Reflective judgment and the adult learners use of metacognative learning strategies

by Alan Eichi Yabui

A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Education
Montana State University

Abstract:
The relationships between adult learners' placement in reflective judgment stages and use of learning strategies and between selected demographic variables and use of learning strategies of adult learners were examined. The study also investigated whether there were groups of adult learners who think and learn in a similar manner. Volunteer participants from Malmstrom Air Force Base, Montana were surveyed between September 1991 and March 1992.

Learning strategy information was collected using the SKILLS survey instrument that had respondents selecting 18 responses to learning strategy questions on 4 learning scenarios. A second survey instrument, the RJQ used four problem scenarios to solicit reflective judgment stage responses for participant stage placement on the Reflective Judgment Model. Two hundred one participant surveys were used in the discriminant analyses and 197 surveys were used in the cluster analysis. Two discriminant analyses and a cluster analysis were to determine the relationship between learning strategies and education, gender, age and learning strategies and reflective judgment. The cluster analysis was used to determine if distinct groups of adult learners had similar patterns of learning and thinking.

Three distinct reflective judgment groups were identified using discriminant analysis. Five cluster groups were identified using cluster analysis. High reflective judgment group members indicated resource management use of human resources and identifying resources along with metacognition adjusting and critical thinking conditional acceptance were important learning strategies. Low learners identified metacognition monitoring and planning and metamotivation reward and attention as major learning strategies. Age and education were important variables for the high reflective judgment learners. Use of human resources, identifying resources, adjusting, and conditional acceptance were learning strategies associated with the high reflective judgment cluster groups. Planning, monitoring, and reward were important learning strategies of low reflective judgment cluster groups.

On the basis of the analysis, it was concluded that there were three distinguishable learner groups identified by reflective judgment stages, cluster groups identified learners who thought and used learning strategies in a similar manner, and among adult learners there are discernible learning strategy patterns associated with different reflective judgment stages.

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ABSTRACT

The relationships between adult learners' placement in reflective judgment stages and use of learning strategies and between selected demographic variables and use of learning strategies of adult learners were examined. The study also investigated whether there were groups of adult learners who think and learn in a similar manner. Volunteer participants from Malmstrom Air Force Base, Montana were surveyed between September 1991 and March 1992.

Learning strategy information was collected using the SKILLS survey instrument that had respondents selecting 18 responses to learning strategy questions on 4 learning scenarios. A second survey instrument, the RJQ used four problem scenarios to solicit reflective judgment stage responses for participant stage placement on the Reflective Judgment Model. Two hundred one participant surveys were used in the discriminant analyses and 197 surveys were used in the cluster analysis. Two discriminant analyses and a cluster analysis were to determine the relationship between learning strategies and education, gender, age and learning strategies and reflective judgment. The cluster analysis was used to determine if distinct groups of adult learners had similar patterns of learning and thinking.

Three distinct reflective judgment groups were identified using discriminant analysis. Five cluster groups were identified using cluster analysis. High reflective judgment group members indicated resource management use of human resources and identifying resources along with metacognition adjusting and critical thinking conditional acceptance were important learning strategies. Low learners identified metacognition monitoring and planning and metamotivation reward and attention as major learning strategies. Age and education were important variables for the high reflective judgment learners. Use of human resources, identifying resources, adjusting, and conditional acceptance were learning strategies associated with the high reflective judgment cluster groups. Planning, monitoring, and reward were important learning strategies of low reflective judgment cluster groups.

On the basis of the analysis, it was concluded that there were three distinguishable learner groups identified by reflective judgment stages, cluster groups identified learners who thought and used learning strategies in a similar manner, and among adult learners there are discernible learning strategy patterns associated with different reflective judgment stages.

CHAPTER 1

INTRODUCTION

Adult Problem Solving

> In the richer problems of every life, one rarely finds that the problem can be constructed as a puzzle, and one of the most difficult aspects of realistic problem-solving is the determination of whether or not a solution has occurred . . . . Another way of saying the same thing is that in social problems like pollution and poverty, there is no authorized source for terminating the inquiry. (Churchman, 1971, p. 144)

Adults solve problems in daily routine that are often complex and ill-structured, i.e., problems that have no one right answer. A puzzle as described in the Churchman quote is a well-structured problem, i.e., all the elements necessary for a solution are known and knowable. Stated another way, puzzles have a single right or wrong answer which is available to the problem-solver. Wood (1983) defined a puzzle as "a situation for which there exists a single correct answer. In such situations the information needed to solve the problem is entirely contained in the problem instructions" (p. 250). In puzzles, the final solution is perceived to be complete and sufficient by qualified individuals because the solution adheres to explicit rules for formulation and inference within the context of the puzzle situation.

Commenting about IQ tests, a form of academic puzzle solving, Sternberg observed that tasks in IQ tests "are formulated by other people, are of little or no intrinsic interest, have all needed information available from the beginning, and are distant from an individual's ordinary experience." Different skills are needed to problem solve on IQ tests than for solving real-world problems. According to Sternberg (1986), Neisser coined the term "practical intelligence" to describe "intelligent performance in natural settings." Practical intelligence was defined as "responding appropriately in terms of one's long-range and short-range goals, given the actual facts of the situation as one discovers them" (p. 211).

Adult problems are rarely puzzle-like; therefore, puzzle solving methodology is limited in scope and of little value in the daily decision-making activities of an adult. Cavanaugh, Kramer, Sinnot, Camp, and Markley (1985) observed that adults make decisions based on "what they believe, how they feel, how motivated they are, and an assessment of their own knowledge and situational factors" (p. 147).

The adult who faces real-world problems is often confronted with the dilemma of choosing or devising a strategy among many perceived possible strategies to resolve a given ill-structured situational problem. Ill-structured problems are problems with poorly defined structures and ones in which the outcomes of a given act are not known with certainty (Wood, 1983, p. 251). Although the problems are unique, many real-world problems or dilemmas have similar characteristics so that resolution strategies are often repetitive or modifications of previously used strategies. The adult's prior success in solving a

like problem, perception of situational reality, and how he/she conceptualizes truth and knowledge contribute greatly to the decision-making process. Strategy choices range from looking for advice and possible solutions from an expert to a thoughtful personal examination of one's knowledge base and the known evidence.

Kitchener and King (1981) developed a seven-stage Reflective Judgement Model outlining how individuals justified decisions based on assumptions about knowledge. The stages in the Kitchener and King model are sequential and hierarchical. It begins with Stage 1, in which an individual accepts knowledge absolutely and believes knowledge to simply exist, to Stage 7, in which the individual conceptualizes that knowledge gained by critical inquiry can be used to create an approximation of reality that is held constant across several domains. Each reflective judgment stage is qualitatively different, and each stage represents an organization of thought based on an understanding of the nature of inquiry and perception of knowledge. The Reflective Judgment Model stages are further explained in Chapter 2.

As an individual progresses through the reflective judgment stages, thinking processes also increase in complexity. The cognitive processes used by an individual to solve problems basically constitute selecting strategies that are perceived to be useable to attain some type of acceptable solution. The individual strategy selection an individual uses often is an intrapersonal mental process or what Flavell (1976) termed "metacognition." According to Flavell, metacognition

refers to "one's knowledge concerning one's own cognitive processes and products or related to them" (p. 232).

Gavelek and Raphael (1985) indicate that metacognition has two major concerns. First, it assumes that the learner is an active organism and that metacognitive knowledge enables learners "to behave proactively or to influence the input that in turn influences the activity." Second, metacognition addresses "transfer or generalization of what has been learned . . . it is reasoned that to the extent individuals know what and how they know, such higher-order knowledge should be utilizable across different settings" (p. 129). The concept of metacognition is covered in more detail in the Literature Review, Chapter 2.

Statement of the Problem

Thinking individuals process information to derive opinions and make decisions. The technique of integrating new information with presently held knowledge and how one justifies belief in the accepted knowledge affect how an individual goes about seeking additional data. How adults use their present knowledge base and how they transform and develop their decision-making skills are acknowledged as important questions in the education of adults. Until recently, the relationship between the use of decision-making strategies and reflective thinking has been rarely mentioned in the research literature. Most of the studies about decision making and problem solving that refer to reflective thinking have been categorized under the label "critical thinking." Kitchener (1983) stated that

critical thinking studies usually fall under two general categories: studies that group themselves around the hypothetic-deductive method and studies that examine critical thinking as a process of inquiry. Both approaches assume the use of a set of critical thinking skills, i.e., assume a close relationship between problem solving processes and the scientific method (p. 78). Kitchener further argued that to view reflective thinking as a subset of the logic-based scientific method fails to recognize that there are different sets of assumptions about knowledge involved in reflective thinking. Paraphrasing Dewey, Kitchener (1983) stated,

> Reflective thinking can only take place when there is an awareness that a true problem exists and that uncertainty about a solution is at the basis of that awareness. Not all epistemological assumptions acknowledge such uncertainty. (p. 78)

Mezirow (1990), in discussing reflection and adult education, commented that research in the area of adult learning has basically ignored studying "the process of reflecting back on prior knowledge to determine whether what we have learned is justified under present circumstances" (p. 5). Mezirow referred to reflection as "a generic term for those intellectual and affective activities in which individuals engage to explore their experiences in order to lead to new understandings and appreciation" (p. 5). He further speculated that reflective action may be an integral part of decision making. He defined reflective action as "action predicated on a critical assessment of assumption," which may be interpreted as "the process of correcting distortions in our reasoning and attitudes" (p. 6, 7).

The process of individual critical assessment of knowledge address both the issues of "What do I presently know?" and "How do I best resolve the situation being encountered?" These questions are basically metacognition questions. The problem is that we have little research data on the relationship of learning processes to such reassessment of knowledge.

Purpose of the Study

This study was conducted to determine the relationship between reflective judgment and adult learning. Few studies have explored the use of King and Kitchener's Reflective Judgment Model to determine if an adult's placement at different stages affects the use of different learning strategies in problem solving. Many studies assume adults have some level of knowledge to design potential resolutions for day-to-day problems that often do not have definite solutions. Most adults, however, accept best alternatives as solutions that temporarily or permanently alleviate problems without having the information or the know-how necessary to collect information to make a "good" decision. Real-world problems which adults encounter have no given solution as one finds in a puzzle, and there are many possible alternative solutions to ill-structured problems. How does an adult choose the best solution? The Reflective Judgment Model places adults at different stages of justification of knowledge and reality perception that impact acceptance of alternative solutions in decision making. The relationship of

reflective judgment and an adult's use of learning strategies in problem solving situations was explored in this study.

The purpose of this study was to investigate whether individuals at various stages of reflective judgment use different learning strategies. Secondly, the study investigated whether individuals at various stages of reflective judgment were different demographically in levels of education, age, and gender and different in the use of learning strategies. Thirdly, this study investigated whether there were grouped clusters of people who think and learn in a similar manner. Participants for this study were selected from individuals who work at Malmstrom Air Force Base, Montana.

Relationships were examined between a participant's individual reflective judgment score derived from a Reflective Judgment Questionnaire (RJQ) designed as part of this study and the participant's use of learning strategies measured by the Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS) developed by the Center for Adult Learning Research at Montana State University. The demographic factors were level of education, gender, and age. Education factors included highest level of education completed in a post-secondary education program.

Research Questions

This study investigated the relationship between learning strategies measured by SKILLS and reflective judgment scores measured by the Reflective Judgment

Questionnaire of military and civilian personnel who were stationed or worked at Malmstrom Air Force Base in Great Falls, Montana. Three research questions were tested in the study.

Research Question 1: Among Malmstrom Air Force Base personnel is it possible to discriminate among the participants with the highest Reflective Judgment Questionnaire scores, the participants with approximately the middle Reflective Judgment Questionnaire scores, and the participants with the lowest Reflective Judgment Questionnaire scores based on measurements of learning strategies scores on SKILLS?

Research Question 2: Among Malmstrom Air Force Base personnel is it possible to discriminate among the participants with the highest Reflective Judgment Questionnaire scores, the participants with approximately the middle Reflective Judgment Questionnaire scores, and the participants with the lowest Reflective Judgment Questionnaire scores based on measurements of learning strategies scores on SKILLS and demographic variables?

Research Question 3: Is it possible to identify distinct clusters among Malmstrom Air Force Base personnel based on learning strategies scores on SKILLS, Reflective Judgment Questionnaire scores, and demographic variables.

Significance of the Study

Information about an adult learner's use of learning strategies and the relationship of learning strategies to reflective judgment stages has the potential of impacting adult education programs in a significant manner. Knowledge about student learning strategies and reflective judgment scores could be used by instructors and program administrators to provide better educational learning environments for students. Do varied approaches to teaching, programming, and learning relate to intellectual development? Should programs be structured to encourage reflective judgment development? Would training in the use of learning strategies promote intellectual development? This study lays the basis for such considerations by determining whether there is a relationship between reflective judgment, learning strategies, and certain demographic variables.

The development of higher order thinking skills involves challenging one's basis for assumptions about knowledge. King and Kitchener hypothesize that epistemological changes most likely will occur as a student accepts responsibility for investigating and accepting the relative nature of knowledge and uncertainty. With the commitment and responsibility for investigating and acceptance of the reality of one's judgment of knowledge, students may be able to choose more alternatives during situations of decision making.

Brookfield (1987) stated that the ability to consciously reflect on one's learning style is a crucial element in an adult's ability to develop critical thinking habits (p. 83). Brookfield further stated that,

> Becoming aware of our learning styles, and learning how to adjust for weaknesses and emphasize strengths, is not a pedagogic exercise of interest only to academics. It is a fundamentally liberating way by which we can free ourselves of tendencies and inclinations that act to prevent us from becoming critical thinkers. (p. 85)

Smith (1982) commented in his book, Learning How to Learn, that adult learning intersects with learning how to learn in such a way that as an adult learns, the learning impacts on his/her motivation for further learning, which affects the adult learners potential of being a more efficient, effective, and meaningful learner (p. 58).

Definition of Terms

Judgment Sampling: Non-random sampling method in which the researcher's judgment is used in deciding which elements of a universe to include in a sample. The researcher selects "typical" individuals or groups to represent the population (Hamburg, 1987, p. 177).

Knowledge: "The act of having a clear and justified grasp of what is so or of how to do something. Knowledge is based on understanding or skill, which in turn are based on thought, study, and experience" (Paul, 1990, p. 557).

Learning Strategies: "The techniques and skills that an individual elects to use in order to accomplish a specific learning task. Such strategies vary by

individual and by learning objective. Often they are so customary to learners that they are given little thought; at other times much deliberation occurs before a learning strategy is selected for a specific learning task" (Fellenz & Conti, 1989, p. 1).

Memory: "The capacity of humans to retain information, to recall it when needed and recognize its familiarity when they later see it or hear it again" (Wingfield & Byrnes, 1981, p. 4).

Metamemory: Term to describe how an individual uses "knowledge about how, when and why" to intentionally store and retrieve information from memory (Leal, 1987, p. 35). Flavell and Wellman (1977) describe the attributes and properties of metamemory as "[An] individual's knowledge of and awareness of memory, or of anything pertinent to information storage and retrieval . . . [for example,] a person has metamemory if he [or she] knows that some things are easier to remember than others, is aware that one item is on the verge of recall, while another is wholly irretrievable at present" (p. 4).

Metamotivation: Learner control of motive strategies in a learning situation. McClelland (1987) defines motive as "a recurrent concern for a goal state based on a natural incentive--a concern that energizes, orients, and selects behavior" (p. 590).

Problem Solving: A thinking strategy that starts with the recognition by the learner that a "discordant situation" exists that needs some type of resolution. It involves the process of clearly identifying the nature of the problem,

establishing a plan to resolve the problem, and acting on the plan to meet the need to resolve the problem (Beyer, 1987, p. 28).

Resource Management: Individual strategies used in gathering data and resources to be applied in conjunction with familiar and known problem solving techniques in a learning or problem resolution situation.

Skill: "The ability to execute or perform in an expert, rapid, accurate way . . . [when associated with cognitive or thinking operations, synonymous with] recalling, analyzing, detecting fallacies . . . also refers to discrete, thinking operations such as clarifying, detecting bias, synthesizing" (Beyer, 1987, p. 25).

Thinking Operation: The use of skills and strategies to analyze, evaluate and resolve discordant situations (Beyer, 1987, p. 33).

Assumptions and Delimitations

An assumption in this study was that the Reflective Judgment Questionnaire, a paper and pencil survey, used in this study approximated the Reflective Judgment Inventory, an interview-type instrument used in the King and Kitchener Reflective Judgment Model.

Participants were administered the SKILLS and RJQ under both controlled and uncontrolled situations. In the uncontrolled situation, the instruments were handed out to participants at their respective work centers and the participants were requested to return the instruments to a central location at their work centers.

In the controlled situation, the instruments were administered by the researcher or an instructor to selected college and military education courses at the Malmstrom Air Force Base Education Center. It was assumed that the participants answered both instruments under both conditions truthfully and in an unbiased manner. All participants in this study volunteered to respond and complete the RJQ and SKILLS instruments.

The study was delimited to civilian and military personnel who worked at or were assigned to Malmstrom Air Force Base between September 1991 and April 1992. Volunteer participants were chosen from work centers which represented a high percentage of the civilian work force at the base and from military and college courses which had enlisted and officer personnel as students.

CHAPTER 2

REVIEW OF RELATED LITERATURE

Introduction

In the 1970's cognitive psychologists working with children and adults demonstrated that immature learners had a tendency to use little or no strategy to aid their learning. After being taught specific strategies to improve their learning skills, the immature learners were not able to use newly learned strategies very efficiently. Only after specific instructions were given on how to use the learning strategies on specific tasks did learning improve. This led researchers to examine learners' awareness of their own memory processes and how individual learners used memory processes when studying subject matter, how learners used memory during the learning task, and how learners used memory in the application of learning strategies. Flavell coined the phrase "metamemory" to explain this area of cognitive research, which basically asked the question, "What might a person conceivably come to know, or know how to find out, concerning memory as a function of cognitive growth and learning experience?" (Brown, Bransford, Ferrara, & Campione, 1983, pp. 82-83). Research in metamemory eventually progressed into a wider range of cognitive concerns referred to as "metacognition."

Of major importance in this study is the relationship of the learner's knowledge, the learner's learning process, and the strategies that the learner uses to perform a learning task. Metacognitive concepts and the Reflective Judgment Model were used to examine this relationship. Although the concept of metacognition is not clearly defined among adult educators and cognitive psychologists (Fellenz & Conti, 1989; Gavelek & Raphael, 1985; Reynolds & Wade, 1986), the examination of metacognition strategies and reflective judgment stages may shed light on an adult's process of learning and decision making. The components of the Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS) instrument are explained under metacognition as the "meta" strategies fall under the category of "thinking about" memory or motivation. Resource management and critical thinking also imply the use of "meta" skills.

This review will examine SKILLS strategies associated with metacognition, memory, metamemory, resource management, and critical thinking. Additionally, Kitchener and King's Reflective Judgment Model will be reviewed.

Metacognition Strategies

Overview

As stated in Chapter 1, Flavell (1976) defined metacognition as "one's knowledge concerning one's cognitive processes and products or anything related to them, e.g., the learning-relevant properties of information or data." He further added that the processes of metacognition involve "the active monitoring,

consequential regulation, and orchestration of these processes in relation to the cognitive objects on which they bear, usually in the service of some concrete goal or objective" (p. 232). Flavell's definition in essence refers to self-monitoring on specific cognitive tasks.

Flavell (1979) identified four classes of phenomena that were required for cognitive monitoring to occur: metacognitive knowledge, metacognitive experiences, goals (or tasks), and actions or strategies. Metacognitive knowledge refers to a person's stored world knowledge. Metacognitive experiences are any conscious or affective experiences that pertain to a person's intellectual activity. He added that "metacognitive experiences are especially likely to occur in situations that stimulate a lot of careful, highly conscious thinking" (p. 908). Flavell believed that conscious metacognitive strategies can affect either cognitive or metacognitive goals by adding, deleting, or revising metacognitive knowledge. Goals (or tasks) are the objectives of the cognitive activity, and actions are the behaviors that are used by a person to achieve goals (p. 906).

Flavell (1979) stated that metacognitive knowledge concerns the interactions or combinations of interactions among person, task, and strategy. He described metacognitive knowledge as "knowledge or beliefs about what factors or variables act and interact in what ways to affect the course and outcome of cognitive enterprises" (p. 907). He identified three variables of metacognitive knowledge: person, task, and strategy. As used by Flavell, the term "person" referred to the nature of people (self and others) as cognitive processors. Individual referred to

reference of oneself (intrapersonal). Others referred to how individuals relate to others (interpersonal) and how individuals used cognitive strategies (universals of cognition) in the learning process. To explain the use or belief in universals of cognition, Flavell used the example of a child using various degrees of remembering, attending, and problem solving to address a learning situation. However, even if the child used such strategies, the child could have learned that failure to understand may be the end result because the use of metacognitive strategies had not guaranteed the problem situation would be understood correctly, or that the variables of the problem would be presented coherently (p. 907). Task was concerned with information availability to a person during a cognitive enterprise, and strategy was concerned with ways or procedures an individual used in attaining a goal.

Yussen (1985) stated that "metacognition is that mental activity for which other mental states or processes become the object of reflection . . . metacognition is sometimes referred to as thoughts about cognition, or thinking about thinking" (p. 253).

Yussen (1985) clarified Flavell's description of metacognitive knowledge and experiences by stating, "Metacognitive experiences are here-and-now reactions to the ongoing cognitive activity, whereas metacognitive knowledge consists of stored concepts (declarative and procedural) which are called up from memory to guide the cognitive activity" (p. 256). He attributed to Brown the refining of the definition and description of metacognitive knowledge through her belief that there

are two kinds of metacognitive knowledge: static and strategic. According to Brown's definition, static knowledge consisted of the verbalizable things people state about cognition and strategic knowledge consisted of those steps that individuals actually used to regulate and modify the progress of a cognitive activity as it actually occurred. Brown (1985) identified four basic strategies: "planning--figuring out how to proceed; predicting--estimating some quantitative aspect of the outcome of the cognitive activity; guessing--taking a stab at an answer prior to reaching a complete cognitive answer; and monitoring--taking stock of how well one has progressed toward some goal in the cognitive activity" (p. 256). Brown (1978) emphasized the importance of metacognitive processes when she stated that "the processes described as metacognitive are important aspects of knowledge, that what is of major interest is knowledge about one's own cognitions rather than the cognitions themselves" (p. 79).

Gavelek and Raphael (1985), in their research on metacognition within an instructional environment, believed that three questions should be asked to determine if a learner (child) [also may be applied to adults] is utilizing metacognitive knowledge:

a. Does an individual give evidence of monitoring and/or regulating his or her cognitive performance?

b. Is this individual's performance facilitated as a result of such activity?

c. Does the individual engage in the metacognitive activity across multiple settings? (p. 107)

Kuhn (1983) noted that Flavell's description of metacognition failed to recognize two distinctions in metacognition in what she terms "executive 1", i.e., knowledge about the task or problem itself, and "executive 2" strategies, i.e., knowledge of whether a particular strategy is appropriate to apply in a given problem-solving situation. Executive strategies referred to the application of problem-solving skills to business situations.

Kitchener (1983) argued that the distinctions between the two kinds of "knowing about knowing" pointed out by Kuhn are obscured, especially the distinction between an individual's knowing about intrapersonal cognitive processes and when to apply them and knowing about knowledge and the validity of truth claims. Kitchener maintained that "a critical difference exists between knowing that a particular memory strategy is recommended under certain circumstances and knowing that for some problems we can never know a solution is absolutely true" (p. 223).

To clarify a problem situation, a person may ask questions. However, in order to ask questions that will increase comprehension of the situation, the questioner must know something about what is not known in order to ask an information-seeking question (Gavelek & Raphael, 1985). The dilemma, according to Gavelek and Raphael, is similar to a Plato dialogue in which Meno proposed the following problem to Socrates:

> You argue that a man cannot inquire either about that which he knows or about that which he does not know; for if he knows, he has

> no need to inquire; and if not, he cannot; for he does not know the very subject about which he is to inquire. (p. 113)

Sternberg (1986) stated, "Probably more problems remain unsolved because they are never recognized than because they are solved inappropriately" (p. 83). Reynolds and Wade (1986) stated that "Knowledge of how metacognition predicts and affects actual cognition performance is crucial if metacognition is to survive as a useful and important construct" (p. 311).

SKILLS Metacognition Learning Strategies

The three metacognition learning strategies are planning, monitoring, and adjusting. Flavell (1979) and Brown (1978) both contended that planning, monitoring, and adjusting of learning strategies were interactive and dependent on each other.

(1) Metacognitive planning refers to how an individual focuses on a learning task at hand by thinking about the processes that would most likely be employed in the task. This strategy encompasses anticipating what needs to be done, assessing the individual's possessed learning skills, and thinking about the best method to utilize in performing the task.

(2) Monitoring refers to the strategy of assessing how the learning is progressing during the process of the learning task. Monitoring keeps the individual relatively focused on the task at hand and provides feedback to the individual as the task progresses.

(3) Adjusting refers to the learner's ability to make corrections or change procedures as feedback is received regarding the accomplishment of the task. New information may also affect an adjusting strategy as new external information may alter the metacognitive plans mentally conceived before the task was started. Adjusting strategies point to the ability of learners to modify and adjust learning strategies as needed during the performance of learning tasks.

Memory Strategies

Overview

Salthouse (1982) stated that although memory is often thought of as a single process, memory consists of many diverse metal processes. For example, memory may be examined by investigating the distinctions between encoding, storage, and retrieval. Encoding, storage, and recall is also referred to as registration, retention, and recall (pp. 125, 133). Wingfield and Byrnes (1981) stated that "the term memory is an inclusive one that deals with our ability to acquire and retain information, to recall it when needed, and to recognize its familiarity when we see it or hear it again" (p. 17). Long (1983) stated:

> The process of learning and memory are so closely related and interdependent that it is often difficult to determine whether we are concerned with one phenomenon or two . . . one who does not learn has nothing to remember, and without memory there is no evidence of learning. (p. 58)

According to Best (1986, p. 114), the information-processing theory of memory considers memory as a system of initial interrelated components: storage,

control processes, capacity, and decay. This short-term storage system was thought to be of limited duration and only have the capacity to develop memory codes that were acoustic, verbal, or linguistic. This memory was perceived as an individual's mental capability to store information in some storage mechanism using mental codes which could be transferred throughout one compartmented mental store (sensory register) through the use of cognitive codes. The combined total capacity of the sensory register determined the capacity of a person's short-term memory, and each sensory register was thought to be subdivided into specific areas where certain stimuli and perception senses stored specific information. Memory storage was thought to be of a short duration, about 30 seconds for unrehearsed material. As time passed, information not transferred to long-term memory was thought to decay.

The control process that permits transfer of information between short-term to long-term memory is rehearsal. Best (1986) defined rehearsal as cognitive operations that have two functions: procedures that refresh codes stored in short-term memory which assist codes storage in short-term memory and operations that help build up a close duplicate representation or memory trace of "the stored short-term storage codes in long-term storage." In short-term storage information is organized for storage according to acoustical or verbal codes, while in long-term storage codes are organized semantically by meaning (pp. 114-115).

Murdock used the term "recognition memory" to refer to the act of retrieval of information from memory. Recognition memory can take two forms: the

recognition of someone or something, or it can refer to an act of testing memory with several alternatives and making a judgment of familiarity. The utilization of information is in two stages, the inquiry of the memory trace by an encoded probe and the decision that the memory code is a match of the inquiry. Murdock explained that the process of memory for information retrieval is complex and similar to the process of electronic signal detection. Memory is probed for either old information or a signal distribution or a noise (new information). If the probe is successful, the item is retrieved; if not, the probing continues until some decision criterion stops the process (pp. 2-8).

Wingfield and Byrnes (1981) stated that one way of distinguishing different kinds of questions about memory is to distinguish between memory-related questions about process and questions concerning memory structure. Memory structure questions relate to what information is stored, how long the information may last in memory, and how the information is organized in memory, while process questions examine factors such as acquisition, retention, and retrieval (p. 6).

SKILLS Memory Learning Strategies

The SKILLS memory learning strategies are organization, external aids, and application.

(1) Memory organization is the orderly and detailed strategy used by the learner to mentally organize information to facilitate storage and retrieval of information. It is the reordering and restructuring of data or information from an

original verbal or written presentation or an empirical experience. Mental organization of information assists the learner in recalling information. Information is thought to be organized in memory in such a way as to fit into an existing framework of knowledge or to fit into relationships of related items stored in memory, which makes it easier to retrieve when needed (Norman, 1982). In SKILLS it includes imagery, organization relating, and level of processing.

Extemporaneous speaking is an example of the use of imagery, mental organization, and level of processing. From the research of supporting materials, a speaker develops a written outline for informational or persuasive extemporaneous verbal presentation. Through the written outline and verbal rehearsal, the speaker prepares a mental imagery and strategy for an extemporaneous speech. As the extemporaneous speech is presented, the speaker's mental image is translated into a verbal picture for the audience and the speaker processes non-verbal feedback and modifies the speech to accommodate the audience, while at the same time sticking to a strategy to accomplish to purpose of the speech.

(2) The use of external aids to reinforce memory is effective in helping a learner remember information. Zechmeister and Nyberg (1982) maintained that external aids enable a learner to better process information for internal storage in both short- and long-term memory. In using external assistance, the learner attempts to correlate mental processes with the surrounding external environment, such as a contextual interaction with past or future events. Making mental notes of geographic features so one can later retrace a journey or remember where one

placed an object would be examples of contextual external aids. Making lists, using appointment calendars, or asking someone to "remind" one of something to do are other examples.

(3) Memory application refers to the deliberate use of past experiences to help the learner learn. Learners may use memory application to visualize steps they had previously used to solve puzzles. Remembrances and mental images are effective memory applications in real-life learning situations.

Metamotivation Strategies

Overview

McClelland (1987) stated that the subject area of motivation deals with a part of the "why" of behavior and deals with the "how behavior gets started, is energized, is sustained, is directed, is stopped" (p. 4). Metamotivation deals with a learner's thinking about the variables of motivation and how the variables affect learning outcomes.

Deci and Ryan (1985, p. 3) maintained that motivation has two essential components: energization and direction of behavior. Energization refers to needs satisfaction that McClelland (1987, p. 595-598) infers come from three basic human motives: achievement, power, and affiliation.

Motive is defined by McClelland (1987) as "a recurrent concern for a goal state based on a natural incentive--a concern that energizes, orients and selects behavior." Under this definition, a person focuses on goal states, that is, being

focused on the outcomes of specific tasks on a recurrent basis rather than an infrequent and sporadic basis. Goal states "pop into" a person's thinking often but not continuously (pp. 590-592). Learners using metamotivation techniques need to be constantly reinforced with the goal or goals of the learning task.

Direction of behavior may be explained by McClelland's use of the phrase "goal state." It is important because the outcomes of directed behavior of movement toward the goal state may be more important than the specific activities to attain the outcome. For example, a learner trying to improve work productivity by becoming more efficient in performing a given task would be satisfied with the final outcome of increased efficiency rather than with the accomplishment of the several tasks that led to the final outcome. According to this perception of motive, the outcome outweighs the importance of the achieved intermediate tasks.

Deci and Ryan (1985) referred to "intrinsic motivation" as an innate ability of an individual to muster capacities to pursue a held interest without the need of external rewards or environmental controls (p. 43). They asserted that intrinsic motivation was an important motivator of learning, growth, and adaption in a person's mental skills competency development. They also pointed out that without intrinsic motivation, an individual may exhibit negative behaviors: boredom, inactivity, and alienation.

Deci and Ryan (1985, pp. 229-230) used an information-processing model to explain intrinsic motivation. In their model information signals (information input) were processed by individuals in one of two ways: intuitive appraisal and reflective

judgment. Intuitive appraisal referred to the immediate decoding of the information input that was based on an individual's intuition and might lead to an uncertain decoding since this decoding was based on a "gut feeling." The example Deci and Ryan used to explain intuitive appraisal was an individual's feeling of being out of balance while standing. The signal which may lead one to self-correct this feeling of imbalance is to reach out to grab an object to protect against falling to the floor or ground. Reflective judgment referred to the ability of the individual in certain instances to respond to information with deliberation and reflection. For example, when an individual decides to buy an expensive piece of antique furniture, the decision to purchase is often based on a deliberate and reflective decision strategy.

Relevant intrinsic motivation information fed into an individual's need structure energizes behavior. The information signals come from both external environmental signs and an individual's internal physiological nervous system. Deci and Ryan (1985) explained that

> the concept of an intrinsic need for competence and self-determination, which provides energizing inputs, is the element that makes [the] theory a truly active-organism theory, for it not only describes the energization of intrinsically motivated behavior but also the energization of the physiological processes involved in self-determined behavior. (p. 230)

Smith (1982) found that a very common problem in adult self-directed learners was "wavering" motivation. Unless a clear goal is established, initial enthusiasm falls prey to unexpected difficulties or time demands that divert the

learner from completing the project (p. 103). He observed that distinction between the novice and knowledgeable self-directed learner in the following description:

> Knowledgeable learners expect cycles in motivation and plateaus in achievement. They monitor their learning behavior for clues as to patterns, tendencies, and potential pitfalls. They develop strategies for rekindling interest and commitment--varying the learning tasks, changing the pace or location of learning, assessing how far they've come as well as how far they have to go, granting themselves rewards . . . . They may review personal learning style in relation to resources and strategies. (p. 103)

SKILLS Metamotivation Learning Strategies

The SKILLS metamotivation learning strategies used in this study were attention, reward, and confidence.

(1) Attention refers to the learner's decision to focus on the materials to be learned. This factor is concerned with the attention that a learner places on a learning task. For example, the degree to which a learner focuses on developing a positive atmosphere conducive to learning or establishing a proper study time environment would be in this category.

(2) Reward describes the learner's metamotivation activity that anticipates or recognizes the value of learning specific materials, that is, accomplishing a desired learning outcome. Reward strategies reflect a learner's recognition that a learning task is either useful, relevant, or important in advancing toward a final positive learning outcome.

(3) Confidence is an important metamotivational factor because the perception that a learner has about the likelihood of success or failure has a direct

influence on performance. It is important that a learner have a sense of self-efficacy or personal responsibility. McClelland (1987) cites Atkinson's study in demonstrating that perceived success in performing a task influences what an individual does (p. 506).

Smith (1982) stated that expectation of success plays a major role in determining learning outcomes of adult learners in that most adult learners use self-directed strategies, a positive attitude, and realistic achievement expectations to accomplish learning tasks (pp. 68-69).

Resource Management

Overview

Resource management learning strategies refer to how a learner manages learning resources, specifically, how a learner identifies the appropriate information needed to perform the task, how the learner critically uses the information materials in the learning task, and how the learner uses human resources in the learning activity. The efficient use of learning resources makes a difference in the quality outcome of a learning task.

Shaaden and Raiford (1984) found that adults are ill-prepared educationally and informationally to cope with information associated with technological change, i.e., the use of computers and television, countless magazines, and "how to" books that are available from public and private sources. Shirk (1983) found in his research of adult learners that the information sources most often used by adults

were their own printed resources, their neighbors, or their friends, even though they admitted that these sources were not the most efficient. When Shirk asked what resources the learners would use on future projects, most respondents admitted that they would use the same resources. Based on Shirk's study, it appears that availability outweighs appropriateness when resources are considered.

In his research, Tough (1971) found that adult learners had major problems with learning resources. He stated, "Certain persons would not or could not give the required help, and certain printed materials were useless. Even when beneficial help was received from certain resources, much of it cost the learner a great deal of time, money, effort, or frustration" (p. 105).

In discussing "blocks and obstacles" to self-directed learning, Smith (1982) stated that unexpected barriers emerged during learning projects: written directions were difficult to understand, resources were hard to obtain, time to study was sparse, an important task was too difficult, and support from family members failed to materialize. He also noted that adult learners found "more printed or audiovisual materials available on a topic than they know what to do with." Adult learners also reported that the reading materials were "overly technical or too detailed" (p. 103).

SKILLS Resource Management Learning Strategies

The SKILLS resource management learning strategies used in this study were identification of potential resources, critical use of resources, and the use of human resources.

(1) Identification strategies identify a learner's awareness of a variety of learning materials and the willingness to use available learning resources.

(2) Critical use of resources refers to the ability of the adult to make insightful decisions in the selection of materials to use in a learning project. In many learning situations learners are confronted with the task of selecting the learning materials that will best suit their skills, allotment of time to accomplish the project, and ability to reject biased materials.

(3) Human resources refers to the use/choice of "experts" to help with the learning task. Interpersonal, small or large group contact sometimes is vital in completing a task. The face-to-face communication can be in the form of "formal" structured classes or individual consultations with teachers, hobbyist, friends, extension agents, or other experts.

Effective identification and critical selection of resources plus wise use of human resources appear to assist adults in becoming efficient learners.

Critical Thinking

Overview

There are numerous definitions of critical thinking. "Critical thinking is disciplined, self-directed thinking which exemplifies the perfection of thinking appropriate to a particular mode or domain of thought" (Paul, 1990, p. 33). Ruggiero (1991) defined critical thinking as "reviewing the ideas we have produced, making a tentative decision about what action will best solve the problem or what belief about the issue is most reasonable, and then evaluating and refining that solution or belief" (p. 149).

Ennis (1985, p. 45) defined critical thinking as "reflective and reasonable thinking that is focused on deciding what to believe or do." Implied in the definition are the creative thinking strategy steps of problem definition, formulation of a hypothesis, questioning, developing alternatives, and developing of plans to evaluate alternative solutions.

Beyer (1987), citing Allen and Rott, distinguished critical thinking from problem solving by pointing out that:

> Critical thinking begins with a previous claim, conclusion or product, and considers the question, "Of what truth or worth is it?" Problem solving, on the other hand, begins with a perceived problem and asks, "How might this difficulty be resolved?" (p. 33)

Additionally, Beyer described critical thinking as "careful, precise, persistent and objective analysis of any knowledge claim or belief to judge its validity and/or worth" (p. 271). Citing Fraser and West, he noted that critical thinking involves the

"alertness to the need to evaluate information, a willingness to test opinions, and a desire to consider all viewpoints." Beyer further stated that critical thinking is a dynamic process of inquiry where the learner's questioning goes beyond "when" and "how" and actually exhibits an intent to perform inquiry (p. 35). Fellenz (1990) suggested that critical thinking is a contextual thinking process where adults analyze information to formulate new ideas.

The cited definitions of critical thinking mainly refer to an individual's rigorous evaluation of information to determine its reliability for use in a learning task. Critical thinking is related to an individual's judgment of knowledge and belief of reality.

Brookfield (1987, p. 12) implied that critical thinking was more than a mechanical rational thinking activity. He suggested that affective factors, "feelings, emotional responses, intuitions, [and] sensing," are important in the critical thinking process of adults. Brookfield goes on to identify four components in the critical thinking process: identifying and challenging assumptions, recognizing the importance of context, imagining and exploring alternatives, and reflective skepticism.

SKILLS Critical Thinking Learning Strategies

The SKILLS critical thinking learning strategies used in this study were test assumptions, generate alternatives, and conditional acceptance.

(1) The test assumptions learning strategy refers to the adult learner's decision to critically judge assumptions used in the learning task and to evaluate information accumulated concerning the assumptions relative to the learning task. Ruggiero (1991) suggests that it is natural to make assumptions; however, he also provides a word of caution by stating that assumptions may result in a lack of critical examination of factors taken for granted or assumed to be factual (p. 152).

(2) The generate alternatives strategy refers to the adult learner's ability to create additional alternatives for task resolution within the context of the learning task. Beyer (1987) labels the generation of alternatives as creative thinking, a process related to critical thinking. A key element in creative thinking is the generation of alternative ideas or solutions to resolve a problem. "A creative solution is a problem solving act, and, in particular, it is the solution of the ill-defined problem" (p. 35).

(3) The conditional acceptance strategy refers to the learner's continual review of information after tentatively deciding on a solution. With conditional acceptance, the learner reflects on the solution to determine if adjustments are needed before acceptance. Beyer (1987) stated that the process of resolving a problem involves the application of reasoning and analytical skills in evaluation of single or multiple combinations of alternative solutions "over and over again" (p. 37).

Reflective Judgment Model

The Reflective Judgment Model was developed by King and Kitchener in the late 1970's. It draws on Perry's theory developed on college students in the late 1960's which focused on the student's intellectual development. King and Kitchener (1985) expanded on the work of Perry by assuming a developmental process in young adults and adults' process of knowing. They maintain that in the process of knowing the individual's ability to evaluate knowledge and to defend controversial issues are increased. The process evolves as people shift their position about knowledge, about how they come to know things, and how the shifts and knowledge about knowing affects their justification of their beliefs or decisions (pp. 5-6).

Kitchener (1983) argued that in order to understand how adults make decisions on difficult problems, a higher level of monitoring must be used (p. 223). She proposed a meta-meta level of monitoring which she terms "epistemic cognition." Epistemic cognition is at a meta-meta level because "its concern is not on 'what' cognitive strategy is available to solve a problem, but instead on 'whether' it is solvable under any conditions" (p. 226).

Epistemic cognition is defined as the cognitive "processes an individual invokes to monitor the epistemic nature of problems and the truth value of alternative solutions" (Kitchener, 1983, p. 225). Assumed in the definition are: the problem solver's assumptions about what can and cannot be known (e.g., knowledge about certain things are ultimately uncertain), the problem solver's knowledge of

how knowledge is known (e.g., by observing or receiving information from an authority), and the problem solver's confidence in the knowledge (e.g., absolutely, probabilistically) (p. 76). These assumptions are critical in understanding how adults solve ill-structured problems.

For example, if an adult perceives object reality as absolutely knowable or known by someone, then the problem is not distinguishable between a puzzle and an ill-structured problem; therefore, one proceeds to solve the problem by applying a known procedure, like using a preformatted checklist, reading directions from an instruction sheet, or following the instructions from an expert to ensure a proper solution. Under this assumption, all solutions are known; therefore, there is no need to consider the possibility that a "no" answer (solution) may ever be recognized as acceptable for some problems. The type of questions one asks when solving puzzles are metacognition questions, for example, Are the procedures correct?, How can I improve the recall of the elements involved?, and Is the strategy I am using the best strategy? (Kitchener, 1983, p. 226).

If, on the other hand, an adult perceives knowledge as possibly being uncertain and unreliable, the adult problem solver is most likely to be led to believe that better/worse answers are possible. Adults in this situation can distinguish between puzzles and ill-structured problems and recognize alternative solutions are possible, including the possibility that the problem is not solvable. Toulmin noted that once an individual admits that a number of potential solutions are available for a problem, an individual must also consider that these solutions

have the "right to be considered" (1958, p. 18). To consider alternative solutions, the individual needs to construct or develop a strategy to find a solution. When data is perceived to be fallible, epistemic type questions are asked: Can I solve the problem?, How can I solve the problem?, and What are the kind of strategies available to solve the problem? (Kitchener, 1983, p. 227).

In solving ill-structured problems, once the strategies of solving the problem and the epistemic nature of the data are identified, individuals must still use strategies to monitor their own progress in using data and performing tasks within the chosen solution strategy. This, according to Kitchener, is the simultaneous use of meta and epistemic cognitive processes, which meets the conventionally accepted definition of metacognition (1983, p. 227). However, metacognition descriptions and definitions address only the individual's knowledge and beliefs about specific cognitive tasks and how task performances are monitored. They do not include the processes involved in epistemic cognition (p. 227).

Kitchener (1983) postulates a three-tier model of cognitive processing to explain complex problem solving, which includes meta and epistemic cognition as interrelated processes in adult problem solving. Kitchener explains:

> Each level provides a foundation for the next one but is not subsumed by it . . . while the first tier may operate independently of the other two tiers, the reverse is not the case . . . . The second tier operates in conjunction with the first and the third tier acts in conjunction with the first two. (p. 225)

The first level (level 1) of cognition in Kitchener's postulation are cognitive tasks such as computing, memorizing, reading perceiving, and language acquisition.

The second level (level 2) is metacognition. Level 2 is invoked to monitor cognitive processes of level 1 tasks. The third level (level 3) is epistemic cognition. This process is invoked when an individual monitors the epistemic nature and truth values of problems. The Reflective Judgment seven-stage model is a reflection of epistemic cognition stages.

William Perry's Theory of Intellectual and Ethical Development

Between 1954 and 1963 William Perry studied a group of undergraduate Harvard University students (King, 1977, p. 2). The study started as an exploratory and descriptive venture to document the experiences of undergraduates in a college learning environment. The data eventually led to what Perry (1970) described as a "common sequence of challenges to which each student addressed himself in his own particular way." This formed the core of the scheme that he labeled "Main Line of Development" (p. 8). Perry described the scheme as follows:

> Since the sequence of these forms [through which a person addresses knowing, valuing, and responsibility] in our student reports appears to us to manifest a logical order . . . our description itself takes its own second-order form as a pattern or scheme of development. In its full range the scheme begins with those simplistic forms in which a person construes his world in unqualified polar terms of absolute right-wrong, good-bad; it ends with those complex forms through which he undertakes to affirm his own commitments in a world of contingent knowledge and relative values. The intervening forms and transitions in the scheme outline the major steps through which the person, as evidenced in our students' reports, appears to extend his power to make meaning in successive confrontations with diversity. (p. 3)

Perry's scheme had nine positions posted along a linear dimension in the development of young adults during the process of completing their college education. Perry (1970) used the phrase "position" instead of "stage" to describe the scheme's structures for three reasons: the word position makes no assumption about duration, it describes a central tendency of student responses, and it represents an appropriate image of the world. Perry used the term structure to refer to "the formal properties of the assumptions and expectations a person holds at a given time in regard to the nature and origins of knowledge and value . . . its reference can appropriately extend beyond the purely cognitive assumption to those forms of action, thought, feeling, purpose, and care that are congruent with the assumption and incongruent with any other" (pp. 43).

Movement or progress linearly from position 1 through 9 represented maturity and growth. According to Perry (1970), such growth or positive movement was represented by advancement, which he assumed to be a major part of adult development (p. 44). The nine positions could be further grouped into three broader categories.

Positions 1, 2, and 3 represent what Perry called "Dualism." In this category, an individual started from "a bifurcated structuring of the world" between the positions of right-wrong or good-bad and gradually modified his/her position to the acceptance of simple pluralism, i.e., the acceptance of authority as not being absolute. As perceived by students in Perry's research, authority was in individuals

who had knowledge or had access to knowledge. Positions 1, 2, and 3 were described by Perry (1970, p. 9) as:

> Position 1: The student sees the world in polar terms of we-right-good vs. other-wrong-bad. Right Answers for everything exist in the Absolute, known to Authority whose role is to mediate (teach) them. Knowledge and goodness are perceived as quantitative accretions of discrete rightnesses to be collected by hard work and obedience . . . .
>
> Position 2: The student perceives diversity of opinion, and uncertainty, and accounts for them as unwarranted confusion in poorly qualified Authorities or as mere exercises set by Authority "so we can learn to find The Answer for ourselves."
>
> Position 3: The student accepts diversity and uncertainty as legitimate but still temporary in areas where Authority "hasn't found the answer yet." He supposes Authority grades him in these areas on "good expression" but remains puzzled as to standards.

Positions 4 and 5 were labeled "Multiplicity." This represents a pluralistic world where points of views, evaluations, and answers with reference to similar topics have more than one view, providing the view that "anyone has a right to his own opinion." As perceived by students, a learner was still subjected to evaluation by an external Authority. Positions 4 and 5 were described by Perry (1970, pp. 9, 10) as:

> Position 4: (a) The student perceives legitimate uncertainty (and therefore diversity of opinion) to be extensive and raises it to the status of an unstructured epistemological realm of its own in which "anyone has a right to his own opinion," a realm in which he sets over against Authority's realm where right-wrong still prevails, or (b) the student discovers qualitative contextual relativistic reasoning as a special case of "what They want" within Authority's realm.
>
> Position 5: The student perceives all knowledge and values (including authority's) as contextual and relativistic and subordinates

> dualistic right-wrong functions to the status of a special case, in context.

Positions 6, 7, 8, and 9 represented "Relativism." These positions represent a plurality of views much more complex than the previous positions. The individual demonstrates more commitment in learning and the dominance of Authority diminishes to the point where the individual begins to take responsibility for analysis and judging of the relative state of knowledge. Perry (1970, p. 10) described the four positions under Relativism as:

> Position 6: The student apprehends the necessity of orienting himself in a relativistic world through some form of personal Commitment (as distinct from unquestioned or unconsidered commitment to simple belief in certainty).
>
> Position 7: The student makes an initial Commitment in some area.
>
> Position 8: The student experiences the implications of Commitment, and explores the subjective and stylistic issues of responsibility.
>
> Position 9: The student experiences the affirmation of identity among multiple responsibilities and realizes Commitment as an ongoing, unfolding activity through which he expresses his life style.

Perry also had three deflections: temporizing, escape, and retreat in the scheme. The deflections in the scheme provided an "escape" route from the linear positions at various critical points. The escape routes represent conditions where individuals decide to stop progress in the scheme because of feeling "unprepared, resentful, alienated or overwhelmed" (p. 12).

In developing a new paradigm which King (1977) named Reflective Judgment, she examined the criticism of Perry's work by Boyd (1972), Broughton

(1975), Heffernan (1971), and Kurfiss (1975). The four cited researchers basically criticized Perry's shift from "epistemological development" implied globally (with such concepts as "nature of knowledge, nature of reality, relation to authority, and the process of decision making) in position 2 and described in his lower five positions. Perry shifts to commitment and moral issues in the later four positions (p. 8).

The four critics cited by King do not agree at what stages the relativism shift occurs. Broughton argues that the shift occurs between stages 6 and 7, while Boyd argues that the shifts occur throughout Perry's scheme. Kitchener points out that Broughton's main criticism of Perry's theory was Perry's confusion of content and structure in the highest three positions. According to Kitchener (1978, p. 28), Perry's major shift occurs between position 5 and 6 where he introduces the concept of relativism, which Kitchener interprets to mean that "Knowledge was contextual, with right or wrong judgments deriving from particular settings." Heffernan describes the shift to be between position 5 and 6. Rather than addressing Perry's position shifts, Kurfiss pointed out that Perry bridged the gap between the development of intellect with the development of identity in late adolescent development, thus noting the strength of the scheme. This was a significant bridging according to King (1977), as late adolescence researchers during the 1970's addressed development of intellect and identity as two separate domains (pp. 5-12).

What do the shifts mean? According to King, Heffernan's summation best described the shift in domains from one of intellectual meaning to one of establishing identity. King (1977, p. 7), in citing Heffernan, states:

> He [Perry] identifies positions 1-5 as dealing primarily with "forms of intellectual meaning, the personal epistemological frameworks, or structures by which students perceive and order knowledge and values" (p. 9), and positions 6-9 as addressing ". . . ways of establishing identity, finding personal stability in the chaos of relativism, orienting oneself through acts or a series of commitments, and refining a meaningful life-style" (p. 9).

Kitchener (1978, p. 25) points out that Perry's contribution to the concept of reflective judgment was his views unifying the "complexity-simplicity dimension with changing views of reality and knowledge" and with the addition of the role of authority and the making of judgments in intellectual development.

To clarify the positions of Perry and to refine the intellectual connection between Perry's work and the development of human thought, King cited John Dewey's work on reflective thought as explicated and clarified by Lawrence (King, 1977, p. 13-16).

> Dewey understood the concept of thought as being comprised of a series of interrelated, interconnected judgments. Judgments are thus the "constituent units of thought" (p. 119). While the term "judgment" and "decision" are synonymous in common usage . . . they have quite distinct meanings in Dewey's definition, where the decision is the outcome of a series of judgments. Lawrence (1973) outlines three major defining characteristics of Dewey's concept of Judgment. These are:
>
> 1) <u>A judgment arises from doubt or controversy, and is related to a situation.</u> A judgment is a response which is related to a problem requiring a solution (Dewey, 1933, p. 127).

2) A judgment is the judgment of an agent. Thus judgments are influenced by an individual's previous responses, presuppositions, and the way we have of approaching judgment-making with "certain acquired habitual modes of understanding" (Dewey, 1933, p. 125).

3) A judgment involves a process consisting of three elements:
   a) selection of relevant facts, according to their availability and relevancy;
   b) selection of principles involved (by this, according to Lawrence, Dewey seems to mean "laws of Procedure" which allow one to weigh the facts for appropriateness and relevance);
   c) termination in a decision, or the solution to the original problem. "The decision is the termination of the judgmental process, although it is usually tentative and may be changed in light of the consequences of acting on it" (Dewey, 1933, p. 130).

According to King (1977), the importance of Dewey's reflective judgment is the process of decision making, and not necessarily the final decision itself. Judgment, if viewed as process, can also be viewed as a cognitive, intellectual activity. King distinguished between two types of judgments: formal/logical and reflective judgment. Formal/logical judgment referred to a problem that has one logically valid answer which could be verified by reference to logical rules of procedures, such as problems that can be solved by using deductive reasoning. This type of problem solving usually falls in the areas of mathematics and logic (p. 15). Reflective judgment, on the other hand, deals with open ended problems that do not have one correct or logically correct response. Perry's scheme deals with reflective judgment problems.

King and Kitchener's Reflective Judgment Model

Kitchener and King (1981, pp. 91-92) developed a seven-stage Reflective Judgment Model. The stages in the model are sequential and increase in complexity as relationships between assumptions about knowledge and reality change through the seven stages. The process of each stage is based on an individual's assumptions about knowledge and reality and how belief of knowledge and reality impacts justification about judgments.

According to the King and Kitchener sequential stages, if a person at a lower stage assumes that knowledge can only come from empirical observation and explanations by authority figures, then that person would probably reject any knowledge not derived from these two sources. For example, assume that an individual heard from a child, not perceived to be an authority about the moon, that "a man walked on the moon." The person would most likely accept the information as a child's fantasy and reject the knowledge and reality that astronauts did in fact visit the moon. If, however, the individual was attending an astronomy class and the professor (authority figure) said, "In 1969, Neil Armstrong was the first human being to step foot on the moon," the individual would probably accept the professor's statement as fact.

The sequential stages of the Reflective Judgment Model hypothesize that as an individual advances from lower to higher stages knowledge sources change and judgments about knowledge and reality change; therefore, developing new sets of

knowledge and reality variables that impact how that individual makes judgments about information, which in turn impacts justifications about decisions. Kitchener and King (1981) state that "different assumptions about knowledge and reality at each stage imply different forms of justification" (p. 92). The differences in justification at each stage also differentiate the ability of individuals in higher stages (5-7) to consciously reflect on their decision making, a process which lower stage (1 and 2) individuals are not able to perform. The gaps between stages are present because there is no clear definition of where "reflective" ability appears in the Reflective Judgment Model stages (Kitchener & King, 1981, p. 101).

The individual at each advanced stage uses the cumulative sequence of assumptions from lower stages and develops new rules of inquiry and use of evidence to judge and organize perceived information in order to make judgments about problems or situations at hand. When the process culminates at the highest stage, an individual's knowledge statements are able to approximate reality. The approximation of reality, in turn, must be able to withstand the most rigorous test under accepted rules of inquiry, or, using Kitchener and King's phrase, the approximation of reality must withstand "open scrutiny and criticisms of other rational people." The total process of evaluating knowledge and reality through the Reflective Judgment Model's seven stages is referred to as "reflective judgment" by Kitchener and King (p. 92).

Reflective judgment stages by Kitchener and King's definition "refer to the degree to which a person is able to make reflective judgments." They point out that at each stage justification has associated with it metacognitive beliefs including:

> Such elements as what data are relevant to the problem-solving enterprise, how discrepant data ought to be viewed, and whether differences in opinion reflect crass bias or legitimate differences in interpretation of data. This suggests that there is a interactive relationship between more basic cognitive assumptions and meta-cognitive beliefs. (Kitchener & King, 1981, p. 101)

In describing each stage, Kitchener and King (1981) reviewed the major assumptions of knowledge and reality and their corresponding concepts of justification. Listed are Kitchener and King's stage examples (pp. 92-100):

Stage 1

> Assumption of Reality. There is an objective reality which exists as the individual sees it. Reality and knowledge about reality are identical and known absolutely through the individual's perceptions.
>
> Assumption of Knowledge. Knowledge exists absolutely. One's own views and those of authorities are assumed to correspond to each other and to absolute knowledge. Knowledge is gained through the individual's perceptions and prior teaching.
>
> Concept of Justification. Beliefs simply exist; they are not derived and need not be explained. Differences in opinion are not perceived, and justification is therefore unnecessary.

Stage 2

> Assumption of Reality. There is an objective reality which is knowable and known by someone.
>
> Assumption of Knowledge. Absolute knowledge exists, but it may not be immediately available to the individual. It is, however, available to legitimate authority.

Concept of Justification: Beliefs either exist or are based on the absolute knowledge of a legitimate authority.

Stage 3

Assumption of Reality. There is objective reality, but it cannot always be immediately known, even to legitimate authorities. It is possible to attain knowledge about this reality, but our full knowledge of it is as yet incomplete and therefore uncertain.

Assumption of Knowledge. Absolute knowledge exists in some areas, but in others it is uncertain, at least temporarily. Even authorities may not have certain knowledge, and therefore cannot always be depended upon as sources of knowledge. Knowledge is manifest in evidence which is understood in a concrete, quantitative way such that a large accumulation of evidence will lead to absolute truth.

Concept of Justification. Beliefs either exist or are based on accumulation of evidence that leads to absolute knowledge. When such evidence is not available, individuals claim that while waiting for absolute knowledge to become available, people can temporarily believe whatever they choose to believe.

Stage 4

Assumption of Reality. There is an objective reality, but it can never be known without uncertainty. Neither authorities, time or money nor a quantity of evidence can be relied upon to ultimately lead to absolute knowledge.

Assumption of Knowledge. Absolute knowledge is for practical reasons impossible to attain, and is therefore always uncertain. There are many possible answers to every question, but without certainty and a way to adjudicate between answers, there is no way to decide which one is correct, or even whether one is better than another. Knowledge is idiosyncratic to the individual.

Concept of Justification. Beliefs are justified with idiosyncratic knowledge claims and on idiosyncratic evaluations of data ("what is true for me, but not

necessarily for everyone else"). The individual is the ultimate source and judge of his or her own truth.

Stage 5

Assumption of Reality. An objective understanding of reality is not possible since objective knowledge does not exist. Reality exists only subjectively, and what is known of reality reflects a strictly personal knowledge. Since objective reality does not exist, an objective understanding of reality is not possible.

Assumption of Knowledge. Knowledge is subjective. Knowledge claims are limited to subjective interpretations from a particular perspective based on the rules of inquiry and of evaluation compatible with that perspective.

Concept of Justification. Beliefs are justified with appropriate decision rules for a particular perspective or context, e.g., that a simpler scientific theory is better than a complex one.

Stage 6

Assumption of Reality. An objective understanding of reality is not possible since our knowledge of reality is subject to our own perceptions and interpretations. However, some judgments about reality may be evaluated as more rational or based on stronger evidence than other judgments.

Assumption of Knowledge. Objective knowledge is not possible to attain because our knowledge is based on subjective perceptions and interpretations. Knowledge claims cam be constructed through generalized principles of inquiry and by abstracting common elements across different perspectives. The knower must play an active role in the construction of such claims.

Concept of Justification. Beliefs are justified for a particular issue by using generalized rules of evidence and inquiry. However, since our understanding of reality is subjective, any such justification is limited to a particular case, time or issue.

Stage 7

> Assumption of Reality. There is an objective reality against which ideas and assumptions must ultimately be tested. Despite the fact that our knowledge of reality is subject to our own perceptions and interpretations, it is nevertheless possible, through the process of critical inquiry and evaluation, to determine that some judgments about that reality are more correct than other judgments.
>
> Assumption of Knowledge. Knowledge is the outcome of the on-going process of reasonable inquiry which ultimately leads to a concordance between belief and reality. The process of inquiry, however, may not always lead to correct claims about the nature of reality since the process itself is fallible. Knowledge statements must be evaluated as more or less likely approximations to reality and must be open to scrutiny and criticisms of other rational people.
>
> Concept of Justification. Beliefs reflect solutions that can be justified as most reasonable using general rules of inquiry or evaluation. Criteria for evaluation may vary from domain to domain (e.g., religion, literature, science), but the assumptions that ideas, beliefs, etc., may be judged as better or worse approximations to reality remains constant.

In testing the Reflective Judgment Model, Kitchener and King (1981) used 60 people; namely 20 high school juniors, 20 college juniors, and 20 doctoral graduate students. The college students all were chosen from the liberal arts field. The group was equally divided between males and females (p. 102).

The model's instrument was a reflective judgment interview designed by Kitchener and King that was composed of four dilemmas which were read aloud and a standardized set of questions. The questions were designed to "elicit statements of knowledge, of evidence and of the role of authority in resolving a

controversy as well as openness to alternative views or frames of reference." For example, one dilemma stated:

> There have been frequent reports about the relationship between chemicals that are added to food and the safety of those foods. Some studies indicate that such chemicals can cause cancer, making these food unsafe to eat. Other studies, however, show that chemical additives are not harmful, and actually make the foods containing them more safe to eat. (Kitchener & King, 1981, p. 104)

Each interview was conducted and scored by two trained interviewers. The interview sessions lasted for approximately 60 minutes.

The range of the mean Reflective Judgment Interview scores for the three groups were: high school juniors, 2.17 to 4.04; college juniors, 2.46 to 5.58; and doctoral graduate students, 3.83 to 6.92 (Kitchener & King, 1981, p. 107).

Kitchener and King concluded that the high school junior students justified their beliefs with absolute assumptions about knowledge and that data had to support beliefs on knowledge (Stages 1 and 2). College juniors tended to view knowledge as idiosyncratic and held that there was some personal acceptance of uncertainty about absolute knowledge (Stages 3 and 4). Doctoral students assumed knowledge claims needed to be or could be rationally justified as reasonable representations of reality (Stages 5 and 6).

Kitchener and King tested reflective judgment against verbal ability, formal operations, socioeconomic status, and verbal fluency. They found that there were no significant relationships between verbal ability, socioeconomic status, and formal operations reasoning ability. A moderate relationship was found between verbal

fluency (overall correlation of .4 in a covariance analysis) and reflective judgment. The .4 correlation was judged as insignificant by Kitchener and King.

Strange and King (1981) conducted a study of 64 college subject using the Reflective Judgment Interview to determine to what degree college attendance and to what degree different levels of maturation had on intellectual development. The participants in the study were grouped into four groups: 18-year-old freshmen, 22-year-old freshmen, 22-year-old seniors, and 26-year-old seniors. The mean reflective judgment interview scores for the four groups were: 18-year-old freshmen, 3.74; 22-year-old freshmen, 3.79; 22-year-old seniors, 4.27; and 26-year-old seniors, 4.41. Based on the scores, Strange and King concluded that advanced levels of reasoning were associated with advance levels of education: 3.76 for freshmen and 4.34 for seniors (pp. 290, 292). Strange and King's analysis also found that age was not a factor (4.01 for 18-year-old freshmen; 4.10 for 22 and 26-year-old students) in the variance in reflective judgment interview scores, therefore, could not be accounted for as a factor that impacted on the development of critical reasoning (p. 291).

Welfel (1982) examined the relationship between reflective judgment, academic major, year in college, and grade point average. Although her conclusions agreed with the findings of other researchers using the Reflective Judgment Interview, Welfel found only a small difference in the reflective judgment interview scores between freshmen and seniors. Welfel cited Astin's study to explain the low differences. Astin claimed students at large public institutions with

high ratios of commuters had little opportunity to interact with faculty and fellow students and participate in special activities and, therefore, tended to show less change in the affective and cognitive domains than students who attended smaller institutions (p. 495).

Welfel also found no significant difference in the performance between male and females, supporting the findings of most reflective judgment researchers (p. 495).

Brabeck (1984) discussed the Reflective Judgment Model as part of an examination of learning theories dealing with sequential changes in intellectual development between adolescence and adulthood. She also examined the use of longitudinal studies in examining sequential intellectual development. She summarized 11 studies that used the Reflective Judgment Model, and surmised that the studies, all using the Reflective Judgment Interview, supported theories that stipulated that as "individuals mature, they develop more adequate ways of thinking about complex issues about the nature of knowledge itself" (p. 24).

King, Kitchener, Davison, Parker and Wood (1983) found education had the most impact on changes in reflective judgment stages on a two-year longitudinal study on 59 adolescent and young adult subjects (high school juniors, college juniors, and graduate students). The change in scores were: 2.79 to 3.61 for high school juniors; 3.75 to 4.18 for college juniors; and 6.03 to 6.26 for graduate students. On the average none of the group's means increased more than one stage. Although the two-year change was small, the researchers concluded that

"The changes that occur in people's assumptions about knowledge and reality, and subsequently in their concepts of justification, are important because they color how intellectual problems are understood and the extent to which problem solving is seen as a process of rational justification" (p. 115).

Kitchener, King, Wood, and Davison (1989) reported on a six-year longitudinal study of 57 subjects who participated in the 1977 study Kitchener and King had conducted using high school juniors, college juniors, and doctoral graduate students. The 57 participants were retested in 1983. The 1977 high school juniors scores changed from 2.83 to 4.99, college juniors changed from 3.72 to 4.89, and doctoral students changed from 6.15 to 6.27. According to the data on stage changes, the 1977 high school juniors made the largest stage change at 2.16 stages and the doctoral students made the least change at .12 stages.

The Kitchener et al. (1989) longitudinal study demonstrated a high correlation between Reflective Judgment mean score and age. The overall correlation was .79. According to the analysis, "The frequency of usage of Stages 2 and 3 decreased after age 20.5, while Stage 4 increased up to age 20.5--24.5 then decreased. Stage 5 usage increased monotonically from a low of 5% at age 16-20.5 to a high at age 28.5-32.5 and then dropped" (p. 83). What the data suggests is that lower stages drop with age and later stages increase with age, indicating that growth in intellectual development continues among the young adults.

Kitchener et al. (1989), however, stated that the changes in stages could not be attributed to age alone. The data for the high school juniors who did not enroll

in college at age 18 but enrolled at a later age exhibited the same characteristics on Reflective Judgment Interview scores as their 18-year-old counterparts. Subjects with higher levels of education exhibited higher Reflective Judgment scores than subjects with less education. These results were similar to findings in studies done by Rest and Thoma in 1985 and Colby et al. in 1983 (p. 86).

In summarizing the progress of research using the reflective judgment model concept, Kitchener and King (1990a) stated that several studies have confirmed that formal educational experiences had a greater impact than age in an individual's reflective judgment development. Strange and King (1981) compared two groups of college students: 18 to 22-year-old freshmen and 22 to 26-year-old seniors. They found that educational level was more important than age in reflective judgment shifts for the participants in the study.

Although reflective judgment research indicates that education is an important variable, none of the studies demonstrated how education influenced intellectual development. In earlier studies, King and Kitchener had argued that it may be that the Reflective Judgment Interview only measures one aspect of critical thinking: how learners solve ill-structured problems (1990a, p. 87).

Kitchener (1986) maintained that the model has stood up to various tests of sequentiality and structure and it measured assumptions about knowledge with "reasonable accuracy and reliability (pp. 89, 91). In a summary of ten years of reflective judgment research, Kitchener and King (1990b) concluded that they had learned that "People do change in the assumptions they hold about knowledge itself

and how it is acquired, and that these assumptions are reflected in the way they resolve ill-structured problems." Kitchener and King further found that age and education were important factors related to reflective judgment and, lastly, reflective judgment had emerged as "a description of an aspect of intellectual development that is distinct from verbal ability, critical thinking, scholastic aptitude, and formal operations" (p. 75).

CHAPTER 3

METHODOLOGY

Introduction

This study utilized two survey instruments, the Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS) and the Reflective Judgment Questionnaire (RJQ), and two multivariate statistical techniques, discriminant analysis and cluster analysis, to study the relationships between reflective judgment stages, learning strategies, and selected demographic characteristics of the study population.

The study design is causal-comparative research. Gay (1987) describes causal-comparative research as "research in which the researcher attempts to determine the cause, or reason, for existing differences in the behavior or status of groups of individuals" (p. 287). In a causal-comparative research design, the researcher evaluates the data using a multivariate statistical technique like discriminant analysis or cluster analysis to determine if individual variable differences occur in a group and from these differences attempts to identify the major factor that created the difference. This type of research design is also termed "ex post facto" because the researcher studies the effect and probable cause after the event had occurred.

Population

Malmstrom Air Force Base, Montana, is located in Cascade County, Montana, on the eastern boundary of the city of Great Falls. In the Base's Economic Resource Impact Statement, 30 September 1991 report, (Malmstrom Air Force Base, 1991) the base active-duty military population was listed at 4,290. The civilian work force totalled 541 employees. These figures reflect the base population sampled between September 1991 and April 1992. Since April 1992, federal budget cutbacks impacted both military and civilian personnel at the base. The personnel cutbacks have little impact on this study's population because all participants were surveyed before the major cutbacks were implemented.

Sampling

The sample for the study was drawn from the work force, both civilian and military, at Malmstrom Air Force Base, Montana. A judgment sampling technique was used since a random technique was not feasible. Permission had to be obtained from the Base Commander to conduct the survey at Malmstrom Air Force Base. Permission to conduct the survey was granted by the Base Commander after the survey procedure was approved by a representative of the civilian union and the Base Commander was assured that the survey would only include volunteer and anonymous participants.

Researcher judgment was used to select work centers and Malmstrom Education Center college classes which would closely approximated the work force distribution of Malmstrom Air Force Base. The work centers and college classes were selected so volunteers would represent males and females and a broad sample of education level, ages, and work tasks. The researcher was stationed at Malmstrom Air Force Base for five years and worked with personnel at several of the work centers selected as survey locations. The researcher used his judgment in selecting the work centers which would represent a fair representation of the civilian and miliary work force distribution. Military dependents residing on-base were not included in the study.

Samples were collected from work centers with large civilian worker populations, from major support agencies that were indirectly related to the missile, flying, or security police missions of the base, and at the Malmstrom Education Center. Personnel attending Military Education courses and college undergraduate and graduate courses were surveyed with permission from the Malmstrom Education Center's director and instructors of the courses.

A total of 275 packets containing a cover letter explaining the purpose of the study, a demographic survey sheet, the RJQ, and SKILLS were distributed on base. Forty-six packets were not returned. Of the returned packets, 201 were used in the study. The remaining 28 were not completely filled out and thus unusable for the study.

Roscoe (1975) recommended that when using a multivariate statistical technique "the sample size should be several times (preferably 10 or more times) as large as the number of variables" (p. 184). This study used a total of 19 variables, 15 variables from SKILLS and 4 from the RJQ; therefore, the sample size of 201 exceeds Roscoe's recommended minimum standard of 10 sample participants per variable.

Instruments

Two questionnaires were used in this study, the Reflective Judgment Questionnaire (RJQ) and the Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS).

The Reflective Judgment Questionnaire (RJQ)

This questionnaire was designed using the principles of the Reflective Judgment Model (Kitchener, 1986, pp. 78, 79). The Reflective Judgment Model is a hierarchical and sequential seven-stage model, while the RJQ is a five-stage questionnaire.

The original Kitchener and King instrument was the Reflective Judgment Interview (RJI), which consisted of a four-scenario interview which included the interviewer asking a predetermined set of questions. All question responses were audiotaped and later judged and scored by two trained observers. This method was not used in this study because the Reflective Judgment Interview requires two

observers to be trained by either Kitchener or King at their respect universities. The interview takes approximately 45 minutes and the follow-up analysis by the two observers takes between one and two hours.

In the RJQ, respondents could approximate the Reflective Judgment Model stages one through seven by responding from one to five on the RJQ. In changing the RJQ scale to five instead of seven, the median for the RJQ is three, while the median for the Reflective Judgment Model is four; therefore, the common points for the RJQ and Reflective Judgment Model are 3.0 score on the RJQ and 4.0 on the Reflective Judgment Model. Since the RJQ is condensed at both ends, a RJQ 5.0 would actually represent Stages 6 and 7 and a RJQ 2.0 would represent Stages 1 and 2 on the Reflective Judgment Model.

RJQ Response 1 approximates the characteristics of Stages 1 and 2 and reply number 5 approximates the characteristics Stages 6 and 7 of the Reflective Judgment Model. RJQ Responses 2, 3, and 4 approximate the characteristics of Stages 3, 4, and 5 respectively. This was done because after field testing of a seven question instrument using students in a lower division Speech Communication undergraduate class and two Education graduate classes, very few respondents responded to stage one and seven descriptions. The seven stage questionnaire was redesigned to the five response questionnaire. The wording of the questionnaire was also simplified as the pre-test questionnaire was too confusing and complex. After further testing of the RJQ with the same group of students, the final version used in the initial reliability test was adopted.

The RJQ is composed of four scenarios: teen-age substance abuse, disposal of low radiation waste, rural crime, and image of Mongolia. Each scenario has five descriptive replies that reflect the stages of the Reflective Judgment Model.

Initial reliability testing of the six scenario questionnaire (four were selected for this study) was conducted using 55 undergraduate students enrolled in two lower division Speech Communication courses at Montana State University. A pre-/post-test design was used. Each participating student was administered the six scenario questionnaire on two consecutive weeks. Each scenario was tested using the Pearson product-moment correlations for pairs of variables. Individual scenario pre-/post-test correlations were below the recommended .7 Pearson correlation coefficient.

Next, combinations of scenario groupings were pre-/post tested. The six scenario combination pre-/post tests correlation coefficient was .7, however, the six scenario combination was rejected because of a wide correlation coefficient range (.44 to .67) among the pre-test scenarios when tested against the pre-test cumulative average of all the scenarios. When tested against the post-test scenario cumulative average, the correlation coefficient ranged from .54 to .72. The six-scenario set was abandoned in favor of a four-scenario combination. Of the six scenarios tested, four were selected for the study.

The four scenarios chosen for this study were substance abuse, low level radiation, rural crime, and Mongolian image. This combination had a cumulative correlation coefficient of .67, which was rounded off to .70. The scenario pre-test

variable correlation coefficient range was .53 to .67. When each scenario was analyzed against the four scenario post-test cumulative average, the post-test correlation coefficient range was .51 to .77. When the pre- and post-test correlation coefficients were averaged, the correlation coefficient ranged from .60 to .65. Based on this correlation analysis, four scenarios were used to survey the study participant sample.

After all the surveys were collected, another correlation analysis was conducted on the RJQ to verify the reliability was consistent with the initial test. The same test used for the initial reliability test was performed by comparing the cumulative average of the four scenarios against each scenario. On the survey participants' sample of 201, the correlation coefficients ranged from .41 to .56. Squaring the correlation coefficient would indicate what percentage of the variance each variable contributed. Ideally, since there are four variables, each variable should contribute 25%. The low correlation score of .41 on the Mongolian Image scenario contributed approximately 17% of the variance in the total score, therefore, it was eliminated from the study.

A second reliability analysis was conducted to determine the correlation and variance values for the remaining three variables when they were compared against the cumulative average of the three variables. The correlation coefficients ranged from .54 to .63. Since only three variables are used in this analysis, each variable should contribute .33 of the variance of the cumulative average. The lowest score, .29, was for low level radiation waste scenario. The other two variables accounted

for .39 (substance abuse) and .32 (rural crime) of the variance. Since the three variances appeared to be strong, the three scenarios of substance abuse, low level radiation, and rural crime were used in this study. The reliability tests on the sampling data were consistent with the initial reliability test.

Criterion validity of the Reflective Judgment Questionnaire was supported through the comparison of the RJQ average of five educational groupings of the study respondents. The 201 participants were divided into five groups: High School (including individuals with no formal education), Technical School (including participants with an associate degree from a community college), Some College Education (individuals who had attended or were presently enrolled in an undergraduate program), College Graduates (students awarded an undergraduate degree who may or may not have been enrolled in a graduate program), and Graduate Degrees (participants who had completed a graduate or equivalent professional degree). Each group's RJQ average was compared to the mean ranges or to means reported by Kitchener (1983, p. 86). Additionally, the frequency distribution of mean scores for each RJQ group was examined to determine what percentage of the respondents scored within the Reflective Judgment Inventory group mean ranges.

The RJI group mean scores reported by Kitchener were high school students (no-college) mean of 2.77 with a range from 2.17 to 4.04, college students mean of 3.65 with a range of 2.46 to 5.58, and graduate students mean of 5.67 with a range from 3.83 to 6.92. The RJQ group mean scores and mean ranges were High School

3.51 and (1.33 to 5.00), Technical School (includes associate degrees) 3.29 and (1.33 to 5.00), Some College 3.86 and (2.00 to 5.00), College Graduate 4.12 and (2.00 to 5.00), and Graduate Degree 4.13 and (3.33 to 5.00) (see Table 1).

Table 1. Comparison of RJI Scores and RJQ Scores.

	Mean	Ranges
High School Juniors (RJI)	2.77	2.17 - 4.04
High School (RJQ)	3.51	1.33 - 5.00
Technical School (RJQ)	3.29	1.33 - 5.00
Some College (RJQ)	3.86	2.00 - 5.00
College Juniors (RJI)	3.65	3.46 - 5.58
Graduate Students (RJQ)	4.13	3.33 - 5.00
Doctoral Students (RJI)	5.67	3.83 - 6.92

Source: Kitchener (1983, p. 86) for statistics of RJI scores.

For the High School group, 45% (21/47) of the scores were below the mean and below the Kitchener upper limit score for high school students. Additionally, 72% (34/47) of the scores were one score (3.3) above the mean. The Technical School group had 38% (12/32) below the mean and 66% (21/32) one score (3.33) above the mean. The Technical School group had 91% of the scores below the upper limits of the Kitchener upper limit for college students. The Some College

group had 47.5% (29/61) below the Kitchener college student mean and 54.1% (33/61) one score above the mean. This group also had 86.9% of the scores below or near Kitchener's upper limit for college students. The Graduate Degree group had 46.7% (7/15) of the scores below the mean and 100% of the scores below the Kitchener upper limit for graduate students.

To compare the Kitchener and RJQ scores, one point was added to each RJQ range mean score to adjust for the one point difference in the means of the Reflective Judgment Model stages and the RJQ survey. Except for the High School group, which had only 47.5% of its mean scores below the Kitchener study upper limits for high school students, all other groups had range mean scores at 86.9% or 100% below the upper limit score of the Kitchener study. Based on this, it was judged that the RJQ limits were within the limits of the Reflective Judgment Model results. Results for the RJQ high school group were probably higher than the Reflective Judgment Model because of the age and job training (education) of the participants. Kitchener and King (1981) and Kitchener et al. (1989) observed that age and education were factors that influenced Reflective Judgment Model scores among the high school juniors studied three and six years after the original observation.

Content validity was conducted using a panel of experts: Robert Fellenz, Gary Conti, and Wendy Hamilton. Each panel member has a doctoral degree in adult education and all were members of the faculty at Montana State University when the content validity was conducted. Panel members were asked to assess each

scenario and related responses to determine if the scenarios measured the intended area. Panel members concurred that the RJQ scenarios measured the intended areas of the Reflective Judgment Model.

Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS)

Learning strategies were examined using the instrument, Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS), developed by the Center for Adult Learning Research at Montana State University. The instrument contains six scenes dealing with real-life learning situations each of which has 18 learning strategies potentially useful in that scenario. The respondent is asked to select four scenarios and identify six strategies for each category labeled as "Definitely Use," "Possibly Use," and "Not Likely Use." Scores are assigned each category: 3 points for each response under "Definitely Use," 2 points for each response under "Possibly Use," and 1 point for each response under "Not Likely Use." Fifteen of the 18 learning strategies were used in this study. The learning strategies enjoyment, rehearsal, and assess content were not used in this study. The learning strategies were previously discussed in Chapter 2.

The SKILLS instruments validity and reliability were analyzed by Conti and Fellenz (1991). Construct validity was examined through literature review and by obtaining judgment from a group of adult education and educational psychology professors. Additionally, two prominent scholars, Robert Sternberg and Wilbert

McKeachie, assessed and commented on the construct validity of SKILLS (Conti & Fellenz, 1991, p. 69).

Content validity of SKILLS was field tested as well as judged by a panel of experts assessing each item for its measure of the intended area. In the field test, a sample set of 253 participant responses confirmed the assessment of the jury of adult educators (Conti & Fellenz, 1991, p. 70).

The reliability correlation of equivalence of SKILLS were "between forms .72, equal length Spearman-Brown .84, and Guttman split half .84" from a sample of 53 respondents. The reliability test analyzed the six scenarios dealing with pet care, auto insurance, dental care, burial customs, selecting leaders, and planning for a trip to Yellowstone Park (Conti & Fellenz, 1991, p. 71). These scenarios were used in this study.

Statistical Tests

The multivariate analysis techniques of discriminate analysis, cluster analysis, and analysis of variance (ANOVA) were used in this study. Data were collected and entered on a computer data management program, dBase III PLUS, Version 1.0, for data organization and analysis. The Statistical Package for Social Sciences (SPSS/PC+) computer statistics program was used to analyze the data.

Discriminant analysis is a multivariate statistical technique that allows a researcher to analyze or study the differences between several groups of objects with several variables simultaneously (Klecka, 1990, p. 7). Discriminant analysis

can be used to interpret how groups are different or the technique can be used to classify by the derivation of one or more equations that can be used to predict group membership for the purpose of classification (Klecka, 1990, pp. 8, 9). This study used discriminant analysis to interpret how RJQ groups differed in respect to the SKILLS and demographic variables mix.

The discriminant analysis used data from the RJQ to develop reflective judgment score differences as a basis for the three discriminant groups. The RJQ scores were the dependent variables for the study; the independent variables were the fifteen factors from the SKILLS questionnaire and four demographic variables: gender, age, education, and enrollment in an education course.

Discriminant analysis procedures used two combinations. The first analysis used three RJQ scores groups as dependent variable groupings with the 15 SKILLS variables acting as the independent variables. The analysis determined what variable groupings were major determinants in the discriminant analysis. The second discriminant analysis was similar to the first except that the demographic variables of gender, age, level of education, and enrollment in a post-secondary course were added to the independent variables to determine how much difference the demographic variables had on the variable groupings.

Two hypotheses were tested to determine if it was possible to discriminate among participants with the high, medium, and low RJQ scores. Two criteria were used in judging the hypotheses. The first criterion was that the discriminant function had to correctly classify at least 45% of the cases in the sample. Since the

analyses of these hypotheses contained three groups, the probability of randomly assigning cases correctly was 33%. The 45% criterion level is a 12% increase over chance prediction. In this study, the discriminant function had to be clearly definable in order for a research question to be answered and had to make at least a 12% improvement over chance in accuracy of classification ability. The second criterion was that the discriminant function produced by the analysis had to be describable using structure coefficients with a value of .3 or greater.

Cluster analysis is a statistical technique that lets a researcher study relatively homogeneous groups called "clusters" that share common characteristics. Aldenderfer and Blashfield (1990) state that cluster analysis is the generic name for a wide variety of multivariate statistical procedures that can be used to create a classification (p. 7). These procedures empirically form "clusters" or groups of highly similar entities. Lorr (1983) defines cluster classification as "a process of sorting individual variables or objects into an end group which then can be categorized based on its unique characteristics" (p. 1).

According to Aldenderfer and Blashfield (1984), "Clustering methods are used to discover structure in data that is not apparent by visual inspection . . . . The key to using cluster analysis is knowing when these groups are real and not merely imposed on the data by the method" (p. 76).

The appropriate clusters for the data are determined by a graph formed by using the fusion or amalgamation coefficient of the cluster analysis. The amalgamation coefficient represents "the numerical value at which various cases

merge to form clusters" (Aldenderfer & Blashfield, 1984, p. 76). Visually, the hierarchical tree graph sharply changes slopes indicating a divide where the number of clusters would provide a "best fit" for the data. An initial cluster analysis was conducted using the hierarchical agglomerative clustering method to determine how many potential distinct groups could be formed for further analysis. Complete sets of data for all variables were available on 197 participants. SKILLS variables, RJQ scores, and four demographic variables were used in the analysis.

The agglomeration schedule from the hierarchical agglomerative clustering method was used to determine possible groupings for analysis (Norusis, 1988b, p. B-77). The correlation scores of each cluster stage were used to pick the potential number of groupings. Cluster analysis puts each variable into groups until all 197 variables are combined into a single end group. Each variable is agglomerated into groups and the groups grow larger and larger, similar to a tree branching out, until all 197 variables in the analysis form a single group.

A total of 196 groups were identified with group 196 being the largest single group containing all 197 variables. The agglomerative correlation coefficient or "Coefficient" is the squared Euclidean distance between groups or clusters. To find potential clusters for analysis, one has to start with the larger group (Norusis, 1988b, p. B-77). Starting with group 196, correlation scores were compared sequentially to find a major difference between adjacent scores. The major difference determined where the potential clusters for further analysis were located.

The major break in the coefficient scores occurred at group 191, indicating that the study potentially had six discernible groups.

Different cluster group sizes were analyzed using different numbers of cluster groups. The study cluster group size was determined to be five, since five groups provided the "best" combination of participant distribution. According to Aldenderfer and Blashfield (1984, p. 58) there are no standardized methods of selecting cluster groups. Cluster groups are selected using the researcher's "best judgment."

The SPSS cluster analysis program was used in the initial phase of the cluster analysis phase of this study. After the number of cluster groups were determined, the SPSS quick cluster procedure was used in this study because it "can be used to cluster large numbers of cases efficiently without requiring substantial computer resources" (Norusis, 1988b, p. B-91). This procedure also only produces one solution for the number of clusters specified by the researcher.

The cluster group center mean for each SKILLS and demographic variable was analyzed using a one-way analysis of variance (ANOVA) statistical procedure to determine if there were significant differences among each SKILLS and demographic variable cluster center mean. Fourteen variables had SKILLS and demographic variables with significant differences. A significance level of $P < .05$ was used to determine the SKILLS and demographic variables used in the cluster group's description. Descriptions of the five cluster groups were based on the SKILLS and demographic variables rated "low" or "high" for each group.

CHAPTER 4

DATA ANALYSIS

Participants

A total of 275 questionnaires were distributed to various work stations at Malmstrom Air Force Base between September 1991 and March 1992. Two hundred twenty-eight questionnaires were returned for a return rate of 87%. Of these, 27 were removed because they were incomplete. In the data analysis, 201 were used in the discriminant analysis. However, in the cluster analysis four additional cases were deleted because they demonstrated extreme scores which were not associated with any cluster.

The 201 participants in the study appeared to represent a cross section of the Malmstrom Air Force Base work force. Males constituted 68.2% (137) of the participants, which is representative of the ratio of males to females in the Malmstrom Air Force Base work force. The participants ages ranged from 18 to 60 years. The minimum age for an entering enlisted person is 18 years of age. Although, there are some work-study students employed at Malmstrom, full-time civilian employees in the civilian force are hired on a competitive basis starting at GS-4, which requires a minimum qualification of a high school diploma. The mean

age for the participants was 32.4 years, with a standard deviation of 10.38. Most military members sampled were under age 40. No senior non-commissioned officer or commissioned officer was surveyed.

Approximately 77% of the participants had participated in some form of post-secondary education. The category of some college courses accounted for 30.3% of the participants, individuals with technical certificates and associate degrees accounted for 16%, baccalaureate degrees for 21.9%, masters degrees for 7.5%, and doctoral degrees for 1%. Because of the extensive technical training programs offered by the Air Force and the opportunity to participate in off-duty college courses, the diverse education levels of the participants approximated the work force population of the base. Commissioned officers are required to have a college degree. Many skilled positions require enlisted personnel to complete technical training courses before being assigned to the base. Individuals assigned to non-technical skills such as vehicle drivers, field cooks, and some administrative personnel are usually assigned to the base directly from basic training. These individuals receive job training through a self-paced "on-the-job" training program administered by a supervisor in the work section. Civilian personnel also have opportunities for post-secondary education participation in programs sponsored by the federal government.

SKILLS and RJQ Procedures

Participants completing SKILLS and RJQ were given instructions both orally and in writing by the survey proctor prior to completing the instruments. The participants were asked to pick four of the six scenarios included in each SKILLS packet and answer all four RJQ scenarios.

Only three of the RJQ scenarios were used in this study (see analysis of RJQ in Chapter 3). The five responses for each question corresponded to the seven stages of the Kitchener and King's Reflective Judgment Model: Response 1 represented Stages 1 and 2, Response 2 represented Stage 3, Response 3 represented Stage 4, Response 4 represented Stage 5, and Response 5 represented Stages 6 and 7. The total scores were used in the discriminant and cluster analyses.

A set of six SKILLS scenarios were used in the study. Participants were asked to respond on four of the six scenarios by rating 18 SKILLS learning strategy questions as one they would "definitely use," "possibly use," or "not likely use." The SKILLS answer sheet was arranged in the three categories with spaces for six responses, therefore, forcing the participants to categorize their 18 responses into three specific groups as specified above. This "forced choice" method obligated the participants to make choices between the three categories, thus forcing the participants to think about the options and make meaningful choices and preventing respondents from stacking their responses in one or two categories. Scores were calculated by assigning weights: 3 points for "definitely use," 2 points for "possibly

use," and 1 point for "not likely use." From the 18 questions, 15 SKILLS learning strategies were identified that represented the five learning components of metacognition, metamotivation, critical thinking, memory, and resource management (see Table 2).

Table 2. Components of Self-Knowledge Inventory of Lifelong Learning Strategies.

Metacognition

Definition: Knowing about and directing one's own thinking and learning processes.

Strategies: **Planning**--analyzing the best way for one's self to proceed with a specific learning task.
Examples: Follow own learning style, skim or overview, determine purpose or focus, plan.

Monitoring--assessing how one is proceeding through a learning project.
Examples: Review plans, check if on task, compare to accepted standard or model.

Adjusting--directing and improving one's learning processes.
Examples: Evaluate, seek feedback, change approach, decide when done.

Metamotivation

Definition: Awareness of and control over factors that energize and direct (motivate) our learning.

Strategies: **Attention**--focusing on material to be learned.
Examples: Set aside time for learning, resolve to learn, avoid distractions.

Reward--anticipating or recognizing the value to one's self of learning specific material.
Examples: Recognizing learning as relevant or useful, important or worthwhile, problems of not knowing.

Confidence--believing that one can complete the learning task successfully.
Examples: Feel confident or reassured, remind self of past success, get support from.

Table 2. Continued.

Memory

Definition: The storage, retention, and retrieval of knowledge.

Strategies: **Rehearsal**--reviewing or accenting material for the purpose of improved retention.

Examples: Practice telling, repeating to self, highlighting or marking, count in mind.

Organization--structuring or processing information so that material will be better stored, retained, and retrieved.

Examples: Image, elaborate or translate, chunk, pattern, summarize, or fit together, memory devices.

Memory Application--using remembrances, mental images, or other memories to facilitate planning or problem solving.

Examples: To avoid mistakes, to know what to expect, to select methods, to provide background information.

Critical Thinking

Definition: A parallel process by which individuals analyze given information in a contextually specific situation and create new ideas.

Strategies: **Test Assumptions**--recognize and evaluate in relation to learning situation.

Examples: Examine accuracy of assumptions, identify relationships, spot inconsistencies, critical acceptance, questioning value sets.

Generate Alternatives--hypothesize but ground options within the given situation.

Examples: Brainstorm or envision future, hypothesize, rank order, identify other solutions.

Conditional Acceptance--reflective and tentative maintenance of principles.

Examples: Question simplistic answers, monitor or evaluate results, predict consequences.

Table 2. Continued.

Resource Management	
Definition:	The process of identification, evaluation, and use of resources relevant to the learning task.
Strategies:	**Identification**--knowing how to locate and use the best sources of information. Examples: Modern information sources, print sources, people or models, professional or agencies.
	Critical Use--using appropriate rather than available resources while recognizing their limitations. Examples: Contact expert or outsider, check second source, observe or ask to check bias.
	Human Resources--integrating others into the social and political process of knowing. Examples: Dialogue or discuss, check opinions, listen to all, support from or network with others.

Source: Fellenz, Robert A., & Conti, Gary J. (nd). Modified from Components of Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS). Worksheet. Bozeman, MT: Montana State University Kellogg Center for Adult Learning.

Discriminant Analysis

Discriminant analysis is "a statistical technique which allows the researcher to study the differences between two or more groups of objects with respect to several variables simultaneously" (Klecka, 1980, p. 7). In discriminant analysis the emphasis is placed on analyzing variables together at the same time, therefore making it possible to study how variables relate to one another. Discriminant

analysis makes it possible to predict group membership and also to differentiate groups by variable characteristics.

In this study, discriminant analysis was used to determine which variables contributed the most to identifying participants with low, medium, and high RJQ scores. The low group had 41 participants with total scores ranging from 4 to 9, which made up 20% of the total participants. The medium group had 55 participants who had total scores ranging from 11 to 12, which made up 37% of the total participants. The high group had 46 participants with scores ranging from 14 to 15, which made up 23% of the total participants. Scores of 10 and 13 were not included because these scores were used as the buffer between the discriminant groups. Ten was the buffer between the low and medium groups and 13 between the medium and high groups. Fifty-nine participants, 31 for the lower buffer and 28 for the upper buffer were not included in the discriminant analyses. Such a buffer was considered necessary to distinctly demarcate the three discriminant groups so that the groups formed would have unique characteristics.

The upper limit for the low group was 9, which approximates Stage 4 of the Reflective Judgment Model, and the lower limit for the high group was 14, which approximates Stages 6 and 7 of the Reflective Judgment Model. Both scores of 9 and 13 are approximately one standard deviation below and above the group mean ($\underline{m}$ = 11.279, $\underline{SD}$ = 2.55). The three discriminant groups included 70% of the total study participants.

Both discriminant analyses used the stepwise selection method for three groups to "produce an optimal set of discriminant functions" (Klecka, 1980, p. 53). The Wilks' lambda was the selection criteria. The Wilks' lambda "is a statistic which takes into consideration both the differences between groups and the cohesiveness or homogeneity within groups" (Klecka, 1980, p. 54). The stepwise procedure selects variables based on their small Wilks' lambda.

Discriminant analysis was used to determine if the three groups were different. Two discriminant analyses were conducted. The first discriminant analysis analyzed the three RJQ groups using SKILLS strategies as discriminating variables. The second discriminant analysis analyzed the three RJQ groups using SKILLS and the demographic factors of gender, age, education, and enrollment in education as discriminating variables.

Discriminant Analysis with SKILLS

Discriminant analysis was used to test the research question that it is possible to discriminate between participants with low RJQ scores, participants with medium RJQ scores, and participants with high RJQ scores using SKILLS strategy scores as discriminating variables. The three groups contained a total of 142 of the 201 participants in the study.

The pooled within-groups correlation matrix of predictor variables was examined for the presence of interdependence among the variables. Interdependence among variables in multivariate analysis can impact the analysis as

the correlation matrix is calculated by averaging the separate covariances for the groups in the matrix (Norusis, 1988a, p. B-5). This examination revealed that no strong correlation existed within the groups of discriminating variables. The highest positive correlation was .26. Thus, the variables in this discriminant analysis were not related to each other and did not share a common variance.

Wilks' Lambda identifies the cohesiveness within groups. Cohesiveness refers to the degree which discriminant variables cluster near their group centroid (Klecka, 1980, p. 54). A group centroid "is an imaginary point which has coordinates that are the group's mean for each variable" (Klecka, 1980, p. 16). Since discriminant analysis is a multivariate statistic, individual mean scores are not useful in describing the interaction among variables. However, the centroid represents this interaction.

The stepwise procedure was used to eliminate unnecessary variables from the analysis. The stepwise procedure "begins by selecting the individual variable which provides the greatest univariate discrimination. The procedure then pairs the first variable with each of the remaining variables, one at a time, to locate the combination which produces the greatest discrimination" (Klecka, 1980, p. 53).

The stepwise process identified four variables which provided the greatest discrimination among the RJQ groups (see Table 3). These were the resource management strategy of identifying resources (Identify), the metacognition strategy of adjusting (Adjust), the resource management strategy of use of human resources (Human), and the critical thinking strategy of acceptance (Accept). The analysis

Table 3. Variables Providing the Greatest Discrimination Among the RJQ Groups.

Variable	F Score	Wilks' Lambda
Identify	6.4858	.92532
Adjust	2.6420	.87757
Human	2.2123	.87223
Accept	1.9367	.86880

stopped at Step 4 because the F levels indicated that discrimination would have been insignificant beyond this step. The final order of variable selection is summarized in Table 4. These variables were the major variables that discriminate among the low, medium, and high groups on the RJQ.

Table 4. Summary of Selected SKILLS Discriminant Variables.

Variable	Wilks' Lambda	Significance
Identify	.93376	.0085
Adjust	.89246	.0034
Human	.86880	.0035
Accept	.84474	.0031

Since this analysis had three groups on the RJQ, two canonical discriminant functions were formed in the analysis. The number of functions in a discriminant analysis is determined by the number of groups. The number of functions

calculated is one less than the total number of groups. However, all of the functions which are produced may not be meaningful (Klecka, 1980, p. 23). The strength of the eigenvalue for each group determines if the function contributes significantly to the analysis. An eigenvalue is the same as the unstandardized canonical discriminant function coefficient, which is a ratio of between-groups sum of squares divided by within-groups sum of squares.

The magnitude of the eigenvalue indicates the relationship of the discriminating power of the two functions. The eigenvalue of Function 1 (.1265) was 2.5 times greater than that of Function 2 (.0508). Function 1 accounted for 71.34% of the discriminating power while Function 2 accounted for 28.66%.

Function 1 had three variables with high standardized canonical discriminant function coefficients: resource management identify resources (Identify, .89), metacognition adjusting (Adjust, .60), and critical thinking conditional acceptance (Accept, .28). Function 2 had two variables with high standardized canonical discriminant function coefficients: resource management use of human resources (Human, .80) and critical thinking conditional acceptance (Accept, .64).

The classification function equation for Function 1, Flexible Learner, was:

D = .37(Adjust) + .16(Accept) + .59(Identify) + .04(Human) - 9.64

The classification function equation for Function 2, Enthusiastic Learner, was:

D = .49(Human) - .06(Adjust) + .35(Accept) - .18(Identify) - 4.95

The structure matrix contains the coefficients which show the similarity between each variable and the total discriminant function, which shows how closely the discriminant variables are related to the canonical discriminant function. The structure matrix coefficients are the pooled-within-groups correlations formed from the relationship between the discriminant variables and the canonical discriminant functions (see Table 4).

In the interpreting process, only variables with a coefficient of .30 and above were considered. The three variables with coefficients above the .30 criterion level for Function 1 were identifying resources (.729), adjusting (.420), and acceptance (.336). The two variables above the .30 criterion for Function 2 were use of human resources (.730) and critical acceptance (.539). Critical thinking conditional acceptance (Accept) had standardized canonical discriminant function coefficients above .30 for Function 1 and Function 2 (see Table 5).

Table 5. Structure Matrix of Standardized Canonical Discriminant Function Coefficients for SKILLS.

Learning Strategy	Function 1	Function 2
Resource Management Identification	.729	-.270
Metacognition Adjusting	.420	.060
Critical Thinking Conditional Acceptance	.336	.539
Resource Management Human Resources	.028	.730
Memory External Aids	.022	-.017
Metamotivation Reward	-.217	-.136
Generate Alternatives	-.179	.089
Memory Organization	-.122	.021
Metamotivation Attention	-.021	-.278
Metacognition Monitoring	.056	-.041

Based on the strengths of the discriminant variables of identifying resources, adjusting, and conditional acceptance in Function 1, this discriminant function was named Flexible Learner. The combination of the three SKILLS learning strategies indicates that the Flexible Learner is one who would tentatively accept a learning task alternative but who would at the same time reflect on the accepted alternative before proceeding to the final acceptance of a solution. The reflection in conditional acceptance is complimented by the metacognition strategy of adjusting. This learning strategy suggests that the learner is willing to make adjustments to new information. The Flexible Learner has the ability to identify appropriate learning resources without depending on others. For example, the Flexible Learner does not use others or a single source of information because they have put effort into locating learning sources on their own.

Function 1 identifies participants grouped in the medium group with a group centroid of .30189. The high group had a -.11958 group centroid and the low group had a -.53915 group centroid.

The -.53915 group centroid shows an inverse relationship with the medium group which would indicate that the three learning strategies of resource management identification, metacognition adjusting, and critical thinking conditional acceptance are not widely used by low group members. This group of learners was at the low end of Function 1, and their characteristics were used in this analysis to describe the low learner group. Since Function 1 and Function 2 accounted for all of the variance, the description of the low learner group was an approximation.

The low learner group would mostly likely be associated with participants who were placed below reflective judgment Stage 4.

The second discriminant function provides explanation after the first has done its best (Klecka, 1980, p. 25). Since Function 2 accounted for nearly 29% of the discriminating power in the analysis, it was examined second. The structure matrix indicated the use of human resources (.730) and critical thinking acceptance (.539) as the two major discriminant variables. This discriminant function is named Pragmatic Learner. This name was chosen to illustrate that this type of learner reflects on tentative solutions in learning situations and relies on other people as resources for learning information. Being able to facilitate learning through interaction with other people expands the intrapersonal learning situation to a larger social interpersonal learning environment. Function 2 identified the high group. It had a group centroid of .31318 while the low and medium groups had group centroids of -.07617 and -.20515 respectively. The negative group centroids for the low and medium groups indicate that high group members are distinct in their reliance on the use of human resources and the critical thinking use of conditional acceptance.

Discriminant analysis can also be used as a classification statistical procedure. According to Klecka (1980), "classification is a separate activity in which either the discriminating variables or canonical discriminant functions are used to predict the group to which a case [participant] most likely belongs" (p. 42).

Cases are assigned to groups according to their calculated discriminant scores. The assignments are based on the discriminant score's proximity to the group centroids.

A linear combination of the discriminant variables combined to form a single index is used to assign cases to groups. The single index, classification function, is the score for a case which is then used to assign the case to a group as determined by how it most resembles the characteristics of a given group or discriminant faction. The assignment is based on a closeness of fit or the "best" separation between groups (Norusis, 1988b, p. B-6). The discriminant variable and associated unstandardized canonical discriminant function coefficients identified in the discriminant analysis are used in a linear equation to determine the classification function.

The percent of cases (participants) in the sample correctly classified shows the accuracy of the discriminant analysis. The discriminant analysis was 47.89% accurate in classifying cases. Of the 41 cases in the low group, the analysis correctly placed 58.5% (24). It correctly placed 23 of 55 (41.8%) in the medium group and correctly placed 21 of 46 (45.7%) of the cases in the high group. There were 59 participants that were not classified in any of the three groups. Based on a chance placement of 33.33% for three groups, the discriminant function was a 14.56% improvement over chance placement. The discriminant score for the medium group and high group demonstrate that the discriminant analysis could produce a recognizable predictive score that is accurate and which explains 58.88% of variance.

The discriminant functions were definable with a value of .3 or greater and the discriminant function correctly classified at least 45% of the cases. Research Question 1, which states that among Malmstrom Air Force Base personnel it is possible to discriminate among the participants with highest Reflective Judgment Questionnaire scores, the participants with approximately middle Reflective Judgment Questionnaire scores, and the participants with the lowest Reflective Judgment scores based on measurements of strategies scores on SKILLS, was answered.

Discriminant Analysis with SKILLS Scores and Demographic Data

After discriminant analysis with learning strategies was completed, a second analysis was conducted to determine if the discriminating power among the groups could be improved by adding demographic variables. Discriminant analysis was used to determine if there was a discriminant score capable of discriminating between the same RJQ groups as Research Question 1 using SKILLS scores and demographic data as independent discriminant variables. Three demographic variables, gender, age, and educational level, were added to the discriminant analysis.

The pooled-within-groups correlation matrix revealed no strong correlation. The highest correlation was below .30. This demonstrated that the discriminant variables were not related to each other and consequently were not sharing a common variance.

As in the analysis of Research Question 1, stepwise selection was used to determine if the added variables changed the relationships of the variables, thereby creating new discriminate variable relationships in the functions and different discriminant scores for group classification. Only 10 variables were selected because F scores after step 10 were statistically insufficient for further analysis (see Table 6).

Table 6. SKILLS and Demographic Variables Providing the Greatest Discrimination Among the RJQ Groups.

Variable	F Score	Wilks' Lambda
Identify	6.0605	.76782
Gender	5.2559	.75913
Education	4.1427	.74710
Adjust	2.7565	.73212
Organization	2.0045	.72399
Monitor	1.7390	.72113
Human	1.5837	.71945
Age	1.3119	.71651
Plan	1.3045	.71643
Apply	1.0329	.71350

The final summary of discriminant variables identified and their order of removal are summarized in Table 7. These were the variables used in describing the characteristics of Function 1 and Function 2, two groups synthesized as a result of the discriminant analysis of the low, medium, and high RJQ groups.

Table 7. Summary of SKILLS and Demographic Discriminant Variables Identified.

Variable	Wilks' Lambda	Significance
Education	.92479	.0044
Identify	.85925	.0003
Adjust	.82925	.0002
Gender	.79921	.0001
Human	.77453	.0001
Organization	.75147	.0001
Monitor	.73766	.0002
Age	.72473	.0002
Plan	.71350	.0003
Apply	.70234	.0005

The standardized canonical discriminant function coefficients were utilized to determine which variables were the most important in the two functions that were created after the three group analyses. In Function 1, the major standardized canonical discriminant function coefficient variables were memory organization (.435), use of human resources (.355), gender (-.563), age (.338), and education (.605). The eigenvalue for Function 1 was .2179, which accounted for 56.3% of the variance.

In Function 2, the major standardized canonical discriminant function coefficient variables were planning (.303), monitoring (.383), adjusting (.548), memory application (.362), identifying resources (.748), and gender (.479). The eigenvalue for Function 2 was .1691, which accounted for 43.7% of the variance.

The eigenvalues for Function 1 and Function 2 were much closer that the first discriminant analysis.

The discriminant score for Experienced Learner was:

D = .37(Education) - .13(Plan) - .14(Monitor) + .11(Adjust) + .26(Organization) + .01(Apply) + .19(Apply) + .19(Identify) + .21(Human) + 1.23(Gender) + .03(Age) - 5.024257

The discriminant score for Enthusiastic Learner was:

D = .02(Education) + 17(Plan) + .23(Monitor) + .34(Adjust) + .03(Organization) + .22(Apply) + .49(Identify) - .11(Human) + 1.05(Gender) + .002(Age) - 13.00743

The structured matrix contains the pooled-within-groups correlations of the discriminant variables and the canonical discriminant functions. The correlation shows how alike each individual variable is to the total discriminant score. The structure matrix also shows the variables that have the strongest relationships in the discriminant analysis. These variables are used to name the discriminant function (see Table 8).

Function 1 strongest variables above the .30 standard were Education (.606), Age (.358), and Human (.325). The group centroids for Function 1 were low (-.457), medium (.203), and high (.650). Based on the group centroids and the structure matrix correlations, Function 1 represents the high group and is named Experienced Learner. This group represents the same group of learners identified as Pragmatic Learner in the discriminant analysis using only learning strategies.

Two demographic variables, education and age, and the SKILLS resource management use of human resources characterize members of this group as older

Table 8. Structure Matrix of Standardized Canonical Discriminant Function Coefficients for SKILLS and Demographic Variables.

	Function 1	Function 2
Education	.606	.088
Age	.358	.158
Resource Management Human Resources	.325	.157
Metacognition Planning	-.225	.192
Memory Organization	.195	-.013
Memory Application	.149	.044
Resource Management Identifying Resources	.131	.630
Gender	-.297	.318
Metacognition Adjusting	.169	.310
Metacognition Monitoring	-.099	.239

participants with higher education levels and who were comfortable using human resources to accomplish a learning task. The learning strategies variable metacognition adjusting, which was above .30 on the structure matrix for the first discriminant analysis, had a value of .169 in this analysis.

Function 2 had the following major variables: identifying resources (.630), gender (.318), and adjusting (.310). Individual members of this group were knowledgeable in the use of available learning resources to complete a task, and they were willing to change, i.e., to modify or adjust procedures of completing a learning task as new information became available. Women accounted for 22 of the 55 participants (34.4%) in Function 2.

The group centroid values for Function 2 were low (-.496), medium (.479), and high (-.131). The .479 indicated that the characteristics of Function 2

represented the medium group. This discriminant function is named Enthusiastic Learner. The Flexible Learner identified in the first discriminant analysis had the same RJQ group as the Enthusiastic Learner.

The low centroid scores for the low group were (-.457) for Function 1 and (-.479) for Function 2. These scores were used as a projection for the low learner group. Since the two negative centroids were nearly equal, the approximation of the low learner group was based on both Function 1 and Function 2. The low learner group had about the same characteristics as the low learner group described in the first discriminant analysis. The age of the low learner group was estimated to be younger and the education lower than the Experienced Learner and the Enthusiastic Learner.

The percent of grouped cases correctly classified for the discriminant analysis for Research Question 2 was higher than for Research Question 1. The discriminant score was 54.93% accurate in classifying cases. It correctly placed 21 or 41 (51.2%) for the low or Inexperienced Learner group, 30 out of 55 (54.5%) for the medium or Enthusiastic Learner group, and 27 out of 46 (58.7%) for the Experienced Learner or high group. There were 59 participants not placed in any of the three groups. The 59 participants were used as buffers between the low to medium and the medium to high RJQ groups. With a 33.33% chance occurrence for three groups, this analysis was 21.60% above the chance level. The improvement from Research Question 1 was 7.04%.

The discriminant function was definable with a value of .3 or greater and the discriminant function correctly classified 45% of the cases. Research Question 2, which asks, "Is it possible to discriminate among the participants with the highest Reflective Judgment Questionnaire scores, the participants with approximately the middle Reflective Judgment Questionnaire scores, and the participants with the lowest Reflective Judgment Questionnaire scores based on measurement of learning strategy scores on SKILLS and demographic variables?" was answered.

The seven percent difference in predictability between discriminant analysis with SKILLS and discriminant analysis with SKILLS and Demographic Variables was accounted for by the addition of the demographic variables Age, Gender, and Education.

Cluster Analysis of SKILLS, RJQ and Demographic Variables

Cluster analysis was used to determine if distinctive learner groups could be formed based on SKILLS, RJQ, and demographic variables. Cluster analysis is a multivariate statistical procedure that can be used to create a classification (Aldenderfer & Blashfield, 1990). Cluster analysis procedures empirically create or form "clusters" or groups that have similar data characteristics. It is a multivariate clustering method "that starts with a data set containing information about a sample of entities and attempts to reorganize these entities into relatively homogeneous groups" (p. 7).

The sample information for this study included the 15 learning strategies of SKILLS, 3 scenario scores from RJQ, and the demographic variables of gender, age, and education level. Initially, all 201 participant samples were included in the analysis. However, as the data were analyzed to determine the best number of groups that would provide distinct participant groupings, four participant samples were eliminated from the study because they had extreme scores on at least one variable that prevented them from clustering with other groups.

Cluster analysis using the Ward's method was conducted on the 197 participant samples. The Ward's method of forming clusters was used because it is designed to optimize the minimum variance within clusters. The method tends to create clusters of relatively equal sizes. This method has been widely used in the social sciences (Aldenderfer & Blashfield, 1990, p. 43). From the hierarchical agglomeration schedule the bottom 12 stages were examined to determine if there was a definite "break" (separation) in the coefficients (see Table 9). The hierarchical agglomeration schedule is derived from the search for a N X N similarity matrix, where N refers to the number of entities, and the entities are sequentially merged to form similar groups. The agglomeration process is like a tree diagram. Eventually, the total number steps necessary to cluster a similarity matrix is N-1 (Aldenderfer & Blashfield, 1990, p. 36).

A common method in choosing the number of clusters is the "scree slope" method. The scree slope is named after the flattened slope that is formed where an original abrupt change in slope of a hill or steep sided valley was filled-in with

Table 9. Cluster Analysis Agglomeration Schedule.

Cluster	Coefficient
12	8635.46
11	8855.62
10	9095.63
9	9346.06
8	9646.84
7	9983.64
6	10387.87
5	10863.52
4	11342.28
3	13127.03
2	15682.21
1	30991.93

large weathered rocks over time. If the cluster stages and coefficients were plotted on a graph with the cluster stages on the y-axis (with the last stage at the origin) and the coefficients on the x-axis (with the lowest coefficient at the origin), the position along the graph where there is a definite flattening of the graph's slope, or the scree slope, is the location of the "break" point that determines the number of clusters that are chosen for the cluster analysis (Aldenderfer & Blashfield, 1984, p. 54).

The separation at the 191st step was judged to be the start of the scree slope; therefore, Cluster 6 was chosen as a starting point to determine the number of groups to include in the study. Below Cluster 6, the coefficient separations were

much smaller than the separation above Cluster 6; therefore, the slope depicted was fairly steep.

There is no "right" method to determine the selection of cluster groups. Although the social sciences have attempted to adopt formal rules, heuristic approaches are most common in selecting clusters. Because there are no established correct procedures for choosing clusters, researchers are cautioned that different numbers of clusters from the same sample set may provide different results (Aldenderfer & Blashfield, 1990, pp. 54, 58).

In order to determine the most meaningful solution for the "best" distribution of sample participants among the groups that would demonstrate distinct and unique relationships of SKILLS learning strategies, RJQ scores, and demographic data, the final six clusters were examined. The original six groups were narrowed down to five groups after comparing the sizes of the cluster groups between the six and five cluster group sets. Five cluster groups were chosen based on the distribution of participants in each group. Participants were distributed among the five groups as follows: Group 1--13, Group 2--11, Group 3--63, Group 4--69, and Group 5--41.

After the five cluster solutions were chosen, the means for each group were calculated for SKILLS scores, RJQ, and the demographic variables. Then, a one-way analysis of variance was performed on each SKILLS score, RJQ, and the demographic variables to determine if there were significant differences among the five groups. Variables on which the groups differed significantly were retained in

the analysis. Fourteen variables had significant differences among clusters: education ($F=2.64$, $df=4/196$, $p=.04$), metacognition planning ($F=12.73$, $df=4/196$, $p=.001$), metacognition monitoring ($F=11.46$, $df=4/196$, $p=.001$), metacognition adjusting ($F=15.82$, $df=4/196$, $p=.001$), metamotivation attention ($F=2.98$, $df=4/196$, $p=.02$), metamotivation reward ($F=12.94$, $df=4/196$, $p=.001$), metamotivation confidence ($F=9.23$, $df=4/196$, $p=.001$), memory application ($F=4.32$, $df=4/196$, $p=.002$), critical thinking testing assumptions ($F=13.33$, $df=4/196$, $p=.001$)), critical thinking alternative ($F=10.15$, $df=4/196$, $p=.001$), critical thinking acceptance ($F=25.56$, $df=4/196$, $p=.001$), resource management critical use of resources ($F=5.04$, $df=4/196$, $p=.001$)), resource management use of human resources ($F=13.80$, $df=4/196$, $p=.001$), and RJQ scores ($F=44.47$, $df=4/196$, $p=.001$).

The means of the five cluster groups for each of the 14 significant variables were selected as characteristic indicators. Each cluster group's cluster center mean was analyzed by arranging the scores on a linear scale. Scores on the opposite ends (positive and negative) were selected to determine which variables should be assigned to a given cluster group. Cluster center mean scores that fell between the identified "high" and "low" scores were only used in the analysis when the intermediate scores were "close" to the perimeter cluster's center mean scores.

For example, the cluster center means for metacognitive planning for cluster 2 was 7.09 and the score for cluster 1 was 10.77 (see Table 10). No other metacognition planning scores were assigned to cluster groups. Use of human

Table 10. Cluster Center Mean Scores.

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Gender	1.40	1.20	1.24	1.39	1.40
Age	57.40	53.20	29.15	41.13	21.90
Education *	2.67	5.67	4.66	4.71	3.69
Enrolled	1.60	1.93	1.25	1.74	1.33
Planning *	10.77	7.09	9.00	9.84	9.34
Monitor *	9.38	6.09	8.41	7.48	7.56
Adjustment *	5.84	6.00	7.84	7.55	6.12
Attention *	8.46	8.36	9.06	8.93	9.61
Reward *	5.92	7.18	7.22	6.28	8.02
Confidence	6.23	6.45	7.32	6.23	7.61
Organization	9.00	8.00	7.95	7.80	7.59
External	7.85	7.82	8.37	7.83	7.34
Application *	6.15	8.82	7.27	7.20	7.07
Assume *	11.15	10.00	8.51	9.46	9.39
Alternative *	6.46	7.91	6.97	8.45	7.49
Acceptance *	7.08	9.27	7.59	9.46	6.85
Identify	9.84	9.91	9.38	8.91	9.00
Use *	9.15	9.45	8.00	8.81	8.85
Human *	8.80	11.09	9.02	7.99	7.98
RJQ *	11.31	13.64	12.37	12.06	8.22

* Variable in which significant difference ($p < .01$) was found among cluster center means in the analysis of variance.

resources had two cluster center means that were fairly close, on the low end, 7.98 for cluster 5 and 7.99 for cluster 4. The high score for use of human resources was 11.09 for cluster 2. Both the negative scores were used to explain cluster 4 and cluster 5 and the positive score was used to explain cluster 2. The distinct variables in each group were selected and used to explain each cluster group.

There were five distinct cluster group formed. Three cluster groups had reflective judgment stages between 6 and 7, one had members between reflective judgment Stages 4 and 5, and one cluster group's members were placed below reflective judgment Stage 4. All five groups had clusters members with distinct levels of education and age. Some groups used similar learning strategies.

Research Question 3 was answered. All five cluster groups were unique, exhibiting different characteristics.

Results of the Cluster Analysis

Cluster learner groups had distinguishable characteristics that identified learners who thought and used learning strategies in a similar manner. Cluster group members also had similar education, age, and reflective judgment profiles.

Cluster 1: Veteran Status Quo Learner. Cluster 1 is named Veteran Status Quo Learner because of the age and low level of education of group members. Cluster 1 was composed of 13 participants who had high cluster center means in planning (10.77), monitoring (9.38), and testing assumptions (11.15). Cluster 1 had low means in adjusting (5.84), reward (5.92), application (6.15), generating alternatives (6.46), and conditional acceptance (7.08). This cluster group ranked first in age (57.40), fourth in RJQ score (11.31), and fifth in education (2.67). Only two members of this group had bachelors degrees, eight had some college, one had an associate degree, and two were high school graduates. The cluster center mean

RJQ score was 11.31, which placed group members between reflective judgment Stages 4 and 5.

Based on the learning strategies cluster center mean scores, members of this group can be described as learners who plan their learning activities ahead of time. Group members assess their learning process through periodic checks that the learning task conformed to the prescribed learning plan. Adult learners in this group were attentive to testing the accuracy of assumptions and finding inconsistencies in reasoning. Group members were slow in reacting to information that did not "fit" what was being worked on, as they tended to be inflexible in adjusting to new information and resisted changing their learning plan under changing learning situations. This group probably had not relied heavily on memory application techniques to anticipate potential problem areas that might impact the learning or problem solving activity.

Cluster 2: Active Learner. Cluster 2 is named Active Learner because of this group's high present enrollment in post-secondary education programs. Cluster 2 had 11 participants. Group members had high cluster center means in education (5.67), application (8.82), conditional acceptance (9.27), critical use of resources (9.45), use of human resources (11.09), and RJQ score (13.64). This group had low cluster center means in planning (7.09), monitoring (6.09), adjusting (6.00), and attention (8.36).

This group's RJQ cluster center mean (13.64) ranked first among the five cluster groups. The RJQ cluster center mean placed this group between reflective judgment Stages 5 and 6. This group also had the highest ranking for education level of all five cluster groups. Two group members had masters degrees and four had bachelors degrees. Eight of the 11 members of this group were currently enrolled in some type of post-secondary education when they were surveyed. The cluster center mean for age was 53.20, which ranked second among the five groups.

Based on the high and low cluster center means, the 11 members of this group can be described as the most experienced decision makers of the five cluster groups. The low metacognition scores for planning, monitoring, and adjusting indicated that group members of this group were proactive, i.e., they were action oriented decision makers. The absence of conditional acceptance skills for this group may indicate group members do not solicit feedback.

Members of this group appear to be skilled at anticipating potential pitfalls and obtaining background information during a learning or decision-making task. Members of this group relish making situational decisions to solve problems within their realm of responsibility.

Cluster 3: Reactive Learner. Cluster 3 is named Reactive Learner because the high score in metacognition adjusting indicated that group members react rather than think things through during the learning process. Cluster 3 had 63 participants. This cluster had the third highest cluster center means in education

(4.66). Of the 63 members, 13 members had some college, 20 members a bachelor's degree, and 5 members at least a masters degree. Group members ranked second in RJQ scores (12.37) and fourth in age (29.15). The RJQ score placed Cluster 3 members in reflective judgment Stages 5 and 6.

The high cluster center mean for learning strategies was adjusting (7.84). Metacognition adjusting indicated that members of this group were confident of their ability to direct their own learning and were aware of what was happening to them in the learning process.

This group's low means were testing assumptions (8.51) and critical use of resources (8.00). The low score in the critical use of resources indicated that group members used less resources in making decisions. Group members were less inclined to examine the accuracy of assumptions and identifying relationships among information variables.

Cluster 4: Analytical Learner. Cluster 4 is named Analytical Learner because of group members' abilities to analyze information in learning situations. Cluster 4 had 69 participants. They scored high in the critical thinking areas of generating alternatives (8.45) and conditional acceptance (9.46). They were low in the areas of reward (6.28) and use of human resources (7.99).

This group had the second highest educational level. The cluster center mean for RJQ was 12.06, which ranked third among the five cluster groups. The RJQ score indicated that Cluster 4 group members were between reflective

judgment Stages 5 and 6, but 1.58 RJQ scores below Cluster 2 and .31 RJQ scores below Cluster 3 members. The average age of this group was 41.13.

The combination of the two critical thinking variables and high education indicated group members had a high reliance on education and critical thinking skills. This cluster had 28 members with at least an undergraduate college degree and 13 individuals with at least a masters degree. The critical thinking variables of generating alternates and conditional acceptance indicated that group members appeared to be skilled at using learning strategies that prioritize information, generate ideas, and develop alternate hypotheses while problem solving during a learning task. They also questioned simplistic answers and were not afraid to predict the consequences of alternative proposed solutions.

The group's low mean for reward (6.28) was close to the (5.92) of Cluster 1. Other low means were critical thinking testing assumptions (9.46) and use of human resources (7.99), which were the same for Cluster 5. The low cluster center mean in reward indicated that group members were still not fully comfortable in setting and striving toward personal learning goals. The low mean for testing assumptions indicated that group members had not fully developed their skills to test assumptions in a learning environment. The low cluster center mean for use of human resources indicated that group members infrequently consulted with others they consider to be experts or sought outside assistance from experts during a learning or decision-making situation.

The high age of this group indicated that a high percentage of classified and professional civilian workers make up this cluster's membership. The high education indicated that junior officers and civilians working in jobs requiring college degrees were also members of this group.

Cluster 5: Insecure Learner. Cluster 5 is named Insecure Learner because group members kept reminding themselves why they were performing the learning task. Cluster 5 had 41 participants. This group scored high in the metamotivation areas of attention (9.61) and reward (8.02). Their low scores were in the areas of conditional acceptance (6.85) and use of human resources (7.98). By far, they had the lowest reflective judgment score (8.02), which placed this group below reflective judgment Stage 4. Their score was 3.1 points below the next lowest group, Cluster 1. Age (21.90) ranked fifth, indicating that group members were the youngest of the five cluster groups

The cluster center mean for education (3.69) ranked fourth among the five cluster groups. Thirteen members of this group had a high school education and 12 either had a technical or associate degree. Only two members of this group had college degrees. This lower level of education attainment may partly be explained by the fact that this group is the youngest (21.90) of all the groups. Cluster 1 and Cluster 2 are over twice as old as this group. Cluster 4 is also nearly twice as old, and Cluster 3 is almost a decade older.

The high cluster center means for attention and reward indicated that group members had to push themselves to complete a learning task. It was important for them to reassure themselves that the learning task was worthwhile. Many of the learning tasks that learners concentrated on were "materials to be learned" type activities and the focus was on the learner's own learning goals. Metamotivation reward indicated that group members looked for intrinsic satisfaction on completion of their learning task.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Overview of the Study

This investigation had three purposes. The first purpose was to determine whether individuals at various stages of reflective judgment use different learning strategies; the second was to discover whether individuals at various stages of reflective judgment were different in levels of education, age, gender, and use of learning strategies; and the third was to find out if there were clusters of participants that think and learn in a similar manner.

To accomplish these purposes, 275 sets of data gathering questionnaires were distributed to various work stations at the Malmstrom Air Force Base Education Center between September 1991 and March 1992. Two hundred and one completed questionnaires were used in the discriminant analysis, and 197 were used in the cluster analysis statistical procedures used in this study.

Demographic variables, e.g., levels of education, age, and gender were integrated into the analytical procedures. However, detailed analysis of the demographic characteristics of participants was not possible because of the research

constraint placed by the Malmstrom Air Force Base Commander that individuals participating in this study be volunteers and each volunteer remain anonymous.

Discussion of the Analysis

Two discriminant analyses and a cluster analysis were employed in this study. The discriminant analyses were used to determine if individuals at different stages of reflective judgment used different learning strategies and if individuals at different stages of reflective judgment were different in levels of education, age, gender, and use of learning strategies. The RJQ scores were used to form three discriminant groups analyzed in this study. Cluster analysis was employed to discover if there were clusters of participants that think and learn in a similar manner. Five cluster groups were used in this study.

Results of the Discriminant Analysis Using SKILLS and RJQ

The first discriminant analysis which examined individuals who were at various stages of reflective judgment and who used different learning strategies identified two discriminant groups named Pragmatic Learner and Flexible Learner. A third group of learners was identified using the inverse canonical discriminant function score of the Flexible Learner.

The first group of individuals was named Pragmatic Learner because of the learning strategies use of human resources (resource management) and conditional acceptance (critical thinking). This group was identified with the "high" RJQ group.

RJQ scores for this group reflected 4.67 to 5.0 scores, which indicated that members of this group were in reflective judgment Stages 6 and 7. Learners that used human resources were usually skilled or experienced learners who knew how to locate available material resources from the work place, experts, or from library resources as well as use learning strategies as a social and political process in the work place to accomplish a learning task or solve a problem. Most of the individuals in this category work in supervisory positions at Malmstrom AFB and were required routinely to coordinate laterally or vertically in the organization. Conditional acceptance and use of human resources may likely be strategies that were used together to seek consensus on practical solutions that were based on information about costs, manpower, demands from the command hierarchy, and time constraints. Since this group works at an Air Force installation, the best solution alternative may be one that satisfied the organization's immediate "mission" requirements of keeping an aircraft or missile on a high readiness status.

The Flexible Learner group was composed of learners who relied strongly on three learning strategies: identifying resources (resource management), adjusting (metacognition), and conditional acceptance (critical thinking). The combination of these three learning skills demonstrated that members of this group considered it important to locate and use learning resources, to adjust learning plans, and to use new information and new insights gained from reflective thinking about alternative solutions to solve a problem or complete a learning task. Identifying resources also indicated that Flexible Learners were confident, self-reliant learners who did not

depend on others or a single source for learning resources. The Flexible Learners were not content to immediately accept solutions to learning tasks. They often had the initiative to seek information to clarify or modify conditionally accepted solutions.

This group was composed of the middle RJQ group that scored in the reflective judgment Stage 4 to Stage 5 range indicating that individuals in this group were beginning to accept responsibility for their own ability to collect information and make knowledge judgments. The researcher while stationed at Malmstrom AFB worked with and observed individuals, most likely belonging to this group, who pursued an off-duty education for self-development and to gain knowledge to enhance productivity in the work place.

Counter to the Flexible Learner was the low RJQ group which had reflective judgment scores below Stage 4. The canonical discriminant function score of this group demonstrated a negative inverse relationship in the canonical discriminant function of the group centroid of the Flexible Learner (medium) group indicating a low use of the three strategies used by the Flexible Learner.

A reasonable explanation about the low group was that members are still dependent on authority figures for most of their learning. Group members seldom employed strategies to make learning decisions on their own. This group was composed of airmen who were first term enlistees between the ages of 18 and 22 who were assigned to their duty section directly out of Air Force Basic Training. The researcher supervised first term airmen in a transportation motor pool who had

to be trained to do new tasks while performing their assigned jobs. These individuals were provided checklists to follow or were assigned repetitive tasks. Because the daily routine varied according to the needs of the agencies on base being supported, it took several months before newly assigned enlistees could perform tasks with minimum supervision.

In the discriminant analysis investigating whether individuals at different stages of reflective judgment used different learning strategies, the percentage of cases correctly classified was 47.9%. Based on a 33.3% chance occurrence for correctly placing individuals in three discriminant variable groups, the discriminant function improved on chance by 14.6%. The accuracy of the placement of cases in the three discriminant groups was 58.5% (24) in the low group, 41.8% (55) in the Flexible Learner or medium group, and 45.7% (21) in the Pragmatic Learner or high group. Fifty-nine of the 201 participants in the study were used as a buffer between the low to middle and middle to high RJQ groups and were not assigned to any group.

Research Question 1, which asked whether discriminant analysis could be used to discriminate among Malmstrom Air Force Base personnel with the high, middle, and low RJQ scores according to the learning strategies they used, was answered in the affirmative. It was possible to describe two reflective judgment groups by using the pooled-within-groups correlations of the discriminant structure matrix. The third, a low group, was described using the inverse canonical discriminant function of the group mean of the middle group.

Results of the Discriminant Analysis Using SKILLS, RJQ, and Demographic Data

The second discriminant analysis of individuals at various stages of reflective judgment identified three similar RJQ groups as indicated by the same number of RJQ members, 41, 55 and 46 respectively. This analysis used the discriminant variables of learning strategies, level of education, age, and gender. This discriminant analysis identified two groups named Experienced Learner and Enthusiastic Learner. The third group was identified by using the negative canonical discriminant function of the Enthusiastic Learner.

The Experienced Learner was identified with the high RJQ group and was characterized by two demographic variables, level of education and age, and the learning strategy use of human resources (resource management). Members of this group were at reflective judgment Stages 6 to 7. Members have the highest level of education, were older than the other two groups, and also demonstrated competence in the use of human resources. Members of this group were the same as the Pragmatic Learner identified in the first discriminant analysis.

This group had a negative canonical discriminant function for gender at -.297. The negative correlation for gender can be accounted for by the larger number of female civilian classified workers who mainly work in administrative positions. There have been very few women in high civilian supervisory positions. Historically, women have not made the military a career, and only in the last 15 years have more women been recruited and retained in the Air Force. The senior

civilian management positions were dominated by men. Therefore, the base population has had a higher percentage of women holding civilian middle management and non-commissioned officers positions than in the senior supervisory or senior non-commissioned officer billets. Over the last 15 years, the Air Force's population of women has increased from approximately 11% to 18%.

The second group identified in this discriminant analysis was the Enthusiastic Learner, which was the same as the RJQ group identified as Flexible Learner in the first analysis. The difference between Flexible Learner and Enthusiastic Learner was conditional acceptance (critical thinking) being replaced by gender in the second discriminant analysis. The learning strategies variables, identifying resources (resource management) and adjusting (metacognition), were the same as in the first discriminant analysis. The group centroid identified this group with the medium RJQ group, indicating that learners in this group scored between reflective judgment Stages 4 and 5.

Enthusiastic Learners observed at Malmstrom AFB were in the early stages of post-secondary education and were concerned about identifying and locating learning resources, but may not have been wise enough to look for resources and change learning plans. They had not developed their confidence to depart totally from an authority figure or from established printed material and other learning resources. They periodically reassessed their learning progress and made adjustments to accommodate their learning styles. This group was composed of participants who were enrolled in a post-secondary education program. The

demographic variable gender represented the classified female worker and the female non-commissioned officer. Like the Flexible Learner, the Enthusiastic Learner's enrollment in a post-secondary program at Malmstrom AFB was closely tied to an individual's strategy of self-development and seeking new knowledge for job performance enhancement.

The third group of learners were members of the low group identified from the inverse reciprocal discriminant function centroid of the Enthusiastic Learner. The low learner group lacked skills to adjust to their own learning processes and were not skilled at identifying learning resources. This group's members were below reflective judgment Stage 4.

The percentage of cases correctly classified was 54.9%. The low group had 51.2% (21) correctly classified cases, the Enthusiastic Learner or medium group had 54.5% (30) correctly classified cases, and the Experienced Learner or high group had 58.7% (27) correctly classified cases. There were 59 cases not assigned to any group. Based on a 33.3% chance placement for a discriminant analysis with three discriminant variables, the result of this analysis was 21.6% above the chance level.

The second research question which asked "Among Malmstrom AFB personnel is it possible to discriminate among the participants with the highest Reflective Judgment Questionnaire scores, the participants with approximately the middle Reflective Judgment Questionnaire scores, and the participants with the lowest Reflective Judgment Questionnaire scores based on measurements of

learning strategies scores on SKILLS and demographic variables?" was answered in a positive manner.

Results of the Cluster Analysis

Cluster analysis procedures were used to determine if it was possible to identify distinct clusters among Malmstrom AFB personnel based on learning strategies scores on SKILLS, RJQ scores, and demographic variables.

Five discernible learner groups emerged using cluster analysis. Each of the groups had distinctive SKILLS and demographic variable characteristics. Although none of the cluster groups matched closely with any of the discriminant analyses groups, there were some similarities exhibited between some cluster groups and the SKILLS and demographic data of the discriminant analysis learner groups.

The Active Learner cluster group members most closely exhibited characteristics of the Experienced Learner. Group members had the highest cluster mean education level, scored between reflective judgment Stages 5 and 6, and used the learning strategies: use of human resources, critical use of resources, conditional acceptance, and memory application. Group members were skilled at anticipating potential problems and asking for advice from experts or accumulating learning resources to address the learning task. Like the Experienced Learner, group members readily accept the challenges of confronting difficult learning and decision-making situations.

The Reactive Learner was unique in that group members had very little in common with any of the SKILLS and demographic data discriminant analysis learner groups. Group members had a cluster mean age of 29.15 indicating that members were in the middle range when compared to the older Active Learner and Analytical Learner groups and the younger Insecure Learner group. This group's major learning strategy was adjusting learning plans. Little use was made of learning strategies of critical use of resources or testing assumptions.

The Analytical Learner group also exhibited little resemblance to the SKILLS and demographic discriminant analysis groups. The major learning strategies group members used were generating alternatives and conditional acceptance (critical thinking). Group members felt little need to use human resources or motivate themselves with reward strategies. The cluster mean for age was 41.13, indicating older members who were skilled at analyzing learning situations, developing alternative solutions within a learning framework, and monitoring the results of an accepted solution. Testing assumptions or asking clarification questions outside an accepted paradigm was not a strong suit for group members.

The Veteran Status Quo group had the oldest members, were placed between reflective judgment Stages 4 and 5, and relied on three learning strategies: planning, monitoring and testing assumptions. The Veteran Status Quo learner worked in a reactive decision-making environment where checklists and regulations were routinely used in performing tasks.

The Insecure Learner, like the Veteran Status Quo Learner, resembled the low group of learners identified in the discriminant analysis which used SKILLS scores and demographic data. Unlike the older Veteran Status Quo Learner, the cluster mean for age for group members was 21.9, indicating that members may not have had the opportunity to actively participate in additional education programs. The metamotivation learning strategies attention and reward were high for members. Use of human resources and conditional acceptance were seldom used by members of this group. Apparently these young people required some assistance and reassurance in performing learning activities.

Based on the emergence of five distinct learner groups characterized by the cluster analysis, Research Question 3 was answered in a positive manner. Cluster analysis can be used to categorize distinct learner groups based on SKILLS scores, RJQ scores, and demographic variables.

Conclusions

Conclusion 1: Three Distinguishable Learner Groups

There were three distinguishable learner groups identified by reflective judgment stages: the Pragmatic Experienced Learner, the Flexible Enthusiastic Learner, and the Novice Inexperienced Learner. Each group had distinctive characteristics based on learning strategies, age, and education.

The Pragmatic Experienced Learner. The Pragmatic Experienced Learner's use of learning strategies, namely, use of human resources, adjusting learning plans, and conditional acceptance of solutions, made members of this group unique. Members of this group scored highest on the RJQ with scores that placed them between reflective judgment Stages 5 and 7. This group's characteristics were identified by the Pragmatic Learner and Experienced Learner discriminant analyses groups. It appeared that learners in this category were individuals who routinely generated alternative solutions, collected much pertinent information before making decisions, and evaluated new information to determine how that information might change the potential solution. Pragmatic Experienced Learners were individuals who were comfortable looking at different combinations of factors in learning situations before deciding on any one solution.

The frequent use of other people as learning resources by the Pragmatic Experienced Learner could be partly explained by the age and level of education of group members. The discriminant analysis for Experienced Learner indicated that age and level of education were important demographic factors for the Pragmatic Experienced Learner. Older civilians with college degrees and older civilians in technical supervisory positions most likely influenced the make-up of this group of learners. Age could have been influenced by the Civil Service and Air Force management system's rank structure which places a heavy emphasis on years of service before an individual is promoted to the next higher management rank.

This researcher's knowledge of conditions and practices at Malmstrom Air Force Base has led him to conclude that individuals in senior supervisory or management jobs held positions within an organizational structure that provided access to a network of experts at Malmstrom Air Force Base or at higher headquarters located outside Montana to consult with when difficult or unusual problems arose in learning situations. In some cases, decision making situations at the base level dictated interaction of available local experts and decision makers. Senior management personnel attended daily or weekly staff meetings, monthly project reviews, and quarterly program evaluation discussions. Prior to the meeting, staff members prepared information briefing slides and position outlines on agenda items. The background staff work provided a working environment where participants used multiple learning strategies. Before a solution was recommended at a weekly staff meeting or a program review, the solutions were debated and several potential solutions were tested for feasibility by key staff members. During the process, criteria clarification and evaluation standards were reviewed and discussed along with the potential solutions. Certain senior management members were also members of special management groups, referred to as battle staffs, organized by the flying and missile organizations on base to handle decision making during actual or exercise major emergency situations or war plans scenarios. When a battle staff convened, most normal activities for the battle staff member ceased and decision making concentrated on the emergency or war plans situation.

Welfel (1982), King, Kitchener, Davison, Parker, and Wood (1983), Kitchener, King, Wood and Davison (1989), and Strange and King (1981) found that education influenced an individual's reflective judgment score. Age also influenced scores but less consistently than education (Welfel, 1982). Age and education indicated that for the Pragmatic Experienced Learner, seeking new knowledge or refining knowledge may be a constant pursuit and a life-long learning strategy. It appeared that the opportunity to interact with other individuals and the learning strategies used by Pragmatic Experienced Learners enable them to tackle complex and large scale decision-making or learning tasks.

The Flexible Enthusiastic Learner. The Flexible Enthusiastic Learner was distinguished from the Pragmatic Experienced Learner by the learning strategies of identifying resources, metacognition adjusting, and critical thinking conditional acceptance. The appearance of common learning strategies in the Pragmatic Experienced Learner and Flexible Enthusiastic Learner seemed to indicate that learning strategies vary with reflective judgment stages, for the Flexible Enthusiastic Learner had reflective judgment stages between Stages 4 and 5, i.e., averaging 1.5 stages below the Pragmatic Experienced Learner.

The high use among resource management skills of identifying resources and the absence of use of human resources as learning strategies made this group unique and different from the Pragmatic Experienced Learner.

As indicated earlier, the organizational opportunities that were available for the Pragmatic Experienced Learner probably were not available to the Flexible Enthusiastic Learner. Members of this group performed jobs that did not have final decision-making responsibilities. The decision-making supporting roles that group members performed were at a lower hierarchical level than the Pragmatic Experienced Learner. The decision-making and learning environments were usually affected by a person or regulations higher on the chain of command. Often, decision making was done by following checklists closely.

For junior officers and middle range non-commissioned officers, who were members of this group, compliance with standards in manuals and regulations to meet "mission requirements" dictated using different learning strategies than the Pragmatic Experienced Learner. Most tasks assigned to junior officers and middle range non-commissioned officers were tasks that could be completed by one person, limited in scale, and requiring little manpower or resources. When projects were assigned to these individuals, the parameters were limited by the task requirements or the perceptions of a more senior person in the chain of command. Individuals usually sought clarification and feedback from the senior person to ensure that they stayed within the boundaries of the task. Recommended solutions were updated and sometimes completely changed to accommodate the immediacy of the situation. The final acceptance of a solution rested with a higher ranking person, not the individual who suggested the solution.

The Flexible Enthusiastic Learner's limited access to experts and senior staff members dictated a more systematic search of regulations, technical publications, and manuals as information sources. This may explain the strong influence of resource management identifying resources. During battle staff activities, for example, persons identified as Flexible Enthusiastic Learners usually played a supporting role. Work center personnel supported the battle staff members by collecting and relaying information related to the situation and by acting as expert consultants. For example, if the emergency was a ruptured 400 gallon diesel tank at one of the missile sites, the battle staff attempted to find solutions by consulting a fuel expert on how best to remove the spilled fuel, a transportation expert on how to haul the spilled diesel fuel from the site, and a bioenvironmental engineer on how to best clean-up the spill. The function of using experts reinforced the learning strategies of use of human resources for the Pragmatic Experienced Learner and identifying resources for the Flexible Enthusiastic Learner.

The Flexible Enthusiastic Learner may have had the potential to handle complex learning tasks. The level of education of group members was just below that of the Pragmatic Experienced Learner. The scale and complexity of the learning task handled by medium group learners may be more determined by opportunity than ability.

The Novice Inexperienced Learner. The Novice Inexperienced Learner relied heavily on metamotivational learning strategies to focus on the learning task

at hand and to justify their learning experience as being worthwhile. This group of learners was formed by using the descriptions of the inverse reciprocal centroids of the Flexible Learner and Enthusiastic Learner. Group members did not exercise the critical thinking, resource management, or metacognition learning strategy skills of the Pragmatic Experienced Learner and the Flexible Enthusiastic Learner.

This learner group rated metamotivation strategies of attention and reward as the most frequently used learning strategies. Use of human resources (resource management), adjusting (metacognition), conditional acceptance (critical thinking), and identifying resources (resource management) were rated as least used learning strategies. Group members RJQ scores placed them at reflective judgment Stage 4, indicating group members were quite satisfied with their judgment of knowledge. The Novice Inexperienced Learners were content with their information gathering techniques, which when compared to the techniques used by the Pragmatic Experienced Learner and Flexible Enthusiastic Learner, were quite biased and limited in rigor. Group members' low scores in use of human resources and adjusting indicated that group members were not accustomed to locate and use information sources that could assist them in their learning, had not attained the skill to use experts as part of their learning, and were not skilled in evaluating their own learning processes. Learners in this group most likely had little knowledge of how to seek feedback of how they were progressing in their learning activity and on how to use different learning strategies to overcome barriers to learning tasks. Because the skill level of group members was not at the stage of testing

decision-making assumptions and making a choice from multiple alternatives, locating learning resources and evaluating information sources were not high priority learning strategies.

Based on the author's familiarity with Malmstrom Air Force Base practices, the Novice Inexperienced Learner worked in a reactive decision-making environment in which performance tasks were delegated or specific guidelines were provided on how the task should be accomplished. Members of this group consulted with co-workers on how to perform or accomplish a task, but this was not viewed as consulting with others by members of the group. For example, the person unfamiliar with a maintenance procedure may ask his fellow worker at the adjacent maintenance work bench how to do a particular task and later the fellow worker may ask for help in completing a task. This type of reciprocal consultation was not considered using an expert by the participants in the activity.

Group members most likely were not ready to perform difficult or large scale tasks independently. Novice Inexperienced Learners may be able to complete a specific subtask of a larger learning project without supervision; however, group members generally required some form of assistance from the medium or high learner groups to complete complex decision-making or learning tasks.

Conclusion 2: Discernible Learning Strategy Patterns

There are discernible learning strategy patterns associated with different reflective judgment stages.

Group members above reflective judgment Stage 6 indicated that they used resource management, critical thinking, and metacognition learning strategies more frequently than individuals placed in lower reflective judgment stages. Lower reflective judgment stage learners used metacognitive planning and monitoring, and metamotivational reward and attention more frequently.

Cluster groups with high reflective judgment stages generally had older and more educated members. Cluster groups with low RJQ scores had the lowest education levels. The discriminant analyses groups also demonstrated that higher age and education were factors common to the advanced reflective judgment stage learners. Like the discriminant analyses learner groups, the cluster learner groups with high RJQ scores had members using similar learning strategies associated with resource management, metacognition, and critical thinking.

The learning strategies used in a learning or decision situation may be influenced not only by the learner's reflective judgment stage but also by the context of the learning situation. High reflective judgment learners appeared to be skilled at identifying recommended solutions for complex learning tasks. By using the learning strategies of use of human resources and identifying resources (resource management), of adjusting (metacognition), and of conditional acceptance

(critical thinking), high reflective judgment learners seemed to demonstrate a strong commitment to using the latest or best available information to make sound decisions. Effects of the potential decision appeared to be an important factor in the learning process. The use of experts indicated that learners had established some type of interpersonal communication network with individuals they considered to be valuable information sources. This may also suggest the learner's willingness to put forth extra effort to obtain current information. McKenna (1991) found that use of learning strategies by school administrators was contextual and that resource management and critical thinking skills were used more frequently than other learning strategies (p. 97).

Low reflective judgment learners appeared to approach learning by focusing more on the learning task as a guideline while progressing with the task. Stimulating one's motivation seemed to be necessary for satisfactory task completion. The effects or the potential outcomes of the learning or decision task were not a major consideration for low reflective judgment learners. The learning situation encountered by these types of learners most likely were less complex and smaller in scale than the high reflective judgment learners. Age and education level were also factors for the low reflective judgment learners. The older learner who had little post-education reinforcement and the young learner who had not experienced or participated in post-secondary education scored low in reflective judgment. The groups with high education levels scored higher in reflective judgment.

Results from this study may indicate why reflective judgment scores do not always advance with age. Age may indicate why group members also scored low on the RJQ. The RJQ scores of cluster Veteran Status Quo Learner indicate that without learning reinforcement, age may not be a factor in increasing reflective judgment positions. The age range of 18 to 21 years for the younger members of the group and the lack of post-secondary education participation may also be factors in low RJQ scores and reflective judgment positioning on the low end of the reflective judgment stage sequence. Kitchener (1978) and King (1977) in their original studies found that junior high students scored between reflective judgment Stages 2 and 4. Kitchener, King, Wood, and Davison (1989) reported that non-college-educated adults who entered college as freshmen were at reflective judgment stages of traditionally aged entering college freshmen (p. 86).

Conclusion 3: Cluster Learner Groups and Research Methodology

Although some similarities were present when comparing the learner groups formed by discriminant analyses and cluster analysis, enough differences existed between the groups identified by both analyses to prevent integrating completely. Because of the requirement to maintain the anonymity of the study participants, learner group descriptions were limited and drawn from observations and experiences the researcher had while stationed at Malmstrom Air Force Base between 1984 and 1989.

This study found that a qualitative follow-up method can be an extremely useful component when used with cluster analysis. Interviews of participants after the data were analyzed would have helped in answering questions raised about the learning experiences of the participants and the reason they used the learning strategies they identified in SKILLS. It would also have contributed greatly in providing a better description of each cluster learner group. Additionally, a follow-up on the demographic data would have clarified the contribution of gender, age, and education level to the group descriptions. Further, qualitative data could have identified how individuals at advanced reflective judgment stages utilized human resources and critical thinking strategies.

Recommendations

1. It is recommended that further research be conducted to determine if a learner's level of knowledge in a specific domain or subject area affects the use of learning strategies and the learner's reflective judgment stage. Both the SKILLS and RJQ tested hypothetical situations that learners may encounter. Specific knowledge domains were not tested in this study.
2. It is recommended that further research be conducted to test the reflective judgment questionnaire (RJQ) with Kitchener and King's Reflective Judgment Inventory (RJI) to verify the compatibility of the RJQ with the RJI in measuring individual placement in the Reflective Judgment Model stages. The RJQ was a survey instrument which contrasted with the RJI, a two person

judged interview instrument. As part of the compatibility research, it is recommended that work be continued to improve the RJQ to make it a stronger survey instrument.

3. It is recommended that SKILLS be tested against the Reflective Judgment Model RJI using discriminant analysis and cluster analysis to verify that individuals at different stages differ in the use of learning strategies. By using the RJI for individual placement in the reflective judgment stages, the concept of SKILLS learning strategy sequencing in reflective judgment stages may be compared with other RJI studies. Learning strategy sequencing could be examined by using homogeneous groups similar to those used by Kitchener and King.
4. It is recommended that future SKILLS and RJQ studies using discriminant analysis and cluster analysis include interviewing of participants in the research design. This would enable the researcher to ferret out objective as well as qualitative information about group members to add insight about why group members used the learning strategies identified for the group.
5. It is recommended that an adult education learning strategies course be designed and offered to educate adult educators in the use of learning strategies related to the five major components of SKILLS: metacognition, memory, metamotivation, resource management, and critical thinking. Adult learning strategy skills training would provide an excellent alternative to the "how to study" commercial courses or workshops. The major component of the

course should be a 40-hour training module that could be used in technical or transition training programs. This course module should be designed to assist adult learners with little or no post-secondary education experience.

6. It is recommended that an adult learner learning strategies research project be created to support the learning strategies training program. Data collected from the training program could further increase knowledge about adult learning.
7. It is recommended that the 40-hour learning strategies module be field tested. For example, the Malmstrom Air Force Base Education Center could offer the course recommended above to middle range non-commissioned officers (E-4 to E-6) and to all civilian workers in middle management supervisory positions. The learning strategies courses would provide opportunity for the middle management work force at Malmstrom Air Force Base to increase their learning and problem solving skills. In an era when the Air Force is adopting the concept of Total Quality Management and participatory management, increased decision-making skills are needed to empower all workers in decision making. By providing learning strategies training, the Malmstrom Education Center has an excellent opportunity to "lead" the Air Force in an innovative education offering that has the potential of combining Total Quality Management and adult education concepts in increasing worker productivity.
8. It is recommended that the 40-hour training module be examined as a possible course to enhance learning for first time participants in post-secondary

education programs. For example, the Malmstrom Education Center could provide the opportunity to first time post-secondary education participants to participate in a learning strategies training program as part of an orientation program for new students. This type of course could have the potential of motivating more first term enlistees in participating in off-duty college courses offered at the Malmstrom Education Center. It also has the potential of increasing worker productivity for the Malmstrom Education Center participants.

9. It is recommended that a longitudinal study be conducted using RJQ and SKILLS to measure long-term changes in adult learners' use of learning strategies. For example, the Malmstrom Education Center could sponsor a two-year and a four-year longitudinal study patterned after this study to measure the impact of the base education program and its contribution to the improvement of the education program participant's work productivity. Results from the recommended longitudinal study could have potential impact on how statistics are collected for the Air Force Education Center Total Quality Management program.
10. It is recommended that learning strategies training be taught to educators who teach part-time in post-secondary programs. For example, the Malmstrom Education Center could conduct a learning strategies workshop patterned after the recommended 40-hour learning strategies module for all adjunct faculty who teach the various college courses at the Malmstrom Education Center.

This could be made a mandatory requirement for all adjunct faculty teaching at the Center.

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APPENDICES

APPENDIX A

PERMISSION TO CONDUCT SURVEY

27 June 1991

SUBJECT: Request to Conduct an Educational Survey at Malmstrom AFB

TO: Lt Col Joanne L. Skidmore
849 MSSq/CC
Malmstrom AFB, MT 59402

Dear Lt Col Joanne L. Skidmore:

Request permission to conduct an educational survey at Malmstrom AFB as part of my Montana State University doctoral dissertation in Adult and Higher Education. My research proposal has been submitted for review by both Mr. Neil Parisot and yourself. I would like to survey a population of volunteer participant of at least 200 military and civilian personnel. The survey includes two educational questionnaires. One of the questionnaires asks the respondents to provide information on their reflective judgement in solving ill-structured problems, i.e., problems with no defined correct solution or solutions. The second questionnaire asks the respondents what types of metacognitive strategies they used in solving various problems. The reflective judgement questionnaire has three scenarios with five questions each and the metacognitive questionnaire asks the respondent to pick four of six scenarios with 18 questions each.

The participants are not asked to identify themselves. Biographic questions that are asked mainly asks questions on gender, level of education, age, hours worked per week, and present enrollment in post-secondary courses. No major commerical publications will result from they surveys. Normal dissertation publication by the University of Michigan Microfilm service is anticipated. If professional articles are written, the name Malmstrom AFB will not be used. The term "a population of government workers in a Rocky Mountain state" will be used.

I would like to collect data at the Malmstrom Education Center, using students enrolled in the Park College, Northern Montana, University of Montana, and Embry-Riddle programs. Additionally, I would like to collect data from civilian personnel who volunteer to participate in the survey and I would like to survey a group of enlisted personnel who are not presently enrolled in any college program. I hope to work the details for soliciting volunteers with the Civilian Personnel and Education Offices.

As you already know, I am a retired USAF officer. My last duty station was Malmstrom AFB. I was stationed at Malmstrom from August 1984 to September 1989. While stationed at Malmstrom I served as the Assistant RM, Chief of the Command Post, and worked as a special project officer on the activation of the 40th Air Division. I also worked with the Communication Squadron in procuring the telephone system for the command post, and I coordinated the move of the various organizations to what I knew the building as, "Building 500". I also have worked very closely with Mr. Neil Parisot on education issues while on active duty and

over the past two years.

Since retiring the Air Force I have been a full-time doctoral candidate at Montana State University while at the same performing as an Adjunct Assistant Professor in the Speech Communication Department. Additionally, in the academic year 1989-1990, I worked closely with Mr. Parisot in attemting to get a graduate Industrial Engineering non-engineering masters degree program for Malmstrom. This project was put on hold when the Embry-Riddle program filled the void left by the termination the University of Southern California program. This past academic year, I worked closed with Mr. Parisot again to formalize the doctoral program in Adult Education from Montana State University at Great Falls. Although we have suffered a minor set back on the timetable to establish the program in Great Falls, my support for the program is still very strong. Hopefully, the proposal will go through the Montana State University channels in the near future.

The purpose of my doctoral research is to determine characteristics of adult learners by comparing different stages of knowledge levels of adult learners and how they use metacognitive strategies in solving problems. Put another way, I feel strongly that adults make problem solving and learning decisions by reflecting on prior knowledge and using strategies of memory search to solve problems. The present literature on critical thinking, the present buzz word of higher education, is that most adults make decisions using linear deductive strategies to arrive at solutions. The implication of my research is a redefinition of teaching strategies and how adult learners are perceived by teachers. What I am striving for is the treatment of students as "individual customers" of knowledge, placing the responsibility on the teacher to provide teaching techniques that will be tailored to the learner's knowledge level and for the learner to take responsibility for his/her own learning.

I have agreed to share all my research information with Mr. Neil Parisot and the Malmstrom Education Center. As far as I can determine, there is no PRP implications in my study.

Thank you for considering my request.

Sincerely,

Alan E. Yabui
Adjunct Assistant Professor
Department of Speech Communication
Montana State University
Bozeman, Mt 59715
Phone: 406-994-3815

DEPARTMENT OF THE AIR FORCE
840TH MISSION SUPPORT SQUADRON (SAC)
MALMSTROM AIR FORCE BASE, MONTANA 59402-5000

REPLY TO ATTN. OF: MSE — 20 Aug 91

SUBJECT: Request to Conduct Educational Survey

TO:
840 MSSq/MSP SMB/20 Aug 91
840 MSSq/CC 80/30 Aug 91
840 CSG/CC (In Turn)

1. The attached request from Alan E. Yabul (Lt Col, USAF Ret) Montana State University Doctoral Candidate is forwarded for consideration.

2. This survey does not contain anything that would be detrimental to the U.S Air Force and the results will be used to enhance the education program considerations at Malmstrom.

3. Recommend approval of Alan E. Yabul's request to conduct the attached survey.

NEIL J. PARISOT, GM-13
Chief, Education Services

1 Atch
Survey ltr

1st Ind, 840 CSG/CC — 21 Aug 91

TO: MSE

TENTATIVE
~~Approved/disapproved.~~

TERRY S. PEHAN, Colonel, USAF
Commander

I want to see the details on how student, enlisted and civ personnel "volunteers" are established before granting approval. also, coord w/ L-R rep MA M.... (MSC) has to be accomplished plus civilian employee involvement.
P 21

2nd Ind, 341 SPTG/CC — 26 September 1991

TO: 341 MSSQ/MSE

Approved.

TERRY S. PEHAN, Colonel, USAF
Commander

Peace . . . . is our Profession

DEPARTMENT OF THE AIR FORCE
840TH MISSION SUPPORT SQUADRON (SAC)
MALMSTROM AIR FORCE BASE, MONTANA 59402-5000

REPLY TO ATTN OF MSCE

12 Sept 91

SUBJECT Non-DOD Survey

TO JOE OLGUIN Jr. Pres
AFGE Loan #2609

Request you approve the attached survey for dissemination to some bargaining unit employees on 13 Sept 1991.

This survey is totally voluntary, no-one is to be coerced into participating.

RAYMOND MEHRENS
Chief, LMR/EMR

Union Concurs
12 Sept 91

Copy for HGI Al Yatui

DEPARTMENT OF THE AIR FORCE
840TH MISSION SUPPORT SQUADRON (SAC)
MALMSTROM AIR FORCE BASE, MONTANA 59402-5000

REPLY TO ATTN OF: MSCE

12 Sept 91

SUBJECT: Non-DOD Survey

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Request you approve the attached survey for dissemination to some bargaining unit employees on 13 Sept 1991.

This survey is totally voluntary, no-one is to be coerced into participating.

RAYMOND MEHRENS
Chief, LMR/EMR

Union Concurs
12 Sept 91

Peace . . . . is our Profession

MONTANA STATE UNIVERSITY
1893•CENTENNIAL•1993

Department of Speech Communication
College of Letters & Science
2-179 Wilson Hall
Montana State University
Bozeman, Montana 59717

Telephone 406-994-3815
FAX 406-994-2893

20 September 1991

SUBJECT: Dissertation Research

TO: Colonel Terry S. Pehan
341 SPTG/CC
Malmstrom AFB, MT 59402

Dear Colonel Terry S. Pehan:

1. Mr. Neil Parisot informed me that you had some concerns about my proposed research at Malmstrom AFB. This letter is a response to your concerns.

2. On 12 September 1991, Mr. Ray Mehrens obtained approval from the union representative for me to include Malmstrom civilian personnel as volunteer participants in my education survey.

3. Mr. Parisot relayed to me that you had concerns about my definition of "volunteer participant". Researchers in Adult Education have found that adults only participate in an activity that they desire to participate in. My graduate committee has agreed that participants in my survey at Malmstrom AFB need not be a random sample of the base population. I hope to get a cross section based on age, gender and level of education. "Volunteer participant", means each participant will be asked to participate in the survey. If a respondent declines, he/she will not be included in my study.

4. I will notify each volunteer participant that I will provide feedback on his/her survey response. No names or individual's identification will be used in the study. My research results will be shared with the Malmstrom Education Center.

5. I hope that I have answered your concerns. Thank you for letting me conduct my education research at Malmstrom AFB.

Sincerely,

Alan E. Yabui

cc: Mr. Neil Parisot

COL PEHAN:

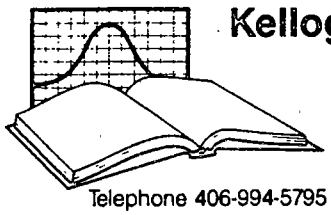
The attached letters from Mr Mehrens /AFGE Local #2609 and LtCol Alan Yabui, USAF RET are provided in response to your question about the conduct of an education survey on MAFB.

Neil Parisot

23 SEP 1991

APPENDIX B

SURVEY INSTRUMENTS



Kellogg Center for Adult Learning Research

Montana State University
Bozeman, Montana 59717

Telephone 406-994-5795

3 September 1991

SUBJECT: Educational Questionnaires

TO: Participants

1. Thank you for participating in this educational survey. The information from the Biographical Survey sheet, Reflective Judgement Questionnaire and the Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS) will be used in a doctoral dissertation research project that I am conducting to satisfy the requirements for the Doctor of Education in Adult and Higher Education degree from Montana State University.

2. The information you provide will be held in the strictest confidence. No names will be used in the research project, nor will names be published as a result of this project. What findings and recommendations that come out of the study will be shared with the Malmstrom Education Center.

3. Hopefully, through the information collected in this study, better teaching methods and techniques will be developed that will directly benefit you. The surveys that you fill out will analyze your present use of thinking (metacognitive) strategies and what your present awareness of knowledge is concerning the three topics covered in the reflective judgement scenarios. The biographical data will be used to determine if gender, age, and/or education level affect people's use of thinking strategies and their perception and belief of knowledge.

4. Again, thank you for participating in this research project.

Sincerely,

Alan E. Yabui

BIOGRAPHICAL SURVEY

This Biographical survey compliments the research project conducted on Reflective Judgement and Metacognition. Information collected on this survey will only be used with information collected on the Reflective Judgement Questionnaire and SKILLS.

---

1. Gender: Male_____ Female_____

2. Age:_____

3. Highest Education Level Completed:

   _____ Little or no formal education

   _____ High School

   _____ Technical School (Certificate)

   _____ Associate Degree

   _____ College (Fr._____, So._____, Jr._____, Sr._____)

   _____ College (Bachelor's degree)

   _____ College (graduate degree) Please list:_____

   _____ Other: (Please specify:_____

4. Are you presently enrolled in an education program? _____

5. If yes to question 4, Please specify type program and year in school):_____

6. How many hours of employment per week? (please mark one)

   _____ 40 or more

   _____ between 20 and 40 hours

   _____ less than 20 hours

   _____ none

7. Are you presently enrolled in an On-The-Job Training (OJT) course: Yes_____ No_____

8. If yes to question 7, please specify:_____

Reflective Judgement Questionnaire

Directions: Please read each scenario and select the statement that best describes you. *Pick only one response for each scenario!!* **Place a circle around the number to indicate your answer. There are a total of four scenarios in this packet.**

Substance Abuse

One of the major problems in American society is teen-age substance abuse. Several programs to combat substance abuse are on-going in the community and in the schools conducted by private and public agencies. However, the problems seems to remain about the same. How would you resolve this problem?

1. I trust and believe in what the experts are doing now.
2. The substance abuse problem is beyond our capability to solve since we know only a portion of what is really going on.
3. There is no one right or wrong way to approach teen-age substance abuse.
4. I need more information about the subject before I offer a plan to resolve the problem. My recommendations will only address situations that I am familiar with.
5. I would offer my recommendations after analyzing technical information and consulting with experts in the field of teen-age substance abuse.

Radiation Waste

The disposal of low level radiation waste is a problem for many communities across the United States. There is no national policy that addresses this hazardous waste problem. If you were asked to provide recommendations to resolve this problem, what would be your most likely response?

1. I believe this is a national problem. My recommendations would be based on information collected from users of low radiation technology, transportation and nuclear waste experts, and technical reports on nuclear waste disposal sites.
2. Based on the information I have and information readily available, I believe that I can develop recommendations to resolve the problem by applying it to a local situation.
3. I believe my idea would probably be as good as any approved method presently in use.
4. There are too many things that I do not know about low level radiation waste for me to have an opinion about this subject.
5. If there is such a problem, it is best to let legitimate authorities solve it.

Rural Crime

Crime statistics published for 1990, indicate that violent crime (homicide, rape, aggravated assault and robbery) percentages are increasing faster in rural areas than urban areas. For example, Montana had the largest percentage increase in violent crimes, 23.4%, among rural states. (Rural states are states with population densities of 50 or less people per square mile.) If you were asked to provide recommendations to resolve this problem, what would be your most likely response?

1. Violent crime exists, but if we work together we can rid Montana of most crime.
2. I do not know why Montana is ranked so high. I cannot explain Montana's large percentage increase in violent crime.
3. Statistical reports do not always portray the "true" picture on what is really going on. I can demonstrate that Montana's rural areas are safe.
4. To be more accurate, the data must be examined at the county or city level. Only through narrowing the problem, can I suggest potential ways to resolve the problem.
5. I could recommend how to decrease Montana's violent crime rate increase. But first, I need to study information collected from police and legal experts, and from my own personal investigation.

Mongolian Image

Recently, the Mongolian Ambassador to the United States commented that he would like to see an exchange program established between Mongolia and Montana. The Ambassador commented that the geography of Mongolia and Montana are very similar. Both areas are perceived as underdeveloped and out-of-the-way places. If you were asked to solve the image problem of Mongolia, how would you most likely response?

1. Before I offer any suggestions for improving the image of Mongolia, I need to know which Mongolia (Inner or Outer). Maybe a Genghis Khan or a Marco Polo theme would work.
2. Improving Mongolia's image is similar to Montana's problem. My recommendations would probably be based on something unique about Mongolia.
3. I know how I would change the image of Montana, but I am not sure that it will work for Mongolia. I believe many Montanans feel the same way I do.
4. Mongolia may be about the same as Montana, but I am sure that the people are different. I do not know enough about Mongolia to help change its image.
5. I am familiar with Montana, and can only accept the statements of the Mongolian Ambassador about what Mongolia is like.

Directions and Answer Sheet for SKILLS

First: Read the six scenes dealing with real-life learning situations. Select **four** that make sense to you as situations that apply to you. Check these four on the following list:

___ Auto Insurance	___ Pet Care
___ Burial Customs	___ Job Regulations
___ Local History	___ Cholesterol Level

Second: After you have selected four scenes, turn to the pages for these scenes that describe various learning strategies that you might use in these situations. For each scene, select the 6 learning strategies that you would Definitely Use, 6 that you might Possibly Use, and 6 that you would Not Likely Use. Enter the number for each of these 6 items in the proper box below.

Scene 1: _____

Definitely Use	Possibly Use	Not Likely Use

Scene 2: _____

Definitely Use	Possibly Use	Not Likely Use

Scene 3: _____

Definitely Use	Possibly Use	Not Likely Use

Scene 4: _____

Definitely Use	Possibly Use	Not Likely Use

Real-Life Learning Situations

AUTO INSURANCE

Your insurance company has better rates on auto insurance and better customer service than any company you have ever found. However, they believe that informed drivers are good drivers and have just started giving tests about driving laws and practices to everyone who wants to renew their insurance policy with the company. **How likely are you to use the following learning strategies in preparing for the test?**

BURIAL CUSTOMS

Funeral arrangements are being made for your best friend's father. You want to attend the funeral services. Because your friend is of a distinctively different culture, you are afraid you will not know how to act and thus will offend your friend's family. **How likely are you to use the following strategies in learning what you need to know about this friend's customs related to death and burial?**

LOCAL HISTORY

You have gotten a book on the history of the place where you live because you want to be able to tell friends and visitors interesting facts and stories about your town. **How likely are you to use the following strategies to learn everything you want to learn and remember about the history of your area?**

PET CARE

You have agreed to watch your friends' pet during their extended vacation. Your friends love their pet. The pet unexpectedly begins to act very strangely, and you do not know what to do. **How likely are you to use the following strategies in finding out how to care for the pet?**

JOB REGULATIONS

Some of your fellow workers start talking about the new regulations that will affect everybody with your job or position. You hear that copies of the regulations are in a big manual in the library and in the court house. **How likely are you to use the following learning strategies in finding out what the regulations are and what you need to do to keep your job?**

CHOLESTEROL LEVEL

You have recently visited the doctor and discovered that your cholesterol level is well above a healthy level. You have been advised to regulate this condition through diet. You are now left with the task of learning about proper nutrition and of changing your eating habits. Your next checkup is in six weeks. **How likely are you to use the following strategies in learning what you need to do in order to change your eating habits?**

AUTO INSURANCE

Your insurance company has better rates on auto insurance and better customer service than any company you have ever found. However, they believe that informed drivers are good drivers and have just started giving tests about driving laws and practices to everyone who wants to renew their insurance policy with the company. **How likely are you to use the following learning strategies in preparing for the test?**

1. Starting the learning by looking at materials to determine what is most important to study
2. Making up your mind to study the testing information because you want to renew your policy
3. Asking your local insurance agent whether the company has prepared material to help people study for the test
4. Marking those areas you think are important on a copy of the material you are studying
5. Thinking about the advantages and disadvantages of continuing with the insurance company
6. Reminding yourself periodically that you do not want to have to change your insurance company
7. Checking out the correct practice with an expert if you disagree with answers suggested in study material
8. Comparing the recommendations offered in the study material with your driving practices
9. Stopping to ask yourself questions while studying to see if you are remembering specific information
10. Making a concerted effort to study for the test because you are confident you will pass if you do study
11. Developing visual images in your mind, such as picturing a page in the manual, to help you remember
12. Finding another person taking the test who can quiz you over the material
13. Making a list of the things you have trouble remembering in order to review them often before the test
14. Imagining what might happen if you did or did not observe these regulations
15. Thinking of the personal pride you will have in passing the test and being able to tell others about it
16. Thinking about past experiences you have had taking exams so you can avoid difficulties on this test
17. Deciding to stop studying when you feel you are prepared for the exam
18. Thinking through the difference between things you learn that may help you pass the test and those that may actually improve your driving

BURIAL CUSTOMS

Funeral arrangements are being made for your best friend's father. You want to attend the funeral services. Because your friend is of a distinctively different culture, you are afraid you will not know how to act and thus will offend your friend's family. **How likely are you to use the following strategies in learning what you need to know about this friend's customs related to death and burial?**

Directions: Select the 6 strategies from the following list of 18 that you feel you would definitely use and place the number of these strategies on the lines in the *Definitely Use* box of the answer sheet. Select 6 other strategies that you might possibly use and place the number of these strategies in the *Possibly Use* box of the answer sheet. Select 6 other strategies that you would least likely use and place the number of these strategies on the lines in the *Not Likely Use* box of the answer sheet.

1. Thinking about what might interfere with your attempts to learn about the customs of other people
2. Resolving to study about your friend's burial customs because you want to be of help
3. Calling those arranging the burial to see if they can offer some advice on appropriate cultural practices
4. Numbering the points you want to remember to see if you can repeat them every once in a while
5. Determining whether the funeral practices that you are familiar with are appropriate for your friend's culture
6. Recognizing that you will need to learn about these funeral customs because inappropriate practices will not provide help or comfort to your friend
7. Checking the behavior you decide is appropriate with a person knowledgeable about your friend's culture
8. Reflecting on your feelings that could interfere with your learning
9. Thinking about how your concern for your friend might influence your learning
10. Feeling confident that you can learn enough in the next few days to understand your friend's burial customs
11. Thinking through what you will do at the funeral so you will not fall into old habits
12. Asking other friends whether they have had any experience with burial customs in this or other cultures
13. Jotting down any unfamiliar names or customs so you can refer to them when paying your respects
14. Thinking of other ways you can pay your respects to your friend's family
15. Thinking of how you will feel by bringing comfort to your friend
16. Recalling other things you know about the customs of your friend's family to see if what you are learning fits in
17. Deciding to stop looking for differences in customs when you believe you know enough not to offend your friend's feelings
18. Testing out in your mind different practices to see if they are appropriate

LOCAL HISTORY

You have gotten a book on the history of the place where you live because you want to be able to tell friends and visitors interesting facts and stories about your town. **How likely are you to use the following strategies to learn everything you want to learn and remember about the history of your area?**

Directions: Select the 6 strategies from the following list of 18 that you feel you would definitely use and place the number of these strategies on the lines in the *Definitely Use* box of the answer sheet. Select 6 other strategies that you might possibly use and place the number of these strategies in the *Possibly Use* box of the answer sheet. Select 6 other strategies that you would least likely use and place the number of these strategies on the lines in the *Not Likely Use* box of the answer sheet.

1. Reviewing the table of contents to select the topics about your town to investigate
2. Setting aside a specific time when you are going to study local history
3. Checking the computerized catalogue at a library to see if there are other history books on the area
4. Practice telling the stories you have learned so you will remember the details
5. Looking for the complete story behind popular interpretations of local history
6. Stopping to think about how nice it will be to have such stories to tell friends and visitors
7. Checking to see if this book and author are trustworthy sources for information about your town
8. Imagining the types of things your friends will most likely want to hear about
9. Comparing your understanding of how history generally develops with your local history to determine what you need to learn
10. Stopping to reassure yourself that you can find plenty of interesting facts about your town
11. Painting a mental picture of the area as a setting for the story you want to remember
12. Discussing your ideas with people who have lived a long time in the area to see if their insights are different from what you are learning
13. Jotting down notes about the major points you want to remember
14. Asking yourself whether you have stories that would be of interest to visitors of varied ages and backgrounds
15. Thinking of the fun you will have finding out facts to tell your friends
16. Remembering what it might have been like to live in your area at the turn of the century to check if these stories have been glorified over time
17. Deciding when the information you have gathered is adequate for telling interesting stories
18. Accepting the author's account of many past events but continuing to look for information that may better explain interpretations given by the author

PET CARE

You have agreed to watch your friends' pet during their extended vacation. Your friends love their pet. The pet unexpectedly begins to act very strangely, and you do not know what to do. **How likely are you to use the following strategies in finding out how to care for the pet?**

Directions: Select the 6 strategies from the following list of 18 that you feel you would definitely use and place the number of these strategies on the lines in the *Definitely Use* box of the answer sheet. Select 6 other strategies that you might possibly use and place the number of these strategies in the *Possibly Use* box of the answer sheet. Select 6 other strategies that you would least likely use and place the number of these strategies on the lines in the *Not Likely Use* box of the answer sheet.

1. Identifying what you need to know in this unexpected situation to care for the pet
2. Admitting to yourself that you need to begin immediately paying close attention to the pet's behavior
3. Beginning to form a list of resources you might use to check the pet's behavior
4. Repeating to yourself a list of things the pet does so you will be able to describe its behavior
5. Questioning whether there are things other than illness that could be causing the pet's strange behavior
6. Reminding yourself of how hard it would be to tell your friends that something happened to their pet
7. Checking with several other people who should be knowledgeable about this type of pet to see if all give similar advice
8. Watching the pet closely to see if you have missed any clues as to what is wrong with the pet
9. Checking to see if what you are finding out is helping you understand the pet's behavior
10. Reflecting on your experience with other pets to reassure yourself that you can take control of this matter
11. Watching for patterns in the pet's behavior so you will remember exactly how the pet is acting
12. Discussing the pet's behavior with someone who has a similar type of pet
13. Writing down changes in the pet's behavior so you will be able to describe them to others
14. Checking whether the pet's behavior could be due to your friend's absence
15. Thinking of the smiles on your friends' faces when they return to find their pet healthy and well
16. Recalling similar experiences with other pets to figure out what to look for
17. Deciding if you have enough information to make a decision to begin to care for the pet
18. Testing one of the suggestions you have gotten to see if it changes the pet's strange behavior

JOB REGULATIONS

Some of your fellow workers start talking about the new regulations that will affect everybody with your job or position. You hear that copies of the regulations are in a big manual in the library and in the court house. **How likely are you to use the following learning strategies in finding out what the regulations are and what you need to do to keep your job?**

Directions: Select the 6 strategies from the following list of 18 that you feel you would definitely use and place the number of these strategies on the lines in the *Definitely Use* box of the answer sheet. Select 6 other strategies that you might possibly use and place the number of these strategies in the *Possibly Use* box of the answer sheet. Select 6 other strategies that you would least likely use and place the number of these strategies on the lines in the *Not Likely Use* box of the answer sheet.

1. Thinking through what is important to know about these new regulations in order to decide what needs to be learned
2. Setting aside an evening to visit the library to review the new regulations
3. Finding out if there is an 800 number where you can get answers to specific questions you have
4. Marking on a copy of the regulations those areas that apply to your job
5. Checking to see if the new regulations will change the way you do your job
6. Reminding yourself of the difficulties you may avoid by learning the new regulations
7. Deciding to look through the regulations themselves.
8. Thinking through just how your performance on the job might have to change
9. Comparing your understanding of the new regulations with commonly accepted practices on the job
10. Reminding yourself that you have always been able to keep up with new regulations for a job
11. Remembering the new regulations by organizing them according to the daily routine you follow at work
12. Checking with your supervisor and fellow workers to find out if they have similar ideas about the new regulations
13. Placing your list of key points in a convenient place so they will remind you of what you have to do
14. Thinking of various ways that you can use the new regulations to improve your job situation
15. Thinking about how good you will feel when you figure out how to deal with the changes
16. Remembering past experiences at the courthouse and library so you can avoid wasting time
17. Asking yourself if there are any parts of the job regulations that still confuse you
18. Beginning to test some of the new procedures on the job to see if they are going to work for you

CHOLESTEROL LEVEL

You have recently visited the doctor and discovered that your cholesterol level is well above a healthy level. You have been advised to regulate this condition through diet. You are now left with the task of learning about proper nutrition and of changing your eating habits. Your next checkup is in six weeks. **How likely are you to use the following strategies in learning what you need to do in order to change your eating habits?**

1. Making a plan that will help you learn enough about cholesterol in order to change unhealthy eating habits
2. Focussing on learning about good diet practices instead of worrying about the health hazards from excess cholesterol
3. Getting a book that has recipes for a low cholesterol diet and information on cholesterol from your local book store
4. Repeating to yourself the various types of ingredients to avoid so you will recognize them when reading labels
5. Checking for other ways of lowering your cholesterol besides changing your diet
6. Challenging yourself to learn enough about diets to reduce your cholesterol significantly by your next visit to the doctor
7. Setting up an appointment with a dietitian to help you make sense of all the information you have been receiving and hearing about
8. Thinking about what foods you are willing to give up in order to improve your health
9. Checking to see if what you are learning is actually helping you solve your cholesterol problems
10. Reminding yourself you have been able to learn new health practices before
11. Organizing high cholesterol foods into certain categories to help remember what foods to avoid
12. Calling several friends who have had high cholesterol to discuss what lifestyle changes worked best for them
13. Placing a cholesterol information sheet on your refrigerator as a reminder to change your eating habits
14. Studying various eating habits so you can set priorities on which changes will have the most impact on lowering your cholesterol
15. Thinking of how good it will feel to know that you can control your cholesterol level
16. Reflecting on previous experiences you have had with diets to know what techniques and attitudes work for you
17. Revising your learning method if you find you are becoming confused
18. Deciding to implement a specific low-cholesterol diet with the understanding that you will periodically check its effectiveness.