



An investigation of learning strategies utilized by Air Force officers
by Daryl Lee Korinek

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

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Abstract:

Air Force officers spend a considerable amount of time in the classroom environment. In an era of declining defense spending, every officer must have the skills necessary to learn as much as possible in the least amount of time. However, the use of learning strategies has never been identified as an educational issue with the Air Force. The purpose of this study was (a) to identify the learning strategies of United States Air Force adult learners in officer (leadership) positions; (b) to investigate the relationship of these learning strategies to career advancement, gender, age, education, and experience; and (c) to explore patterns of learning of distinctive groups of learners that may exist. The data were collected from the Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS), a demographic survey, and a follow-up qualitative questionnaire.

Discriminant analysis was used to deductively impose sense on the data to determine if different groupings made a difference in learning strategies used by Air Force officers. Variables such as age, gender, time in service, military rank, and attendance/performance at professional military education were originally thought to be worth examining. However, none of the demographic variables could discriminate one group of officers from another in this study.

Cluster analysis and one-way analysis of variance (ANOVA) were also used in this study to inductively determine if groups of learners could be identified based on SKILLS learning strategies. This process identified four distinct groups of learners. These groups were named Problem Solvers, Counselors, Teachers, and Executives. Problem Solvers tend to look for ways to improve their learning skills; Counselors rely on learning dynamics to advise and guide others; Teachers use learning preferences to train other officers; and Executives are officers who make decisions based on previously internalized data.

Two conclusions were made from this study. Four distinct groups of Air Force officer learners exist, and learning strategies are not a useful tool for discriminating among various demographic officer variables. Recommendations included learning strategy training during initial commissioning training, instructor training in learning strategies and preferences, and update regulations to reflect progressive learning strategy training.

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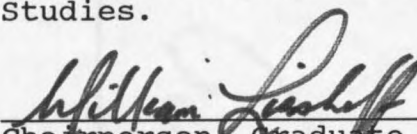
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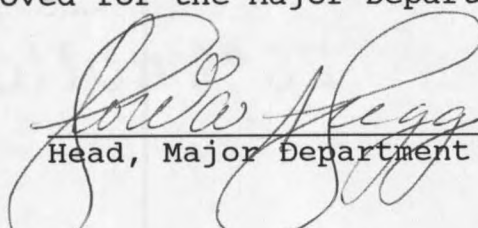
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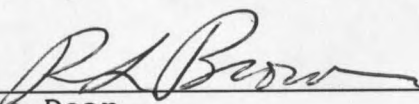
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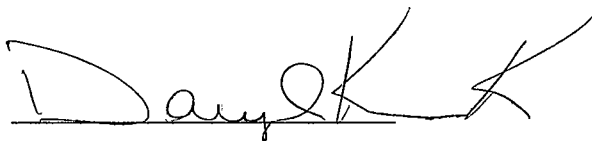
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ABSTRACT

Air Force officers spend a considerable amount of time in the classroom environment. In an era of declining defense spending, every officer must have the skills necessary to learn as much as possible in the least amount of time. However, the use of learning strategies has never been identified as an educational issue with the Air Force. The purpose of this study was (a) to identify the learning strategies of United States Air Force adult learners in officer (leadership) positions; (b) to investigate the relationship of these learning strategies to career advancement, gender, age, education, and experience; and (c) to explore patterns of learning of distinctive groups of learners that may exist. The data were collected from the Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS), a demographic survey, and a follow-up qualitative questionnaire.

Discriminant analysis was used to deductively impose sense on the data to determine if different groupings made a difference in learning strategies used by Air Force officers. Variables such as age, gender, time in service, military rank, and attendance/performance at professional military education were originally thought to be worth examining. However, none of the demographic variables could discriminate one group of officers from another in this study.

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Two conclusions were made from this study. Four distinct groups of Air Force officer learners exist, and learning strategies are not a useful tool for discriminating among various demographic officer variables. Recommendations included learning strategy training during initial commissioning training, instructor training in learning strategies and preferences, and update regulations to reflect progressive learning strategy training.

CHAPTER 1

INTRODUCTION

Background

Adult learning encompasses a great number of programs and an ever increasing interest from the education community. Demographically, the population of the United States is becoming older and older with a continued increase of adults in educational situations. Learning in adulthood should be considered a personal activity that may involve a great deal of time and money.

Yet at the same time, a multibillion-dollar enterprise has arisen in response to adult learning interests--an enterprise that spends more dollars than elementary schools, high schools, and post-secondary schools combined (Merriam & Caffarella, 1991, p. xi).

With all of this interest being focused on the adult learner, it is important to address how to best facilitate the process of learning.

Self-directed adult learning is an issue at the focal point of education. "Self-directed learning from this perspective is a form of study in which learners have the primary responsibility for planning, carrying out, and evaluating their own learning experiences" (p. 41). This concept can and should be taken several steps further.

As a field of practice, the emphasis in research and conceptual development had been on providing services, with learning viewed simply as one component of educational programs. But a shift to a field of study with the individual learner as the central concern opened whole new realms, such as self-directedness and individual development, to the field (Fellenz & Conti, 1989, p. 1).

A shift to the focus on the learner in education is becoming more prevalent in today's society. This shift to the learner is an important issue for adult education because adults can have the greatest impact on the direction their education takes. Learning strategies that adults use to determine what and how they will learn is the next logical step upon which adult educators need to focus.

Learning Strategies

Regardless of the type of setting, learners use various strategies to accomplish their learning needs. Learning strategies are those techniques or specialized skills that the learner has developed to use in both formal and informal learning situations (McKeachie, 1980). There is a subtle difference between learning styles and learning strategies. While learning styles refer to the inherent ways that people process information, learning strategies deal with the way people approach specific learning situations (Conti & Kolody, 1995). Not all learning strategies are available or at the disposal for every learner.

It is important to be able to distinguish between different learning strategies and to quickly recognize what

strategy the learner is using. This will help the adult educator facilitate the learning process and guide the adult learner in their desired direction. Research in the area of learning strategies in adult education has centered on five areas (Conti & Fellenz, 1991; Fellenz & Conti, 1989). These are metacognition, metamotivation, memory, critical thinking, and management of resources. Metacognition can be thought of as the executive control of learning. It is composed of planning how to go about learning, monitoring how well the learning plan is being carried out, and adjusting the plan depending on progress toward the learning goal. Metamotivation deals with how individuals build and maintain internal motivation to complete learning tasks. Memory as it relates to learning strategies involves (a) how a learner organizes new information into knowledge already known, (b) the use of external memory aids such as item lists, and (c) self-knowledge about personal memory and knowledge of strategies that are useful in remembering (Fellenz & Conti, 1993, pp. 5-8). Critical thinking involves how one discriminates and reflects upon learning material. Management of learning resources relates to how learners identify and critically use appropriate sources of information. All of these aspects of learning strategies are thought to play an internal part in how much and how well students achieve in learning situations (McKeachie, 1980).

Since the recent development of the Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS), researchers such as McKenna (1991), Hill (1991), Yabui (1993), Hays (1995), Moretti (1995), Conti and Kolody (1995), and Kolody and Conti (1996) have found that various groups of learners can be distinguished by the learning strategies which they use. This dramatic breakthrough for adult education now empowers not only the adult learner but the adult educator to more effectively interact in the learning environment. Many adult educators feel that the military education system has been making great strides in following the current trends in education. The learning strategies that military officers use should be the next trend in education in which military education experts participate.

Military Leadership Training

Officers in the Air Force attend numerous educational classes that must be successfully completed in order to be promoted or to function in their work environment. Due to the high cost of education, most learning situations are fast paced and encompass a wide range of topics. These topics include leadership, technical training, team building and cooperative learning. "Performance is the ingredient that will get you promoted. Performance is the ingredient that will get you that next job" (Head Quarters Air Force

Space Command [HQ AFSPC], 1995, p. 7). Competition and performance are the key to the Air Force educational system. Because of the high cost of education and the time spent away from the workcenter, not everyone will participate in advanced or intermediate training. Therefore, competition is a constant variable in the military educational system. The better the officer does in the learning environment determines how likely that officer will be promoted or be able to attend any further training. With increased training received by an officer, the more of a chance that officer has to attain increased leadership positions and promotion.

There are basically two types of training or educational opportunities in the Air Force for an officer. The most prevalent type is job training and is required for every new officer. Job training is used to teach officers what they need to know in order to perform their particular entry level job. This training could take place in the normal classroom environment with part or all of the training in the work environment. Each position to which an officer is assigned after this initial training could and oftentimes requires additional training or education. "Preparation for work with adult learners ranges from on-the-job training to formal graduate course work, but a key component of all the different modes of preparation is

understanding adult learners and how they learn best"

(Merriam & Caffarella, 1991, p. xi).

In the past, the Air Force has tended to neglect the role the adult learner plays in one's own education and how that individual learns best. The Air Force apparently does this in an effort to present a standardized educational format that everyone will have an equal opportunity to achieve and compete for promotion.

Finally, the traditional lecture method is ill-suited for meeting many of today's broader educational objectives. In an age where greater emphasis is placed on teaching students how to learn, using critical and creative thinking skills, stimulating writing across the curriculum, and cultivating independent, yet cooperative, learners, it is questionable whether the use of the traditional lecture method can accomplish any of these goals. (Shakarian, 1995, p. 22)

Yet, the traditional lecture method is widely used in the Air Force educational system with little apparent regard for the learner.

The second type of education or formal adult learning activity that an Air Force officer can participate in is professional military education (PME). "PME builds a solid foundation of officership and it is crucial to recognize its importance" (HQ AFSPC, 1995, p. 8). Therefore, professional military education is a natural place to start applying the principles related to learning strategies. However, to date, research using tools such as SKILLS that measure an officer's learning strategies has not been conducted.

Factors such as cost and lack of need for every officer to have the advanced training contribute to the lack of data on learner strategies.

Professional military education is broken down into three different time periods or stages. They are Squadron Officer School (SOS), Air Command and Staff College (ACSC), and Air War College (AWC). These schools are offered to officers depending upon their rank and overall competitiveness throughout their career.

Squadron Officer School is the first professional military educational opportunity for the officer and is accomplished at the 4-7 year point on active duty. Approximately 95% of active duty officers attend SOS. The intent of this 7-week course is to familiarize the officer with the many different aspects of military leadership and how this leadership relates to the work environment. Academic testing is a significant factor for the SOS student along with stressful physical challenges that task the officer's ability to learn quickly. SOS is competitive in nature with the top 10% receiving "Distinguished Graduate" recognition. A distinguished graduate from SOS is much more likely to attend the next type of PME.

Air Command and Staff College or Intermediate Service School (ISS) is the next step or type of professional military education for the advancing officer. "Once selected as a major, an officer is eligible to start ACSC by

either correspondence or seminar. Selection for ISS in residence is extremely competitive" (HQ AFSPC, 1995, p. 11). Approximately 20% of the active-duty officer force attends this school in residency. Selection to attend ACSC and the curriculum are both very competitive with past performance in PME being used as a selection criteria. An officer with 9-13 years of experience has the opportunity to compete for an ACSC slot. Those who are not chosen for school before their 13 year point are not eligible to attend that particular school.

Air War College or Senior Service School (SSS) is the third and final step in an officer's professional military education. "Senior Service School should be completed by correspondence or seminar at the earliest opportunity to remain competitive with your contemporaries. The goal is to be selected for SSS in residence" (HQ AFSPC, 1995, p. 12). If the officer did not attend Air Command and Staff College, then that officer has a substantially lower chance of attending AWC. Selection for Air War College is even more competitive than SOS or ACSC. An officer who is not promoted to the next rank will also be ineligible for Air War College. Officers who attend AWC do so at their 15-23 year point on active duty. Approximately 12% of the officers in the Air Force attend Air War College, and this is used as an indicator for future promotion. Officers

attending Air War College are either at the colonel or lieutenant colonel rank.

Officers can also participate in distance learning by accomplishing their professional military education through correspondence. Squadron Officer School is a 3 to 12-month course depending upon the speed at which the officer can learn the material. Speed at which an officer learns is a relevant issue because completion of SOS by correspondence will make the officer more competitive for the residency program. Air Command and Staff College is designed to be accomplished in 12 months with regular meetings with other students in the course. Air War College is a 24-month course that includes lectures and strategy development in a classroom setting. This distance learning program contains some of the same information that is provided in the residency programs but is not considered as an equivalent to a residency program.

Problem Statement

Learners are empowered to take the knowledge of their learning and apply it to life-long learning experiences. This takes place when the instructor or facilitator can help the learner understand the learning process. The ability to recognize the learning strategy being used by an individual is critically important if the most productive learning is to take place. "An appreciation of one's learning style,

the development of strategies that promote learning, and an insight into metacognitive processes enable people to exert control over learning processes and outcomes" (Fellenz & Conti, 1989, p. 23). Yet, the use of learning strategies has never been identified as an educational issue with the military. Military education tends to be instructor or leader focused rather than learner focused. The military instructor oftentimes does not concentrate on learner modalities or strategies when preparing lesson plans or educational opportunities. These important areas of learning are excluded from the educational environment.

Military education is provided in several different forms ranging from self-directed distance learning to highly structured, formal learning environments. The time line for the self-directed distance learning can be anywhere between 9 weeks and 24 months with the formal classroom learning ranging between 7 weeks to 12 months. The issue that exacerbates the learning problem in the military is that education is oftentimes competitive with the results being used to predict and to promote the highest academic achievers. In this situation, learning strategies really become an important factor in the educational environment because the emphases should be on the learner and not the person providing the information. It is not good enough to learn what one needs to know, but the successful officer must learn more than others in the course. Their military

career is contingent upon learning the greatest amount of information in the least amount of time and then to be able to articulate that information in a standardized testing format.

Learning strategies are "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" (Fellenz & Conti, 1989, p. 7-8). Because of the content-centered structure of the Air Force educational system, it does not consider the techniques or skills that an individual uses and therefore only develops a certain type of officer. Those officers that fail to compete in this environment are oftentimes eliminated from the military, or they fail to be promoted to the next level of rank. The successful officer tends to learn fairly quickly in the classroom environment where the educator lectures to the learners. Air Force leadership tends to equate someone who learns the way they teach with the person who is the best leader in an operational environment.

Purpose of the Study

The purpose of this study was (a) to identify the learning strategies of United States Air Force adult learners in officer (leadership) positions; (b) to investigate the relationship of these learning strategies to career advancement, gender, age, education, and experience;

and (c) to explore patterns of learning of distinctive groups of learners that may exist. After the distinct groups of learners were identified, follow-up questioning was conducted to gather additional data to better describe the learning patterns of these groups.

Research Questions

This study investigated the learning strategies used in real-life learning situations by Air Force officers. The use of specific learning strategies was measured with SKILLS. The following research questions were addressed in this study.

1. What is the profile of learning strategies of Air Force Officers at the Pentagon.
2. Is it possible to use learning strategies scores as measured with SKILLS to discriminate between the most successful learners and least successful learners when measured by their ability to achieve higher rank and compete or receive professional military education?
3. Among Air Force officers, it is possible to use learning strategies scores as measured with SKILLS to discriminate between groups formulated by the following demographic variables of gender, age, and career advancement.
4. Is it possible to identify distinct clusters of learners in the US Air Force using SKILLS?

5. If distinct groups of learners exist, what differentiates one group from another?

Assumptions and Delimitations

It was assumed that the participants of this study answered the Self-Knowledge Inventory of Lifelong Learning Strategies and the demographic questionnaire honestly and accurately. For this study, SKILLS was administered over the electronic mail system at the Pentagon and sent to each participant at their work center. It was assumed that the participant's ability to interface with the electronic mail system did not have an affect on their responses to SKILLS or the demographic questionnaire. All participants in this study volunteered to respond, to complete the SKILLS instrument, and to participate in cluster group questionnaires.

The research was delimited to active duty Air Force officers who were working at the Pentagon in Washington D.C. This study was further delimited to officers currently holding the rank of major, lieutenant colonel, or colonel.

Definition of Terms

ACSC: An acronym for Air Command Staff College. Air Command and Staff College (ACSC), the Air Force's intermediate professional military education (PME) school, prepares field grade officers of all services (primarily majors and major selects) and US civilians to assume positions of higher responsibility within the military and other government arenas. (Air Command and

Staff College. On-line. Internet. Available from <http://www.au.af.mil/au/cat/acsc.htm>)

Adult: A person who has reached the maturity level where a personal assumption of responsibility for self and sometimes others takes place. (Hiemstra, On-line. Internet. Available from <http://www.distance.syr.edu/train1/htm>)

Adult Learner: Any adult who engages in some type of activity, formal or informal, for the acquisition of knowledge or skill, in an examination of personal attitudes, or in the mastery of behavior. (Hiemstra, On-line. Internet. Available from <http://www.distance.syr.edu/train1/htm>)

Adult Learning: The acquisition of knowledge, attitudes, and skills, often resulting in behavioral change of some sort in an adult. (Hiemstra, On-line. Internet. Available from <http://www.distance.syr.edu/train1/htm>)

Air University: The center for advanced education in the Air Force. It, provides this education through its professional and specialized education programs, research and doctrinal studies, and baccalaureate programs at civilian educational institutions. (Air University Commander's welcome. On-line. Internet. Available from [ht://www.au.af.mil/au/cat/intro.htm](http://www.au.af.mil/au/cat/intro.htm))

AWC: An acronym for Air War College. The War Department established the Air War College (AWC) in 1946 at Maxwell Field, Alabama, and the college has operated continuously since that time, except for a period of six months during the Korean conflict. The student body consists of a select group of senior military officers and civilians with diverse backgrounds who are brought together for 10 months of graduate-level study. (Air War College. On-line. Internet. Available from [ht://www.au.af.mil/au/cat/awc.htm](http://www.au.af.mil/au/cat/awc.htm))

Critical Thinking: A reasonable, reflective thinking that is focused on deciding what to believe or do. It includes identifying and challenging assumptions, challenging the importance of context, imagining and exploring alternatives, and reflective skepticism. (Brookfield, 1987, p. 12)

Electronic Mail: E-mail is used to communicate between any two people on the Internet. It differs from ordinary mail in that it is virtually instantaneous and very

inexpensive. (On-line. Internet. Available from [ht.//www.uwannawhat.com/ernet/EMailOverview.html](http://www.uwannawhat.com/ernet/EMailOverview.html))

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: Learning strategies which help adults in learning situations. These include rehearsal of information, organization and elaboration of information, use of external aids, and the application of self-knowledge about memory and use of mnemonic techniques. (Fellenz, & Conti, 1993, p. 5)

Metacognition: Thinking about the process of learning and emphasizing self-regulatory tactics to insure success in the learning endeavor (Fellenz & Conti, 1989, p. 2).

Metamotivation: Tactics and techniques used by the learner to provide internal impetus in accomplishing learning tasks. These are based on a model developed by Keller (1987) which emphasizes focusing attention, fostering confidence, anticipating reward, and enjoying learning activities. (Fellenz & Conti, 1989, p. 8)

Professional Military Education (PME): The portion of military education that: (1) Provides the Nation with military personnel skilled in the employment of air and space power in the conduct of war and in missions short of war (e.g. peacekeeping, humanitarian assistance); (2) Provides officers and enlisted personnel with the skills and knowledge to make sound decisions in progressively more demanding leadership positions within the national security environment; (3) Develops strategic thinkers and war fighters. (Air Force Instruction 36-2301. On-line. Internet. Available from [ht.//.afpubs.hq.af.mil/elec-products/pubs-pages/36-pubs.html](http://.afpubs.hq.af.mil/elec-products/pubs-pages/36-pubs.html) July 1994, p. 1)

Resource Management: The identification of appropriate resources, critical use of such sources, and the use of human resources in learning. (Fellenz & Conti, 1989, p. 3)

Self-Directed Learning: A learning activity that is self-planned, self-initiated, and frequently carried out

alone. (Hiemstra, On-line. Internet. Available from <http://www.distance.syr.edu/train1/html.>)

SKILLS: An acronym for the Self-Knowledge Inventory of Lifelong Learning Strategies. This is a learning strategies inventory with established validity and reliability which asks respondents to rate 15 learning strategies in 4 of 6 scenarios commonly found in everyday life and which call for a learning effort on the part of the respondent. (Fellenz & Conti, 1989, p. 2)

SOS: An acronym for Squadron Officer School. The initial course in the Air Force officer professional military education (PME) System. SOS's goal is to help officers grow professionally. Officers step out of their specialties and broaden their focus on officership, the Air Force core values, and on the Air Force as an institution in the profession of arms. (Squadron Officers School. On-line. Internet. Available from <http://www.au.af.mil/au/cat/sos.htm>)

CHAPTER 2

LITERATURE REVIEW

Educating military officers is becoming more and more important as our national security policy necessitates the use of military force in humanitarian and peace keeping efforts. Military force is also being used to support and defend our nation's foreign policy. Senior Air Force officers are faced with an ever increasing need to be able to assimilate information quickly and be able to make important decisions concerning that information.

It is quite clear that our national security becomes ever more dependent on the minds of men rather than their brute strength. Particularly is this evident in the United States Air Force which is faced with periodic crises and realignments of power politics as well as tremendous technological advances that constantly modify its mission, its capabilities, and its operations. (Davis, 1989, p. 35)

The power and complexity of the information age has brought with it many challenges for the Air Force officer. With so much information available and with every decision the senior officer makes being critical, learning has become an ever increasingly important task.

With the great deal of information that must be understood, more emphasis needs to be placed on the learner in the military educational system. Change is taking place

so quickly that learning efficiently has become a necessity. Such acceleration of change necessitates flexibility, the ability to learn and unlearn and relearn, and a willingness to experiment and take risks. Several of the increasingly complex problems and issues of today's world have no clear cut solutions in textbooks, databases, or authority figures (Dickinson, 1996, p. 1). Any learning strategy that the officer uses to understand information should be examined and if possible improved upon. However, little if any research has been done on the learning strategies of officers or how to improve those strategies.

Recent literature concerning military education focuses on the actual need for education and not on how to best facilitate that education. Many officers tend to devalue their professional military education (PME) and to view it as another hurdle to pass in order to be promoted. Many times there is a surge of course completions prior to promotion boards. This indicates that these officers considered PME important for advancement but not particularly relevant to function or even compete in their jobs (Davis, 1989, p. 35). This counterproductive attitude towards PME adds little value to the officer's competency. Adults learn by constructing meaning from their experiences, and situations which are not viewed as meaningful are typically rejected as a source of learning (Hermanson, 1996).

Officers are commissioned after completing a minimum of a bachelor degree and Air Force training. The Air Force training consists of leadership, military situational awareness, history, and force projection. Table 1 defines the current Air Force rank structure and the number of personnel currently occupying each rank.

Table 1. Air Force Rank Structure

Rank Structure	Grade	Current Number
1. Second Lieutenant	O-1	7145
2. First Lieutenant	O-2	7321
3. Captain	O-3	30305
4. Major	O-4	15933
5. Lieutenant Colonel	O-5	10346
6. Colonel	O-6	3951

Source: (Air Force Magazine, 1997, p. 26).

Each year a promotion board is held for each rank and all of the eligible officers are evaluated against their peers for a set number of promotion slots. If an officer is selected for promotion, the officer could wait up to 18 months before actually receiving the promotion. This is due to the large number of officers promoted each year. In this case the officer is designated a "select" for promotion purposes. For example, a lieutenant colonel select is a major who has been selected for promotion but who has not received the promotion yet.

Military Leadership Training

Officer professional development (OPD) is an integral part of the officer's career. It must be successfully completed in order for the officer to be competitive for promotion or advancement. OPD is essential to support the Air Force mission.

Officers who are professionally prepared to assume responsibilities that go with each promotion and assignment will be more effective at carrying out this mission. (Air Force Instruction 36-2611, 1996, p. 14)

Thus, officer education is viewed by Air Force leadership as something that adds value to completing the military operational mission. This is appropriate because the actual mission comes first and foremost for each branch of the military. Officer education also improves upon the individual's ability to execute the mission in the most productive manner possible.

The Air Force provides education for its officers through a formal classroom environment at Air University. Air University's schools include the Air War College; the Air Command and Staff College; and Squadron Officer School (Introduction to Air University, 1996 p. 1) It is very clear that "service members must place the nation's defense above self and possess an in-depth knowledge of war and the military sciences" (Air University Commander's Welcome, 1996, p. 1). Air University is chartered to provide this education for the Air Force.

Formal professional military education at Air University occurs at three distinctly different times in an officers career. Squadron Officer School, Air Command and Staff College, and Air War College are completed by the officer at different points in his or her career. Most officers compete for the honor to attend each different school in residency and complete the correspondence program in preparation for the residence school.

Squadron Officer School

Squadron Officer School is the first opportunity Air Force officers have to attend or participate in a professional military education program. SOS is highly structured and is designed to provide junior officers with the skills they will need for future leadership challenges.

SOS also provides Air Force captains the leadership tools they need to build military teams and lays a foundation for critical thinking in air and space power through education on air power history and doctrine. (Air Force Instruction 36-2611, 1996, p. 5)

SOS in residency is conducted at Maxwell Air Force Base in Alabama with most officers traveling there in order to attend.

There are approximately 5 SOS classes each year with each class consisting of 700 or more students. SOS is the first opportunity that many officers have to compete with their peers outside the officer's particular career field. The competition is for athletic honors and overall ranking

in the SOS class. This opportunity to compete is considered very important and is usually taken seriously.

Most junior officers have a great deal of interest in the selection process for Squadron Officer School. In the Air Force, second lieutenants, first lieutenants, and captains are considered junior officers. Each unit is allocated a certain number of positions for every class. The squadron commander nominates a percentage of the company grade officers (junior officers) in the unit to compete at a local selection board. The individual selection boards consider many areas including demonstrated leadership, past performance, and future leadership potential of each officer under consideration. If selected, the chosen officer normally has about 8 weeks to prepare for school.

The interaction between the instructors and students at SOS is relatively high. SOS instructors are typically senior captains with 7 to 10 years of active duty service. Each instructor is required to provide feedback and evaluations on the students he or she instructs. The selection process to become an SOS instructor is quite competitive with those officers who did well at SOS being chosen to return.

The rules for conduct and engagement are spelled out in the introduction package every officer receives before arriving at Air University. This package describes the mission and objectives for each officer during SOS. "The

mission of SOS is to improve the professional competence of company grade officers and inspire their dedication to the profession of arms" (Squadron Officer School, 1996, p. 1). The objectives which each officer is required to complete in order to graduate are derived from the SOS mission. Another area that SOS participants must focus on is officership. The Air Force definition of officership is an area that concentrates on values essential to successful Air Force officers (Squadron Officer School, 1996, p. 2).

The course curriculum at SOS consists of five general areas of officership which include officership values, officership application, leadership tools, air and space power, and electives. The overall program involves 212 academic hours. Within each of the five broad categories are several specific components.

Area 1: Officership Values (42 academic hours)
Officership values consists of three phases: Principles of officership, values analysis, and values in action. Principles of officership examines the historical origins of officership and core values and their evolution through time. Values analysis looks at such current issues such as discrimination and ethics and how they affect Air Force officers. Values in action uses case studies and inspirational speakers to provide real-life examples of officership values.

Area 2: Officership Application (86 academic hours)
This area allows the students to draw their officership talents together by applying knowledge they have gained in leadership tools, air and space power, and officership values.

Area 3: Leadership Tools (56 academic hours)
Leadership tools has four phases: Supervisory tools, principles of leadership, team leadership,

and communication skills. Supervisory tools introduce students to counseling and feedback techniques, military justice, and officer professional development. Principles of leadership teaches individual leadership and group interaction skills that contribute to the development of successful teams. In the team leadership phase, students learn about and apply individual and group leadership principles, concepts, and techniques to build effective teams.

Area 4: Air and Space Power (18 academic hours)
Air and space power concentrates on introducing students to the employment of air and space power. This area starts with an understanding of basic air and space doctrine, its historical development, and the nature of modern warfare.

Area 5: Electives (10 academic hours)
SOS offers a limited number of electives which allow students to tailor their SOS experience to their individual professional needs. Electives are in such subjects as history of strategic thought, performance appraisal writing, total force, and joint operations.
(Squadron Officer School, 1996, p. 2)

The staff at SOS have instituted a distinguished graduate (DG) program at the school in order to recognize the top 10% of each graduating class. This honor sets the recipient apart from his or her peers and is used in determining future promotions and job selections. Competition is very high for the DG recognition and in many ways undermines the real focus of the school. Competition drives many officers to do things they wouldn't do in other circumstances. Many times, officers who know they are not going to win will do less than their very best. Air University as well as the Air Force should focus on the professional education and development of the experiences that the officers need to excel in the work environment.

Air Command and Staff
College (ACSC)

Majors who have competitive records and possess significant leadership potential are selected to attend Air Command and Staff College in residency. Approximately 20% of all eligible officers will attend ACSC in residency between their 11 and 14 active duty year point. The nonresident program provides the same in-depth education for those officers not selected or for whatever reason cannot attend.

Those officers who were promoted below the zone to major are automatically placed on the selection list. Captains are evaluated for early advancement (below the zone) 2 years before they are eligible to compete for promotion. This evaluation is also conducted 1 year before the officer is eligible to promote. Approximately 2% of officers are selected for early promotion to major each year.

The curriculum at ACSC is highly structured and is derived from the mission and objective statements of the school. "ACSC's mission is to educate midcareer officers to develop, advance, and apply air and space power" (Air Command and Staff College, 1996, p. 1). In this school, there is an obvious shift from the mission of SOS to "improve the professional competence of company grade officers" to the ability to project and manage military power (Squadron Officer School, 1996, p. 2).

The course work at ACSC is considered graduate level work with a comprehensive project required in partial fulfillment for graduation. Most if not all officers already have a masters degree before they start ACSC so they are well prepared to participate in this progressive, fast-paced environment.

Joint training for those officers with exceptional potential is conducted after the officer attends ACSC. Joint professional military educational takes officers from each branch of military service and provides an opportunity to learn joint service operations.

It is essential that our Joint Professional Military Education (JPME) programs provide our warfighters with an understanding of strategic concepts in the future environment where military force will be applied, as well as in-depth understanding of individual Service systems and how the integration of these systems enhance joint operations. (Vision for Professional Military Education, 1996, p. 1)

This is the first opportunity to attend joint professional military education for the officer and is considered by many to be invaluable.

The course curriculum at ACSC consists of nine general areas of leadership which include command and leadership, strategic structures, joint operations and comparing concepts, war, conflict, and military objectives, operational structures, campaign 2000+, war theory, theater air campaign studies, and war termination. This course has

594 content hours. Within each of the nine broad categories are several specific components.

Area 1: Command and Leadership (55 academic hours)

This course enhances student leadership skills in three areas. Phase one, management skills, is a review of Air Force quality issues, statistical process important concepts, leading-edge concepts regarding management of change, chaos theory, effective writing and briefing, and managing diversity. Phase two covers fundamentals and theories of leadership ethics and values. Phase three is a 14-part series studying critical aspects of commanding a squadron.

Area 2: Strategic Structures (87 academic hours)

This course teaches coalition theory and introduces power projection instruments. It examines the process of making security assessments and analyses of hostile and friendly centers of gravity as well as the role of intelligence in the national security process.

Area 3: Joint Operations and Campaign Concepts (67 academic hours)

This course involves an in-depth study of service joint doctrine. After studying joint deliberate and crisis action planning, students use this knowledge to construct a campaign plan.

Area 4: War, Conflict, and Military Objectives (20 academic hours)

This course sets the stage for the remainder of the curriculum by clarifying the distinction between war and conflict and by introducing and defining the concepts essential to the study of the geopolitics of violence.

Area 5: Operational Structures (100 academic hours)

This course focuses on an adversary's operational centers of gravity and the process of identifying and targeting them as part of a cohesive campaign plan.

Area 6: Campaign 2000+ (51 academic hours)

This course defines possible future force structures needed to meet an undefined and technologically accelerating future in the hope

that the US can control rather than react to change.

Area 7: War Theory (56 academic hours)
A cornerstone of the ACSC curriculum, this course systematically examines warfare. Modern warfare is as much an intellectual endeavor as a technological one, and military theorists have long attempted to impose order and rationality on what is essentially an irrational enterprise.

Area 8: Theater Air Campaign Studies (134 academic hours)
The goal of this course is to produce students who can plan and execute an air campaign. It addresses the changing nature of war and future technologies and their effects on warfare.

Area 9: War Termination (24 academic hours)
This course addresses one of the most important, yet least understood, areas of war * termination. From prehostilities to the end of fighting, war termination is a critical issue for campaign planners at the strategic and operational levels.
(Air Command and Staff College, 1996, p. 1)

Air War College

The Air Force provides professional military education for its senior officers through the Air War College (AWC).

As the senior Air Force professional school, the AWC annually educates 250 resident and 4,000 associate students from all US military services, federal agencies, and 40 other nations. (Air War College, 1996, p. 1)

The resident program is a fast-paced, graduate-level program that lasts approximately 10 months. Officers and their families are relocated to Maxwell Air Force Base in Alabama to attend school. The associate program is designed for those students who are unable to attend AWC in residency. Those motivated to compete and learn in a fast-paced environment should derive a professionally gratifying

experience from either of the associate programs provided by the AWC Directorate of Associate Programs (Air War College 1996, p. 7). Many officers complete the associate program before attending AWC in residency because it demonstrates initiative and can make the officer more competitive for one of the highly selective residence slots.

Like any other part of the Air Force, AWC is highly structured with the mission and objectives clearly articulated for everyone to understand.

The mission of the Air War College is to prepare senior officers to lead in the strategic environment emphasizing joint operations and the employment of air and space power in support of national security. (Air War College 1996, p. 1)

Acceptance to the resident program is very competitive with approximately 12% of those eligible attending.

The course curriculum at AWC consists of five major areas of leadership which include the departments of conflict and change, leadership and ethics, international security studies, strategy, doctrine, and air power, and joint force employment. This course has 316 content hours. Within each of the five broad categories are several specific components.

Area 1: Department of Conflict and Change (50.5 academic hours)

The department of conflict and change prepares future senior leaders to analyze the features of individuals, groups, and states that have traditionally caused conflict, avoided fighting, or promoted peace; and to recognize the forces of change that will affect conflict and war in the future. The department also develops future

leaders strategic leadership skills required to meet the challenges of war and peace.

Area 2: Department of Leadership and Ethics (39 academic hours)

The mission of the Department of Leadership and Ethics is to prepare senior officers for leadership in the strategic environment through the study of individual and organizational ethics, principles, and examples. The aim of the departments curriculum is to shift the students focus from the tactical level of leadership-involving the leadership and management of individuals and small units as well as learning ethical standards-to the strategic level of leadership-involving the leadership and management of other leaders and large units as well as establishing ethical standards.

Area 3: Department of International Security Studies (26 academic hours)

The International Security Studies course provides senior officers with the analytic tools and information to understand and interpret the broad political and economic currents that impact global, regional, and national security conditions. This course emphasizes conceptual approaches to understanding how US national security is intertwined with the political and economic conditions and events in Europe, Asia, Russia, Latin America, the Middle East, and Africa.

Area 4: Department of Strategy, Doctrine, and Air Power (38 academic hours)

The mission of the Department of Strategy, Doctrine, and Air Power is to provide students with an understanding of the strategy formulation process and the role historically played by strategy, doctrine, and leadership in planning for the employment of military force with particular emphasis on air power.

Area 5: Department of Joint Force Employment (133.5 academic hours)

The mission of the Department of Joint Force Employment is to enhance the AWC students comprehension of joint and combined operations and to develop skills to enable the students to excel in any joint assignment. The department addresses several areas: the application of national security strategy and national military strategy

in attaining national security objectives in peacetime and in war; theater-level operations focusing on leadership and employment of multi-service and multinational forces used in joint and combined operations in war and military operations other than war; the interrelationship of national and defense planning systems; and awareness of DOD-wide requirements as well as individual service capabilities, problems, and needs. (Air War College, 1996, pp. 2-7).

Professional Military Education and Competition

The Air Force uses Squadron Officer School, Air Command and Staff College, and Air War College to give officers the opportunity to compete with one's peers. This environment is set up to separate and identify those officers who meet the highest professional military standards of conduct. The separation or classification is conducted on both a formal and an informal basis. Categorization is formally conducted by documenting the outcome of PME on the officer's performance reports. The performance report is kept for the entire career of the officer. Informally, the separation gives those selected to attend school an opportunity to interact with others who were selected for school. This is a very important point because through these associations with one's peers comes the networking and exposure that contributes to receiving the best career opportunities and advancements. Those officers who do not attend school will most likely never receive another chance to attend school in residency.

The senior officer experience comparison command and control graph (see figure 1) demonstrates the success of those officers chosen for the various professional military educational schools and promoted below the zone with those that are not. Of those officers who were not promoted to the rank of colonel, less than 1% went to AWC and none of them were ever promoted below the zone (BPZ). This is a powerful statement for those who do not attend PME or who are not promoted BPZ. Significantly, approximately 40% of those who worked at Headquarters Air Force (HAF), which is located in the Pentagon, were promoted to colonel. (See Figure 1).

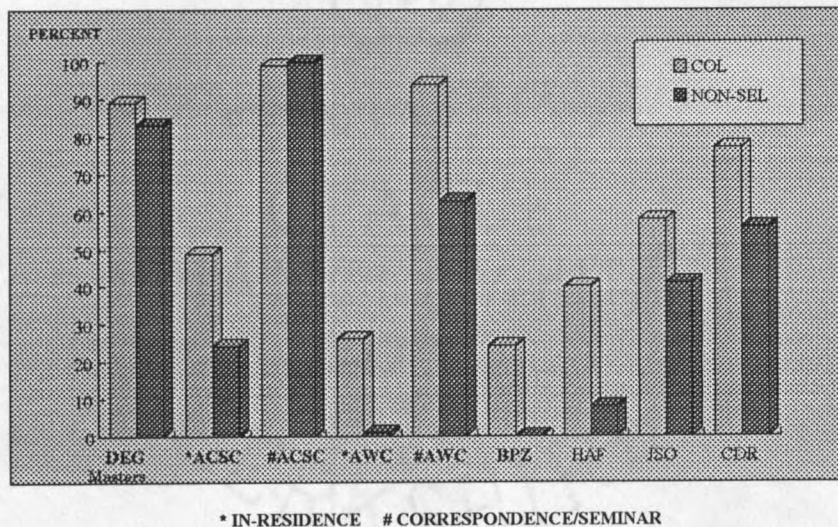


Figure 1. Senior Officer Experience Comparison (Command and Control). (Air Force Pamphlet 36-2630, 1995, p. 48)

For those officers who want to be promoted it is obvious that accomplishing their professional military education in residency is critically important. There also

is a building block affect with those going to school being the same individuals who are promoted early and then continue to promote throughout their career.

Air Force Instruction

The Air Force maintains a set of regulations that guide its instructors through the entire learning process. Many of the guidelines are actually regulatory requirements that must be followed by all Air Force instructors. Instructor school is provided for those individuals selected by their work centers to become instructors and in many cases is specialty unique. Military officers receive some kind of initial training and oftentimes will receive recurring training throughout their career. This makes it obvious how powerful the instructional guidelines are that military instructors must use.

Air Force leadership long ago recognized the need and benefit of sound instruction. Education is essential to the professional development of Air Force leaders at any level of the officer structure. "Air Force education programs expand knowledge and increase one's understanding of the role of aerospace power in war" (Air Force Policy Directive 36-23, 1993, p. 1).

Air Force Learning theory

The behavioral theory of education is used throughout Air Force instruction and classroom management.

As classroom instructors, though, we need to realize the importance of controlling learning experiences by manipulating the classroom environment (stimuli) which gives our students a chance to behave or perform (respond) in the way that we desire and can reward (reinforce). Behaviorism certainly explains the way our students learn much of what we teach. We need to be aware of the importance of stimulus, response, and reinforcement as they affect our classrooms. (Air Force Manual 36-2236, 1994, p. 4)

This behavioral approach to education and learning can stifle the open learning environment that is prevalent in many progressive education programs today.

Students tended to experience growth only with the non-authoritarian environment that emphasized self-directed learning, support, mutual trust, and respect, and that being forced to accept an external locus of control in more traditional learning environments might well result in an actual decline in ego level. (Dickinson, 1996, p. 2)

The behavioral approach to education is predominately used in order to maintain a high degree of structure and to be able to determine who in the class has demonstrated the greatest mastery of the material. "We have no choice, then, but to measure behavioral indicators which we will accept as evidence of learning" (Air Force Manual 36-2236, 1994, p. 2).

The behavioral approach to learning and the need to judge the learning effort of each student is a major concern of all Air Force instruction. However, "we must plan learning experiences which allow students to go beyond simple recall and which cause students to gain an

understanding of what they study" (Air Force Manual 36-2236, 1994, p. 4).

The underlying concept of truly understanding the necessary material before student graduation is the predominant objective of every learning situation. "The approach which retains the notion of cognitive learning while measuring behavioral outcomes seems to be the most workable" (Air Force Manual 36-2236, 1994, p. 5). There is a cultural need to rank order each class by performance, but the overall objective of each learning situation is that each officer learns the material in sufficient detail to be able to operate in a safe efficient manner.

The Air Force not only uses instructors for each learning situation but evaluators as well. Most instructors are not evaluators, and most evaluators are not instructors. However, both instructors and evaluators use information derived from the other group to assess the officers learning record.

We use data from evaluation programs in two ways:
(1) to compare students to stated objectives and
(2) to compare students to each other. If our goal is to compare the achievement of our students to specific objectives, we should use criterion-referenced or objective-referenced testing and analysis programs. ISD encourages criterion-referenced testing and analysis. In contrast to this type of evaluation, there are norm-referenced programs for comparing the performance of individual students to the group. These programs usually result in rank ordering students, typically represented by letter grading. (Air Force Manual 36-2236, 1994, p. 63)

The evaluator's job is to determine the ability of the officer to accomplish certain critical tasks after the instruction has been given. With the evaluator's aid, the instructors rank order the class through performance criterion.

Lesson planning is a major portion of the instructor's duties. As with every other Air Force learning situation, lesson planning is outlined by regulations that must be followed by the instructor. Air Force lesson planning consists of eight general areas which include determining the objective, researching the topic as defined by the objective, selecting the appropriate instructional method, identifying a usable lesson planning format, deciding how to organize the lesson, choosing appropriate support material, preparing the beginning and ending of the lesson, and preparing a final outline. Within each of the eight broad areas are several specific components.

Area 1: Determine The Objective

Although the first step of the lesson planning process is to determine the objective, our objective may not fully evolve until after we have completed other steps of the process. We should not state them in terms of what we want to teach, but rather they should be stated in terms of what we want our students to learn.

Area 2: Research The Topic As Defined By The Objective

The objective should determine the research that needs to be done. Usefulness and appropriateness are two important criteria for selecting relevant material. To be appropriate, information should relate to the lesson objective and have a high possibility for student retention. To be useful,

it should aid both the instructor and the students in the teaching-learning process.

Area 3: Select The Appropriate Instructional Method

After deciding exactly what to teach, the instructor determines how best to teach it and what instructional method to use. When related to instruction, "method" refers to a combination of techniques or skills used by the instructor to engage students in meaningful learning experiences. A method is a broad approach to instruction; for example, the lecture method or the guided discussion method.

Area 4: Identify A Usable Lesson Planning Format

Good lesson planning is essential for any systematic approach to instruction. Although many instructors become discouraged by the time required for good lesson planning, a well written and properly used lesson plan can be a very worthwhile teaching aid. They also serve as convenient records of an instructor's planning techniques and methods of teaching. One of the most practical functions of lesson plans is that they serve as step-by-step guides for instructors in developing teaching and learning activities.

Area 5: Decide How To Organize The Lesson

Every lesson needs an introduction, body, and conclusion. In most instances the body of the lesson should be prepared before the introduction or conclusion. After we prepare the body or main part of the lesson, we will be in a better position to begin or conclude the lesson. Arrangement of the main points and subpoints of a lesson will help both the instructor and the students; the instructor in teaching it and the students in learning.

Area 6: Choose Appropriate Support Material

A major factor determining development of the lesson outline is the kind of support material we decide to use. While the organization of ideas forms the basic structure of any lesson, almost all ideas need some form of clarification or proof if the student is to learn. The subject, the method, the ability of students, the size of the class, and similar factors will help determine the amount and kinds of support material we need.

Area 7: Prepare The Beginning And Ending Of The Lesson

Usually before we outline, however, we will want to consider how to begin and end the lesson. The introduction to a lesson should serve several purposes: to establish a common ground between the instructor and students, to capture and hold attention, to outline the lesson and relate it to the overall course, to point out benefits to the student, and to lead the student into the lesson content. The instructor should use the introduction to discuss specific reasons why the students need to learn whatever they are about to learn. For most instructional methods, the introduction should provide an overview of what is to be covered during the class period. The conclusion of a lesson may stick with the students longer than anything else said. For this reason, we should give much care to its preparation. The conclusion of most lessons should accomplish three things: summarize, remotivate, and provide closure.

Area 8: Prepare A Final Outline

We may, in fact, prepare two versions of the outline. One version will be very complete—almost in manuscript form—so we can return to it several weeks or months later when we have to teach the lesson again or when someone else must teach the lesson. Another version will be much briefer—perhaps only one page long, or written on cards so we can carry it with us to the classroom and teach from it. This brief outline may be thought of as a keyword outline with key words and phrases to remind us of main points, subpoints, support material we plan to use, questions we might ask, and the things we want to mention in the introduction and conclusion of the lesson.

(Air Force Manual 36-2236, 1994, p. 43)

Learning Strategies

There are three learning theories that currently dominate educational research. The behaviorist theory founded by John Watson makes three assumptions about learning.

First, observable behavior rather than internal thought processes is the focus of study. Second, the environment shapes one's behavior; what one learns is determined by the elements in the environment, not by the individual learner. And third, the principles of contiguity (how close in time two events must be for a bond to be formed) and reinforcement (any means of increasing the likelihood that an event will be repeated there must detectable behavior (Merriam & Caffarella, 1991, p. 126)

Behavior of the learner is the key to this theory and regulates the military learning environment.

The cognitive orientation is the second dominant learning theory. "Perception, insight, and meaning are key contributions to cognitivism from Gestalt learning theorists" (Merriam & Caffarella, 1991, p. 128). The internal dynamics of the learner is the focal point in this theory. Actual demonstrated behavior is not relevant and therefore, is inconsistent or not used with military education. Military educators need to witness or observe the learner accomplishing an actual task to conclude that learning has actually taken place.

The third dominant learning theory is the humanist orientation. "Humanist theories consider learning from the perspective of the human potential for growth" (Merriam & Caffarella, 1991, p. 132). The experience of learning what the individual wants to learn is important with the humanist theory.

Introduction

Learning is a skill that needs to be understood not only by educators but everyone in society. Poor learning skills that are used in an inappropriate manner can hamper an individual's ability to function and compete for scarce resources. Oftentimes learning can be a very complex task that can take a considerable amount of time to complete. Learning is also considered a form of problem solving that involves analyzing a learning task and devising a strategy appropriate for that particular situation (Derry, 1989, p. 4). Learning strategies help the individual become more productive in any learning situation.

Learning strategies are those skills that enable the individual to learn in different circumstances and environments. However, there is much confusion about the term learning strategy. The term is used to refer to specific learning tactics such as rehearsal, imaging, and outlining (Cook & Mayer 1983; Leven 1986). Fellenz & Conti (1989) defines important learning strategies for real-life learning as being composed of metacognition, metamotivation, memory, resource management, and critical thinking. Derry (1989) explains that the plan one uses for accomplishing a learning goal is a person's learning strategy. Learning strategies may be simple or complex, specific or vague, or intelligent or unwise. Obviously, some learning strategies work better than others.

Learning strategies that are used in real-life situations are considered even more important than those strategies used in the classroom environment. Sternberg (1990) calls for learning and perfecting strategies which are based in the actuality of life situations. There are several important differences between learning for real-life situations and learning for academic achievement. First, outside of the classroom, learners distinguish for themselves problems encountered in the real world as distinct from those problems identified and defined by someone such as a teacher. Second, real-life problems are usually not as well structured as those problems encountered in an academic setting. Third, most often school-related problems lack the contextualization existing in those encountered in the real world. Fourth, often in the school setting, information is given which enables the learner to work efficiently in solving problems. However, in real life it is often difficult to obtain or discover the information that would aid the learner in resolving day to day problems. Fifth, in solving real problems, one must look not only at one's own perspective for resolution of the problem but also at those arguments that might be put forward by an opposing side. Sixth, school-related problems predominantly teach learners to confirm what they already believe and understand. Seventh, good feed-back is often lacking in real-life situations; sometimes it does not come until it is

too late. Eighth, school environments teach people to work on problem solving on an individual basis. Real-life problems are quite frequently resolved by the group process of discussion.

Real-life learning situations that can be brought into the classroom can effectively bridge the gap between the artificiality of the classroom and the uncontrollable nature of real-life. This will help the instructor to examine or more closely observe the learning strategy that each student is using in a more controlled fashion. This is important because it is known that not all students learn in the same way. Teachers who consistently use different active learning strategies have a better chance of not only matching students' learning style preferences but also of strengthening the styles in which students are weak (Claxton & Murrell, 1987; Guild & Garger, 1985; Schmeck, 1988).

Educators need the skills or techniques to be able to determine what each student or adult is doing with reference to his or her own learning strategy. Learning strategies require knowledge of specific learning skills or tactics (Derry & Murphy, 1986). In addition, the educator must be sensitive enough to monitor the tactics being used by the adults in the classroom.

Learning strategies are considered to be a vital part of learning research by a number of researchers (Conti & Fellenz, 1991; McKeachie, 1988; Mayer, 1988; Weinstein,

1988). Learning strategies may improve classroom achievement" (McKeachie et al., 1989) as well as learning which takes place outside educational institutions (Fellenz & Conti, 1993; Hill, 1992, p. 38). In the area of adult education, important learning strategies for real-life learning have been defined as being composed of metamotivation, metacognition, memory, resource management, and critical thinking (Fellenz & Conti, 1989).

Metacognition

"Metacognition is popularly conceived of as thinking about the process of thinking" (Fellenz & Conti, 1989, p. 9). Metacognition includes Planning, Monitoring, and Adjusting.

Metacognitive planning focuses on the best way for one's self to proceed with a specific learning activity. Metacognitive monitoring keeps learners on the track as they learn. It reminds them of the purpose, resources, previous experiences, and of their strengths and weaknesses. Metacognitive or adjusting strategies help learners evaluate and manage their learning activities. They include revision of learning plans and change of learning strategies in light of new knowledge or greater insight into the learning task or our own learning abilities. (Conti & Fellenz, 1991, p. 66)

Thus, "it has become evident that the learner who is conscious of his or her learning processes exercises more control over those processes and becomes a more effective learner" (Conti & Fellenz, 1991, p. 66). The cognitive appreciation of one's own learning needs appears to be very important to the process of learning.

Christman (1995) has identified metacognition as consisting of three basic elements. They are developing a plan of action, maintaining/monitoring the plan, and evaluating the plan. Within each of the three elements are several specific questions that should be answered throughout the metacognitive learning process.

Metacognition consists of three basic elements

Developing a plan of action

Before - ask yourself:

1. How much time do I have to complete the task?
2. In what direction do I want my thinking to take me?
3. What should I do first?
4. Why am I reading this selection?
5. What in my prior knowledge will help me with this particular task?

Maintaining/monitoring the plan

During - ask yourself:

1. How am I doing?
2. Am I on the right track?
3. How should I proceed?
4. What information is important to remember?
5. Should I move in a different direction?
6. What do I need to do if I do not understand?
7. Should I adjust the pace depending on the difficulty?

Evaluating the plan

After - ask yourself:

1. How well did I do?
 2. What could I have done differently?
 3. How might I apply this line of thinking to other problems?
 4. Do I need to go back through the task to fill in any blanks in my understanding?
 5. Did my particular course of thinking produce more or less than I had expected?
- (Strategic Teaching and Reading Project Guidebook, 1995)

The questions concerning learning must be asked at different times in the learning process. The first step is

to develop a plan of action and to question why the learning is or should take place. Questions asked during the actual learning situation help keep the learner on the desired track and if required to guide the learner back to the desired situation. The questions asked after the learning situation has terminated are feedback type questions that should help the adult improve his or her learning process in the future.

Metamotivation

Metamotivation is the term used to describe the internal drive or force that inspires an adult to learn. It is also used to describe the strategies that a learner uses to maintain or increase his or her own motivation towards the learning situation.

The word metamotivation was used to emphasize this learner control of motivational strategies. This was also done to distinguish the traditional juncture of motivation and participation in the field of adult education from the individual's metamotivational energizing and direction given to personal learning. (Conti & Fellenz, 1991, p. 68)

The learning strategy of motivating one's self to engage the need to learn is a powerful tool that should be readily available to all adults.

"Meta" in the term metamotivation "was given to the component to identify it specifically as motivation of the individual to learn and to distinguish it from factors relating to reasons for participating in educational programs" (Fellenz & Conti, 1993, p. 10). The need to

participate in learning situations should not be related to the factors that motivate an individual to learn.

The three SKILLS metamotivation learning strategies are attention, reward/enjoyment, and confidence. Attention is the focusing of an individual's learning abilities on material to be learned. Reward/enjoyment is the motivational factor of anticipating or recognizing the value of one's self of learning specific material. Confidence is reassurance of one's efficiency and support for feelings of confidence (Conti & Fellenz, 1993).

Outside forces such as competition or the need to achieve a specific grade do not appear to be consistent with the idea of metamotivation. Adults do not like competitive class situations. "Adults do not like to be compared with others, nor do they respond well to disciplinary measures. Adults work better in cooperative, noncompetitive, non-evaluative settings" (Hiemstra, 1996, p. 5). Many adults bring a great deal of training and experience to the learning situation and have a lot of dignity to lose if they are failing.

Memory

There are many different definitions of memory, but those specifically related to learning are the most relevant concerning learning strategies. As memory research suggest (e.g., Bolles, 1988; Craik & Lockhart, 1972), memory is the deep and dynamic processing of knowledge that increases the

likelihood of recalling it later. The ability to repeatedly store, recall, and process information is a fundamentally important skill when dealing with learning strategies.

Memory, more specifically long-term memory, is a limitless storage space that holds all the information that a person has been exposed to or has experienced. The important mechanism in memory that relates to learning and performance concerns the retrieval process of data. Getting information into memory has more to do with perception. What is just as important as storing experiences is getting the experiences to resurface in order to be reused. If data are stored or organized appropriately, then it can be used in varying settings or contexts (Buriak, McNurlen, & Harper, 1996, p. 8).

The recall ability of memory or the need to retrieve information has produced different techniques that can help adults. "Adults learn more easily and recall more readily when material is 'framed' for them in ways that help them link the course material to knowledge they already have" (Michel, 1992, p. 17). Coming out of the 1970s, the field's emphasis on metamemory was energized by another set of generally replicated findings, these having special implications for strategy-based educational research (Belmont, 1989, p. 144).

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

Organization is the structuring or processing of information so that material will be better stored, retained, and retrieved. External aids is using external aids to reinforce memory. Memory application is using remembrances, mental images, or other memories to facilitate planning or problem solving. (Fellenz & Conti, 1993, p. 30)

Critical Thinking

The need to think critically in education has been seen as a necessity and a desired trait that adults should possess. "Decision making, problem solving, logic, rational thinking, or, as it is more likely to be called today, critical thinking is an aspect of education that has received intense study for centuries" (Conti & Fellenz, 1991, p. 67). Critical thinking as it pertains to learning strategies is a fairly new and inventive idea that can increase an adult's learning ability.

Brookfield has been a leader in the field of adult education in analyzing the process of critical thinking. The four components of critical thinking in Brookfield's (1987) model are (a) identifying and challenging assumptions, (b) challenging the importance of context, imagining and exploring alternatives, and (d) reflective skepticism. Brookfield also emphasized the need to apply critical thinking to real-world learning situations. The critical thinking component of SKILLS is based upon Brookfield's conceptualization.

Thus, critical thinking is a reflective process that involves a set of skills used to process and generate

information and the tendency, based on intellectual commitment, of using those skills to guide behavior (Scriven & Paul, 1996, p. 1). The need to use critical thinking in education and apply it to real world learning situations is very relevant.

Recent modern times is typified by a heightened awareness of and respect for diversity, both within and among societies. Diversity reflects difference in perspective, and all perspectives must be considered as potentially relevant for determining the future, for that future impinges on us all. And so, there is a requirement that people of all classes in every society have an intelligent appreciation of the problems facing humankind and be empowered to recommend and evaluate possible strategies for their solution. (Weinstein, 1996, p. 3)

The ability to appreciate the need for diversity on a critical level demonstrates the need for further research in the area of critical thinking and learning strategies.

Resource Management

Resource management is the "identification of appropriate resources, critical use of such sources, and the use of human resources in learning" (Fellenz & Conti, 1993, p. 3). The appropriate use of resources in an information age society is not only obvious but it is also essential. Time is a resource that cannot be wasted with a dysfunctional learning strategy. "As everyone seems to agree, not only is the amount of information increasing, but the rate of increase is itself increasing" (Weinstein, 1996, p. 2).

The three SKILLS resource management strategies are identification, critical use, and human resources.

Identification is knowing how to locate and use the best source of information. Critical use is using appropriate rather than available resources while recognizing their limitations. Human resources is integrating others into the social and political processes of learning. (Conti & Fellenz, 1993, p. 30)

Thus, the "effective selection of resources depends on both awareness of appropriate sources and confidence in one's ability to use such sources" (Conti & Fellenz, 1993, p. 30). This has a profound effect on the adult in any learning situation.

Adult Learning

"To be responsive and successful in the field of adult education today, requires the understanding of how adults learn" (Hiemstra, 1996, p. 6). Learning is indistinguishable from engagement in the world, and intellect is inseparable from experience. The definition of the seven principles of learning can guide the adult educator in the direction that is most responsive in today's society.

Principle 1. Learning is fundamentally social. An important part of what makes adults professionally successful and productive is their ability to integrate their work with their social lives.

Principle 2. Knowledge is integrated in the life of communities. United by a common enterprise, people come to develop and share ways of doing things, ways of

talking, beliefs, values--in short, practices--as a function of their joint involvement in mutual activity.

Principle 3. Learning is an act of membership. It is what enables people to enter and participate in new communities of practice, and is what enables them continually to modify their places in and contribution to the community.

Principle 4. Knowing depends on engagement in practice.

A productive lifelong learner--a person who can adapt and learn swiftly in new situations--is a person who can transform all situations into learning situations.

Principle 5. Engagement is inseparable from empowerment.

Meaningful participation in a community involves the power to affect the life of that community.

Principle 6. Failure to learn is the result of excluding from participation.

Limited privileges of participation do not entail the right to contribute and make meaning, hence do not provide opportunities for engaged learning.

Principle 7. We already have a society of lifelong learners.

People learn what enables them to participate in communities of practice--not just any communities of practice, but those that appear to them to be real, to be available, and to hold possibility for meaningful participation.

(Institute for Research on Learning, 1996, pp. 1-2).

Electronic Learning

Learning through an electronic medium is becoming more and more prevalent in our information-age society. It is incumbent upon everyone to find out how to gain access to the technology so that it can be used to do jobs better and more efficiently (Miller, 1996, p. 4). Electronic learning

is so powerful because students have the ability to seek out the information they need and have instantaneous access to that information. Self-directed learning now becomes more important than ever. Rogers (1961) wrote, "I have come to feel that the only learning which significantly influences behavior is self-discovered, self-appropriated learning" (p. 276). The Internet and electronic mail offers the unlimited access to information needed to experience self-discovered learning.

Military officers use the electronic medium everyday to learn complex information. The Air Force is using the Internet to enhance the productivity of its officers and airmen in their work environment. Air University, the Air Force's center for advanced education has put many parts of its graduate curriculum on the Internet. Electronic connections provide links or pathways to expertise of the faculty and staff in Air University institutions as well as a link to recent and ongoing scholarly and scientific research in which Air Force officers may wish to collaborate (Introduction to Air University, 1996 p. 1). The Air Force provides electronic mail access to the professors at Air University and to all of its officers. The access to the AU professors enables the officer to gain the needed information from established experts in the field of study. Officers can gain access to the experts in a relatively short amount of time.

Electronic mail is also a viable resource concerning research and access to other invaluable information. "We have found e-mail to be a much more reliable form of communication with our students, as most have e-mail as a necessary part of their program of study" (Miller, 1996, p. 2). Electronic mail is an excellent medium to distribute surveys and to gather an abundance of other related information.

Though I have been an avid user and supporter of electronic mail since I stumbled upon it by accident five years ago doing a survey and looking at other surveys conducted on e-mail have reinforced my convictions that e-mail has become an indispensable tool for international educators, if not for all educators. (Miller, 1996, p. 1)

The military uses electronic mail extensively in ways that lend itself to research.

CHAPTER 3

METHODOLOGY

Introduction

This descriptive case study investigated the relationship of learning strategies and Air Force officers who were working in the Pentagon during February, 1997.

Descriptive research involves collecting data in order to test hypotheses or answer questions concerning the current status of the subject of the study. A descriptive study determines and reports the way things are. (Gay, 1991, p. 14)

The Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS) was used to measure the learning strategies of the officers involved in this study. Additionally, the data gathered from the learning strategies instrument was used to generate four clusters of learners. Follow-up qualitative questionnaires were used to gain additional information concerning how the officers learn and the commonalties found in the different groups.

Phase 1 of this descriptive study utilized survey research techniques to investigate if learning strategies can be used to discriminate between the most successful and the least successful United States Air Force officers. Success was measured by achievement of rank and overall

ranking in professional military education. Attendance and class ranking in professional military education (PME) helped to determine the current success level of each officer who participated in this study. Promotion time to each rank level was also used as a measure of success for each officer. Learning strategies were measured with the Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS), a valid and reliable instrument (Conti & Fellenz, 1991).

Data were collected by administering SKILLS to a representative sample of Air Force officers at the Pentagon in Washington D.C. Coordination with the Department of Personnel was established with a list of names being generated of officers who meet certain qualifications. Officers who hold the rank of colonel, lieutenant colonel, or lieutenant colonel select (major) were targeted for this descriptive study. SKILLS was sent out to each participant through electronic mail with detailed instructions on how to take the test. Demographic information was also requested from each participant through the electronic mail system in the Pentagon. The demographic information was limited to data that are readily available to each officer. This was done to help avoid any confusion and frustration while still collecting all of the relevant data. A telephone number was provided so that participants could contact this researcher to answer any additional questions that they had.

Phase 2 consisted of deductive questioning through discriminant analysis. The purpose of this phase was to impose sense on the data to determine if different groupings make a difference in the learning strategies used.

With the deductive approach, researchers impose sense upon the data by asking questions of the data that are meaningful to the researcher and which the researchers bring to the study based upon their knowledge, experience, and intuition (Conti, 1996, p. 67)

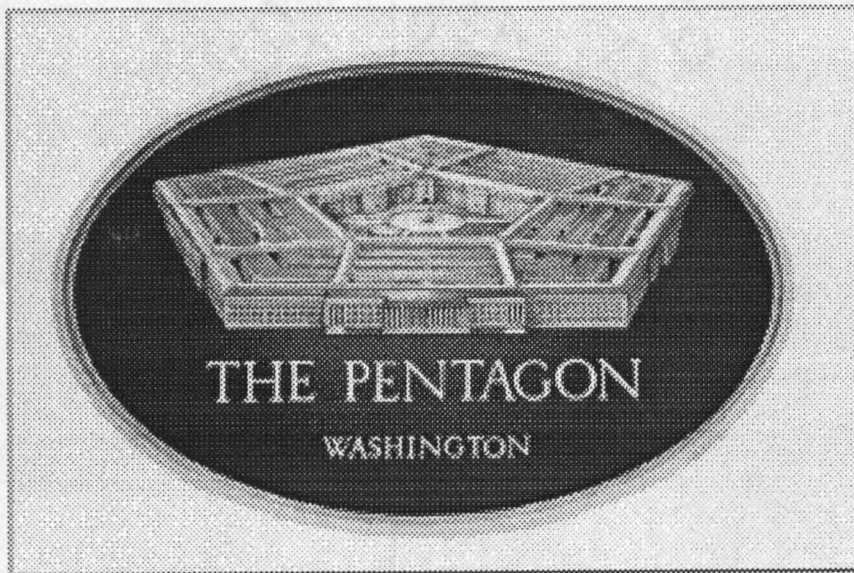
Phase 3 of this study utilized inductive questioning through cluster analysis to divide the learners into groups. Cluster analysis is a multivariate statistical procedure that seeks to identify homogenous groups or clusters in the data (Aldenderfer & Blashfield, 1984, Chapter 1). Its strength lies in its ability to examine the person in a holistic manner (Conti, 1996, p. 67). One-way analysis of variance was used to identify how each of the variables included in the cluster solution related to each cluster.

The cluster analysis identified four distinct groups of learners. To better describe those clusters, a qualitative questionnaire was sent to a random sample of participants in each of the four different clusters of learners. These questionnaires were sent through the electronic mail system at the Pentagon. Questionnaires were sent to approximately 25 officers in each cluster. The purpose of the questionnaire was to elicit responses from the participants that describe their learning patterns and preferences to determine why and how the groups differ.

The Pentagon

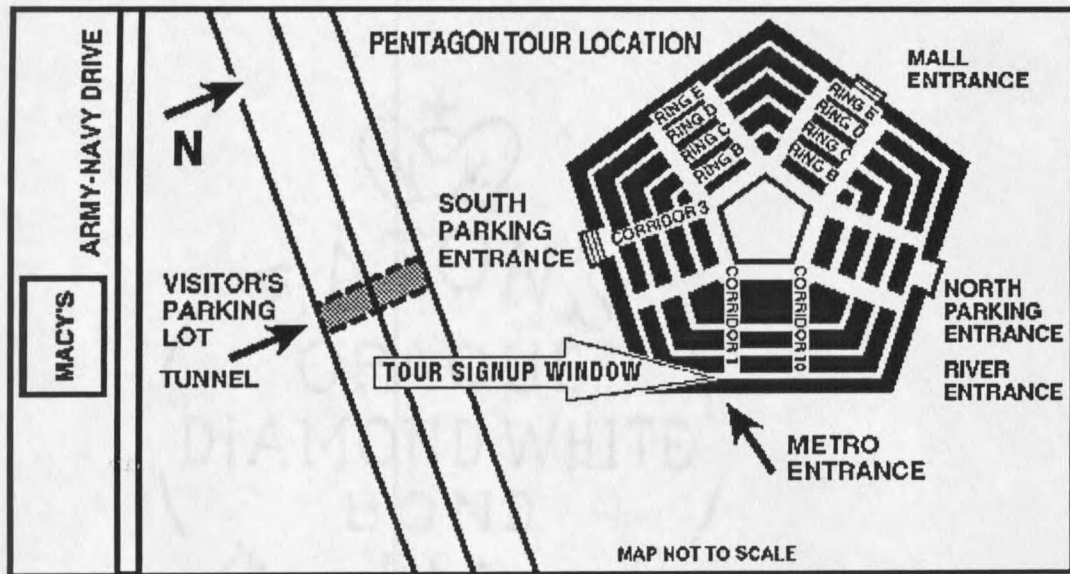
The Pentagon is the home of the Office of the Secretary of Defense and the four different branches of the military. Approximately 23,000 employees, both military and civilian, work in the Pentagon each day. It is an incredibly large building that was designed and built over 50 years ago. "It is twice the size of the Merchandise Mart in Chicago, and has three times the floor space of the Empire State Building in New York" (Smith, 1993, p. 7). Figures 1 and 2 show the layout of the Pentagon with the different levels and corridors.

Figure 2. The Pentagon



(Source: <http://www.dtic.mil/defense link/pubs/Pentagon/index.html#narrative>)

Figure 3: Pentagon Tour Location



(Source: <http://www.dtic.mil/defense/links/pubs/Pentagon/index.html#narrative>)

The Pentagon has five floors above ground and several below. It is broken down into five different rings with corridors separating each section. There are thousands of different offices throughout the building along with several cafeterias, a bank, bakery, shoe store, and several clothing stores. The Pentagon has its own police department that restricts access to the building and patrols the thousands of acres of parking lots. It is also a central hub for an underground commuter rail system and is a central bus location.

The culture of the Pentagon is very different from many organizations. To fully appreciate how different the Pentagon is, it is necessary to look at the people who work there. The military members who work in the Pentagon rotate into the area in 3-year assignments. This means that the

service member must work in the Pentagon for at least 3 years before being able to leave. Most military members are officers and predominately majors or above. Because the Pentagon is the headquarters for each branch of the military, it is very competitive to be selected to work in the Pentagon. Many consider the people who work in the Pentagon to be more talented, dedicated, and effective than in almost any other government office building in the world (Smith, 1993). A large percentage of military members who work in the Pentagon have been in the military for at least 10 years and have outstanding leadership skills and potential.

There are several thousand civilian employees who also work in the Pentagon. These government employees and contractors work in just about every possible area. The civilian employees provide continuity to the work environment because they can work their entire professional career and never leave the Pentagon (Smith, 1993).

Population

The population consisted of Air Force officers who worked at the Pentagon in Washington, D.C., during February, 1997, and who held the rank of colonel, lieutenant colonel, or lieutenant colonel select (major). This target population was approximately 600. Therefore, the sample size for this study was 305 (Krejcie & Morgan, 1970).

There were 67 majors (lieutenant colonel select), 173 lieutenant colonels, and 64 colonels who participated in the initial phase of the research. There were 44 females and 260 males. Their average age was 41.6 and ranged from 31 to 52. Concerning their prior military training, 201 participants attended Squadron Officer School (SOS) in residency, 171 attended Air Command and Staff College (ACSC) in residency, and 71 attended Air War College (AWC) in residency. The distinguished graduates were distributed as follows: SOS-64, ACSC-39, and AWC-12. Several were below the zone for promotion: Major-70, lieutenant colonel-48, and colonel-22. The average time in service was 19.3 years with a range of 10 to 27 years. The average time in grade was 3.8 years with a range of 1 to 10 years.

Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS)

Components

Self-Knowledge Inventory of Lifelong Learning Strategies is an instrument used to measure adult real-life learning strategies that has been developed by researchers at Montana State University-Bozeman (Conti & Fellenz, 1991; Lockwood, 1997). SKILLS consists of real-life learning scenarios with responses drawn from the areas of metacognition, metamotivation, memory, critical thinking, and resource management (Conti & Fellenz, 1991). Each of the five areas consists of three specific learning

strategies: Metacognition--Planning, Monitoring, and Adjusting; Metamotivation--Attention, Reward/Enjoyment, and Confidence; Memory--Organization, External Aids, and Memory Application; Critical Thinking--Testing Assumptions, Generating Alternatives, and Conditional Acceptance; and Resource Management--Identification of Resources, Critical Use of Resources, and Use of Human Resources.

SKILLS uses several different scenarios to gather information concerning the participants learning strategies. Participants are asked to read a scenario or a real-life situation that they could possibly encounter. They are then asked to answer 15 questions intended to evaluate which learning techniques or strategies they would use to resolve a particular learning task (Lockwood, 1997). The SKILLS instrument measures important parts of the adult learning process as it takes place when adults encounter real-life learning needs. "It emphasizes a process rather than a componential approach" (Lockwood, 1997, p. 123). The questions in SKILLS are used to distinguish specific applications of these 15 learning strategies.

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 on 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: Organization§structuring or processing information so that material will be better stored, retained, and retrieved.
 Examples: Elaborate or translate, image, chunk, pattern, summarize, or fit together, memory devices.

External Aids§using external aids to reinforce memory.

Examples: Write down or list, put or display, ask another to remind.

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 reflective thinking process utilizing higher order thinking skills in order to improve learning.

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.

Table 2. Continued.

Conditional Acceptance#reflective and tentative maintenance of principles.

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

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: Contract 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 other. (Fellenz & Conti, 1993)

Scoring

Participants are asked to divide the 15 strategies into three equal categories. They must select those that they would Definitely Use, Possibly Use, and Not Likely Use.

Scores on the instrument are determined by giving 3 points to each strategy chosen for definite use, 2 points for those marked probably use, and 1 point for those not likely to be used. Points for each of the 15 strategies on the four selected scenarios are summed to give a total score for

each strategy. These total scores for each strategy can also be added to determine the degree to which each strategy area is used over the four scenarios. (Fellenz & Conti, 1993, p. 2)

Thus, the possible range of SKILLS scores for the learning strategy areas range from 12 to 36. Likewise, the individual component learning strategies have a range of 4 to 12.

Validity and Reliability

Validity is the "degree to which a test measures what it is supposed to measure and, consequently, permits appropriate interpretation of scores" (Gay, 1996, p. 138). For SKILLS, "numerous pilot and field tests of the developing inventory were also conducted using a variety of groups of adults. Finally, the instrument was presented to practicing adult educators at a variety of state, regional, and national conferences. Through these processes, the reliability, validity, and usefulness of SKILLS was determined" (Fellenz, 1991, p. 6).

"Construct validity is the degree to which a test measures an intended hypothetical construct" (Gay, 1996, p. 140). "Construct validity for SKILLS was established through a literature review which documented the source of the concepts in SKILLS" (Conti & Fellenz, 1991). "When selecting a test of a given construct, the researcher must look for and critically evaluate evidence presented related

to the construct validity of the instrument" (Gay, 1996, p. 141).

"Content validity is the degree to which the sample of test items represents the content that the test is designed to measure" (Borg & Gall, 1989, p. 250). Additionally, content validity "requires both item validity and sampling validity" (Gay, 1996, p. 139). Content validity of the SKILLS instrument was field tested in numerous settings including adult basic education programs, undergraduate and graduate university courses, museums, health-care providers, continuing education programs, and elderhostel programs (Conti & Fellenz, 1991). In the field tests, a sample set of 253 participant responses confirmed the assessment of the group of adult educators previously mentioned above that the items in SKILLS adequately represented the five conceptual areas of the instrument (p. 70). Sternberg, McKeachie, and a group of adult educators also confirmed the content validity of SKILLS using a similar assessment process as that performed in regards to construct validity.

"Reliability may be defined as the level of internal consistency or stability of the measuring device over time" (Borg & Gall, 1989, p. 257). Reliability for the SKILLS instrument was addressed by calculating a coefficient based on two equivalent forms administered to the same group. "Equivalent-forms reliability is the most commonly used estimate for reliability for most tests used in research"

(Gay, 1996, p. 147). The Cronbach alpha coefficient of the scores was .71. The split-half test of reliability was computed using the Guttman method with a resulting .83 correlation. Another .83 correlation was obtained by applying the Spearman-Brown formula. After statistical analysis was completed, it was determined that all correlations were in the acceptable range and that SKILLS is "a reliable instrument for assessing adult learning strategies in real-life situations" (Conti & Fellenz, 1991, p. 7).

Procedures

The Pentagon electronic mail (email) system was used to administer SKILLS to the participants in the research. Assurances were provided to each participant that the information gathered from the demographic questionnaire and the SKILLS instrument would not be released without their consent. Each participant was also assured that their cooperation was on a volunteer basis and they could discontinue participation at anytime during the research.

A demographic questionnaire was administered at the time of the initial SKILLS assessment of officers. The purpose of this questionnaire was to gather demographic information related to age, gender, rank, educational background, promotion history, time in service, and time at current rank. Completion of professional military education

through correspondence and in residency status was also included. This data provided the intake interviewer with needed information for further discussion and evaluation.

A total of 305 packets were distributed over the email system at the Pentagon. Each packet contained a cover letter explaining the purpose of the study, a demographic intake sheet, and the SKILLS instrument. All but one packet was returned over the same email system; this provided a return rate of 99.7%. Thus, a total of 304 officers participated in the study. The packet of information was sent to each participant from a civilian computer system and returned to that same civilian system.

Cluster analysis was conducted to uncover distinct groups of learners in the sample. The analysis identified four clusters. Questionnaires were emailed to a cross-section of each learning cluster almost immediately following the administering of the SKILLS instrument. Approximately 25 officers in each cluster were sent these questionnaires.

For this study, four of the original SKILLS scenarios were changed to fit the context of the learning environment an Air Force officer could possibly encounter. Minor word substitutions helped participants focus on the SKILLS scenarios and potentially maintain a higher level of interest throughout the application of the instrument. As with other studies using SKILLS, "since these scenarios used

the same basic format as SKILLS for the scenario and responses and since they were based on the real-life situations of the participants, it was assumed that the word changes did not affect the scenarios' validity" (McKenna, Conti, & Fellenz, 1994, p. 261). Scenarios that focused on a letter to the commander, recruiting leaders, putting a heads up display together, and job regulations all lend themselves to the functionality of an officers' work related routine. "The validity and reliability checks on the scenarios created for this study support the use of this approach" (McKenna, Conti, & Fellenz, 1994, p. 263).

The situations in each of the revised scenarios are familiar to Air Force officers. A letter to the commander was chosen because oftentimes written correspondence is the primary means of communication from one office to another. It is safe to assume that every officer in the Pentagon has at one time or another written a letter to their commander. The Air Force is comprised of officer leaders, and many jobs are recruited for to fill a vacancy. Recruitment of leaders takes place on a continuous basis and is accomplished by every officer. All of the current fighter aircraft as well as several of the larger transport aircraft in the Air Force inventory utilize a heads up display. The modernization of aircraft is also currently taking place so many maintenance officers and most pilots deal with heads up displays on a routine basis. The Air Force is governed by regulatory

requirements with just about every function being documented and controlled. Regulations must be referenced and used to ensure their compliance. Thus, these four scenarios are common to almost all of the participants in the research and lend themselves to the application of SKILLS.

CHAPTER 4

QUANTITATIVE FINDINGS

Introduction

Data were collected from three sources. These were the Self-Knowledge Instrument for Lifelong Learning Survey (SKILLS), a demographic survey, and email data derived from questionnaire responses. A total of 305 SKILLS packets were distributed with 304 packets being completed for use in this study. Statistical analysis included frequency counts, one-way analysis of variance, discriminant analysis, and cluster analysis.

Learning Strategy Scores

The Self-Knowledge Inventory of Lifelong Learning Strategies (SKILLS) instrument was developed to investigate learning strategies in adult real-life learning situations. The staff at the Center for Adult Learning Research at Montana State University developed the SKILLS instrument "since no instrument currently existed to measure adult learning strategies in real-life learning situations" (Conti & Fellenz, 1991, p. 65). SKILLS consists of several different scenarios with 15 items in each scenario. For this study, four of the

original scenarios were altered to aid in the testing of the learning strategies utilized by Air Force officers. All participants of the study took the same four scenarios. Two different sets of scores were calculated from data gathered by the SKILLS instrument. One set of scores was for the five learning strategy areas. The other set was for the 15 individual learning strategies. A profile of the officers was established from the information gathered in the study.

Scores were computed for each of the five learning strategy areas included in the instrument. The learning strategy scores for the areas of Metacognition, Metamotivation, Memory, Critical Thinking, and Resource Management are listed in Table 3. The possible range of SKILLS scores for the learning strategy areas range from 12 to 36 and the individual component learning strategies range from 4 to 12. All of the means fell within the range of 22.96 (Memory) to 24.77 (Metamotivation). Thus, all of the mean scores for the learning strategy areas were near the middle of the possible range. Scores in Metacognition (23.94) and Critical Thinking (23.63) were for the most part in between Metamotivation, Memory, and Resource Management. The scores indicated that officers tended to use the learning areas of Metamotivation and Resource Management slightly more often than Critical Thinking or Memory. Although each of the learning strategies areas had a fairly wide range, the standard deviations for the areas were small indicating that

the scores tended to cluster near the mid-point of the range. Since the scores of the five specific learning areas of Metacognition, Metamotivation, Memory, Critical Thinking, and Resource Management were in such a narrow range, further analysis of these larger groups was not performed. Instead, the 15 individual learning strategies were used in additional analysis.

Table 3. Means of SKILLS Learning Strategy Areas.

Learning Strategy	Mean	<u>SD</u>	Range
Metamotivation	24.77	2.83	15-30
Resource Management	24.59	2.87	15-32
Metacognition	23.94	2.69	18-31
Critical Thinking	23.63	3.21	14-31
Memory	22.96	2.71	18-32

The 15 learning strategy area scores were computed for the participants of this study. Individual learning profiles were generated for each participant. Means of the individual learning strategies ranged from 7.20 for Critical Thinking Conditional Acceptance to 9.23 Metamotivation Attention. The Resource Management area strategy of Identification of Resources was the only strategy that had a range of other than 4-12 with a range of 5-12.

Learning strategies used most by the officers in this study were Metamotivation Attention (9.23), Metacognition

Planning (9.06), and Resource Management Identification of Resources (9.09). Metamotivation Reward/Enjoyment (8.23) and Critical Thinking Testing Assumptions (8.78) were the next highest scores recorded from the SKILLS instrument. The lowest scores were Critical Thinking Conditional Acceptance (7.20), Metacognition Monitoring (7.47) and Adjusting (7.41), and Metamotivation Confidence (7.31). No other notable deviations in the learning areas of the remaining learning areas were noted.

Table 4. Means of Individual Learning Strategies.

Learning Strategy	Mean	SD	Range
Metacognition			
Planning	9.06	1.71	4-12
Monitoring	7.47	1.77	4-12
Adjusting	7.41	1.93	4-12
Metamotivation			
Attention	9.23	1.70	4-12
Reward/Enjoyment	8.23	1.66	4-12
Confidence	7.31	1.81	4-12
Memory			
Use of External Aids	7.71	1.97	4-12
Organization	7.70	1.91	4-12
Memory Applications	7.55	1.84	4-12
Critical Thinking			
Testing Assumptions	8.78	1.66	4-12
Generating Alternatives	7.65	1.93	4-12
Conditional Acceptance	7.20	1.90	4-12
Resource Management			
Identification of Resources	9.09	1.56	5-12
Critical Use of Resources	7.79	1.77	4-12
Use of Human Resource	7.71	1.95	4-12

Discriminant Analysis

Discriminant analysis is "a statistical technique which allows the investigation of the differences between two or more groups in relationship to several variables simultaneously" (Klecka, 1980, p. 7). In discriminant analysis as with other multivariate techniques, the emphasis is upon analyzing the variables together rather than singly. In this way, the interaction of multiple variables can be considered. "Discriminant analysis is useful when known and distinct groups exist" (Conti, 1993, p. 91).

Unlike univariate analyses which examine individual variables separately and allow them to be disassociated from the total person who is a synergistic composition of these variables, discriminant analysis examines people on a set of variables to determine if any of them interact in a combination that can explain the person's placement in the group (p. 91).

The results of discriminant analysis can be used in research for the prediction of group membership and to describe the way groups differ (Huberty & Barton, 1989).

While a discriminant function is produced, it may not be useful. The structure matrix is used to clarify and name the function (Conti, 1993, p. 91; Klecka, 1980, pp. 31-34).

Researchers that have used discriminant analysis have indicated that these functions should be describable using structure coefficients with a value of .30 or greater (Conti, 1993; Hays, 1995; Hill, 1992; Kolody, 1997; Lockwood, 1997; Moretti, 1994; Strakal, 1995; Yabui, 1993).

Grouping by Rank

Discriminant analysis was used to describe the combination of variables that could be used to distinguish between the majors (lieutenant colonel selects), lieutenant colonels, and colonels who participated in the study. For purposes of analysis, the 304 respondents were placed in three groups. One group of 67 contained individuals who were majors (lieutenant colonel select) at the time of the administration of the SKILLS instrument. The second group of 173 was made up of those officers who had been promoted to lieutenant colonel, and the third group was made up of 64 officers who had attained the rank of colonel.

Two criteria were used for judging the hypothesis that it is possible to discriminate between the different officer ranks. The first criterion was the discriminant function produced by the analysis had to be describable using the structure coefficients with a value of .30 or greater. The second criterion was that the discriminant function had to correctly classify at least one-half of the cases beyond the chance placement that might occur in the groups (Kolody, 1997, p. 69).

The first criterion was necessary because the formula for discriminant analysis produces a discriminant function regardless of whether the function is meaningful. The structure matrix contains the coefficients which show the similarity between each individual variable and the overall

discriminant function. If several of the variables do not have a coefficient of at least .3, it is impossible to discern the meaning of the function. In analyses which use a large number of variables, it is possible to get functions which have high predictive ability but which correlate with so many of the variables that it is impossible to decipher the meaning of the function (Hill, 1992). Therefore, this criterion places a logical restriction on the interpretation of the statistical output which requires that it must be clear before it is judged useful (Conti, 1993, p. 93; Kolody, 1997, p. 69).

The second criterion demands that the discriminant function account for a large amount of variance before it was judged useful. Since this analysis contained three groups, the percentage of correct classification of cases into a group if placements were made randomly was 33.3%. The evaluation requires that the discriminant function account for at least one-half of the remaining variance (or 33.3%) plus the chance placement of 33.3%. Thus, the criterion for being judged useful in this analysis was a correct placement of 66.6%.

For purposes of the discriminant analysis, the respondents were divided in three groups according to rank. The set of discriminating variables used to predict placement in these groups consisted of all 15 learning strategies which included Planning, Monitoring, Adjusting, Attention, Reward/Enjoyment, Confidence, Organization, Using External Aids, Memory Application, Testing Assumptions, Generating

Alternatives, Conditional Acceptance, Identification of Resources, Critical Use of Resources, and Using Human Resources. The attributes used to distinguish among groups are called discriminating variables" (Lockwood, 1997, p. 132) "These variables must be measured at the interval or ratio level, so that means and variances can be calculated" (Klecka, 1980, p. 9). The same set of 15 discriminating variables was used in all of the discriminant analyses performed.

The pooled within-groups correlations are the correlations for the variables with the respondents placed in their respective program group of either majors, lieutenant colonel, or colonel. A pooled within-groups correlation matrix "is obtained by averaging the separate covariance matrices for all groups and then computing the correlation matrix" (Norusis, 1988, p. B-5). The pooled within-groups correlation matrix of discriminating variables was examined because interdependencies among variable is important in most multivariate analyses (Klecka, 1980, pp. 31-32). "That is, in order for multiple variables to be included in an analysis, they should not be sharing variance; a high correlation indicates that variables are indeed accounting for the same variance" (Lockwood, 1997, p. 135). The within-group matrix reveals how the discriminant function is related to the variables within each group in the analysis.

The examination of the 105 coefficients in this analysis showed that all were at a sufficiently weak level to retain

the variables in the analysis. There were no coefficients at the .5 or .4 level; 5 were at the .3 level; 9 were at the .2 level, and the remaining 91 were below the .2 level. Consequently, the variables in this discriminant analysis were not related to each other and were not sharing a common variance.

Stepwise selection was used to distinguish the majors (lieutenant colonel selects), lieutenant colonels, and colonels who participated in the study. Stepwise procedures produce an optimal set of discriminating variables. "One way to eliminate unnecessary variables is by using a stepwise procedure to select the most useful discriminating variables" (Klecka, 1980, p. 53). Wilk's lambda was chosen for this analysis because it takes into consideration both the differences between the groups and the cohesiveness within the groups (p. 54). Because of its approach to variable selection, Wilk's lambda is commonly used in discriminant analysis studies in education. As a result of this stepwise procedure, seven variables were included in each of the two discriminant functions. The following discriminating variables and their corresponding Wilk's lambda values were selected: Memory Application (.99), Organization (.97), Attention (.96), Planning (.94), External Aids (.94), Confidence (.93), Use of Human Resources (.92). The other eight variables included in the analysis did not account for enough variance to be included in the discriminant function.

Standardized discriminant function coefficients are used to determine which variables contribute most to the discrimination between groups. By examining the standardized coefficients, the relative importance of each variable to the overall discriminant function can be established. Because there were three groups, two discriminant functions were produced. The standardized coefficients for the first function which discriminated the majors (lieutenant colonel selects), lieutenant colonels, and the colonels were as follows: Planning (.48), Attention (.09), Confidence (.34), Organization (-.67), External Aids (.55), Memory Application (.71), Use of Human Resources (.44). The standardized coefficients for second function which discriminated the majors (lieutenant colonel selects), lieutenant colonels, and the colonels were as follows: Planning (.65), Attention (-.78), Confidence (-.38), Organization (.43), External Aids (-.01), Memory Application (-.02), Use of Human Resources (.14).

Another indicator of effectiveness of the discriminant function is the actual discriminant scores in the group (Norusis, 1988). Separation between the groups is defined by the eigenvalue. The eigenvalue is the statistic that gives the ratio of the between-groups sums of squares to the within-groups sums of squares. When there are more than two groups in the analysis, "the function with the largest eigenvalue is the most powerful discriminator, while the function with the smallest eigenvalue is the weakest" (Klecka, 1980, p. 34). In

this analysis, there were three groups, and therefore two functions were produced. Here the eigenvalue was .07 and .03, which are low values for classification into program groups.

The discriminant functions which were used to classify the cases were as follows:

Function 1: $D = .27 (\text{Planning}) + .52 (\text{Attention}) + .19 (\text{Confidence}) - .35 (\text{Organization}) + .28 (\text{External Aids}) + .39 (\text{Memory Application}) + .22 (\text{Use of Human Resources}) - 8.49.$

Function 2: $D = .87 (\text{Planning}) - .46 (\text{Attention}) - .21 (\text{Confidence}) + .23 (\text{Organization}) - .41 (\text{External Aids}) - .11 (\text{Memory Application}) + .69 (\text{Use of Human Resources}) + .17.$

The group centroid "represents the typical position for the group" (p. 16) and is the average value of all the cases in the group (p. 22). The group centroid for Function 1 was -.20 for majors, .19 for lieutenant colonels, and -.30 for colonels. For Function 2 the group centroid was -.30 for majors, .02 for lieutenant colonels, and .25 for colonels.

"To summarize the relationship between groups and the discriminant function, the canonical correlation is used" (Lockwood, 1997, p. 137). The canonical correlation is a "measure of association which summarizes the degree of relatedness between the groups and the discriminant function. A value of zero denotes no relationship at all, while large numbers (always positive) represent increasing degrees of association with 1.0 being the maximum" (Klecka, 1980, p. 36). The canonical correlation was .21 for Function 1 and .18 for Function 2. When this is squared, it indicates that the

groups explained only 4.4% and 3.2% of the variation in the discriminant function.

The percentage of cases correctly classified shows how accurate the discriminant function was in grouping the respondents. This discriminant analysis was 42.6% accurate in classifying cases. It correctly placed 29 officers (43.3%) in the major (lieutenant colonel selects), 50 officers (42.2%) in the lieutenant colonel group, and 27 officers (42.2%) in the colonel group. Since there was a 33% likelihood of correct placement in one of the three groups, this discriminant function was only a 9% improvement over chance in predicting group placement over chance. The minimum criterion that was established for accepting the discriminant function as useful was a 66.6% accuracy rate for placement. Consequently, it demonstrates that officers in the rank of major (lieutenant colonel selects), lieutenant colonel group, and in the colonel group cannot be distinguished on the basis of their preference for learning strategies.

The structure matrix contains the coefficients which show the similarity between each individual variable and the total discriminant function. "The variables with the highest coefficients have the strongest relationship to the discriminant function" (Kolody, 1997, p. 76). These coefficients are used to name the discriminant function because they show the relationship the variable and the overall discriminant function. In descriptive studies in the

social sciences, this is the most important use of the discriminant functions. This is the information that allows for the naming of the process that distinguishes the groups from each other. "Since the overall purpose of discriminant analysis is to describe the phenomenon that discriminates the groups from each other, this logical process of giving meaning to the discriminant function by interpreting the structure matrix is central and critical to the whole process" (Kolody, 1997, p. 76). Variables with coefficients of approximately .3 and above are generally used in the interpretation (Conti, 1996, p. 93).

Three variables found in Function 1 of the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: Memory Application (.51), External Aids (.44), and Organization (-.38). Four variables found in Function 2 of the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: Attention (-.59), Organization (.40), Confidence (-.34), and Planning (.31). However, because of the low percentage of variance explained by the discriminant function and the lack of accuracy in classification, the discriminant function was not named. Naming of the function was not done because "one need not pursue further analysis of any functions which are eliminated" (Klecka, 1980, p. 41).

A discriminant analysis was calculated to examine if rank could be distinguished based on SKILLS usage of learning strategy scores for Air Force officers. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use learning strategies to discriminant between groups categorized by rank.

Grouping by Gender

To determine if learning strategy usage differed between the gender of officers, the participants of this study were divided into male and female groupings. A second discriminant analysis investigated the relationship of SKILLS learning strategies and gender groups. As in the previous analysis, the pooled-within correlation matrix of predictors was examined to determine how the 15 discriminating variables within each of the groups were interrelated. Examination of the 105 coefficients in this analysis showed that they were at a sufficiently weak level to retain all the variables in the analysis. There were no coefficients at the .5 or .4 level; 5 were at the .3 level; 12 were at the .2 level, and the remaining 88 were below the .2 level. Consequently, the variables in this discriminant analysis were not related to each other and were not sharing a common variance.

Stepwise selection was used to determine if any of the discriminating learning strategy variables discriminated among gender groups. As a result of this stepwise procedure, three variables were included in the discriminant function. The following discriminating variables and their corresponding Wilk's lambda values were included: Test Assumptions (.99), Reward/Enjoyment (.98), and Memory Application (.98). The other 12 discriminating variables in the analysis did not account for enough variance to be included in the discriminant function.

Standardized discriminant function coefficients generated by the discriminant analysis explain which of the discriminating variables contributed most to the discrimination among gender. The standardized coefficients which discriminated the males and females were as follows: Reward/Enjoyment (.54), Memory Application (.48), Test Assumptions (-.75).

The discriminant function which was used to classify the cases and which can serve as guide for predicting future placement of respondents into these groups was as follows:

$$D = .33 (\text{Reward/Enjoyment}) + .26 (\text{Memory Application}) - .45 (\text{Test Assumptions}) - .69.$$

The group centroid for the gender group was .05 for males and -.32 for females. The eigenvalue for gender was .02 which produced low canonical correlations between the groups. The canonical correlation for gender was .13. When this correlation is squared, it could account for only 1.7% of the

variance due to the group by gender. This weak eigenvalue reveals that the function is not powerful in discriminating between the grouping of officers by gender.

The percentage of cases correctly classified shows how accurate the discriminant function was in grouping the respondents. This discriminant analysis was 57.6% accurate in classifying cases. It correctly placed 140 officers (53.8%) in the male group, and 27 officers (61.4%) in the female group. Since there was a 50% likelihood of correct placement in one of the two groups, this discriminant function was only a 7.6% improvement over chance in predicting group placement over chance. The minimum criterion that was established for accepting the discriminant function as useful was a 75% accuracy rate for placement. Consequently, it demonstrates that male and female officers cannot be distinguished on the basis of their preference for learning strategies.

Three variables in the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: Test Assumptions (-.72), Memory Application (.51), and Reward/Enjoyment (.41). However, because of the low percentage of variance explained by the discriminant function and the lack of accuracy in classification, the discriminant function was not named.

A discriminant analysis was calculated to examine if gender could be distinguished based on SKILLS usage learning

strategy scores of Air Force officers. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use learning strategies to discriminate between groups categorized by gender.

Grouping by Attendance at
Squadron Officer School (SOS)

To determine if learning strategy usage differed between those officers based upon how they attended Squadron Officer School, the participants of this study were divided into three groups. The first group was those officers who attended SOS in residency, the second group was those officers who completed SOS through correspondence, and the third group was comprised of those officers who completed SOS by correspondence and residency. A third discriminant analysis investigated the relationship of SKILLS learning strategies and SOS groups. As in the previous two analysis, the pooled-within correlation matrix of predictors was examined to determine how the 15 discriminating variables within each of the groups were interrelated. Examination of the 105 coefficients in this analysis showed that they were at a sufficiently weak level to retain all the variables in the analysis. There were no coefficients at the .5 or .4 level; 5 were at the .3 level; 19 were at the .2 level, and

the remaining 81 were below the .2 level. Consequently, the variables in this discriminant analysis were not related to each other and were not sharing a common variance.

Stepwise selection was used to determine if any of the discriminating learning strategy variables discriminated among professional military education graduate groups. As a result of this stepwise procedure, six variables were included in the discriminant function. The following discriminating variables and their corresponding Wilk's lambda values were included: Critical Use of Resources (.97), Planning (.95), Identification of Resources (.94), Memory Application (.92), Conditional Acceptance (.91), and Monitoring (.90). The other nine discriminating variables in the analysis did not account for enough variance to be included in the discriminant function.

Standardized discriminant function coefficients generated by the discriminant analysis explain which of the discriminating variables contributed most to the discrimination among SOS attendance. The standardized coefficients for Function 1 were Planning (.61), Monitoring (-.39), Adjusting (.34), Memory Application (.28), Conditional Acceptance (-.40), Identification of Resources (-.01), and Use of Human Resources (-.39). The standardized coefficients for Function 2 were Planning (.13), Monitoring (-.10), Adjusting (.01), Memory Application (.60), Conditional Acceptance (.23),

Identification of Resources (.91), Use of Human Resources (.32).

The discriminant functions which were used to classify the cases were as follows:

Function 1: $D = .36$ (Planning) - $.22$ (Monitoring) + $.17$ (Adjusting) + $.15$ (Memory Application) - $.21$ (Conditional Acceptance) - $.009$ (Identification of Resources) - $.22$ (Use of Human Resources) - $.68$.

Function 2: $D = .08$ (Planning) - $.06$ (Monitoring) + $.003$ (Adjusting) + $.32$ (Memory Application) + $.12$ (Conditional Acceptance) + $.59$ (Identification of Resources) + $.18$ (Use of Human Resources) - 10.38 .

The group centroid for Function 1 was .40 for those officers who attended SOS in residency only, -.29 for officers who completed SOS by correspondence only, and -.11 for those officers who completed SOS by correspondence and residency. The group centroid for Function 2 was .06 for those officers who attended SOS in residency only, .16 for officers who completed SOS by correspondence only, and -.25 for those officers who completed SOS by correspondence and residency.

In this analysis, there were three groups and therefore two functions produced. Here the eigenvalues were .09 and .03, which are low values for classification into program groups. The canonical correlation was .29 for Function 1 and was .17 for Function 2. When this is squared, it indicates that the groups explain only 8.4% and 2.9% of the variation in the discriminant function. This weak eigenvalue reveals that the function was not powerful in discriminating between the grouping of officers by attendance at Squadron Officer School.

The percentage of cases correctly classified shows how accurate the discriminant function was in grouping the respondents. This discriminant analysis was 46.3% accurate in classifying cases. It correctly placed 59 officers (57.3%) in the SOS by correspondence only group, 51 officers (47.2%) in the SOS by residency only group, and 32 officers (34.4%) in the SOS by correspondence and residency group. Since there was a 33% likelihood of correct placement in one of the three groups, this discriminant function was only a 13% improvement over chance in predicting group placement over chance. The minimum criterion that was established for accepting the discriminant function as useful was a 66.6% accuracy rate for placement. Consequently, it demonstrates that officers who attended Squadron Officer School in residency, those who completed it through correspondence, and those who combined these cannot be distinguished on the basis of their preference for learning strategies.

Five variables found in Function 1 of the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: Planning (.56), Use of Human Resources (-.56), Conditional Acceptance (.41), Monitoring (-.37), and Attention (.30). Three variables found in Function 2 of the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: Identification of Resources

(.78), Confidence (-.34), and Memory Application (.32).

However, because of the low percentage of variance explained by the discriminant function and the lack of accuracy in classification, the discriminant function was not named.

A discriminant analysis was calculated to examine if the attendance pattern at Squadron Officer School could be distinguished based on SKILLS usage learning strategy scores of Air Force officers. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use learning strategies to discriminate between groups categorized by SOS attendance.

Grouping by Attendance at Air Command and Staff College

To determine if learning strategy usage differed between those officers based upon how they attended Air Command and Staff College in residency, the participants of this study were divided into three groups. The first group was those officers who attended ACSC in residency, the second group was those officers who completed ACSC through correspondence, and the third group was comprised of those officers who completed ACSC by correspondence and residency. A forth discriminant analysis investigated the relationship of SKILLS learning strategies and ACSC groups. As in the previous three analysis, the pooled-within correlation

matrix of predictors was examined to determine how the 15 discriminating variables within each of the groups were interrelated. Examination of the 105 coefficients in this analysis showed that they were at a sufficiently weak level to retain all the variables in the analysis. There were no coefficients at the .5 or .4 level; 4 were at the .3 level; 17 were at the .2 level, and the remaining 84 were below the .2 level. Consequently, the variables in this discriminant analysis were not related to each other and were not sharing a common variance.

Stepwise selection was used to determine if any of the discriminating learning strategy variables discriminated among professional military education graduate groups. As a result of this stepwise procedure, six variables were included in the discriminant function. The following discriminating variables and their corresponding Wilk's lambda values were included: Confidence (.96), Memory Application (.95), Attention (.93), Adjusting (.92), Planning (.91), and Use of Human Resources (.90). The other nine discriminating variables in the analysis did not account for enough variance to be included in the discriminant function.

Standardized discriminant function coefficients generated by the discriminant analysis explain which of the discriminating variables contributed most to the discrimination among ACSC attendance. The standardized coefficients for Function 1 were Planning (.56), Adjusting

(.29), Attention (-.24), Confidence (.91), Memory Application (-.02), Test Assumptions (.41), and Use of Human Resources (.52). The standardized coefficients for Function 2 were Planning (-.04), Adjusting (.63), Attention (.74), Confidence (.36), Memory Application (.65), Test Assumptions (-.23), and Use of Human Resources (.12).

The discriminant functions which were used to classify the cases was as follows:

Function 1: $D = .33 (\text{Planning}) + .15 (\text{Adjusting}) - .14 (\text{Attention}) + .51 (\text{Confidence}) - .01 (\text{Memory Application}) + .24 (\text{Test Assumptions}) + .27 (\text{Use of Human Resources}) - 10.64.$

Function 2: $D = .32 (\text{Adjusting}) - .02 (\text{Planning}) + .44 (\text{Attention}) + .20 (\text{Confidence}) + .36 (\text{Memory Application}) - .13 (\text{Test Assumptions}) + .07 (\text{Use of Human Resources}) - 9.80.$

The group centroid for Function 1 was -.9 for those officers who attended ACSC in residency only, 1.1 for officers who completed ACSC by correspondence only, and -.04 for those officers who completed ACSC by correspondence and residency. The group centroid for Function 2 was .23 for those officers who attended ACSC in residency only, .07 for officers who completed ACSC by correspondence only, and -.20 for those officers who completed ACSC by correspondence and residency.

In this analysis, there were three groups and therefore two functions produced. Here the eigenvalue was .07 and .04, which are low values for classification into program groups. The canonical correlation was .26 for Function 1 and .21 for Function 2. When this is squared, it indicates that the

groups explain only 6.8% and 4.4% of the variation in the discriminant function. This weak eigenvalue reveals that the function was not powerful in discriminating between the grouping of officers by attendance at Squadron Officer School.

The percentage of cases correctly classified shows how accurate the discriminant function was in grouping the respondents. This discriminant analysis was 55.3% accurate in classifying cases. It correctly placed 63 officers (57.3%) in the ACSC by correspondence only group, 12 officers (70.6%) in the ACSC by residency only group, and 72 officers (46.8%) in the ACSC by correspondence and residency group. Since there was a 33% likelihood of correct placement in one of the three groups, this discriminant function was a 22.3% improvement over chance in predicting group placement over chance. The minimum criterion that was established for accepting the discriminant function as useful was a 66.6% accuracy rate for placement. Consequently, it demonstrates that officers who attended Air Command and Staff College in residency and those who completed it through correspondence cannot be distinguished on the basis of their preference for learning strategies.

Two variables found in Function 1 of the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: Confidence (.69), and Memory Application (-.41). Four variables found in Function 2 of the

structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: Memory Application (.38), Adjusting (.45), Attention (.45), and Test Assumptions (-.37). However, because of the low percentage of variance explained by the discriminant function and the lack of accuracy in classification, the discriminant function was not named.

A discriminant analysis was calculated to examine if attendance or completion of Air Command and Staff College could be distinguished based on SKILLS usage learning strategy scores of Air Force officers. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use learning strategies to discriminate between groups categorized by ACSC attendance.

Grouping by Attendance at Air War College

To determine if learning strategy usage differed between officers based upon how they attended Air War College (AWC), the participants of this study were divided into three groups. The first group was those officers who attended AWC in residency, the second group was those officers who completed AWC through correspondence, and the third group was comprised of those officers who completed AWC by correspondence and residency. A fifth discriminant analysis investigated the relationship of SKILLS learning

strategies and AWC groups. As in the previous four analyses, the pooled-within correlation matrix of predictors was examined to determine how the 15 discriminating variables within each of the groups were interrelated. Examination of the 105 coefficients in this analysis showed that they were at a sufficiently weak level to retain all the variables in the analysis. There were no coefficients at the .5 or .4 level; 6 were at the .3 level; 16 were at the .2 level, and the remaining 83 were below the .2 level. Consequently, the variables in this discriminant analysis were not related to each other and were not sharing a common variance.

Stepwise selection was used to determine if any of the discriminating learning strategy variables discriminated among professional military education graduate groups. As a result of this stepwise procedure, six variables were included in the discriminant function. The following discriminating variables and their corresponding Wilk's lambda values were included: Attention (.97), Confidence (.95), Test Assumptions (.93), Adjusting (.92), Memory Application (.90), and Organization (.89). The other nine discriminating variables in the analysis did not account for enough variance to be included in the discriminant function.

Standardized discriminant function coefficients generated by the discriminant analysis explain which of the discriminating variables contributed most to the

discrimination among AWC attendance. The standardized coefficients for Function 1 were Monitoring (.33), Adjusting (.38), Attention (.80), Confidence (.55), Organization (.50), Memory Application (.27), and Test Assumptions (.11). The standardized coefficients for Function 2 were Monitoring (-.29), Adjusting (.45), Attention (.04), Confidence (.49), Organization (-.30), Memory Application (.56), and Test Assumptions (.80).

The discriminant functions which were used to classify the cases were as follows:

Function 1: $D = .16 (\text{Monitoring}) + .20 (\text{Adjusting}) + .46 (\text{Attention}) + .31 (\text{Confidence}) + .26 (\text{Organization}) + .15 (\text{Memory Application}) + .07 (\text{Test Assumptions}) - 13.13.$

Function 2: $D = .24 (\text{Adjusting}) - .17 (\text{Monitoring}) + .02 (\text{Attention}) + .28 (\text{Confidence}) - .16 (\text{Organization}) + .31 (\text{Memory Application}) + .50 (\text{Test Assumptions}) - 8.28.$

The group centroid for Function 1 was -.01 for those officers who attended AWC in residency only, 1.56 for officers who completed AWC by correspondence only, and -.16 for those officers who completed AWC by correspondence and residency. The group centroid for Function 2 was .13 for those officers who attended AWC in residency only, -.21 for officers who completed AWC by correspondence only, and -.28 for those officers who completed AWC by correspondence and residency.

In this analysis, there were three groups and therefore two functions produced. Here the eigenvalue was .10 and .04, which are low values for classification into program groups.

The canonical correlation was .30 for Function 1 and .19 for Function 2. When this is squared, it indicates that the groups explain only 9.0% and 3.6% of the variation in the discriminant function. This weak eigenvalue reveals that the function was not powerful in discriminating between the grouping of officers by attendance at Air War College.

The percentage of cases correctly classified shows how accurate the discriminant function was in grouping the respondents. This discriminant analysis was 61.97% accurate in classifying cases. It correctly placed 65 officers (42.8%) in the AWC by correspondence only group, 7 officers (87.5%) in the AWC by residency only group, and 35 officers (55.6%) in the AWC by correspondence and residency group. Since there was a 33% likelihood of correct placement in one of the three groups, this discriminant function was 28.97% improvement over chance in predicting group placement over chance. The minimum criterion that was established for accepting the discriminant function as useful was a 66.6% accuracy rate for placement. Consequently, it demonstrates that officers who attended Air War College in residency and those who completed it through correspondence cannot be distinguished on the basis of their preference for learning strategies.

Four variables found in Function 1 of the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: Attention (.54), Confidence (.51),

Generate Alternatives (-.34), and Organization (.33). Two variables found in Function 2 of the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: Test Assumptions (.65) and Organization (-.41). However, because of the low percentage of variance explained by the discriminant function and the lack of accuracy in classification, the discriminant function was not named.

A discriminant analysis was calculated to examine if attendance or completion of Air War College could be distinguished based on SKILLS usage learning strategy scores of Air Force officers. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use learning strategies to discriminate between groups categorized by AWC attendance.

Grouping by Early Promotion to Major

To determine if learning strategy usage differed between those officers who were promoted below the zone to major and those that were promoted in the zone to major, the participants of this study were divided into two groups. The first group was those officers who were promoted in the zone and the second group contained those officers who were promoted at least one year early. A sixth discriminant analysis investigated the relationship of SKILLS learning

strategies and early promotion groups. As in the previous five analyses, the pooled-within correlation matrix of predictors was examined to determine how the 15 discriminating variables within each of the groups were interrelated. Examination of the 105 coefficients in this analysis showed that they were at a sufficiently weak level to retain all the variables in the analysis. There were no coefficients at the .5 or .4 level; 5 were at the .3 level; 20 were at the .2 level, and the remaining 80 were below the .2 level. Consequently, the variables in this discriminant analysis were not related to each other and were not sharing a common variance.

Stepwise selection was used to determine if any of the discriminating learning strategy variables discriminated among early promotion groups. As a result of this stepwise procedure, five variables were included in the discriminant function. The following discriminating variables and their corresponding Wilk's lambda values were included: Organization (.99), Confidence (.98), Monitoring (.97), Critical Use of Resources (.97), and Reward/Enjoyment (.96). The other 10 discriminating variables in the analysis did not account for enough variance to be included in the discriminant function.

Standardized discriminant function coefficients generated by the discriminant analysis explain which of the discriminating variables contributed most to the

discrimination among early promotion to major. The standardized coefficients which discriminated those officers who were promoted below the zone to major and those who were not were as follows: Monitoring (.55), Reward/Enjoyment (.36), Confidence (-.67), Organization (.80), and Use of Human Resources (-.47).

The discriminant function which was used to classify the cases was as follows:

$$D = .31 (\text{Monitoring}) + .22 (\text{Reward/Enjoyment}) - .37 (\text{Confidence}) + .42 (\text{Confidence}) + .42 (\text{Organization}) - .27 (\text{Use of Human Resources}) - 2.52.$$

The group centroid was - .01 for those officers who were promoted in the zone to major and .35 for officers who were promoted to major in the zone.

In this analysis, there were two groups and therefore one function produced. Here the eigenvalue was .04, which is a low value for classification into program groups. The canonical correlation was .19. When this is squared, it indicates that the groups explain only 3.6% of the variation in the discriminant function. This weak eigenvalue reveals that the function was not powerful in discriminating between the grouping of officers by early promotion to major.

The percentage of cases correctly classified shows how accurate the discriminant function was in grouping the respondents. This discriminant analysis was 58.25% accurate in classifying cases. It correctly placed 135 officers (57.9%) in the promoted in the zone group and 41 officers

(58.6%) in the promoted below the zone group. Since there was a 50% likelihood of correct placement in one of the two groups, this discriminant function was only a 8.25% improvement over chance in predicting group placement over chance. The minimum criterion that was established for accepting the discriminant function as useful was a 75% accuracy rate for placement. Consequently, it demonstrates that officers who were promoted below the zone and in the zone to major cannot be distinguished on the basis of their preference for learning strategies.

Three variables in the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: Organization (.57), Confidence (-.40), and Use of Human Resources (-.39). However, because of the low percentage of variance explained by the discriminant function and the lack of accuracy in classification, the discriminant function was not named.

A discriminant analysis was calculated to examine if below the zone promotions to major could be distinguished based on SKILLS usage learning strategy scores of Air Force officers. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not

possible to use learning strategies to discriminate between groups categorized by early promotions.

Grouping by Early promotion
to Lieutenant Colonel

To determine if learning strategy usage differed between those officers who were promoted below the zone to lieutenant colonel and those that were promoted in the zone to lieutenant colonel, the participants of this study were divided into two groups. The first group was those officers who were promoted in the zone and the second group contained those officers who were promoted at least one year early. A seventh discriminant analysis investigated the relationship of SKILLS learning strategies and early promotion groups. As in the previous six analysis, the pooled-within correlation matrix of predictors was examined to determine how the 15 discriminating variables within each of the groups were interrelated. Examination of the 105 coefficients in this analysis showed that they were at a sufficiently weak level to retain all the variables in the analysis. There were no coefficients at the .5 or .4 level; 5 were at the .3 level; 17 were at the .2 level, and the remaining 83 were below the .2 level. Consequently, the variables in this discriminant analysis were not related to each other and were not sharing a common variance.

Stepwise selection was used to determine if any of the discriminating learning strategy variables discriminated among

early promotion groups. As a result of this stepwise procedure, two variables were included in the discriminant function. The following discriminating variables and their corresponding Wilk's lambda values were included: Confidence (.99), and Use Human of Resources (.98). The other 13 discriminating variables in the analysis did not account for enough variance to be included in the discriminant function.

Standardized discriminant function coefficients generated by the discriminant analysis explain which of the discriminating variables contributed most to the discrimination among early promotion to lieutenant colonel. The standardized coefficients which discriminated those officers who were promoted below the zone to lieutenant colonel and those who were not were as follows: Confidence (.90) and Use of Human Resources (.45).

The discriminant function which was used to classify the cases was as follows:

$$D = .50 (\text{Confidence}) + .25 (\text{Use of Human Resources}) - 5.5.$$

The group centroid for was .05 for those officers who were promoted in the zone to lieutenant colonel and - .29 for officers who were promoted to lieutenant colonel in the zone.

In this analysis, there were two groups and therefore one function produced. Here the eigenvalue was .02, which is a low value for classification into program groups. The canonical correlation was .12. When this is squared, it indicates that the groups explain only 1.44% of the variation

in the discriminant function. This weak eigenvalue reveals that the function was not powerful in discriminating between the grouping of officers by early promotion to lieutenant colonel.

The percentage of cases correctly classified shows how accurate the discriminant function was in grouping the respondents. This discriminant analysis was 58.4% accurate in classifying cases. It correctly placed 153 officers (60.5%) in the promoted in the zone group and 27 officers (56.3%) in the promoted below the zone group. Since there was a 50% likelihood of correct placement in one of the two groups, this discriminant function was only a 8.4% improvement over chance in predicting group placement over chance. The minimum criterion that was established for accepting the discriminant function as useful was a 75% accuracy rate for placement. Consequently, it demonstrates that officers who were promoted below the zone and in the zone to lieutenant colonel cannot be distinguished on the basis of their preference for learning strategies.

Three variables in the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: Confidence (.89), Use of Human Resources (.43), and Test Assumptions (-.31). However, because of the low percentage of variance explained by the discriminant function and the lack

of accuracy in classification, the discriminant function was not named.

A discriminant analysis was calculated to examine if below the zone promotions to lieutenant colonel could be distinguished based on SKILLS usage learning strategy scores of Air Force officers. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use learning strategies to discriminate between groups categorized by early promotions.

Grouping by Early Promotion to Colonel

To determine if learning strategy usage differed between those officers who were promoted below the zone to major and those that were promoted in the zone to colonel, the participants of this study were divided into two groups. The first group was those officers who were promoted in the zone and the second group contained those officers who were promoted at least one year early. A eighth discriminant analysis investigated the relationship of SKILLS learning strategies and early promotion groups. As in the previous seven analysis, the pooled-within correlation matrix of predictors was examined to determine how the 15 discriminating variables within each of the groups were interrelated. Examination of the 105 coefficients in this analysis showed that they were at a sufficiently weak level

to retain all the variables in the analysis. There were no coefficients at the .5 or .4 level; 8 were at the .3 level; 21 were at the .2 level, and the remaining 76 were below the .2 level. Consequently, the variables in this discriminant analysis were not related to each other and were not sharing a common variance.

Stepwise selection was used to determine if any of the discriminating learning strategy variables discriminated among early promotion groups. As a result of this stepwise procedure, three variables were included in the discriminant function. The following discriminating variables and their corresponding Wilk's lambda values were included: External Aids (.98), Test Assumptions (.97), and Confidence (.95). The other 12 discriminating variables in the analysis did not account for enough variance to be included in the discriminant function.

Standardized discriminant function coefficients generated by the discriminant analysis explain which of the discriminating variables contributed most to the discrimination among early promotion to colonel. The standardized coefficients which discriminated those officers who were promoted below the zone to colonel and those who were not were as follows: Confidence (.68), External Aids (.83), and Test Assumptions (.69).

The discriminant function which was used to classify the cases was as follows:

$$D = .37 \text{ (Confidence)} + .41 \text{ (External Aids)} + .43 \text{ (Test Assumptions)} - 9.62.$$

The group centroid was - .11 for those officers who were promoted in the zone to colonel and .42 for officers who were promoted to colonel in the zone.

In this analysis, there were two groups and therefore one function produced. Here the eigenvalue was .05, which is a low value for classification into program groups. The canonical correlation was .21. When this is squared, it indicates that the groups explain only 4.41% of the variation in the discriminant function. This weak eigenvalue reveals that the function was not powerful in discriminating between the grouping of officers by early promotion to colonel.

The percentage of cases correctly classified shows how accurate the discriminant function was in grouping the respondents. This discriminant analysis was 62.85% accurate in classifying cases. It correctly placed 50 officers (57.5%) in the promoted in the zone group, and 15 officers (68.2%) in the promoted below the zone group. Since there was a 50% likelihood of correct placement in one of the two groups, this discriminant function was only a 12.85% improvement over chance in predicting group placement over chance. The minimum criterion that was established for accepting the discriminant function as useful was a 75% accuracy rate for placement. Consequently, it demonstrates that officers who were promoted below the zone and in the zone to colonel cannot be

distinguished on the basis of their preference for learning strategies.

Four variables in the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: External Aids (.60), Test Assumptions (.44), Use of Human Resources (-.31), and Adjusting (-.31). However, because of the low percentage of variance explained by the discriminant function and the lack of accuracy in classification, the discriminant function was not named.

A discriminant analysis was calculated to examine if below the zone promotions to colonel could be distinguished based on SKILLS usage learning strategy scores of Air Force officers. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use learning strategies to discriminate between groups categorized by early promotions.

Grouping by Distinguished Graduate Recognition at SOS

To determine if learning strategy usage differed between those officers who were selected to graduate from SOS as a distinguished graduate and those officers who did not, the participants of this study were divided into two groups. The first group was those officers who were

distinguished graduates at SOS, and the second group contained those officers who did not receive the distinguished graduate recognition. A ninth discriminant analysis investigated the relationship of SKILLS learning strategies and distinguished graduates. As in the previous eight analyses, the pooled-within correlation matrix of predictors was examined to determine how the 15 discriminating variables within each of the groups were interrelated. Examination of the 105 coefficients in this analysis showed that they were at a sufficiently weak level to retain all the variables in the analysis. There were no coefficients at the .5 or .4 level; 5 were at the .3 level; 19 were at the .2 level, and the remaining 81 were below the .2 level. Consequently, the variables in this discriminant analysis were not related to each other and were not sharing a common variance.

Stepwise selection was used to determine if any of the discriminating learning strategy variables discriminated among distinguished graduate groups. As a result of this stepwise procedure, four variables were included in the discriminant function. The following discriminating variables and their corresponding Wilk's lambda values were included: Test Assumptions (.98), Use of Human Resources (.97), Reward/Enjoyment (.96), and Generate Alternatives (.96). The other 11 discriminating variables in the analysis did not

account for enough variance to be included in the discriminant function.

Standardized discriminant function coefficients generated by the discriminant analysis explain which of the discriminating variables contributed most to the discrimination among distinguished graduates. The standardized coefficients which discriminated those officers who were distinguished graduates and those who were not were as follows: Reward/Enjoyment (.52), Test Assumptions (.69), Generate Alternatives (.38), and Use of Human Resources (.55).

The discriminant function which was used to classify the cases was as follows:

$$D = .32 (\text{Reward/Enjoyment}) + .42 (\text{Test Assumptions}) + .19 (\text{Generate Alternatives}) + .28 (\text{Use of Human Resources}) - 9.99.$$

The group centroid was - .11 for those officers who were distinguished graduates at SOS and .42 for officers who were not distinguished graduates at SOS.

In this analysis, there were two groups and therefore one function produced. Here the eigenvalue was .05, which is a low value for classification into program groups. The canonical correlation was .21. When this is squared, it indicates that the groups explain only 4.41% of the variation in the discriminant function. This weak eigenvalue reveals that the function was not powerful in discriminating between the grouping of officers by distinguished graduate recognition at Squadron Officer School.

The percentage of cases correctly classified shows how accurate the discriminant function was in grouping the respondents. This discriminant analysis was 58.15% accurate in classifying cases. It correctly placed 144 officers (60%) in the non-distinguished graduate group and 36 officers (56.3%) in the distinguished graduate group. Since there was a 50% likelihood of correct placement in one of the two groups, this discriminant function was only a 8.15% improvement over chance in predicting group placement over chance. The minimum criterion that was established for accepting the discriminant function as useful was a 75% accuracy rate for placement. Consequently, it demonstrates that officers who were distinguished graduates at SOS and those officers who were not cannot be distinguished on the basis of their preference for learning strategies.

Four variables in the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: Test Assumptions (.68), Reward/Enjoyment (.43), Generate Alternatives (.34), and Use of Human Resources (.31). However, because of the low percentage of variance explained by the discriminant function and the lack of accuracy in classification, the discriminant function was not named.

A discriminant analysis was calculated to examine if distinguished graduate recognition at SOS could be distinguished based on SKILLS usage learning strategy scores

of Air Force officers. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use learning strategies to discriminate between groups categorized by distinguished graduate recognition at SOS.

Grouping by Distinguished
Graduate Recognition at ACSC

To determine if learning strategy usage differed between those officers who were selected to graduate from ACSC as a distinguished graduate and those officers who did not, the participants of this study were divided into two groups. The first group was those officers who were distinguished graduates at ACSC, and the second group contained those officers who did not receive the distinguished graduate recognition. A tenth discriminant analysis investigated the relationship of SKILLS learning strategies and distinguished graduates. As in the previous nine analyses, the pooled-within correlation matrix of predictors was examined to determine how the 15 discriminating variables within each of the groups were interrelated. Examination of the 105 coefficients in this analysis showed that they were at a sufficiently weak level to retain all the variables in the analysis. There were no coefficients at the .5 or .4 level; 5 were at the .3 level; 19

were at the .2 level, and the remaining 81 were below the .2 level. Consequently, the variables in this discriminant analysis were not related to each other and were not sharing a common variance.

Stepwise selection was used to determine if any of the discriminating learning strategy variables discriminated among distinguished graduate groups. As a result of this stepwise procedure, two variables were included in the discriminant function. The following discriminating variables and their corresponding Wilk's lambda values were included: Generate Alternatives (.99) and Attention (.99). The other 13 discriminating variables in the analysis did not account for enough variance to be included in the discriminant function.

Standardized discriminant function coefficients generated by the discriminant analysis explain which of the discriminating variables contributed most to the discrimination among distinguished graduates. The standardized coefficients which discriminated those officers who were distinguished graduates and those who were not were as follows: Attention (-.51) and Generate Alternatives (.80).

The discriminant function which was used to classify the cases was as follows:

$$D = .42 (\text{Generate Alternatives}) - .30 (\text{Attention}) - .42.$$

The group centroid was - .04 for those officers who were distinguished graduates at ACSC and .30 for officers who were not distinguished graduates at ACSC.

In this analysis, there were two groups and therefore one function produced. Here the eigenvalue was .01, which is a low value for classification into program groups. The canonical correlation was .12. When this is squared, it indicates that the groups explain only 1.44% of the variation in the discriminant function. This weak eigenvalue reveals that the function was not powerful in discriminating between the grouping of officers by distinguished graduate recognition at Air Command and Staff College.

The percentage of cases correctly classified shows how accurate the discriminant function was in grouping the respondents. This discriminant analysis was 60% accurate in classifying cases. It correctly placed 155 officers (58.5%) in the non-distinguished graduate group and 24 officers (61.5%) in the distinguished graduate group. Since there was a 50% likelihood of correct placement in one of the two groups, this discriminant function was only a 10% improvement over chance in predicting group placement over chance. The minimum criterion that was established for accepting the discriminant function as useful was a 75% accuracy rate for placement. Consequently, it demonstrates that officers who were distinguished graduates at ACSC and those officers who were not cannot be distinguished on the basis of their preference for learning strategies.

Three variables in the structure matrix had sufficient coefficients to be included in the interpretation of the

meaning of the discriminant function. They were as follows: Generate Alternatives (.86), Attention (.60), and Planning (.34). However, because of the low percentage of variance explained by the discriminant function and the lack of accuracy in classification, the discriminant function was not named.

A discriminant analysis was calculated to examine if distinguished graduate recognition at ACSC could be distinguished based on SKILLS usage learning strategy scores of Air Force officers. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use learning strategies to discriminate between groups categorized by distinguished graduate recognition at ACSC.

Grouping by Distinguished Graduate Recognition at AWC

To determine if learning strategy usage differed between those officers who were selected to graduate from AWC as a distinguished graduate and those officers who did not, the participants of this study were divided into two groups. The first group was those officers who were distinguished graduates at AWC, and the second group contained those officers who did not receive the distinguished graduate recognition. An eleventh discriminant

analysis investigated the relationship of SKILLS learning strategies and distinguished graduates. As in the previous ten analyses, the pooled-within correlation matrix of predictors was examined to determine how the 15 discriminating variables within each of the groups were interrelated. Examination of the 105 coefficients in this analysis showed that they were at a sufficiently weak level to retain all the variables in the analysis. There were no coefficients at the .5 or .4 level; 5 were at the .3 level; 18 were at the .2 level, and the remaining 82 were below the .2 level. Consequently, the variables in this discriminant analysis were not related to each other and were not sharing a common variance.

Stepwise selection was used to determine if any of the discriminating learning strategy variables discriminated among distinguished graduate groups. As a result of this stepwise procedure, three variables were included in the discriminant function. The following discriminating variables and their corresponding Wilk's lambda values were included: Memory Application (.99), External Aids (.98), and Reward/Enjoyment (.97). The other 12 discriminating variables in the analysis did not account for enough variance to be included in the discriminant function.

Standardized discriminant function coefficients generated by the discriminant analysis explain which of the discriminating variables contributed most to the

discrimination among distinguished graduates. The standardized coefficients which discriminated those officers who were distinguished graduates and those who were not were as follows: Reward/Enjoyment (.48), External Aids (.79), and Memory Application (-.71).

The discriminant function which was used to classify the cases was as follows:

$$D = .29 (\text{Reward/Enjoyment}) + .40 (\text{External Aids}) - .39 (\text{memory Application}) - 2.58.$$

The group centroid was - .03 for those officers who were distinguished graduates at AWC and .79 for officers who were not distinguished graduates at AWC.

In this analysis, there were two groups and therefore one function produced. Here the eigenvalue was .03, which is a low value for classification into program groups. The canonical correlation was .16. When this is squared, it indicates that the groups explain only 2.56% of the variation in the discriminant function. This weak eigenvalue reveals that the function was not powerful in discriminating between the grouping of officers by distinguished graduate recognition at Air War College.

The percentage of cases correctly classified shows how accurate the discriminant function was in grouping the respondents. This discriminant analysis was 66.25% accurate in classifying cases. It correctly placed 192 officers (65.8%) in the non-distinguished graduate group, and 8 officers (66.7%) in the distinguished graduate group. Since

there was a 50% likelihood of correct placement in one of the two groups, this discriminant function was only a 16.25% improvement over chance in predicting group placement over chance. The minimum criterion that was established for accepting the discriminant function as useful was a 75% accuracy rate for placement. Consequently, it demonstrates that officers who were distinguished graduates at AWC and those officers who were not cannot be distinguished on the basis of their preference for learning strategies.

Three variables in the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: Memory Application (-.55), External Aids (.54), and Reward/Enjoyment (.39). However, because of the low percentage of variance explained by the discriminant function and the lack of accuracy in classification, the discriminant function was not named.

A discriminant analysis was calculated to examine if distinguished graduate recognition at AWC could be distinguished based on SKILLS usage learning strategy scores of Air Force officers. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use learning strategies to discriminate

between groups categorized by distinguished graduate recognition at AWC.

Grouping by Number of
Years of Service

To determine if learning strategy usage differed between those officers who had a greater number of years of service with the Air Force, the participants of this study were divided into two groups. The first group was those officers who had 16 or less years of active military service in the Air force and the second group contained those officers who had 17 or more years of active service with the Air Force. A twelfth discriminant analysis investigated the relationship of SKILLS learning strategies and number of years of service. As in the previous eleven analyses, the pooled-within correlation matrix of predictors was examined to determine how the 15 discriminating variables within each of the groups were interrelated. Examination of the 105 coefficients in this analysis showed that they were at a sufficiently weak level to retain all the variables in the analysis. There were no coefficients at the .5 or .4 level; 5 were at the .3 level; 18 were at the .2 level, and the remaining 82 were below the .2 level. Consequently, the variables in this discriminant analysis were not related to each other and were not sharing a common variance.

Stepwise selection was used to determine if any of the discriminating learning strategy variables discriminated among

distinguished graduate groups. As a result of this stepwise procedure, four variables were included in the discriminant function. The following discriminating variables and their corresponding Wilk's lambda values were included: Attention (.98), Confidence (.97), Conditional Acceptance (.96), and Planning (.96). The other 11 discriminating variables in the analysis did not account for enough variance to be included in the discriminant function.

Standardized discriminant function coefficients generated by the discriminant analysis explain which of the discriminating variables contributed most to the discrimination among years of active Air Force service. The standardized coefficients which discriminated those officers who had served the Air Force for 16 years or less and those who had served for 17 years or more were as follows: Planning (-.46), Attention (.84), Confidence (.50), and Conditional Acceptance (.44).

The discriminant function which was used to classify the cases was as follows:

$$D = .50 (\text{Attention}) - .27 (\text{Planning}) + .28 (\text{Confidence}) + .23 (\text{Conditional Acceptance}) - 5.90.$$

The group centroid was .42 for those officers who had 16 years or less of active military service and -.11 for officers who had 17 years or more active military service.

In this analysis, there were two groups and therefore one function produced. Here the eigenvalue was .05, which is a low value for classification into program groups. The

canonical correlation was .21. When this is squared, it indicates that the groups explain only 4.41% of the variation in the discriminant function. This weak eigenvalue reveals that the function was not powerful in discriminating between the grouping of officers who had 16 years or less of Air Force service by those who had 17 years or more of service to the Air Force.

The percentage of cases correctly classified shows how accurate the discriminant function was in grouping the respondents. This discriminant analysis was 59.4% accurate in classifying cases. It correctly placed 37 officers (59.7%) in the 16 years or less of active military service group, and 143 officers (59.1%) in the 17 or more years of service group. Since there was a 50% likelihood of correct placement in one of the two groups, this discriminant function was only a 9.4% improvement over chance in predicting group placement over chance. The minimum criterion that was established for accepting the discriminant function as useful was a 75% accuracy rate for placement. Consequently, it demonstrates that officers who had 16 or less years of active Air Force service and those officers who had 17 or more years of service cannot be distinguished on the basis of their preference for learning strategies.

Three variables in the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows:

Attention (.59), Confidence (.50), and Conditional Acceptance (.35). However, because of the low percentage of variance explained by the discriminant function and the lack of accuracy in classification, the discriminant function was not named.

A discriminant analysis was calculated to examine if time in service could be distinguished based on SKILLS usage learning strategy scores of Air Force officers. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use learning strategies to discriminate between groups categorized by years of active duty Air Force service.

Grouping by Age

To determine if learning strategy usage differed between those officers who were older than other officers in the study, the participants of this study were divided into two groups. The first group was those officers who were 31-40 and the second group contained those officers were 41-52. This division created two groups that were fairly equal in size. A thirteenth discriminant analysis investigated the relationship of SKILLS learning strategies and age of the participants. As in the previous 12 analyses, the pooled-within correlation matrix of predictors was examined to determine how the 15 discriminating variables within each of

the groups were interrelated. Examination of the 105 coefficients in this analysis showed that they were at a sufficiently weak level to retain all the variables in the analysis. There were no coefficients at the .5 or .4 level; 5 were at the .3 level; 20 were at the .2 level, and the remaining 80 were below the .2 level. Consequently, the variables in this discriminant analysis were not related to each other and were not sharing a common variance.

Stepwise selection was used to determine if any of the discriminating learning strategy variables discriminated among distinguished graduate groups. As a result of this stepwise procedure, five variables were included in the discriminant function. The following discriminating variables and their corresponding Wilk's lambda values were included: Use of Human Resources (.99), External Aids (.98), Identification of Resources (.97), Attention (.96), and Organization (.96). The other 10 discriminating variables in the analysis did not account for enough variance to be included in the discriminant function.

Standardized discriminant function coefficients generated by the discriminant analysis explain which of the discriminating variables contributed most to the discrimination among age of participants in the study. The standardized coefficients which discriminated those officers who were 31-40 and those who were 41-52 were as follows: Attention (-.41), Organization (.34), External Aids (.38),

Identification of Resources (.63), and Use of Human Resources (.36).

The discriminant function which was used to classify the cases was as follows:

$$D = .18 (\text{Organization}) - .25 (\text{Attention}) + .19 (\text{External Aids}) + .40 (\text{Identification of Resources}) + .19 (\text{Use of Human Resources}) - 5.65.$$

The group centroid was - .22 for those officers who were 31-40 years old and .19 for those officers who were 41-52 years old.

In this analysis, there were two groups and therefore one function produced. Here the eigenvalue was .04, which is a low value for classification into program groups. The canonical correlation was .20. When this is squared, it indicates that the groups explain only 4% of the variation in the discriminant function. This weak eigenvalue reveals that the function was not powerful in discriminating between the grouping of officers who were 31-40 by those who were 41-52 years old.

The percentage of cases correctly classified shows how accurate the discriminant function was in grouping the respondents. This discriminant analysis was 58.65% accurate in classifying cases. It correctly placed 84 officers (60%) in the 31-40 age group, and 94 officers (57.3%) in the 41-52 age group. Since there was a 50% likelihood of correct placement in one of the two groups, this discriminant function was only a 8.65% improvement over chance in predicting group placement over chance. The minimum criterion that was

established for accepting the discriminant function as useful was a 75% accuracy rate for placement. Consequently, it demonstrates that officers who were 31-40 years old at the time of taking SKILLS and those officers who were 41-52 years old when they took the SKILLS instrument cannot be distinguished on the basis of their preference for learning strategies.

Seven variables in the structure matrix had sufficient coefficients to be included in the interpretation of the meaning of the discriminant function. They were as follows: Use of Human Resources (.56), External Aids (.52), Attention (-.46), Organization (.44), Identification of Resources (.42), Monitoring (-.32), and Planning (-.30). However, because of the low percentage of variance explained by the discriminant function and the lack of accuracy in classification, the discriminant function was not named.

A discriminant analysis was calculated to examine if age could be distinguished based on SKILLS usage learning strategy scores of Air Force officers. Based on the low percentage of variance explained by the discriminant function between groups and the low percentage of accuracy of prediction into the groups by the discriminant function, it was determined that it is not possible to use learning strategies to discriminate between groups categorized by age.

Summary

Discriminant analysis was used to deductively impose sense on the data to determine if different groupings made a difference in learning strategies used by Air Force officers. Variables such as age, gender, time in service, and performance at professional military education were originally thought to be worth examining. However, none of the demographic variables could discriminate one group of officers from another in this study.

CHAPTER 5

CLUSTER ANALYSIS

Introduction

Once the discriminant analysis had been conducted on the quantitative data gathered from the 304 participants during Phase 1 of this descriptive study, Phase 2 was completed to determine if groups of learners could be identified based on SKILLS learning strategies. Phase 2 involved the use of cluster analysis, one-way analysis of variance, and responses from a questionnaire to help describe the clusters. Cluster analysis is a statistical technique that allows researchers to study relatively homogeneous groups or "clusters" that may share common characteristics (Aldernderfer & Blashfield, 1984). Cluster analysis can be used in the social sciences as an enhancement to quantitative research (Conti & Fellenz, 1989; Hays, 1995; Kolody, 1997; Lockwood, 1997; Strakal, 1995; Yabui, 1993).

Cluster analysis is a powerful multivariant tool available to adult educators for inductively identifying groups which inherently exist in the data. "Its power lies in its ability to examine the person in a holistic manner

rather than as a set of unrelated variables" (Conti, 1996, p. 67). Thus, it can be used to add a varied perception to data that are gathered in research studies. It can enhance a study by providing or discovering a structure that is not evident by simply crunching numbers. "Clustering methods are used to discover structure in data that is not apparent by visual inspection" (Aldenderfer & Blashfield, 1984, p. 76).

Computer analysis of clusters has historically been limited because of the cost and unavailability of powerful computer systems. However, with the ever increasing speed of new computers, the statistical package for social sciences (SPSS) was redesigned for use on the personal computer. Because of the large capacity of computer memory required to conduct a cluster analysis of a large sample size, SPSS has developed a procedure called Quick Cluster that allows the researcher "to cluster a large number of cases efficiently without requiring substantial computer resources" (Norusis, 1988, p. B-91). However, for this study, the standard cluster procedure was used. The four-cluster solution generated by this procedure was considered to be the most appropriate for the data gathered from the SKILLS instrument.

The officers in this study fell into four distinctly different clusters. The four clusters were named Problem Solvers, Counselors, Teachers, and Executives (see Table 5).

The frequency and percentage of officers who fell into each cluster is fairly even with the Counselors being the largest group and the Problem Solvers being the smallest group.

Table 5. Cluster Frequency Distribution.

Cluster Name	Frequency	Percentage
Problem Solvers	57	18.75
Counselors	95	31.25
Teachers	86	28.29
Executives	66	21.71

ANOVA of the Clusters

Analysis of variance (ANOVA) is a useful tool for determining which variables are related to each cluster and for determining how the variables are associated with the cluster (Conti, 1996, p. 70).

Analysis of Variance is a hypothesis-testing procedure that is used to evaluate mean differences between two or more treatments (or populations). As with all inferential procedures, ANOVA uses sample data as the basis for drawing general conclusions about populations (Cravetter & Wallnau, 1995, p. 300)

Means for each of the 15 learning strategies in SKILLS were calculated for each of the four cluster groups. A one-way analysis of variance was conducted on each of these 15 variables to determine if there were significant differences among the four cluster groups (Hays, 1995; Kolody, 1997; Strakal, 1995; Yabui, 1993). Significant differences existed in all of the 15 learning strategies (see Table 12).

Consequently, all 15 variables were retained in the analysis to distinguish between the officers in each cluster and to assist in naming the groups.

In addition to the learning strategies which were used in the cluster analysis to identify the groups, the 14 demographic variables which had been collected for each participant were also analyzed to determine if they would be useful in describing the four chapters. A one-way analysis of variance was conducted on each of the 14 demographic variables to determine if there were significant differences among the four cluster groups (see Table 6). Of these 14 variables, the clusters differed only in length of time in the service.

Table 6. ANOVA of significantly different learning Strategies in Clusters.

Strategy	<u>df</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>p</u>
Planning					
Between	3	210.25	70.08	30.92	.0001
Within	300	679.80	.227		
Monitoring					
Between	3	142.11	47.37	17.64	.0001
Within	300	805.68	2.69		
Adjusting					
Between	3	65.26	21.75	6.11	.0005
Within	300	1067.98	3.56		
Attention					
Between	3	259.02	86.34	42.09	.0001
Within	300	615.40	2.05		
Reward/Enjoyment					
Between	3	41.38	13.79	5.24	.0015
Within	300	789.56	2.63		
Confidence					
Between	3	189.06	63.02	23.70	.0001
Within	300	797.87	2.66		
Organization					
Between	3	241.69	80.56	27.84	.0001
Within	300	868.07	2.89		
External Aids					
Between	3	577.62	192.54	96.94	.0001
Within	300	595.88	1.99		
Memory Application					
Between	3	129.76	43.25	14.46	.0001
Within	300	897.50	2.99		
Test Assumptions					
Between	3	228.92	76.31	37.73	.0001
Within	300	606.75	2.02		
Generate Alternatives					
Between	3	131.48	43.83	13.15	.0001
Within	300	999.56	3.33		
Conditional Acceptance					
Between	3	59.37	19.79	5.76	.0008
Within	300	1031.39	3.44		
Identification of Resources					
Between	3	145.48	48.49	24.53	.0001
Within	300	593.12	1.98		
Critical Use of Resources					
Between	3	190.30	63.43	25.11	.0001
Within	300	757.64	2.53		
Use of Human Resources					
Between	3	44.03	14.68	3.96	.0086
Within	300	1112.07	3.71		

Table 7. ANOVA of Demographic Variables Among Clusters

Variable	df	SS	MS	F	p
<u>Variables With Significant Difference</u>					
Service					
Between	3	94.84	31.61	3.24	.0224
Within	300	2923.66	9.75		
<u>Variables With No Significant Difference</u>					
Rank					
Between	3	2.83	.94	2.21	.875
Within	300	128.14	.43		
Gender					
Between	3	.18	.06	.47	.7031
Within	300	37.46	.12		
Attention					
Between	3	7.37	2.46	.90	.4434
Within	300	822.40	2.74		
Education					
Between	3	.05	.02	.92	.4300
Within	300	4.87	.02		
Age					
Between	3	85.32	28.44	2.23	.0848
Within	300	3825.72	12.75		
Squadron Officer School					
Between	3	4.41	1.47	2.31	.0766
Within	300	191.26	.64		
Air Command and Staff College					
Between	3	6.90	2.30	2.41	.0671
Within	300	286.14	.95		
Air War College					
Between	3	4.98	1.66	.96	.4101
Within	300	516.49	1.72		
Early Promotion to Major					
Between	3	.53	.18	.59	.6227
Within	300	90.70	.30		
Early Promotion to Lieutenant Colonel					
Between	3	.90	.30	1.07	.3604
Within	300	84.20	.28		
Early Promotion to Colonel					
Between	3	9.12	3.04	1.65	.1785
Within	300	553.87	1.85		
Distinguished Graduate From SOS					
Between	3	.46	.15	1.09	.3588
Within	300	8.40	.14		

The means of the 15 learning strategies along with the one significant demographic variable for each cluster were used to help identify the significant characteristics of each group. For each of these analyses which showed a significant difference, a Tukey post hoc test was used to identify the differences in the groupings (see Table 8).

Table 8. Means of Cluster Groupings on Learning Strategies and Demographic Variables

Variable	Pro Sol	Coun	Teach	Exec
Planning	10.0	9.0	9.6	7.6
Monitoring	6.2	7.6	8.2	7.5
Adjusting	6.9	8.1	7.2	7.2
Attention	10.5	8.8	9.9	7.9
Reward	8.1	7.8	8.8	8.2
Confidence	6.0	8.2	7.4	6.9
Organization	7.0	8.5	6.6	8.5
External Aids	8.8	7.4	6.0	9.6
Application	7.5	7.4	6.9	8.7
Test Assumptions	9.8	7.6	9.4	8.8
Gen. Alternatives	8.6	7.9	6.8	7.6
Conditional Acceptance	6.5	7.4	7.7	6.9
Identify Resources	9.9	8.3	9.7	8.6
Use Resources	6.3	7.8	8.7	7.8
Human Resources	7.8	8.0	7.1	8.0
Service	18.9	19.5	18.6	20.0
Size of Group	57	95	86	66

The multivariate technique of cluster analysis produced a solution with four definitive clusters of officers. This analysis, which investigated the research question related to clusters of learners existing in the data, demonstrated that it was possible to identify distinct clusters of learners in Air Force officers based on their scores of the 15 learning strategies of SKILLS.

Qualitative Data

Once the four clusters were identified and named, 25 officers from each cluster were randomly selected to participate in the qualitative questionnaire. Questions concerning previous learning experiences were asked of each participant based on the responses obtained from SKILLS. The questions for each cluster were based upon characteristics revealed in the quantitative analysis (Kolody, 1997; Lockwood, 1997, Strakal, 1995). Information gathered from the qualitative questionnaire added a new and unique frame of data. The qualitative data gathered through this process was combined with the quantitative data, and together this expanded data source provided a more comprehensive and accurate description of the clusters (Conti, 1996, p. 71).

The email system at the Pentagon was used in this phase of the research to quickly gather data and to be as unobtrusive as possible. Of the 100 officers who were asked

to respond, 84 officers returned data for further analysis. The responses distributed as follows: Problem Solvers - 21, Counselors - 19, Teachers - 23, and Executives - 21. The design for this stage of data gathering has evolved from a series of learning strategies studies in Montana (Conti & Fellenz, 1989; Conti & Kolody, 1995; Hays, 1995; Kolody & Conti, 1996; Lockwood, 1997; Moretti, 1995; Strakal, 1995; Yabui, 1993). In these studies, "a triangulation process has been developed for interpreting cluster compositions. This process involves using the existing quantitative data and gathering additional qualitative data" (Conti, 1996, p. 70) through personal interviewing techniques.

Thus, quantitative and qualitative analysis, four distinct groups of officers were identified and described. "The combination of these techniques allowed the research questions which asked about the description of these groups to be answered" (Kolody, 1997, p. 142). Questionnaire responses from each officer helped in describing and naming the clusters.

Problem Solvers

Problem Solvers are task oriented and tend to look for ways to improve their learning skills in order to be a better problem solver. Officers who were placed in this group scored relatively high on the learning strategies of Planning, Attention, Testing Assumptions, and the

Identification of Resources. Conversely, Problem Solvers scored low in the areas of Monitoring, Adjusting, Confidence, and Conditional Acceptance. This group was the smallest with 18.75%.

Those officers who scored high on the SKILLS instrument in the learning strategy of Planning were placed in the Problem Solver cluster. Planners analyze the best way to achieve their learning goal and direct their learning from an established blueprint (Fellenz & Conti, 1989). One officer who was categorized as a Problem Solver had this to say about his learning process.

I direct and improve my learning process by asking questions on topics I am unsure of or require more information about. I also try to improve my learning process by enrolling in a structured class whenever possible. This helps me continue to learn about new topics and to broaden my horizons. I like to evaluate and seek feedback after the learning situation has taken place or after I have completed a project. I have to give a lot of presentations so I illicit responses from the officers that I speak to.

An overview of where the Problem Solver is going concerning the learning is an issue. The need to "direct" and "improve" the learning process is important for the Problem Solver and plays an important role in the learning process.

Attention is the metamotivational process of focusing on material to be learned (Fellenz & Conti, 1989). Problem Solvers scored very high on the Attention learning strategy of the SKILLS instrument compared to the other participants

of this study. Many officers wrote that they "set aside time to learn."

Setting aside time to learn is very difficult so I try and turn every unique situation into something I can learn from. I have learned more about history reading to my children then I ever did in college or even high school. I avoid distractions by going in my office or some other quiet place. Many problems that I encounter are very complex so I begin by clearing my desk off and starting with the facts. I only have the materials or tools out for what I will be studying or learning.

The need to "set aside time" to learn is a distinguishing trait of the Problem Solvers. They expressed the need to "avoid distractions" and surround themselves with "only the materials or tools" needed to solve a particular problem. This clear cut focus on the final outcome of the learning situation differentiates the Problem Solvers from the other clusters of officers.

The need to Test Assumptions is another trend for the Problem Solvers. Testing Assumptions is the ability to recognize or evaluate a learning situation (Fellenz & Conti, 1989). The ability to reflect on the need to learn or reflect on the learning situation appears is an important factor for the Problem Solver.

When I need support on my learning process I seek guidance from the instructor or other qualified expert. I like to be straight to the point and not confuse the issue. I inform the person helping me that I am having problems with this topic. When I am having problems with a learning situation I like to reflect on how I handled the last learning

situation I encountered to see if I can use that process for the current problem.

Feedback or the need for post-analysis is a reoccurring theme among the Problem Solvers. They continued to look for more clues to their learning needs and how best to learn. The "end result" is a strong motivator here because the Problem Solver plans in order to complete a project or solve a problem.

At the end of a presentation I like to distribute feedback sheets to the group of officers I am talking with. Many times I feel officers do not take full advantage in discussions or are apprehensive to speak out. However, with feedback sheets officers generally will write down their concerns or questions. Once I have these I can reevaluate my teaching instruction and improve the appropriateness of the learning situation to help the officers in the future.

The last learning strategy area that the Problem Solvers scored higher than the other clusters was Identification of Resources. Resource Management is an important factor in learning and includes knowing how to locate and use the best source of information (Fellenz & Conti, 1989). Problem Solvers do not have any problems here. They had readily identifiable strategies in place and were quite fluent in data gathering.

I locate information that I need to learn through the internet or the library at the Pentagon. The last time I encountered a difficult situation or problem I used the computer system at the library to locate articles I needed. I would ask for help on a learning topic by talking to a specialist on that particular topic.

Problem Solvers were clear in their ability to extract the information they needed to complete a project.

Counselors

Another cluster found from the SKILLS data was named Counselors. Many officers who are placed in leadership roles must counsel their subordinates on a fairly frequent basis. They need the confidence to know how to solve other people's problems or at least guide the person in the right direction to solve the problem. These officers scored high on the learning strategy areas of Adjusting, Confidence, and Use of Human Resources. The officers in the Counselor group scored relatively low in the learning strategy areas of Reward/Enjoyment, Testing Assumptions, and the Identification of Resources compared to the other officers who took the SKILLS instrument. The Counselors were the largest cluster with 31.25% of the officers who participated in the initial SKILLS data collection were placed in the Counselor group.

The mean score for Counselors was high in the learning strategy area of Adjusting. Adjusting is the metacognitive strategy of directing and improving one's learning process (Fellenz & Conti, 1989). Counselors expressed the need to use "trial and error" methods of learning and approached personal problems with the same techniques.

I use the trial and error approach to improve my learning process. I like to try new

learning processes to expand my problem solving ability and to identify those things that work best for me. When I am done with an assignment I reevaluate how I could have accomplished it better or even more efficiently.

This officer is discussing the need to reevaluate the solution to a problem. Many officers who responded to this question expressed a clear understanding of when a problem is resolved and of how to approach future problems in an improved fashion.

The next learning strategy that distinguished Counselors from other officers was in the area of Confidence. The need to feel reassured of success was common with the officers who were placed in this cluster. Confidence is the metamotivational learning strategy of believing that one can complete the learning task successfully (Fellenz & Conti, 1989). Past performance is important for the officers in the Counselors group.

Oftentimes I remind myself of past successes before I start a project. This is especially motivating because I like to avoid new problems. By doing this I can hopefully improve on the next success. I have found that when I am confident about learning I tend to learn more and it is much easier to learn complex information.

New projects can be intimidating and are oftentimes avoided because of the fear of failure. Counselors seem to elude this "fear" by reminding themselves of past successes. The interesting dynamic here is that counselors expressed the

need to remind others of their past successes. The "can do" attitude was prevalent and oftentimes contagious.

I spot inconsistencies in my own learning by watching others learn and tackle difficult situations. I can identify with others and try to put myself in their shoes to create mental images on how I would solve that same problem. This might sound odd, but I oftentimes compare what the person did that I am watching with what I would have done. Inconsistencies are readily apparent with this approach.

This officer is commenting on how he visualizes what others do in order to improve his own skills. The officer continued by adding that he oftentimes discusses his observations with the person he is watching.

The last learning strategy area that Counselors scored high in compared to the other officers in this study is Use of Human Resources. The Resource Management area of Use of Human Resources is integrating others into the social and political processes of learning (Fellenz & Conti, 1989). This officer commented on a briefing in which she was involved and on how the facilitator led the group.

I do not always find it easy to anticipate or recognize the value of learning specific material. Once I go over the material I can recognize its value or put it into action. The last learning experience that was fun was when a presenter had us actively involved in his presentation. The officers actually did hands on activities during the presentation and in the process kept the learning method motivating and fun.

This officer uses the expertise of the facilitator to learn and access new information. She considered the experience

"fun" and has apparently found a new way to experience learning or the gathering of information.

The officers placed in the Counselor cluster demonstrated confidence in their learning and the need to access other people to help them learn. They also shared their learning with others and demonstrated the need to help others learn.

Teachers

There are many officers in the military education system who not only teach but lead others who also teach. It is not surprising to have "teacher leaders" as a cluster of officers in this study. The officers who scored high on the SKILLS instrument in the areas Monitoring, Reward/Enjoyment, and Conditional Acceptance were clustered together in the Teacher group. This was the second largest cluster and had 28.29% of those officers who participated in this study were grouped in this cluster.

Monitoring is a metacognitive learning strategy that focuses on assessing how one is proceeding through a learning project (Fellenz & Conti, 1989). The officers in the Teacher cluster tended to monitor their own learning in an effort to improve themselves.

I improve my learning process by taking and teaching self-improvement classes. For example, my husband speaks Spanish fluently and I thought it would be a fun language to learn. I compare my Spanish to my husband's and try to improve the areas that I am weak

on. Teaching others is also a great way to improve my own learning process or techniques. Continuous learning is very important for my occupation. By improving my ability to communicate, I am more successful and happy as well.

This officer "compares" her Spanish to her husband's. Through this self-monitoring, she converts what she has learned into practical information for when she teaches others. She also comments on "continuous learning" and improving her "ability to communicate". Her last comment on being "happy" through learning is also a common trait of the participants in the Teacher group.

Several of the officers in the Teacher cluster commented on how they accomplish certain tasks in order to be successful. One of the things that motivates the officers in the Teacher cluster is "pride" in what they learn.

I set aside time by prioritizing what needs to be learned and how soon it needs to be accomplished. I take a lot of pride in what I learn. This has helped me be a better learner.

The metamotivational learning strategy of Reward/Enjoyment is evident here. Reward/Enjoyment is expecting or identifying the value of one's self and having fun with the learning activity (Fellenz & Conti, 1989). Several of the officers in the Teacher cluster expressed the need to have "fun" when learning and to have a good time when they are helping others to learn. "The best learning experience I

have ever had is when I helped my EWO learn how to fly the jet in formation."

Conditional Acceptance is the last learning strategy on which the officers in the Teacher cluster scored high. The Critical Thinking learning strategy of Conditional Acceptance is the reflective maintenance of ideals or standards (Fellenz & Conti, 1989). Teachers question to learn better.

The use of mental images helps me to sort out ideas and to put things into perspective. I question everything and try to avoid the easy answer. This increases my comprehension level. I believe I retain the information longer as well.

The end result here is an "increase in comprehension" through the use of fun or enjoyment. Many officers expressed the need to have a good time while they were learning but more importantly while they were instructing. Consequently, the most distinguishing trait of the officers in the Teacher cluster is their willingness to help others learn and to have fun while instructing others.

Executives

Executives are those officers who make decisions based on previously internalized data and who organize themselves for success. Officers who were placed in this group scored relatively high on the learning strategies of Organization, External Aids, and Memory Application. Conversely, Executives scored low in the areas of Attention and

Generating Alternatives. This was the third largest group with 21.71% of the officers.

Those officers who scored high on SKILLS in the learning strategy of Organization were placed in the Executive cluster. Memory and more specifically Organization as it pertains to memory is the configuring or processing of information so that data will be better stored and understood (Fellenz & Conti, 1989). Executives synthesize data by structuring or processing information and making decisions based on the necessary data. One officer who was categorized as a Executive had this to say about his learning process.

I focus on material to be learned by organizing my information and tools ahead of time. I find it more efficient to stay organized and have the material I need right there on my desk. I set aside a hour a night to study extra material for work or class. I get to work at least a hour before everyone else so I can organize the rest of my day.

Organization skills help this officer be more successful and productive. The learning strategies or techniques that make the officer more productive are the ones used and refined.

The next learning strategy that the officers in the Executive group scored relatively high on was External Aids. Lists, putting up displays, or even asking another person to remind the officer of something is considered an External Aid to learning (Fellenz & Conti, 1989).

I use lists to reinforce my memory. It is much easier to look at a list and identify what is missing or what can be strategically

added. I write important items down and as I am going through the procedure I check them off. By doing this it allows me to learn and memorize better. I also like to write down what I have learned.

The need to "check things off" is almost an institutional dynamic because of the way the Air Force trains its officers. Many operational career fields actually require officers to adhere to checklists. If officers fail to execute the checklist the way in which they were trained, then the officers can be liable for any damage to the equipment they are operating. For Executives,

Memory aids are useful tools that I have incorporated into my daily routine. I like to read the material then write down all the important information or summarize what I just examined. Reading and then writing out the most important issues helps me remember the quality information better and longer.

External aids thus become a way of identifying the "quality" information in the learning.

The final learning strategy that distinguishes the Executives from other officers in this study is Memory Application. Memory Application is using mental images or other reminders to aid in learning (Fellenz & Conti, 1989). This officer is describing how remembrances help him in stressful situations.

Storing information is very important for my line of work. I receive several briefing everyday and must be able to assimilate the material. It is also important for me to be able to retrieve that information and in many cases I am required to remember something while interacting in a stressful environment. During a lecture or briefing I will take

notes as the presenter is talking. This gives me a better understanding of what the presenter talked about.

There are many stressful situations in which Air Force officers are placed, and Memory Application is frequently used to help the officer be more productive. The institutional dynamic of "checklist disciple" discussed earlier is also prevalent concerning this learning strategy. "Remembering emergency procedures for the aircraft I fly was always a real pain until we lost pressurization and had only a few seconds to respond before blackout." The obvious benefit of Memory Application for learning is not something that is unique to the officers in the Executive group. However, officers in this cluster tended to gravitate more towards the use of memory for their learning needs as well as other leadership functions they perform.

Executives have several characteristics in common with the Critical Thinkers in Kolody's (1997) study. Like the Critical Thinkers, the Executives make heavy use of the Memory learning strategies of Using External Aids and Application, and both groups score low in Attention. (p. 95) However, the Executives do not make distinctive use of the Critical Thinking strategies that earned the Critical Thinkers their name. Indeed, the Executives score low in the use of generating Alternatives which is a strength of the Critical Thinkers. Thus, while three of the four groups in this study could be viewed as subsets of those in the

Kolody study which had a much more diverse population, this group is only similar in several ways to one of the groups in the Canadian study while also being different in some important characteristics.

CHAPTER 6

CONCLUSIONS, AND RECOMMENDATIONS

Summary

With the ever increasing cost of military training and education, it is a necessity to incorporate the most effective training methods possible for today's Air Force officer. The country's military leadership is asked to accomplish more and more with less resources than ever before. Air Force leadership is tasked with supporting and defending the nation's security policy through humanitarian and peace keeping efforts. To do this, officers must be able to learn new information quickly and be able to apply what they have learned in a dynamic environment.

A significant amount of training is conducted by the Air Force each year. Most if not all officers have been in one way or another affected by the Air Force education system. This system of education is very competitive, and oftentimes this competitiveness overshadows the real reason the officers are brought together. For example, the results of professional military education are oftentimes used to rank the participants and are used as justification for early promotions or other career advancements.

Because of its organization structure, the Air Force educational system does not take into consideration the techniques or skills of the individual. The successful officer tends to learn quickly in the classroom environment where there are definitive answers and all of the information to solve the problem is available. In this environment, the learning strategies used by officers becomes critically important. Although learning strategy research has revealed that various groups of learners can be distinguished by the learning strategies which they use, no knowledge exists of the learning strategies used by Air Force officers. Therefore the purpose of this study was (a) to identify the learning strategies of United States Air Force adult learners in officer (leadership) positions; (b) to investigate the relationship of these learning strategies to career advancement, gender, age, education, and experience; and (c) to explore patterns of learning of distinctive groups of learners that may exist.

Data were collected by administering SKILLS to 304 Air Force officers at the Pentagon in Washington D.C. Officers who held the rank of colonel, lieutenant colonel, or lieutenant colonel select (major) were targeted for this descriptive study. In the first phase of the study, SKILLS instrument was sent out to each participant through the electronic mail system in the Pentagon. Each officer who participated in this study was also asked to provide

demographic information such as gender, age, date of rank, number of years of service, and professional military education attendance/performance results.

The second phase of this study consisted of deductive questioning through discriminant analysis. The purpose of this phase was to impose sense on the data to determine if different groupings make a difference in learning strategies used.

The third phase of this study utilized inductive questioning through cluster analysis to divide the learners into groups. This process identified four distinct groups of learners. These groups were named Problem Solvers, Counselors, Teachers, and Executives.

A qualitative questionnaire was sent to 100 officers who were randomly selected from these four clusters. The questionnaire data were gathered through the electronic mail system at the Pentagon for each of the four clusters. The purpose of the focus questionnaire was to elicit responses from the participants that describe their learning patterns and preferences to determine why and how the groups differ.

Profiles of Learners

This study included 304 officers who worked in the Pentagon. Learning strategies used most by the officers in this study were Metamotivation Attention (9.23), Metacognition Planning (9.06), and Resource Management Identification of Resources (9.09). Metamotivation Reward/Enjoyment (8.23) and

Critical Thinking Testing Assumptions (8.78) were the next highest scores recorded from the SKILLS instrument. The lowest scores were Critical Thinking Conditional Acceptance (7.20), Metacognition Monitoring (7.47) and Adjusting (7.41), and Metamotivation Confidence (7.31).

They ranged in age from 31 to 52; 85.5% of the sample was male, and 14.5% was female. For the officers in the study, 20.4% had been in the Air Force for 16 years or less and 79.6% had been in the Air Force for 17 years or more. All participants had earned at least a baccalaureate degree while 98.4% of the officers had completed a masters degree.

Professional military education (PME) is a common experience variable for officers. For the participants in the study, 64.5% completed Squadron Officer School (SOS) by correspondence, 66.1% completing SOS in residency, and 30.6% accomplished their initial phase of PME by correspondence and residency. Air Command and Staff College (ACSC) was completed by 93.5% of the officers in the study who were eligible with 56.3% attending ACSC in residency only and 50.7% of participants accomplishing this level of education by both correspondence and residency. Air War College (AWC) is the senior school or the last type of PME that an officer normally attends. Of the 223 officers in the study who were eligible to complete AWC, 70.7% completed it through correspondence, 23.3% in residency only, and 20.7% by both correspondence and residency. The officers in the study had

a slightly higher than Air Force average rate for attending their PME in residency.

Attendance at or completion of PME is a strong indicator of past and current performance. The distinguished graduate (DG) recognition from PME is also an indicator of performance in school related criteria. Of the 304 officers in the study, the distinguished graduates from PME were as follows: SOS--20.7%, ACSC--12.8%, and AWC--3.9%. Each school nominates the top 10% of their officers each class for the distinguished graduate honors.

Many officers are promoted below the promotion zone (BPZ) each year. Early promotion to each rank is an indicator of current and past high performance with the overall future potential of the officer taken into consideration. Of the officers in the study, early promotions were as follows: 13% were promoted early to major, 15.8% early to lieutenant colonel, and 7.3% to colonel. For each annual promotion selection board, "the maximum BPZ selection quota is 5 percent to major, 7.5 percent to lieutenant colonel, and 15 percent to colonel" (Air Force Policy Directive 36-23, 1993, p. 3). Every officer is evaluated for promotion two times below his primary zone and once in the primary zone.

Discriminant Analysis

Discriminant analysis was used to examine the differences between groups of learners with respect to the simultaneous interaction of the 15 learning strategies in

SKILLS. Learners were grouped according to rank, gender, age, time in service, time in grade, and performance in professional military education. These analyses failed to produced any powerful functions although weak differences were found.

Rank: The first discriminant analysis was used to describe the combination of variables that could be used to distinguish between the majors (lieutenant colonel selects), lieutenant colonels, and colonels who participated in the study. The discriminant function for this analysis was only a 9% improvement over chance in predicting group placement over chance.

Gender: The second discriminant analysis was used to determine if learning strategy usage differed between the gender of officers. The discriminant function for this analysis was only a 7.6% improvement over chance in predicting group placement over chance.

Squadron Officers School Attendance: The third discriminant analysis was used to determine if learning strategy usage differed between those officers who attended squadron officer school in residency and those that did not. The discriminant function for this analysis was only a 13% improvement over chance in predicting group placement over chance.

Air Command And Staff College Attendance: The fourth discriminant analysis was used to determine if learning

strategy usage differed between those officers who attended air command and staff college in residency and those that did not. The discriminant function for this analysis was a 22.3% improvement over chance in predicting group placement over chance.

Air War College Attendance: The fifth discriminant analysis was used to determine if learning strategy usage differed between those officers who attended air war college in residency and those that did not. The discriminant function for this analysis was only a 22.97% improvement over chance in predicting group placement over chance but was below the criteria function of a useful function.

Below The Zone Promotion To Major: The sixth discriminant analysis was used to determine if learning strategy usage differed between those officers who were promoted below the zone to major and those that were promoted in the zone to major. The discriminant function for this analysis was only a 8.25% improvement over chance in predicting group placement over chance.

Below The Zone Promotion To Lieutenant Colonel: The seventh discriminant analysis was used to determine if learning strategy usage differed between those officers who were promoted below the zone to lieutenant colonel and those that were promoted in the zone to lieutenant colonel. The discriminant function for this analysis was only a 8.4%

improvement over chance in predicting group placement over chance.

Below The Zone Promotion To Colonel: The eighth discriminant analysis was used to determine if learning strategy usage differed between those officers who were promoted below the zone to colonel and those that were promoted in the zone to colonel. The discriminant function for this analysis was only a 12.85% improvement over chance in predicting group placement over chance.

Distinguished Graduate Recognition at SOS: The ninth discriminant analysis was used to determine if learning strategy usage differed between those officers who were distinguished graduates at SOS and those who were not. The discriminant function for this analysis was only a 8.15% improvement over chance in predicting group placement over chance.

Distinguished Graduate Recognition at ACSC: The tenth discriminant analysis was used to determine if learning strategy usage differed between those officers who were distinguished graduates at ACSC and those who were not. The discriminant function for this analysis was only a 10% improvement over chance in predicting group placement over chance.

Distinguished Graduate Recognition at AWC: The eleventh discriminant analysis was used to determine if learning strategy usage differed between those officers who

were distinguished graduates at AWC and those who were not. The discriminant function for this analysis was only a 10% improvement over chance in predicting group placement over chance.

Number of Years of Service: The twelfth discriminant analysis was used to determine if learning strategy usage differed between those officers who had 16 or less years of active military service in the Air Force and the second group contained those officers who had 17 or more years of active service with the Air Force. The discriminant function for this analysis was only a 9.4% improvement over chance in predicting group placement over chance.

Age: The thirteenth discriminant analysis was used to determine if learning strategy usage differed between those officers in one group who were 31-40 and those in another group who were 41-52. The discriminant function for this analysis was only a 8.65% improvement over chance in predicting group placement over chance.

Cluster Analysis

The multivariate technique of cluster analysis produced a solution with four unmistakable and distinct clusters. Analysis of variance revealed that all 15 learning strategies were significantly related to this clustering. Electronic mail interviews were conducted to obtain qualitative data to further enhance the quantitative data in

describing the clusters.

The profile for each group indicates a definite preference for specific learning strategies. Problem Solvers are task oriented and tend to look for ways to improve their learning skills in order to be a better problem solver. Officers who were placed in this group scored relatively high on the learning strategies of Planning, Attention, Testing Assumptions, and the Identification of Resources. Counselors are officers who scored high on the learning strategy areas of Adjusting, Confidence, and Use of Human Resources. Another cluster was named the Teacher because of the officers' need to transfer what and how they learn to others. The officers who scored relatively high on the SKILLS instrument in the areas Monitoring, Reward/Enjoyment, and Conditional Acceptance were clustered together in the Teacher group. The final group was named the Executives because they are the officers who make decisions based on previously internalized data and who organize themselves for success. Officers who were placed in this group scored relatively high on the learning strategies of Organization, External Aids, and Memory Application.

Conclusions

Four distinct groups of Air Force officer learners exist.

Learning strategies are not a useful tool for

discriminating among various demographic officer variables.

The most significant conclusion of this study is that four distinct groups of officer learners exist in the Air Force senior leadership ranks. Each of the four groups of officers had distinct learning strategy preferences. Problem Solvers are task oriented and tend to look for ways to improve their own learning skills; Counselors use confidence to help solve other people's problems; Teachers help other officers learn through transferring what and how they learn to others; and Executives are the officers who make decisions based on previously internalized information.

It is crucial to note that demographic variables had no effect on the officers' placement within a cluster or group. This study examined the learning strategies of Air Force officers in leadership positions. However, these findings have been confirmed through additional studies that examined various diverse populations. Learning strategies were examined for American Express financial planners (Conti, Kolody, & Schneider, 1997); for Native American tribal college students and community members (Bighorn, 1997); for two-year college students in Alberta (Kolody, 1997); and for nursing students within the state of Montana (Lockwood, 1997). Each of these studies is congruent with the major conclusion of this study in that distinct groups of learners

exist in both formal and informal settings based on the learning strategies utilized by the adult learner.

Recommendations

Military Training

1. Line officer training begins at the Air Force Academy, Reserve Officer Training (ROTC), or Officer Training School (OTS). Most officers spend up to 4 years at the Academy and ROTC learning how to be an officer and function in a military environment. OTS candidates spend 12 weeks of intensive military training after they have completed at least a baccalaureate degree. The implications of a learning strategy training course would be enormously beneficial to the prospective officer and the Air Force in general.

Learning strategy training would help "level" the academic playing field and consequently have great impact for new officers. For many career fields, performance during the initial training determines future career progression and opportunity. By helping each officer achieve to his or her highest potential during this initial training, the Air Force would receive the most appropriate individual in each career field for future duty.

Self-Knowledge Inventory of Life Long Learning Strategies (SKILLS) would be a perfect introduction to any learning strategy training course in which the Air Force

could invest. Each officer candidate could have the opportunity to take the SKILLS instrument with an Air Force instructor providing follow-up training. All officers spend time in the classroom environment and this would be a great precursor to that academic training.

2. Air Force leadership has consistently stated the need to provide professional military education to all eligible officers. In this "opportunity for all" environment, Squadron Officer School in residency could be extended to all captains. SOS is approximately 7 weeks long with many different topics being discussed. Learning strategy training would be an excellent elective in this scholastic setting. The competition is very acute at SOS, and learning strategy training would undoubtedly be a hot topic.

Depending upon the implementation of learning strategy training, SOS could be shortened because of the increased learning potential of the school participants. Financially this would be good news for the Air Force considering budget cuts and overall defense monetary constraints. The ability to learn more information in a shorter amount of time would undoubtedly be a skill each officer would desire.

Air Command and Staff College (ACSC) could be another opportunity to demonstrate the benefits of learning strategy training. Officers who attend ACSC read an enormous amount of material and complete a graduate level project at the

conclusion of the course. Any training that would make the time spent at ACSC more productive would be quickly incorporated in the course syllabus. Air War College (AWC) would provide another opportunity for learning strategy training to occur. Senior officers would benefit enormously from training that could help make them more productive in the operational environment.

3. When an officer demonstrates skill or the ability to perform his or her job at a sufficiently high level, then that officer is oftentimes trained to be an instructor. Instructor training can last anywhere from 2 to 26 weeks. Those officers selected to be instructors return back to their original unit and instruct other officers. Learning strategy training would be immensely beneficial here because of the contact instructors have with other officers. In a unit with 60 or more operators, there would potentially be about 10 instructors. Each instructor interacts with the officers in the unit on a weekly or monthly basis. Consequently, an instructor trained in learning strategy principles could propagate that information to 60 other officers each month. It is easy to see how quickly learning strategy training would spread in this environment.

4. Many times Air Force training is very competitive and is used to rank order the participants in the training. Several benefits can be derived from this practice including increased performance from the participants, team building

and operational leadership training, and the unique personality dynamics gained from competition. However, training should be an endeavor to transfer knowledge and skills from one person to another. Competition can break down the transfer of information because the goal in competition is to win rather than to learn. Further research should be conducted in the area of non-competitive Air Force training and education to determine if there is a correlation between competition and functional knowledge.

5. Military training and education is governed by regulatory requirements that each instructor must follow when teaching. The Air Force should update the regulations that instructors must follow with learning strategy concepts. After the instructors are provided with the information concerning learning strategies, they could then help provide that information to the officers with whom they come into contact. The continuity of information from one instructor to the next would be beneficial and fairly easy to achieve.

The SKILLS instrument would be an apparent introduction to any learning strategy training. The applicable learning strategy concepts would be tailored to the military officer and governed by military regulations. Post-testing with the SKILLS instrument would also be a constructive option in this environment.

Further Research

1. Military leaders need to place a higher priority on the development of learning strategies and components. The military commands an enormous amount of resources with the Air Force using approximately 57,000 full-time instructors. A battle lab or reaction team could be formed to research and develop the latest learning strategy concepts and then incorporate that information into military training literature. This information could be shared with the civilian academic community.

2. Further research should be conducted with junior officers using SKILLS to ascertain learning strategy differences. A program to retest the junior officers several times during their careers could help determine if learning strategies can be distinguished on a long term basis. This research would also provide information concerning how or if an individual's learning strategies change as that person matures.

3. Learning strategy research should be conducted that is aimed at individual career fields within the Air Force such as pilots, engineers, administration specialists to determine if any learning strategy patterns exist.

4. Further research should be conducted with other branches of the military to determine if similar clusters of learners exist. Research on Air Force training could be compared with other military services to determine if

learning strategies are used in a consistent manner between services.

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APPENDIX

RECRUITING LEADERS

Your commanding officer has asked you to recruit volunteer leaders for a group that is going to investigate the need for a mentoring program. **How likely are you to use the following learning strategies in learning how to recruit mentors?**

Directions: Select the 5 strategies from the following list of 15 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 5 other strategies that you might possibly use and place the number of these strategies in the *Possibly Use* box of the answer sheet. Select 5 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.

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| <ol style="list-style-type: none"> 1. Asking yourself what specifically needs to be done in your mentoring program before identifying the most appropriate leaders 2. Reminding yourself to focus on learning about leadership rather than worrying about being able to talk people into volunteering 3. Calling the Morale Welfare and Recreation office on your base to see if they have a base leadership group or program from which you could get ideas 4. Reviewing your decisions to see if friendship for certain people has influenced the suggestions you have made 5. Thinking about how your efforts will help your base have a good mentoring program 6. Closely examining the qualifications of those suggested as leaders by interviewing several people who have worked with them 7. Reflecting back to see if you are sticking with your learning plan | <ol style="list-style-type: none"> 8. Feeling confident you will be able to convince those you identify as good leaders to volunteer their services 9. Making up a word or phrase to remind yourself of the things you want to ask potential leaders 10. Talking with base leaders to test out your opinions on the qualities of a good leader 11. Using a notebook or note cards to keep track of ideas that you want to remember 12. Thinking of various ways of recruiting good leaders 13. Recalling similar experiences you have had in selecting leaders so you can remember what worked best 14. Asking yourself if there are any traits of good leaders about which you are still confused 15. Thinking through what could be done if those who are selected turn out to be poor leaders |
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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 Military Personnel Flight (MPF). **How likely are you to use the following learning strategies in finding out what the regulations are and what you need to do keep your job?**

Directions: Select the 5 strategies from the following list of 15 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 5 other strategies that you might possibly use and place the number of these strategies in the *Possibly Use* box of the answer sheet. Select 5 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.

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| <ol style="list-style-type: none"> 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 MPF to review the new regulations 3. Finding out if there is a DSN number where you can get answers to specific questions you have 4. Thinking through how the new regulations will actually change the way you do your job 5. Reminding yourself of the difficulties you may avoid by learning the new regulations 6. Deciding to look through the regulations themselves 7. Comparing your understanding of the new regulations with commonly accepted practices on the job 8. Reminding yourself that you have always been able to keep up with new regulations for a job | <ol style="list-style-type: none"> 9. Remembering the new regulations by organizing them according to the daily routine you follow at work 10. Checking with your supervisor and fellow workers to find out if they have similar ideas about the new regulations 11. Placing your list of key points in a convenient place so they will remind you of what you have to do 12. Thinking of various ways that you can use the new regulations to improve your job situation 13. Reflecting on past experiences at the MPF so you can avoid wasting time 14. Asking yourself if there are any parts of the job regulations that still confuse you 15. Beginning to test some of the new procedures on the job to see if they are going to work for you |
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PUTTING A HEADS UP DISPLAY (HUD) TOGETHER

Your unit has just received a new shipment of HUDs for your F-15s. The contractor has recently gone out of business and can provide no technical support for your mechanics. However, all directions for installation are included with the new shipment. **How likely are you to use the following learning strategies in finding out how the HUDs are installed on the F-15s?**

Directions: Select the 5 strategies from the following list of 15 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 5 other strategies that you might possibly use and place the number of these strategies in the *Possibly Use* box of the answer sheet. Select 5 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.

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| <p>1. Reflecting on whether you learn best by trial and error, by following directions, or by having someone tell you how to do it</p> <p>2. Resolving to learn how to put the HUDs together rather than worrying whether you can learn to do so</p> <p>3. Looking at a HUD that is already put together so you can have a model to examine as you work</p> <p>4. Looking at all the parts of the HUD to see if you will need to follow the directions closely</p> <p>5. Thinking about how nice it will be to save the Air Force money by putting the HUDs together</p> <p>6. Checking to see if the enclosed directions are accurate</p> <p>7. Keeping the overall task in mind to prevent getting lost in details</p> <p>8. Reassuring yourself occasionally that you can put the HUD together</p> | <p>9. Remembering the tools you will need to get by mentally picturing the tasks to be done</p> <p>10. Talking with a friend who has better mechanical skills than you for encouragement in putting the HUDs together</p> <p>11. Sorting out the parts that fit together so you will not leave out any part</p> <p>12. Imagining various ways the HUDs could be put together</p> <p>13. Recalling similar experiences putting things together to remember what methods worked best for you</p> <p>14. Taking a break if frustration interferes with figuring out how to put the HUD together</p> <p>15. Putting parts of the HUD together to see if they work even if you are not sure you are doing it right</p> |
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LETTER TO THE COMMANDER

Many of officers have been concerned about an issue affecting your workcenter. Two of your colleagues want you to help them put together a letter to the editor of your base newspaper that would state your side of the case. You agree to help plan the letter, but you realize that you first must know more about this issue and about the attitude of others toward it. **How likely are you to use the following learning strategies in learning about the issue and in preparing an effective letter to the editor?**

Directions: Select the 5 strategies from the following list of 15 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 5 other strategies that you might possibly use and place the number of these strategies in the *Possibly Use* box of the answer sheet. Select 5 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.

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| <ol style="list-style-type: none"> 1. Deciding what methods work best for you in analyzing issues 2. Focusing on learning about the issues rather than worrying if you can write an effective letter 3. Reading previous letters to the editor to clarify your position 4. Checking the arguments of those opposing your position to pick out inconsistencies in your ideas 5. Thinking of how the letter could improve the cooperative spirit within your workcenter 6. Checking with someone outside the workcenter who knows a lot about such issues 7. Reflective back to see if you are sticking with your plan of learning 8. Confirming your belief that a statement of your position in a letter to the editor will bring about positive change to the issue | <ol style="list-style-type: none"> 9. Forming a mental outline of the points you hear in discussions that you want to remember until you get a chance to write them down 10. Taking time to test your ideas out on people whose opinions differ from yours 11. Keeping a list of the points you want to get more information about before you write the letter 12. Thinking about numerous possible solutions that could be used to address this issue 13. Recalling similar experiences people have had in writing letters to the editor 14. Getting some feedback on your ideas before you sent the letter to the base newspaper 15. Thinking about what will happen if the letter is published by the editor |
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