unfamiliar software package under a variety of conditions. For each condition that you answer "yes", please indicate your confidence by **CIRCLING** a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident," and 10 indicates "Totally confident".

For example, consider the following sample item:

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

	NOT AT ALL CONFIDENT			MODERATELY CONFIDENT				TOTALLY CONFIDENT		
..... if there was someone giving me step by step instructions	YES.. 1	2	3	4	5	6	7	8	9	10
	NO									

The sample response shows that the individual felt that s/he could complete the job using the software with step by step instructions (YES is circled), and was moderately confident that s/he could do so (5 is circled).

SECTION D

The following questions ask for some information about you. This information will help to identify individual differences which may influence the level of knowledge of different groups of participants. Please **CIRCLE** the number of the response which best describes you and/or fill in the information requested.

Q.37 Which of the following best describes the type of organisation for which you work?

1. GOVERNMENT
2. MANUFACTURING
3. UTILITY (electric, gas, etc.)
4. MERCHANDISING
5. HEALTH CARE
6. FINANCIAL SERVICES (e.g., banks, insurance)
7. EDUCATIONAL
8. OTHER (Please specify) _____

Q.38 What is your functional area?

1. ACCOUNTING
2. ENGINEERING, DESIGN, R&D
3. FINANCE
4. GENERAL MANAGEMENT
5. PRODUCTION
6. MARKETING OR SALES
7. PERSONNEL/HUMAN RESOURCES
8. INFORMATION SYSTEMS
9. MANUFACTURING/PRODUCTION
10. OTHER (Please specify) _____

Q.39 What is the level of your position?

1. EXECUTIVE
2. MIDDLE MANAGEMENT
3. PROFESSIONAL
4. TECHNICAL
5. ADMINISTRATIVE
6. CLERICAL OR SECRETARIAL
7. OTHER (Please specify) _____

Q.40 What is your age?

_____ YEARS

Q.41 What is your gender?

1. FEMALE
2. MALE

Q.42 Which is the highest level of education you have completed? (**CIRCLE** the latest category that applies)

1. SOME HIGH SCHOOL
2. COMPLETED HIGH SCHOOL
3. SOME COLLEGE OR UNIVERSITY
4. COMPLETED COLLEGE
5. COMPLETED UNIVERSITY
6. SOME GRADUATE WORK
7. COMPLETED A GRADUATE DEGREE

Thank you for your assistance!

Please be assured that your responses will be held in confidence.

APPENDIX 6**POST-TEST1 QUESTIONNAIRE**

SECTION A

The following statements describe some of the expectations that people may have about using a computer. For each item please indicate your expectations of whether that outcome would be likely to occur by **CIRCLING** a number from 1 to 7, where 1 indicates "Extremely Unlikely," 4 indicates "Neither Likely nor Unlikely," and 7 indicates "Extremely Likely."

Using a computer...

	EXTREMELY UNLIKELY			NEITHER LIKELY NOR UNLIKELY			EXTREMELY LIKELY
Q.1..... will enable me to work more quickly.....	1	2	3	4	5	6	7
Q.2..... will improve my performance.....	1	2	3	4	5	6	7
Q.3..... will increase my productivity.....	1	2	3	4	5	6	7
Q.4..... will increase my effectiveness.....	1	2	3	4	5	6	7
Q.5..... will make my work easier.....	1	2	3	4	5	6	7
Q.6..... will be useful for my work.....	1	2	3	4	5	6	7

Consider the usefulness of using ACCESS specifically. For each of the following items indicate your expectations from using ACCESS by **CIRCLING** a number from 1 to 7, where 1 indicates "Extremely Unlikely," 4 indicates "Neither Likely nor Unlikely," and 7 indicates "Extremely Likely."

Using ACCESS...

	EXTREMELY UNLIKELY			NEITHER LIKELY NOR UNLIKELY			EXTREMELY LIKELY
Q.7..... will be able to work more quickly	1	2	3	4	5	6	7
Q.8..... will improve my performance	1	2	3	4	5	6	7
Q.9..... will increase my productivity	1	2	3	4	5	6	7
Q.10..... will increase my effectiveness.....	1	2	3	4	5	6	7
Q.11..... will make my work easier	1	2	3	4	5	6	7
Q.12..... will be useful for my work	1	2	3	4	5	6	7

SECTION B

This section asks about your ability to use an unfamiliar software package. For each of the following items indicate whether you could use an unfamiliar software package under a variety of conditions. For each condition that you answer "yes", please indicate your confidence by **CIRCLING** a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident," and 10 indicates "Totally confident".

For example, consider the following sample item:

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

	NOT AT ALL CONFIDENT			MODERATELY CONFIDENT				TOTALLY CONFIDENT		
.....if there was someone giving me step by step instructions	YES.. 1	2	3	4	5	6	7	8	9	10
	NO									

The sample response shows that the individual felt that s/he could complete the job using the software with step by step instructions (YES is circled), and was moderately confident that s/he could do so (5 is circled).

SECTION C

The following questions ask how you characterise yourself when you are using ACCESS. For each of the given sentences, please **CIRCLE** the number that best describes you in general when interacting with ACCESS.

	Strongly Disagree	Disagree	Slightly Disagree	Neither Agree nor Disagree	Slightly Agree	Agree	Strongly Agree
29. When using ACCESS, I felt in control.....	1	2	3	4	5	6	7
30. I felt that I had no control over my interactions with ACCESS	1	2	3	4	5	6	7
31. While using ACCESS, I thought about things.....	1	2	3	4	5	6	7
32. While using ACCESS, I was aware of distractions.....	1	2	3	4	5	6	7
33. While using ACCESS, I was totally absorbed in what I was doing	1	2	3	4	5	6	7
34. Using ACCESS excited my curiosity.....	1	2	3	4	5	6	7
35. Interacting with ACCESS made me curious.....	1	2	3	4	5	6	7
36. Using ACCESS aroused my imagination.....	1	2	3	4	5	6	7
37. Using ACCESS bored me	1	2	3	4	5	6	7
38. Using ACCESS was intrinsically interesting.....	1	2	3	4	5	6	7
39. ACCESS was fun for me to use	1	2	3	4	5	6	7

APPENDIX 7

POST-TEST2 QUESTIONNAIRE

SECTION A

This section of the questionnaire asks you to rate the training course. Please **CIRCLE** the response that best describes how you feel about the training.

Q.1 Please evaluate the ACCESS training on each of the following dimensions:

i. Were the **training manuals**:

1	2	3	4	5
HELPFUL				NOT HELPFUL

1	2	3	4	5
WELL DOCUMENTED				POORLY DOCUMENTED

1	2	3	4	5
EASY TO FOLLOW				HARD TO FOLLOW

ii. Were the **hands-on exercises**:

1	2	3	4	5
HELPFUL				NOT HELPFUL

1	2	3	4	5
WELL DOCUMENTED				POORLY DOCUMENTED

1	2	3	4	5
EASY TO FOLLOW				HARD TO FOLLOW

iii. How would you rate the **amount of information in the manuals**?

1	2	3	4	5
TOO MUCH				NOT ENOUGH

iv. Overall, how would rate the **ACCESS training**?

1
HELPFUL

2

3

4

5
NOT HELPFUL

Q.2 What, if anything, did you like or dislike about the manual?

[illegible]

Q.3 Would you recommend this training method to others as a way of learning a computer software?

1. DEFINITELY
2. MAYBE
3. UNDECIDED
4. PROBABLY NOT
5. ABSOLUTELY NOT

Q.4 How often will you now use ACCESS?
(**CIRCLE** one number)

1. NEVER
2. LESS THAN ONCE A MONTH
3. ONCE A MONTH
4. A FEW TIMES A MONTH
5. A FEW TIMES A WEEK
6. ABOUT ONCE A DAY
7. SEVERAL TIMES A DAY

Q.5 Do you have any suggestions or recommendations about the training ?

SECTION B

This section asks about your ability to use an unfamiliar software package. For each of the following items indicate whether you could use an unfamiliar software package under a variety of conditions. For each condition that you answer "yes", please indicate your confidence by **CIRCLING** a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident," and 10 indicates "Totally confident".

For example, consider the following sample item:

I COULD COMPLETE THE JOB USING THE SOFTWARE PACKAGE...

	NOT AT ALL CONFIDENT			MODERATELY CONFIDENT				TOTALLY CONFIDENT		
.....if there was someone giving me step by step instructions	YES.. 1	2	3	4	5	6	7	8	9	10
	NO									

The sample response shows that the individual felt that s/he could complete the job using the software with step by step instructions (YES is circled), and was moderately confident that s/he could do so (5 is circled).

Now that you have completed the ACCESS training, please indicate whether you think you could use ACCESS under a variety of conditions. For each condition that you answer "yes", please indicate your confidence by **CIRCLING** a number from 1 to 10, where 1 indicates "Not at all confident", 5 indicates "Moderately confident," and 10 indicates "Totally confident".

I COULD COMPLETE THE JOB USING ACCESS....

		NOT AT ALL CONFIDENT			MODERATELY CONFIDENT				TOTALLY CONFIDENT		
Q.14if there was no one around to tell me what to do as I go.	YES.....	1	2	3	4	5	6	7	8	9	10
	NO										
Q.15if I had only the software manuals for reference.	YES.....	1	2	3	4	5	6	7	8	9	10
	NO										
Q.16if I had watched someone using it before trying it myself.	YES.....	1	2	3	4	5	6	7	8	9	10
	NO										
Q.17if I could call someone for help if I got stuck.	YES.....	1	2	3	4	5	6	7	8	9	10
	NO										
Q.18if someone helped me to get started.	YES.....	1	2	3	4	5	6	7	8	9	10
	NO										
Q.19if I had a lot of time to complete the job for which the software is to be used for.	YES.....	1	2	3	4	5	6	7	8	9	10
	NO										
Q.20if I had just the built in help facility for assistance.	YES.....	1	2	3	4	5	6	7	8	9	10
	NO										
Q.21if someone showed me how to do it.	YES.....	1	2	3	4	5	6	7	8	9	10
	NO										

Thank you for your assistance!

APPENDIX 8

MANUAL CLASSIFICATION AND SELECTION CRITERIA

MANUAL CLASSIFICATION AND SELECTION CRITERIA FOR THE TRAINING RESEARCH

1.0. Manual Classification and Selection

Several criteria were used to classify manuals as either minimalist or author-elaborated. These criteria are extrapolated from empirical research (e.g., Carroll 1990; Gong and Elkerton 1990; Reder et al., 1986 and Warner, 1987). These same criteria were also be used to select the manual that respectively, best exemplifies a minimalist and author-elaborated design approach. A description of these selection criteria for each instructional approach is presented below.

1.1. Classification Criteria

A. Minimalist Design Principles

i. Brevity

This principle suggests that less is more (Carroll, 1990). That is, shortening the manual improves learning (Carroll, 1990; Gong & Elkerton, 1990). This is achieved by cutting the verbiage, i.e., reducing substantially but not necessarily eliminating overviews, previews, summaries, reviews. This result in (a) substantially less pages and (b) facilitating users to begin practicing the software early into the introduction or immediately after a brief introduction.

ii. Exploration

This principle suggests that the manual should to some extent: (a) encourage users to reason and do things on their own (e.g., incompletely specify procedure such as cursor movements); (b) provide opportunities for users' to use their own (personally relevant) examples. For example, instead of detailed examples in each chapter, "on your own" exercises or open-ended examples which give users the flexibility to use or not to use the example(s) given.

iii. Task-oriented

A task-oriented design principle implies quick orientation to the goals and sub-goals that can be accomplished using the software. This is achieved by making: (a) topic chapters modular, i.e., each chapter covering only relevant goals and subgoals; (b) topic chapters short but with enough conceptual information to allow for increased understanding. For example, in a chapter "creating a table" a subgoal would be to define a table. Defining a table requires specifying the type of data for each field. Rather than just stating that Access supports eight data types and giving one example (e.g., text), each data type is presented with a one-line explanation.

iv. Error support and recognition

It has been observed that committing errors is inherent to any computer training (Carroll, 1990). Thus, the purpose of this principle is to help learners recover from errors or to prevent learners from making errors. This can be achieved in two ways. The first relates to synchronizing the training and the software (i.e., what is on screen). This can be done implicitly by deliberately specifying procedures incompletely or by indirect references for users to check system prompts. An explicit technique is to specifically make reference to a diagram which represents outcome of actions or told to follow the instructions given by the system. Even though the table in the manual and the table on screen may differ in content, both tables would have the same basic format (e.g., field name, data type). For example, the manual would give the steps for creating a new database and then indicate "see figure xx." Another example could be to delete a field (one that has data). The instructions may be to switch the display to "Design View" before deleting with reference "see figure xx" which would be a display of the "Table Design View". The second approach is the use of a universal error symbol (e.g., a red triangle) to warn against error or to indicate error recovery procedures.

B. Author-elaborated manual

i. Conceptual elaborations

In contrast to the minimalist manual, author-elaborated manuals promotes elaborations rather than brevity. Elaborations have been defined as any detailed information which is used to clarify or specify the main points of a text (Reder et al., 1986). Elaborations may take the form of (a) detailed explanations of software concepts, analogies and alternative methods of conducting the same task; (b) detailed previews, overviews, chapter summaries, restatements. This results in a lengthy manual which is a key contrast to the minimalist design principle.

ii. Programmed exercises

This design principle is a major contrast to the minimalist exploration and task-oriented design principles. The programmed exercises principle logically decomposes the tasks and knowledge into components which force users' to follow a sequence of reading and specific example(s). Instruction on how to do a tasks is accompanied with conceptual and alternative methods of doing a task. It does not allow users' to try tasks that are not explicitly instructed.

iii. Error support and recognition

This design principle is common to both approaches. While both make reference to diagram as representing outcome of procedures as an error support means, the author-elaborated approach usually provide (relatively) less tips or error recovery procedures. This is based on the presumption that with explicit instructions and exercises users will, unerringly follow the instructions.

2.0. Evaluation Methodology

Two persons who are experienced in EU computer training were asked to rate the four manuals. Neither of the raters were aware of the experimental focus. They were given the guidelines as well as the rankings and asked to conduct an evaluation of the manuals. The intention being to find the manual that best exemplifies each of the two types of instructional design.

3.0 Review of manuals and their ranking

3.1. Evaluation procedure

The review was conducted in two phases. The first phase was to classify manuals as either minimalist or author-elaborated.

The second phase was to select the manual that **best** exemplifies a minimalist and author-elaborated design approach respectively. Based on the classification, the manuals were evaluated in line with their respective design principle. This served as the selection criteria. Each criterion was given a rank of 1, 2 or 3, where 1 means "criterion completely satisfied," 2 means "criterion satisfied somewhat," and 3 means "criterion not satisfied." **Best** is defined as that manual which receives the most number 1 rank.

3.1.1. Manual Classification

The four manuals were evaluated on all the criteria identified as representing the minimalist and author-elaborated design principles with one exception, the error support and recognition criterion. The exclusion of this criterion does not prevent a manual from being classified as reflecting a minimalist or author-elaborated design approach. However, the exclusion of this criterion reduces the likelihood of a manual being selected as the **best** manual that represents a minimalist design approach. The rationale for this is explained above.

The two manuals that were classified as reflecting a minimalist approach corresponded with the brevity, exploration and task-oriented design principles and therefore diverged from the author-elaborated design principles. Correspondingly, the two manuals that were classified as reflecting an author-elaborated approach, compared favorably with the conceptual elaborations, and programmed exercises design principles. Evidence of a manual's tendency towards one or the other design approach can be inferred from the manual selection evaluation presented below.

3.2.1 Manual Selection

3.2.1.1 Minimalist Manual

Two manuals (10 Minute Guide to Microsoft Access and Access Quick Reference) were evaluated based on the identified minimalist design principles. Below is the result of this evaluation.

i. Brevity

Although the 10 Minute Guide to Microsoft Access contains chapter previews and reviews (one sentence) and the Access Quick Reference does not, the former is still the shorter manual in terms of number of pages (144 vs. 177 pages). The 10 Minute Guide manual also allow users to begin practicing sooner than the Access Quick Reference manual.

ii. Exploration

Although both manuals gave a complete set of cursor movements for moving around the datasheet to inspect or edit records, the 10 Minute guide tended to leave other procedures incompletely specified compared to the Quick Reference. The companion condition to exploration is working on own tasks. This was better managed in the 10 Minute Guide manual. While the manual did not explicitly give "on your own" exercise, it used open-ended examples. For example, the user is instructed how to add records (no data is given) with the suggestion "continue until you have added all the records you want to add." This is consistent with the principle of induction which is that learners work from examples which they are either given or create themselves in order to understand a general procedure (cf. Bostrom et al., 1993). Studies have shown (e.g., Carroll, 1990) that inferential manuals leads to effective learning.

iii. Task-oriented

The topic chapters for both manuals were modular. For example, the 10 Minute Guide has chapter titles, "creating a simple table" and "adding data to a table." The Access Quick reference has chapter titles, "tables," and "working with datasheets." While both manuals chapters were concise, only the 10 minute Guide provided conceptual information which would allow for increased understanding of tasks. For example, rather than just giving one example of a data type (e.g., memo field), each data type is explained briefly. This corresponds to the findings for more structure and detail on the grounds that it enhances task performance (Carroll, 1990).

In addition, the 10 Minute Guide was easier to read in any order. It has a chapter on how to add data to a table, such a chapter was not included in the Access Quick Reference, neither is this procedure covered in any other chapter.

iv. Error recognition and support

Only the 10 Minute Guide satisfied this criterion. Throughout the manual, an error symbol (a panic button) is used to indicate possible errors or to recommend error recovery procedures.

Table 1

Name of manual\Rank	Criteria			
	Brevity	Exploration	Task-oriented	Error recognition and support
Access Quick Reference	1	2	2	3
10 Minute Guide to Microsoft Access	1	1	1	1

As is evident from table 2, the 10 Minute Guide to Microsoft Access received the highest number 1 rank. Therefore, it was deemed the **best** manual which represents a minimalist design approach.

3.1.2. Author-elaborated manual

Two manuals (Visual Guide to Microsoft Access and the Step By Step Guide to Microsoft Access) were reviewed. The rankings for each criterion and an explanation are presented below.

i. Conceptual elaborations

Both the Visual Guide to Microsoft Access and the Step By Step Guide to Microsoft Access, contain chapter overviews and summaries which account for almost a page. The chapters are very detailed resulting in both manuals having in excess of 600 pages. However, the Visual Guide contained more explanations of software concepts. For example, the chapter on "designing your database" was totally conceptual, providing (24 pages) software and database information without any hands-on practice. The Visual Guide consistently provide alternative ways of conducting the same task. For example, it explained how to create tables using "Table Wizards" and by "Design View."

ii. Programmed exercises

Both manuals provided programmed exercises. However, the Step by Step was more detailed and rigorous. For instance, a sequence of readings with explicit instructions (e.g., follow these steps) on the order in which the data are to be added. The instructions are concluded with another sequence of readings

iii. Error support and recognition

Both manuals provided error support and recognition to some extent. Both made explicit reference to a figure (e.g., see figure 2) to indicate what the output should resemble. This facilitated the synchronizing of the training with the software. The Step by Step Guide also presented within a chapter (the chapter on "working with data") a section on "undoing mistakes."

Table 2

Name of manual/ Rank	Criteria		
	Conceptual elaborations	Programmed exercises	Error recognition and support
The Visual Guide to Microsoft Access	1	2	2
Step by Step Guide to Microsoft Access	1	1	1

As is evident from table 2, Step by Step to Microsoft Access received the highest number 1 rank. Therefore, it was deemed the **best** manual which represents an author elaborated design approach.

APPENDIX 9

TRAINING PROGRAM

**COMPUTER SOFTWARE
TRAINING STUDY**

AN

INTRODUCTION TO MICROSOFT ACCESS 2.0

**SCHOOL OF BUSINESS
CARLETON UNIVERSITY**

1994

WELCOME TO THE COMPUTER SOFTWARE TRAINING STUDY

The intent of this study is to further our understanding of how people learn computer software packages. As participants in this study, you will be given a one day introductory training course in MICROSOFT ACCESS.

ACCESS is a computer software package known as a database management system (DBMS). Similar to the storage and retrieval of names, addresses and telephone numbers in a Rolodex, a DBMS allows you to collect and track data. A computerised DBMS like ACCESS, lets you store, retrieve, manipulate and print data.

Several questionnaires will be given over the training session. These questionnaires will ask for demographic information, as well as your computer experience, use and attitude in general and specifically to ACCESS.

Please answer all the questions in the questionnaire. Remember, there are no right or wrong answers and your responses will be held in confidence.

Thank you for participating.

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MICROSOFT ACCESS KNOWLEDGE TESTS

Instructions

There are four knowledge tests to be completed. Please complete them to the best of your ability. On completing each test, please indicate to the researcher or his assistant that you are finished.

You may consult your manuals as much as necessary to perform all the knowledge tests unless otherwise stated. Attached is the data that you will need for the knowledge tests. All the course materials (e.g., manual) are yours to keep.

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MICROSOFT ACCESS KNOWLEDGE TESTS

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APPENDIX 10

EXIT INTERVIEW QUESTIONS AND RESPONSES

EXIT INTERVIEW

The following are the questions that were asked of the participants who volunteered for the exit interview. The questions were asked in the order presented.

- Q1. How did you find the training session (e.g., tiring, frustrating, boring, enjoyable)?
- Q2. What would you attribute your feelings regarding the training to (e.g., the manual, time, exercises)?
- Q3. How would you rate your knowledge of Access? Will you be using it after today? How confident are you to show someone how to use Access based on what you have learned today?
- Q4. What, if any areas of the training would you say contributed the most to your newly acquired knowledge of Access (e.g., explanations in the manual, practice exercises, the tasks you were given)?
- Q5. What is your opinion of the manual?
- Q6. Did you use the manual to perform the tasks you were given? Did you use the on-line help or cue cards? Why?
- Q7. Was there anything that you found particularly difficult to do? Any error(s) you kept repeating? Why? Do you think that you now know the correct method of doing it?
- Q8. What is your opinion of the questionnaires?
- Q9. Would you consider this training method for learning other software packages? Why? What would be your preference (in order of priority) for learning software packages? Why?
- Q10. Generally, were you satisfied with the training? Any particular likes or dislikes?
- Q11. Is there anything about the training you would change? What? Would this just benefit you or would it make the training more beneficial overall?
- Q12. Do you have any other comments/recommendations?

Thank you!

Responses to Interview Questions

Note: The numbers in brackets indicate the number of persons with the same response.

Questions	Response: Minimalist Manual	Author-elaborated Manual
Q1. How did you find the training session?	Easy (2); Good, but long; Somewhat tedious; Interesting; Condensed, geared towards beginners; 1st half was fine. Good (2); Helpful; Enjoyable. Had to do it twice.	Useful; Tiring, too much to do in 1 day; Tedious; Frustrating; Reasonably good; Interesting; Easy . Good (2).
Q2. What would you attribute your feelings towards the training to	Manual easy to use (8); A lot to read and practice. Needed more information to do knowledge tests; Practice exercise was good; Brevity of manual	Liked the structure of the manual and practice exercises. Too much information and time was too short; Too many exercises; Needed someone to teach; Software was user friendly; Enjoyed doing the exercises. Manual easy to use; Desire to learn software; practice exercises were good;
Q3a. How would you rate your knowledge of Access	Proficient; Average, need to know more; Basic, functional (4); Fair (2); More than basic (3); Basic, need more time to practice.	More than basic (5); Very basic; Basic, functional (3);
Q3b. Will you be using Access after today?	Not sure (8); Yes (4);	Not sure (9);
Q3c. Would you be confident to show someone how to use Access?	Yes (9); Yes, but with a manual. Yes, basic things; Not confident;	Yes (7). Not confident, not familiar with windows. Not confident.
Q4. What contributed most to your current knowledge of Access?	Manual (2); Manual, previous database knowledge and knowledge test (2); Manual, exercises, and knowledge tests (7); Previous knowledge of other database and windows (2);	Manual & practice exercises and knowledge tests (6); Practice exercises (2); Previous database knowledge & practice exercises;
Q5. What is your opinion of the manual?	Helped to become functional; Good, wanted more examples; Enough information and easy to follow; Good, allowed for exploring (2); Good (3); Needed more examples to do the knowledge tests (2);	Too much Information; Too detailed for novices (2); Good (4); Wanted more details; Examples were good;

Questions	Response: Minimalist Manual	Author-elaborated Manual
	Short and to the point; Good, but required knowledge of Windows;	
Q6a. Did you use your manual for the knowledge tests?	Yes (6); No (6);	Yes (7); No (2);
Q6b. Did you use on-line help or cue cards?	On-line help, was not helpful (2); Both, not helpful (2); Both, helpful (3); Cue cards, helpful (2); Neither (2); Cue cards, not helpful.	On-line help, not helpful (3); Neither (4); Both, not helpful (2).
Q7. Was there anything you found difficult to do, or any errors you kept repeating?	No (5); Calculations (2); Changing label type; Fonts; Kept leaving out fields; Used forms instead of reports; Setting criteria;	Differentiating between data and design screen; No (4); Problems saving and editing files; Setting field names; Mailing label; Calculations;
Q8. What is your opinion of the Questionnaires?	Ok (2); None (6); Interesting (2); Repetitive; Enlightening, answers changed over time;	Confused general computer with Access; None (5); Ok (2); Repetitive;
Q9a. Would you consider this training method for learning other computer software package?	Yes (10); No (2)	Not 1st preference (2); No (2); Yes (5);

Questions	Response: Minimalist Manual	Author-elaborated Manual
Q9b. What would be your top three training method for learning a computer software package?	Manual with tutor. manual. classroom; Manual. manual with tutor. classroom (3); Classroom. manual with tutor. video; Manual with tutor. video. classroom; Manual with tutor. video with tutor. manual; Manual. manual with helpline; Classroom. manual with tutor. manual (2); Interactive CD. manual with tutor. video; Manual with tutor. classroom. manual	manual with tutor. manual. video (4); Classroom. manual with tutor. manual; Manual with tutor. classroom. manual; Interactive CD. manual with tutor. manual; Manual with tutor. classroom. video with tutor; Manual. manual with tutor. classroom.
Q10a. Generally were you satisfied with the training?	Yes (12);	Yes (8). No.
Q10b. Any particular likes or dislikes?	No like/dislikes (7). Dislikes: Training too long; Computer was slow; Not full manual Likes: Exploring: Easy;	Training too long (4). None (4). Preferred one-on-one training;
Q11. Is there anything you would have changed	No (5); Have more than one session (2); Condense the training; Use colour monitors (2); More exercises; Have a tutor;	No (6); Spread over two days; More exercises; Establish deadlines;
Q12. Would you recommend this type of training to a friend who wants to learn a computer software package?	Yes (7); If they are familiar with computers; Maybe. if able to work on their own (4);	Yes (4); Maybe. if able to work on their own (5);
Q13. Why would you recommend the training to them?	Good way of becoming familiar with the software (8). Was instructive (2); Was fun (2);	Good way of becoming familiar with the software (5). Was helpful (4);
Q14. Do you have any other comments/recommendations?	No (11); Use colour monitor	Not (8).

IMAGE EVALUATION TEST TARGET (QA-3)

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