THE LEARNING STYLES OF PILOTS CURRENTLY QUALIFIED IN U.S. AIR FORCE AIRCRAFT

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CHAPTER I

INTRODUCTION, RATIONALE, AND STATEMENT OF THE PROBLEM

Introduction

In this age of diversity it is readily apparent that we are all different. In addition to the more obvious size, age, and gender differences, we are all different in how we learn. Sometimes our background affects how we learn. Our education and experience, even our motivation and self-image, affect how we approach a learning situation (Sadler-Smith, 1996). One of the differences between individuals is how they process information when learning. This difference in information processing has come to be called learning style.

Research into these learning styles has followed two main paths as it has grown out of the field of psychology. One path has followed the classic Pavlovian stimulus-response approach, using reinforcement of successful completion at each step in a sequential learning process. The other path has focused on the cognitive processes in learning. Researchers conducting current studies of learning styles have mainly chosen this second path, focusing on the cognitive processes of the learner (Sims & Sims, 1995).

The Myers-Briggs Type Indicator (MBTI) is one of the most widely used personality measurement models in the world. The MBTI is based on Jung's personality models and is used to group individuals relative to scales of introversion versus extroversion, sensing versus intuition, and thinking versus feeling. Developed during the 1940s, by the middle of the 1990s it had been used to evaluate more than two and a half million people (Identifying how we think, 1997).

The field dependent/field independent model measures the influence of surrounding events upon the learner. Field dependent learners tend to perceive the grouping at the expense of the individual items within the group. Field independent learners, on the other hand, are able to sort individual elements from within the group (Claxton & Murrell, 1987).

Kolb's Learning Style Inventory is based upon a model of learning from experiences and measures the individual's preferred style of learning based upon where in the four step learning process the individual is most comfortable. The four steps used within this model are experiencing the event, reflecting upon the event, abstracting the event into generalized possibilities, and experimenting to test these generalizations (Kolb, 1984).

The Hermann Brain Dominance Instrument measures right brain/left brain hemispherocity and conceptual vs. experiential preferences (Identifying how we think, 1997). Another approach to hemispheric studies was developed by Crane (1992) and includes a measure of bilateral processing in addition to right brain/left brain measurements.

Whereas each of these researchers' different theories of learning are based on cognitive processes, the common goal is improving a teacher's understanding of the learning style of an individual student to increase student learning (Dyrud, 1995).

Researchers have conducted many studies into learning styles, and developed many different theories about these styles. As Wooldridge (1995) points out, the irony is that more research is still needed. In addition to research on the learning styles of minority students, women, and international students, a review of the implications of advanced technologies on the delivery of education is needed. Cross cultural studies have addressed the differences between European management students (Jackson, 1995) and the individualistic and collectivistic societal influences on Australian and Asians accounting students (Auyeng & Sands, 1996).

Even in training development the concern is what are the required tasks for the training event. The major portion of the indoctrination course in criterion referenced instruction focused on how to develop a complete and comprehensive task list. The task list for the E-3 Airborne Warning and Control aircraft filled five 3-foot-long bookshelves when it was completed. The syllabus for the initial qualification training of pilots using this task list fit, and still fits, into one 4-inch binder. Learning styles were not mentioned in either document. Even the Federal Aviation Administration (FAA) guidance for pilot training requirements is a task list with required proficiency levels (CFAR 61, 1998).

Research within the academic world into pilot's learning styles is sparse. Three recent studies using Crane's brain hemispherocity have examined the cognitive bias of corporate pilots, college aviation students, and airline pilots (Quilty, 1995, 1996, 1997). It is hoped this trend can continue as more pilot training moves into colleges and universities in addition to the traditional independent pilot instructor or FAA certified flight school.

One hundred and forty-six public and private colleges, either two-year or four-year, have professional pilot degree programs (Schukert, 1995). More than three fourths of the college aviation faculty who were surveyed agree that a current and future need exists for a non-engineering doctoral program in aeronautical/aerospace sciences (Johnson & Lehrer, 1995). Studies in cooperative learning (Holubec, Johnson, and Johnson, 1993) have shown improvements in performance of trainees in air traffic control. Internships (Thiesse, Newmeyer, and Widick, 1992) and the use of virtual reality technology (Treiber, 1994) are being used in airfield operations and air traffic controller training programs.

These studies have applied new technology, or occasionally new teaching techniques, to existing training programs. The learning styles of the trainee population were not mentioned in any of these studies of aviation training programs. One study of a computer-based simulation training program for pilots was redesigned to include live instructors, technical manuals, and video tapes after the initial program was critiqued by the students (Bovier, 1993). These critiques were used as an example of a failure of computer-based training rather than a failure of matching learning styles with material presentation. This was the closest any of the above cited studies came to discussing pilot learning styles. Understanding the learning styles of qualified pilots makes improvements in training methods possible, and improvements in the abilities of individual instructors.

Statement of the Problem

The predominant learning styles of currently qualified pilots are not well defined and, therefore, a need exists to categorize them. How students learn is impacted by how the material they are to learn is presented. Increasing student learning, the desired outcome of all instruction, requires developing an ability to recognize students' learning styles and use techniques that increase the probability of achieving success (Anderson & Adams, 1992). Studies have shown that more effective learning is achieved when programs take into account the learning styles of the target population (Wooldridge, 1995).

Following initial qualification training, pilots enter the learning environment on a regular basis. Whether they are upgrading to a new position, learning to fly a different aircraft, or learning how to use new equipment being added to current aircraft, formal training programs are part of the normal routine of a pilot. Today, almost no information is available on how to present the material in these formal training programs based upon how pilots learn. The training programs are developed to present the tasks the pilot must be proficient in by the end of the training program. The presentation of the training program depends upon how the instructor pilot conducting the session learned the material, or upon the instructor pilot's unconscious predominant teaching style. By understanding the learning styles of pilots, courses can be tailored to the best method possible to reach the target pilot population. After all, the goal of learning style theory is to allow instructors to learn as much as possible about how they and their students learn, and to develop teaching techniques to improve the learning of the greatest number of students (Dyrud, 1997).

Purpose of the Study

The purpose of this study is to examine the learning styles of pilots currently qualified in United States Air Force aircraft to determine which learning styles are represented within this group of pilots. Once these learning styles have been identified, this information can be used to improve instructor effectiveness, course design, and "contribute to more effective learning" (Sims & Sims, 1995, p. xii).

Objective of the Study

This study is intended to describe the existing learning styles within this pilot group and to develop a methodology for determining learning styles which can then be applied to other selected pilot groups. Understanding the learning styles of currently qualified pilots also has implications for the design of courses in the areas of continuation training, upgrade training, and systems training programs.

The working hypothesis is that one predominant learning style will be shared by pilots currently qualified in United States Air Force aircraft.

Demographic data collected with the learning styles surveys will be used to assess how pilots' experience level impacts learning styles.

Assumptions

It is assumed that the study participants provided honest answers to the questions asked on the survey.

Because of the regular rotation of pilots through professional schools, training units, and non-deployable units flying the same types of aircraft as the restricted units, the available population is assumed to be all Air Force pilots.

Scope and Limitations of the Study

This study was conducted during March through June of 1998. Because of restrictions in the Freedom Of Information Act, the sample was limited to pilots who are not assigned to units which are regularly deployable or have classified or sensitive missions. These same Freedom of Information Act restrictions prohibit release of the number of pilots who are assigned to deployable or sensitive mission units. According to Krejcie and Morgan (1970) the minimum sample size for a population of 14,000 is 374 to achieve a 95% level of confidence that the sample is representative of the population.

Abbreviations and Definitions

The officer rank structure of the United States Air Force uses the following abbreviations:

2Lt	Second Lieutenant
1Lt	First Lieutenant
Cpt	Captain
Maj	Major
LtCol	Lieutenant Colonel

The following definitions are furnished to provide a common framework for understanding terms used in this study:

Pilots currently qualified in United States Air Force aircraft - Those individuals who have successfully completed United States Air Force Undergraduate Pilot Training.

Currently - This term is used in the sense of current in time and includes those pilots who are not maintaining currency and proficiency in assigned aircraft as defined in United States Air Force training instructions.

CHAPTER II

REVIEW OF THE LITERATURE

Learning Styles

Background

Some definitions of learning style are as simple as how students learn. Other definitions are complex, chapter-length discussions such as the one used by Schmeck in *Learning Strategies and Learning Styles* (1988). Regardless of the length of the definition, research into learning styles focuses on the differences within the learning process of an individual.

Learning styles also describe how an individual goes through the learning process. How this learning process is viewed has changed over the years. Kolb (1984) describes how the influences of rationalist and behaviorist thought led to a decrease in the value of life experience as part of this learning process. Since the origins in the Middle Ages, universities have favored theoretical concepts over practical experience. Even medicine was taught as a theoretical subject. Experiential learning was held in such low esteem by the early universities that a medical student was severely punished for actually dissecting a cadaver. "Gross anatomy was governed for centuries by theories that could have been refuted by direct observation" (Houle, 1984, p. 22).

Experiential learning was relegated to the crafts and the apprenticeship program. By learning specific, practical skills, and demonstrating mastery of them, an individual became a guilded craftsman. Occasionally, an individual accomplished both academic and experiential learning. Studying in private libraries, these adult learners pursued their interests at their own pace, by themselves, and with their own goals. Until the 19th century the blending of academic and experiential learning was an individual effort rather than a systematic endeavor (Houle, 1976).

The industrial revolution, and the changes it brought to society, the crafts and professions, was the catalyst for joining the two methods of learning by the middle 1860s. John Stuart Mill (1874), in his 1867 inaugural address as Rector of St. Andrews University in Scotland, said that

> . . . whatever we do for ourselves, and whatever is done for us by others, for the express purpose of bringing us somewhat nearer to the perfection of our nature; it does more: in its largest acceptation, it comprehends even the indirect effects produced on a character and on the human faculties, by things of which the direct purposes are quite different; by laws, by forms of government, by the industrial arts, by modes of social life; nay, even by physical facts not dependent on human will; by climate, soil, and local position. Whatever helps to shape the human being—to make the individual what he is not—is part of his education. (p. 333)

The university today is expected to provide an education, and also to prepare the graduate for life in the workplace. Internships, work/study, and experiential workshops have appeared both on the university campus and in corporate training departments. Experiences ranging from working in the cafeteria to foreign exchange programs are included in diverse curricula, with the student maintaining a journal to describe the experiences and the knowledge gained (Gordon, 1976).

The integration of academic and experiential learning has not been without problems. Alignment of academic and work objectives has been problematic. The student must decide which activity is more important, academic studies or active work experience. Students and their future employers look for relevance to work-place requirements in the college experience, while university faculties have an academic bias, causing them to support curricula preparing students for academic careers (Gordon, 1976). Kolb (1984) also found that skeptics among the academic community found experiential learning "too thoroughly pragmatic for the academic mind, dangerously associated with the disturbing anti-intellectual and vocationalist trends in American society" (p. 3).

In the years since the Middle Ages, experiential learning and the academic environment of the university have coexisted without either type of learning losing its individual characteristics, much like placing two lumps of coal in the same container. Another possibility is more analogous to putting two cubes of ice in the same glass. They join with each other to create a new, distinct, whole. Houle (1976) describes this melding with an example from Plato's *Meno* in which Socrates guides an uneducated slave boy to the Pythagorean theorem by helping him re-form the facts he already knows (p. 20). Coleman (1976) goes one step further and shows how the steps in learning are the same for academic and experiential learning.

Kolb (1984, p. 3) found that experiential learning "offers the foundation for an approach to education and learning as a lifelong process . . . " In a return to John Stuart Mill's ideas Kolb says that ". . . learning is described as a process whereby concepts are derived from and continuously modified by experience" (p. 26). Kolb's (1984) experiential learning model blends academic and experiential learning into one, contending that whether the learning event is intellectual or physical, the process is the same.

The learning process, according to Kolb (1984), is broken down into four steps: (a) concrete experience, or the ability to become involved ". . . fully, openly, and without bias in new experience . . . ," (b) reflective observation, or the ability ". . . to reflect on and observe . . . experiences from many perspectives . . . ," (c) abstract conceptualization, or the ability to ". . . create concepts that integrate . . . observations into logically sound theories . . . ," and (d) active experimentation, or the ability to ". . . use these theories to make decisions and solve problems . . ." (p. 30).

These abilities represent polar extremes of two learning axes. Concrete experience is the opposite of abstract conceptualization, and reflective observation is the opposite of active experimentation. The concrete/abstract continuum represents how experience is acquired and grasped. Kolb (1984) defines learning from the physical, concrete experiences of life as apprehension. The reliance on interpretation of symbolic representations and abstract conceptualizations is defined as comprehension. How this experience is then processed is represented on the reflective/active continuum. Internal, reflective observation is defined as intention, and active experimentation with the external world is defined as extension.

The process of acquiring knowledge becomes a spiral in which the learner moves continuously through the phases of learning, always building upon prior experiences. That people learn differently, either in terms of rate of learning or level of learning, is an intuitive axiom. How and why these differences exist is less accepted or understood. Psychologist Carl Jung (1921, 1946) described people as feelers, thinkers, sensors, and intuitors when discussing these differences in learning. These terms tend to be recurring themes, perhaps because of the roots of learning style research in the field of intelligence testing. Learning styles research became a significant field in education starting in the 1970s (Lewis & Steinberger, 1991).

Lewis and Steinberger (1991) gave the following summary of the growth of learning style research:

> Current research about learning styles began to develop several decades ago from several different directions. These included early studies on cognitive growth, the areas of the brain related to intelligence and behavior, and the influence of school environmental and social factors on students. (p. 7)

Schmeck (1988) describes the process of style development as the result of positive reinforcement of early learning situations. If a student achieves positive results with a specific style, he or she is likely to repeat that style in later situations. Continued success with a specific learning style, with the resulting positive feelings of achievement and self worth, leads to a long-term reliance on this learning style, even when another style may be more appropriate. This is not to say that the learner can use only one style of learning; rather it is to say that the learner becomes much more comfortable with a learning style. This style then tends to dominate all learning experiences which it can be made to fit. Only when the dominant style proves ineffective does the learner shift to other learning styles.

Within Kolb's (1984) model two sets of polar opposites exist between which the learner will choose. Learners will be either more concrete or more abstract in their learning process. Sufficient studies have been conducted on this abstract/concrete dichotomy that the image of the left-brained, calculating, logical individual compared to the right-brained, spatial, artistic individual is part of the popular culture. These extremes are represented by the stereotypical scientist or engineer, complete with pocket protector, and the Greenwich Village actor or the impressionist painter, recording images only the creator can see.

Similarly, the information processing continuum has polar opposites of active experimentation and abstract reflection. Kolb (1984) uses Carl Jung's introversion and extroversion to describe these two poles. The extrovert prefers to actively participate in the process, getting his or her hands on the object of study. The introvert prefers to internalize the process, thinking through to a logical conclusion. Popular culture again gives us examples of both types of learners: the extroverted, active experimenter jumping off the diving board without bothering to check if the pool has been filled; the introverted, abstract conceptualizer, frozen in thought like Rodin's *Thinker*.

Taking the two methods of acquiring experience and pairing them with the two methods of processing experience yields four styles of learning (see Figure 1). Physical, concrete experience processed internally through abstract reflection is divergent learning. Symbolic, abstract conceptualizations processed internally through abstract reflection is assimilative learning. Symbolic, abstract conceptualizations processed externally through active experimentation is convergent learning. And physical, concrete experience processed externally through active experimentation is accommodative learning (Kolb, 1984).

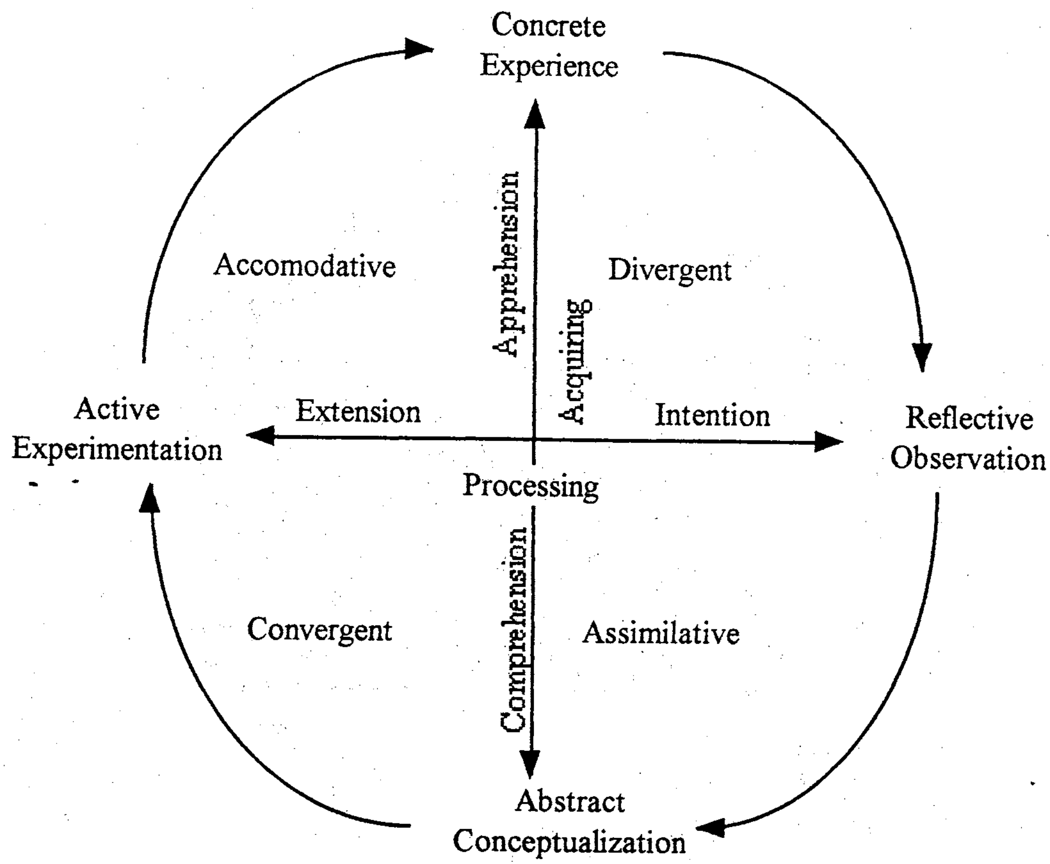

Figure 1. Four Styles of Learning

Kolb (1984, 1985) describes the characteristics associated with each learning style based on the results of research data and clinical observations. The four learning styles represented by the quadrants of the experiential learning cycle form two additional sets of polar opposites. By combining abstract conceptualization and active experimentation the convergent learner organizes knowledge to address specific issues. Reasoning and "what-if" scenarios are used to focus available information on a single solution to the problem at hand. This ability to focus toward a single answer gives the convergent learner strength in problem solving and decision making tasks. The convergent learner is more comfortable with technical issues than emotional or social issues.

The opposite of the convergent learner is the divergent learner. The combination of concrete experience and reflective observation allows the divergent learner to look at concrete situations from many different directions. This ability to look at alternatives gives the divergent learner strength in imaginative pursuits seeking the meaning of events and the values of the participants. The divergent learner is the stereotypical people person, interested in relationships, feelings. They look for the imaginative solution and the relationships of alternate approaches.

In the assimilative learning style the learner combines abstract conceptualization and reflective observation. Like the convergent learner, the assimilative learner prefers to focus on concepts and problems instead of on people. Unlike the converger, the assimilative learner looks at the many possibilities represented by the problem. Inductive reasoning, imaginative approaches, and multiple observations are combined into theoretical answers. Logical and internally consistent answers are more valuable than a precise solution to the assimilative learner. For the assimilative learner the process is more important than the outcome; a sound, cohesive theory is more important than the facts.

The opposite of the assimilative style is the accommodative learning style. Using concrete experience and active experimentation, the accommodative learner works to make the theory fit the facts. The accommodative learner is action oriented, preferring trial-and-error to theoretical discussions. Being more ready to ask for information than to try to reason a problem out for themselves, accommodative learners use people as a valuable source of information. The opportunistic, action oriented approach of the accommodative learner gives them strength in rapidly changing environments requiring adaptive approaches to get things done. The accommodative person is the one who answers a question with "Let's go see."

These four patterns of behavior are evident in both personality typing and task-oriented skill activities. The characteristic learning style is the predominant approach each learner takes to a learning situation. This predominant learning style is not fixed and unchangeable. Rather it is stable from long usage. If the learning objective cannot be achieved using the predominant learning style, the learner will shift as far as necessary into a different learning style to achieve the desired learning outcome.

Pask (1988) found in a series of studies that not only do individuals develop personal preferred learning styles, institutions also develop preferred styles in the way material is presented. Learning is more effective when there is a match between the student's preferred learning style and the institution's preferred teaching style than when these styles do not match.

The way material is presented in the classroom can be altered to take advantage of the known characteristics of the target learning population. In this way the preferred teaching style is changed as an alternative to forcing the learner to make a shift in learning style. Matching the presentation of the material to the student's predominate learning style yields more effective instruction than using other styles. Pask (1988) found this increased effectiveness from matching styles in a series of studies in the United Kingdom during the 1970s and 1980s. Filipczakink (1995) describes this adaptation to the learner's preferred style as style shifting.

How this style shift is made, or if it is made at all, can also affect the learning outcome. Thomson (1997) uses the term schizophrenic to describe the effort to be all things for all students. He suggests instead teaching from the strength of the instructor and using the knowledge of other learning styles to reach out to learners with each style. Allowing the instructor to remain within his or her preferred teaching style transfers some of the responsibility for learning to the student. This shared responsibility for learning fits well with Evuleocha's (1997) concept of meta-learning as a "symbiosis of teacher and learner . . ." (p. 129). Boyatzis and Kolb (1995) echo this theme of shared responsibility when they discuss using learning styles as an aid in learning how to learn.

Whether teaching is perceived as being teacher centered, student centered, or a shared responsibility, all participants must recognize that differences exist between individuals. Any attempt to match learning and teaching styles, or for that matter to mismatch learning and teachings styles in an effort to push learners into exploring new ways of learning, recognizes this individuality of both the instructor and the learner. Any active choice in instructional design which recognizes the individual preferences of the learner is better than ignoring the learner's individuality, or worse, denying that this individuality either exists or matters (Sadler-Smith, 1996).

Educational Studies

Two studies outline the breadth and depth of research into basic learning. Brylinsky (1995) compared theory-based and discovery-based laboratories for motor learning. Bedford (1995) looked for the conditions under which learning occurs and for a measure of what is contained within learning.

Research into learning and behavioral style has investigated differences based on sex, race, age, physical disability, region, and academic subject. A 12-week program based on learning styles of a target group of nonparticipating kindergartners produced a 20% increase in time on a task, a noticeable improvement in kindergarten activities, improved work habits, and increased participation in critical thinking activities (Vallarta, 1991). An experiment showed that only through practice could children improve their accuracy at intercepting a moving target, testing their transfer of training to performance (Bard et al., 1995). An experiment with 40 women learning how to kick a ball had similar results (Jarus & Loiter, 1995).

In a study of approximately 6,000 high school and 1,800 college students Matthews and Hamby (1995) found significant differences between the preferred learning styles of high school and college students. These differences were evident both when comparing the two main groups and when comparing subgroups of male/female and Caucasian/African American within and between the two main groups.

Perhaps more significant are the results of a separate study on self-perception of academic achievement. A significant correlation was found between the student's assessment of academic performance, the teacher's corroboration of that self-assessment, and the student's predominant learning style. Those students whose learning style focused more directly on a problem or activity than on people skills showed significantly higher perceptions of achievement than students with the opposite focus (Matthews, 1996).

Hartman (1995) used Kolb's Learning Styles Inventory to organize study groups with equal representation of the four learning styles. She reports that students show a more positive reaction toward problem-solving after discussing the learning traits identified using the learning style analysis. In addition to improved self-evaluations and instructor evaluation, her students report greater self-confidence and better self-images. This increase in self-awareness and self-confidence is linked to increased student satisfaction, higher retention rates, and greater persistency toward degree completion. Romero (1995) also reports increased mastery of concepts in organizational behavior after using similarly balanced study teams. These groups worked together analyzing each course topic and completing topic related exercises. For eight course evaluation items on end of course critiques, team responses averaged 4.3 (out of 5).

Geary and Sims (1995) review the implications of learning styles on accounting education programs. Learning styles of students and teaching styles of instructors are integrated to provide a cohesive program offering alternative approaches for each area of study. They conclude: "Explicit recognition of the fact that diverse approaches are both inescapable in the learning process and essential in the achievement of diverse goals can dramatically alter the ways faculty and students make the most of their opportunities in the classroom" (p. 126).

Pilot's Learning Styles

Carretta and Seim (1988) describe the research on pilots as having "concentrated on psychomotor skills and perceptual/cognitive abilities" with less research "among pilot personality, attitudes, and performance" (p. 1). The Air Force Officer Qualifying Test, used to determine eligibility for undergraduate pilot training, also tests for cognitive and perceptual abilities.

Studies have been conducted on pilots' personalities and attitudes with goals of understanding the level of assertiveness, motivation, risk sensitivity, and self-confidence. Decision-making and preference for individual or group activities and problem solving as well as field dependence and field independence have been studied (Carretta & Siem, 1988). These studies have all focused on each individual element as a predictor of successful completion of pilot training. The researchers have looked for the characteristics which are required to complete an existing training regimen. Also, while individual elements of each study can be used to interpret how an individual learns, the studies are not measures of core learning styles .

Against the backdrop of significant research into improved effectiveness of instruction by matching course content and presentation to the predominant learning style of the target audience, pilot training still relies on task lists and demonstration/ performance instructional techniques (Upchurch, 1990). Determining the predominant learning styles of pilots will make available the improvements in effectiveness found in other avenues of education and training.

Learning Styles Instrument

The Kolb Learning Styles Inventory (LSI) was developed in 1976 and revised in 1985. It was based on Kolb's (1976, 1984) theory of experiential learning. The LSI consists of 12 sentence stems, each with four possible endings. The subject must rank the possible responses according to how each fits the way he or she learns something new. Each of the possible responses represents one of the four learning modes within the experiential learning cycle. This forced-ranking produces a score of between 12 and 48 for each mode of learning. A scale is used to score the responses, showing the relative strengths of each of the four learning modes. Finally, two combination scores are derived to determine which of the four learning styles is predominant.

The score for concrete experience is subtracted from the score for abstract conceptualization. This difference indicates where the score falls along the abstract/concrete scale. A more positive value represents a more abstract score, and a more negative score represents a more concrete score. Similarly, the reflective observation score is subtracted from the active experimentation score. This difference indicates the level of active versus reflective tendency represented by the score. A positive score represents an active outlook, while a negative score represents a reflective outlook. As with the abstract/concrete scale, the more positive or negative the score is, the greater the relative strength of the specific tendency (Kolb, 1985).

In addition to describing an individual's primary learning style, the LSI displays some predictive ability. Because of the specialization of undergraduate degree programs, it is possible to ". . . expect to see relations between people's learning style and the early training they received in an educational specialty or discipline . . ." (Kolb, 1984, p. 85). Kolb reports significant results for undergraduate education as a predictor of learning style, showing degrees in the arts going to divergers, degrees in the physical sciences going to convergers, and degrees in the social sciences going to assimilators.

Individuals who work in various professions display characteristic learning styles when completing the LSI. Those working in social professions are predominantly accommodators and those working in technical or scientific professions are predominantly convergers (Kolb, 1984).

Validity

The original LSI was normed and validated based upon a sample of 1,933 adults between 18 and 60 years of age. The revised version, published in 1985, was tested for reliability using a sample of 982 graduate and undergraduate students. Psychometric ratings using Curry's learning style topology were strong for reliability and fair for validity (Hickcox, 1995; Kolb, 1984).

Willcoxson and Prosser (1996) reviewed the validity and reliability of the LSI since its initial development and conducted a current study of these features.

They found that construct validity had centered upon three strategies:

> (1) Discipline-based research, exploring the extent to which specified professional or student groupings demonstrate the learning style preferences predicted on the basis of Kolb's (1984) experiential learning theory and research; (2) factor analysis, examining the LSI response alternative in relation to the experiential learning theory on which the instrument was based; and (3) instrument correlations, comparing results obtained on the LSI with those obtained using other instruments which test aspects predicted on the basis of the theory's underlying constructs to relate to learning style preferences. (p. 248)

Discipline-based research showed agreement with predicted outcomes. Willcoxson and Prosser (1996) cited concerns of small sample size and use of simple majorities to assign learning style preference, along with limited gender difference studies as areas requiring future study. Willcoxson and Prosser found no specific agreement among those studies using factor analysis to determine validity. They found some researchers who attributed positive factor results to instrument bias, some researchers who found support only for individual learning styles, and some who found significant factorial validity.

Correlation studies by Moore and Sellers (1982) and Fox (1984) found no relationship between learning and teaching styles, but suffered from using unvalidated instruments for the comparison. The 1987 study by Highhouse and Doverspike found positive correlations when using established, validated instruments for the comparison.

In summary, studies in each of these strategies found the LSI to show internal validity. All of the studies cited by Willcoxson and Prosser (1996) address the original version of the LSI. Their 1996 study sampled 191 students at an Australian university using the revised LSI. They found discipline-based validity for Arts and Sciences. Factor analysis showed validity with the predicted arrangement only for the Sciences. Rather than two bipolar factors as predicted, the Arts showed bipolar arrangements between active experimentation with each of the other three learning styles (p. 256).

Reliability

Reliability studies reviewed by Willcoxson and Prosser (1996) were less conclusive. Results in these studies showed moderate to high internal consistency but low to moderate test-retest reliability. Willcoxson and Prosser found high internal consistency in their study, comparing correlations of coefficient alpha and Pearson product moments to analyze reliability. High internal consistency was shown in both cases. Kagan (1989) found a longer term consistency in the measurements of learning styles of adults. This finding of relative stability has become a consistent theme through the many definitions of learning style (for example, Pask, 1988; Schmeck, 1988; Sims & Sims, 1995).

Advantages

Hickcox (1995) postulates three questions for

> . . . determining the overall quality of a learning style instrument: (1) what are the extent and results of the reliability and validity testing? (that is, sample sizes of the test groups; numbers less than 30 tend to be questionable); (2) Has the instrument been revised since its origination? Relevance of language and issues tested for change with time (for example, an instrument created in 1975 may use gender-biased language in 1995); (3) Is the instrument designed to be administered to your adult population? (p. 26)

The Kolb LSI meets all three of the criteria postulated by Hickcox (1995). Initially developed in 1976, and revised in 1984 (Kolb, 1976, 1984), the LSI has been used, and validated, in such diverse studies as comparing learning styles between high school and college students (Matthews & Hamby (1995), a cross-cultural comparison of the learning styles between Western and Asian learners (Auyeng & Sands, 1995), and comparisons of the learning styles among European management training students (Jackson, 1995). Recent validation studies such as that conducted by Willcoxson and Prosser (1996) have proven the continued usefulness of the LSI as a measure of predominant learning styles.

A final advantage of the Kolb LSI for this study was its length. Using only 12 forced-choice responses resulted in an instrument which is quickly answered. Kolb (1984) considered this a practical approach allowing multiple uses for the LSI. This practical concern is especially relevant in this particular study. On a regular basis the pilots in the United States Air Force receive surveys on quality of life issues, retention issues, and career goals, and surveys which are intended to provide data to the senior leaders of the Air Force. A survey which is quick and easy to complete is less intimidating than a long, involved questionnaire. This contributed to receiving a return rate of over 40% with only one mailing.

Disadvantages

The key disadvantage of the Kolb LSI was the variation in achieved levels of reliability. The high internal consistency and the low test-retest consistency reflect the situation specific nature of the instrument. Without specifying the learning situation the respondent is to use, it is possible to have the two tests completed by the same individual for two different learning situations. Willcoxson and Prosser (1996) note that the same individual may respond differently when focusing on acquiring driving skills than when focusing on studying English Literature.

Specifying an aviation learning experience for the study specifically addressed this issue by focusing the responses on flight related training. This concentration on flight related training activities increased the applicability of the data to other aviation training events.

Applicability to the Study

The Kolb LSI provided a reliable, validated instrument for predicting the learning environment which is most conducive to the learning of the target population. It has been used to investigate the learning styles of many diverse students in a wide variety of learning experiences. This diversity of background is reflected in the pilot population within the United States Air Force.

The predictive nature of the LSI was also appropriate for this study. Air Force Instruction 36-2205 (1996) specifies that for entry into the Air Force Undergraduate Pilot Training program a candidate must have an undergraduate degree and achieve specific minimum scores on the Air Force Officer Qualifying Test. No specific educational specialty or discipline is required. Additionally, aviation by its very nature is a highly technically oriented profession. Both areas of prediction associated with the LSI are useful.

Summary

The preceding review of literature traced the evolution of learning styles from the Middle Ages to current times. In the Middle Ages a clear separation existed between analytic, academic studies, and experiential learning. By the middle of the 1800s the two methods of learning had, at least officially, reached equal status at the university level. In the 20th century, with the development of psychological typing and behaviorist theories of learning, experiential learning and academic learning began to meld into a single process.

Hickcox (1995) reviewed 21 instruments that measured learning style and were developed in the United States, Australia, and Europe. Of these 21 instruments only the Kolb Learning Style Inventory (1976, 1985) produced any independently developed variants. Four variants stimulated by Kolb's experiential learning theory were developed between 1974 and 1977. Kolb's LSI, its derivatives, and similar instruments have been used to address teaching methods and curriculum development. Matching material presentation to preferred learning style is the goal when these instruments are used for this purpose. These assessment instruments are also used for learner self-evaluation. By understanding the learner's own preferred learning style, and the strengths and weaknesses associated with that style, the learner is better able to adjust to different learning situations (Hickcox, 1995).

The review of Kolb's (1984) learning style theory describes how psychological and behaviorist models can be combined to define four predominant learning styles. The learning style inventory developed as a measurement instrument for Kolb's (1984) theory has been used in learning studies based on sex, race, age, physical disability, region, academic subject, and occupation. These studies have shown improved learning when teaching style is matched to predominant learning styles.

Studies of how pilots learn have centered on being able to predict successful completion of existing training programs. This prediction matches students' styles to existing teaching methods instead of adjusting teaching methods to reach a wider group of learners. By studying how pilots learn, adjustments in training programs may be possible, improving the effectiveness of the training program. These improvements in training effectiveness have been demonstrated in studies of academic and technical learning situations (Vallarta, 1991; Matthews, 1996; Hartman, 1995).

The effectiveness of current pilot training programs is measured in terms of accidents per 100,000 flying hours. When the number of accidents exceeds some unidentified number which focuses the attention of senior leaders on flying safety, training issues are addressed. When the accident rate is below this unidentified number, little concern exists for these training issues. By focusing on pilot learning styles, the opportunity exists to improve flight training without the issue of flight safety being the primary concern. In this age of decreasing federal budgets and low rates of pilot retention, achieving more effective training can provide an avenue via which less experienced pilots can acquire the skills they need. Perhaps this information on pilots' learning styles will allow aviation training to share some of the benefits being gained in other training fields.

CHAPTER III

METHODOLOGY

Introduction

The purpose of this study was to determine the preferred learning styles of pilots currently qualified in United States Air Force aircraft. Because a multitude of standard instruments have been developed and validated to assess learning styles, a standard learning style instrument was chosen for this study. The Kolb Learning Style Inventory has been shown to be a valid and reliable instrument to measure learning styles in a number of studies around the world. The ease with which it can be administered, made it a logical choice for this study.

Population of the Study

According to demographic data from the Master Officer Personnel File at the Air Force Personnel Center (AFPC) (1998), approximately 14,000 pilots were on active duty in the United States Air Force as of December 31, 1997. Of the 14,000 pilots, 97.6% are men and 2.4% are women. Table I shows the distribution b grade. Less than 1% of the pilots are listed as American Indian/Alaskan; 1% are Asian/Pacific Islanders; 2% are Black, non-Hispanic, and 1% are Hispanic; 94% are listed as White, with 1% listed as other/unknown. Tables I, II, and III show the demographic data reported by the AFPC (1998).

TABLE I

NUMBERS OF PILOTS BY SEX AND RANK

	No. of Men	No. of Women	Total
2LT	204	8	212
1LT	675	31	706
CPT	7423	217	7640
MAJ	3407	51	3458
LTC	2085	26	2111
Total	13794	333	14127

Source: Officer Master Personnel File as of December 31, 1997

TABLE II

NUMBER OF PILOTS BY MAJOR WEAPON SYSTEM

	Grade					Men		Women		Total
	2LT	1LT	CPT	MAJ	LTC					
	#	#	#	#	#	#	#	#	#	#
Fighter	87	329	1850	1467	844	4556	99.54	21	0.46	4577
Trainer	13	42	76	12	41	177	96.20	7	3.80	184
Bomber (Include U-2)	4	44	499	384	241	1166	99.49	6	0.51	1172
Tanker	47	62	1838	560	319	2687	95.08	139	4.92	2826
Global Airlift	17	105	1674	426	275	2404	96.28	93	3.72	2497
Theater Airlift	7	76	1313	411	239	1996	97.56	50	2.44	2046
Helicopter	10	36	374	191	144	741	98.15	14	1.85	755
Other/None	27	12	16	7	8	67	95.71	3	4.29	70
Total	212	706	7640	3458	2111	13794	97.64	333	2.36	14127

Source: Officer Master Personnel File as of December 31, 1997

TABLE III

PILOTS BY SEX, ETHNIC GROUP AND RANK

	2LT			1LT			CPT			MAJ			LTC			Total	
	#	ROW %	COL %	#	ROW	COL %	#	ROW %	COL %	#	ROW %	COL %	#	ROW %	COL %	#	COL %
MEN																	
American Indian/Alaskan	2	4	1	2	4		22	45		12	24		11	22	1	49	
Asian/Pacific Islander				11	10	2	59	54	1	23	21	1	16	15	1	109	1
Black (non-Hispanic)	2	1	1	15	6	2	154	62	2	48	19	1	29	12	1	248	2
Hispanic	4	2	2	10	5	1	96	51	1	48	25	1	82	17	2	190	1
White (non-Hispanic)	195	1	96	621	5	92	6944	53	94	3266	25	96	1994	15	96	13020	94
Other/Unknown	1	1		16	9	2	148	83	2	10	6		3	2		178	1
Total	204	1	100	675	5	100	7423	54	100	8407	25	100	2085	15	100	18794	100
WOMEN																	
Asian/Pacific Islander							3	100	1							3	1
Black (non-Hispanic)							3	75	1	1	25	2				4	1
Hispanic							1	50		1	50	2				2	1
White (non-Hispanic)	8	3	100	30	9	97	205	64	94	49	15	96	26	8	100	318	95
Other/Unknown				1	17	3	5	83	2							6	2
Total	8	2	100	31	9	100	217	65	100	51	15	100	26	8	100	333	100
Total	212	2	100	706	5	100	7640	54	100	3458	24	100	2111	15	100	14127	100
SUMMARY																	
American Indian/Alaskan	2	4	1	2	4		22	45		12	24		11	22	1	49	
Asian/Pacific Islander				11	10	2	62	55	1	23	21	1	16	14	1	112	1
Black (non-Hispanic)	2	1	1	15	6	2	157	62	2	49	19	1	29	12	1	252	2
Hispanic	4	2	2	10	5	1	97	51	1	49	26	1	32	17	2	192	1
White (non-Hispanic)	203	2	96	651	5	92	7149	54	94	3315	25	96	2020	15	96	13338	94
Other/Unknown	1	1		17	9	2	153	83	2	10	5		3	2		184	1
Total	212	2	100	706	5	100	7640	54	100	3458	24	100	2111	15	100	14127	100

Sample of the Study

The sample for this study was generated by the data retrieval section at AFPC. According to S. Heitkamp (personal communication, April 13, 1998) the data storage system has a built in randomization process for extracting names from the master personnel file based on the specified sort criteria. Using this built-in system a list of 600 pilots was drawn at random from the Air Force Master Officer Personnel File. The list was generated on January 30, 1998. Individuals assigned overseas, or in classified, sensitive, or routinely deployable units were excluded from the sample. Freedom of Information Act restrictions prohibit the release of information on individuals in these categories of assignments. Regular rotation of personnel through professional military education courses, aircraft qualification courses, academic programs such as the Air Force Institute of Technology, and staff assignments provide access to individuals with similar qualifications to the individuals in the excluded group. S. Heitkamp (personal communication, August 6, 1998) confirmed that because of this rotation through positions which are not releasable because of restrictions in the Freedom of Information Act for Air Force studies a sample drawn using this restriction is still considered to be representative of the entire population.

Timing and Administration of the Study

The study was conducted during March through June of 1998. The survey was mailed directly to the duty address provided by the Air Force Personnel Center for each individual. A business reply envelope was supplied with the survey, and the individuals returned the survey using this envelope.

Research Instrument

The Kolb Learning Styles Inventory (LSI) was used to collect primary data. For purposes of this study, the directions to the respondents requested that they consider an aviation training event while completing the survey. Specifying an aviation training event ensured that all respondents completed the survey from the same perspective. By comparing similar learning situations, the data were more consistent across the sample. Additional demographic data were collected to define and describe the sample population. A cover letter was used in lieu of an individual consent form. Copies of the LSI, the demographic data collection form, and the cover letter are in the appendixes.

Data Collection

Each individual completed the LSI and the demographic survey, which were returned via supplied business reply envelopes.

Statistical Methods

Analysis of the responses to the learning styles instrument was as prescribed by the instrument designers to maintain validity and reliability. A frequency sort was made of the resulting preferences of learning styles. In addition to the individual preferences of learning style, the sample mean and sample median were used to provide a group learning style.

Chi-square was used to test the sample/population relationship. Descriptive statistics, analysis of variance, and chi-square comparisons were calculated using JMP-IN Version 3.1.5 (1995).

CHAPTER IV

FINDINGS

Demographic Data

The purpose of this study was to determine the learning styles of pilots currently qualified in United States Air Force aircraft. Copies of the Kolb Learning Style Inventory and an accompanying demographic data questionnaire were mailed to 600 United States Air Force pilots in March, 1998. Two hundred and thirty three surveys were returned by the end of June, 1998, with completed and usable instruments. Another 63 surveys were returned by the United States Postal Service as undeliverable. The return of 233 of 537 surveys provided a 43.8% response rate for this study.

The original sample size was chosen to provide a 95% probability of matching the population of 14,000 pilots in the United States Air Force. The rank structure of the final sample very closely approximated this population, with slightly fewer than expected captains, and slightly more than expected majors. Table IV shows the distribution of the sample relative to the population for rank structure, gender, ethnicity, and type of aircraft flown.

TABLE IV

SAMPLE VS. POPULATION DISTRIBUTIONS

	Sample %	Population %
Grade Distribution		
2LT	3.4	2.0
1LT	5.1	5.0
CPT	48.1	54.0
MAJ	27.9	24.0
LTC	15.5	15.0
Gender Distribution		
Female	5.2	2.4
Male	94.8	97.6
Ethnic Distribution		
American Indian/Alaskan	1.3	0.3
Asian/Pacific Islander	0.4	1.0
Black (non-Hispanic)	1.7	2.0
Hispanic	1.7	1.0
Other	2.6	1.0
White (non-Hispanic)	92.3	94.7
Aircraft Distribution		
Fighter/Attack/Reconnaissance (FAR)	27.5	33.7
Tanker/Transport/Bomber (TTB)	57.1	60.1
Helicopter (HELO)	5.2	5.3
Other/None	0.0	0.5
Both	9.9	0.0

Sample distributions for gender and ethnicity also closely approximated population distributions. The sample held 5% females and 95% males compared to a population of 2.5% female and 97.5% male. Sample distributions for ethnicity were within two percentage points in all categories. The distribution of the sample based upon type of aircraft flown was within three percent of the population distribution for all types of aircraft. Distribution comparisons for female pilots were not meaningful because of the small number in the sample.

Chi-square analysis of the expected distribution of the sample, rank, gender, and ethnicity produced a statistically significant match between the sample and the population. A Pearson product moment of 28.5, with 12 degrees of freedom returns a probability of <0.005 of achieving the sample distribution by random chance.

Survey Results

To complete Kolb's Learning Style Inventory the individual ranks four possible endings to each of 12 sentence stems using a scale from one to four. The rank given to each ending provides a score for the four learning modes within the experiential learning cycle. When the rankings for the sentence endings are summed over the 12 sentences, a range between 12 and 48 results for each learning mode. The four totals represent the learner's emphasis on each mode of learning.

The four learning modes are concrete experience, abstract conceptualization, active experimentation, and reflective observation. The score for concrete experience (CE) indicates the level of the learner's involvement with situations and represents the "people" or feeling orientation. Abstract conceptualization (AC) indicates the learner's tendency towards logical approaches and ideas rather than people. This is a thinking or "things" orientation. Active experimentation (AE) is the tendency to get involved with the problems and can be described as a "doing" orientation. Finally, reflective observation (RO) scores indicate a tendency toward observing (Kolb, 1984).

By comparing the scores for polar opposite modes, a measure of the relative emphasis the learner places on each mode is obtained. This score provides a measure of where the learner falls along a scale represented by these polar opposites. The formula abstract conceptualization minus concrete experience shows the learner's relative emphasis along the things/people scale. Active experimentation minus reflective observation shows the learner's relative emphasis along the watching/doing scale (Kolb, 1984). Descriptive statistics for the sample, showing the scores for each of these six measurements are shown in Table V. Individual scores from which these statistics were developed are in Appendix C.

TABLE V

SURVEY RESULTS--DESCRIPTIVE STATISTICS

	CE	RO	AC	AE	AC-CE	AE-RO
Mean	23.85	28.98	32.24	34.91	8.39	5.93
Median	20.00	28.00	32.00	37.00	11.00	9.00
Standard Deviation	10.28	6.47	7.23	9.10	14.86	12.41

The range of 12 to 48 on each individual learning model yields range extremes of plus or minus 36 for the active experimentation minus reflective observation and abstract conceptualization minus concrete experience scales. These formulas provide a numerical representation of a learners active emphasis for the types of learning represented by each axis. There is no qualitative differentiation between the learning modes, rather this process provides a way to display the results in a linear presentation showing the relative strength of a specific style for an individual.

Kolb's (1984) norming process for the Learning Style Inventory produced median scores of 5.9 for active experimentation minus reflective observation and 3.8 for abstract conceptualization minus concrete experience. The sample result of 5.93 for the active experimentation minus reflective observation axis shows there is no greater emphasis placed upon active experimentation or reflective observation by pilots than is shown in the general population. The sample result of 8.39 for abstract conceptualization minus concrete experience, however is significant. Two-tailed t-test probability is less than .0001 for achieving this result at random. Pilots show a significantly stronger tendency to emphasize abstract conceptualization over concrete experience.

Based on the concrete experience and abstract conceptualization data, it can be said that the average pilot in the United States Air Force significantly emphasizes things and thought over people and feelings. While the reflective observation and active experimentation data reflects a preference for active participation over observation, however, this preference is not statistically significant different from the preference shown by the population at large when compared to the norming sample (Kolb, 1984).

Learning Styles

Plotting active experimentation minus reflective observation and abstract conceptualization minus concrete experience as the "X" and "Y" axes of a grid forms a matrix which can be used to define the quadrants of the experiential learning cycle. Kolb (1984) used this graphic representation to plot the four learning styles (Figure 2). The intersection is defined by the median scores for active experimentation minus reflective observation (5.9) and abstract conceptualization minus concrete experience (3.8).

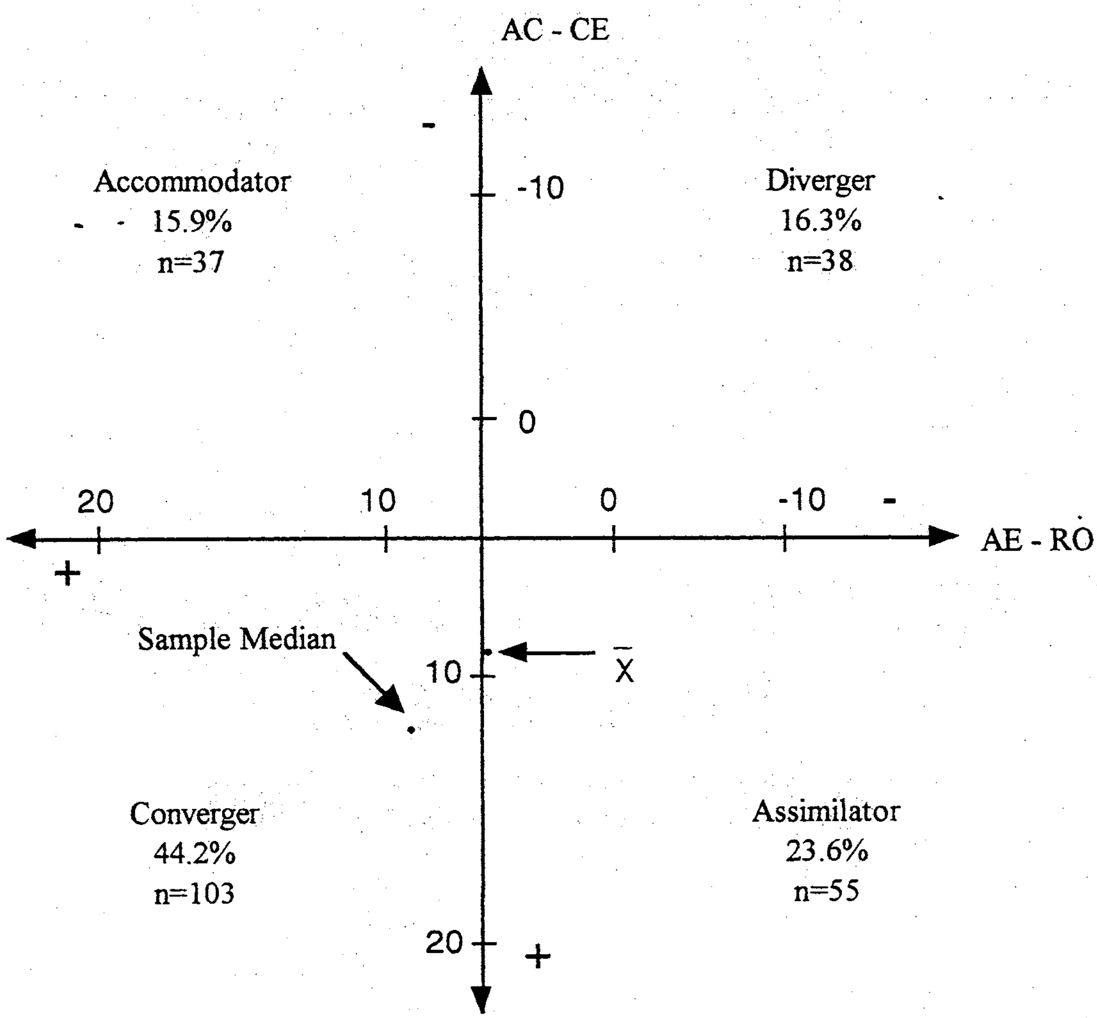

Figure 2. Style Grid

The means value from the sample were 5.93 for active experimentation minus reflective observation and 8.39 for abstract conceptualization minus concrete experience. When plotted on the grid these means value fall on the boundary between Converger and Assimilator. Medians for the sample were 9.0 for active experimentation minus reflective observation and 11.0 for abstract conceptualization minus concrete experience. The plot for these median values fall within the Converger learning style. When individual responses are plotted on this grid 15.8% (n=37) are accommodators, 23.6% (n=55) are assimilators, 44.2% (n=103) are convergers, and 16.3% (n=38) are divergers.

This distribution of learning styles is significant ($p < .0001$) relative to a hypothetical distribution of 25% in each style as would be shown in a random sample of the population at large. This significance corresponds to the predictive nature of the Learning Style Inventory (Kolb, 1984). In the case of pilots currently qualified in United States Air Force aircraft the predominant learning style is convergence. A secondary learning style is assimilation. Divergent and accommodative learning styles are each used by significantly small groups of pilots within the study group. A discussion of why pilots prefer the learning strategies of convergent and assimilative learners over the strategies of divergent and accommodative learners is in Chapter V.

The analysis of pilot's learning styles was based upon average data for the entire sample. Demographic data was collected for military rank, gender, ethnicity, type of aircraft flown, and number of flying hours. In all categories except ethnicity the convergent learning style was the predominant selection at a statistically significant level.

Analysis of learning styles by ethnicity was not accomplished due to the small number of non-white ethnic groups within the sample. Learning styles for each category within the demographics are shown in Table VI.

TABLE VI

SURVEY RESULTS - LEARNING STYLES BY DEMOGRAPHIC CATEGORY

	Rank*		Degree Type**		Gender		Total Flying Hours				
Learning Style	Company Grade	Field Grade	Arts	Science	Female	Male	750	1500	2250	3000	3500+
Accommodator											
n=	22	15	15	19	3	34	3	6	5	11	12
Column %	16.67	14.85	17.44	14.18	25.00	15.38	12.50	25.00	15.62	15.94	14.29
Assimilator											
n=	28	27	22	30	2	53	6	2	8	19	20
Column %	21.21	26.76	25.58	20.91	16.67	23.98	25.00	8.33	25.00	27.54	23.81
Converger											
n=	58	45	32	68	5	98	10	13	14	28	38
Column %	43.94	44.55	37.21	50.75	41.67	44.34	41.67	54.17	43.75	40.58	45.24
Diverger											
n=	24	14	16	20	2	36	5	5	5	11	14
Column %	18.18	13.86	19.77	14.18	16.67	16.29	20.83	20.83	15.62	15.94	16.67
Column Total	132	101	85	137	12	221	24	24	32	69	84

* Company Grade includes 2Lt, 1Lt, and Captain, Field Grade includes Major and Lt. Col.
** Science degrees include engineering and the core sciences Arts degrees include the humanities and other degrees

CHAPTER V

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Introduction

The purpose of this study was to determine the learning styles of pilots currently qualified in United States Air Force aircraft. How students learn is impacted by how the material they are to learn is presented. Studies have shown that more effective learning is achieved when programs take into account the learning styles of the target population (Wooldridge, 1995). Increasing student learning, the desired outcome of all instruction, requires developing an ability to recognize students' learning styles and use techniques that increase the probability of achieving success (Anderson & Adams, 1992).

The study of learning styles has its roots in the field of psychology. Two main paths for study have moved forward from these roots. One path has followed the classic Pavlovian stimulus-response approach, using reinforcement of successful completion at each step in a sequential learning process. The other path has focused instead on the cognitive processes in learning. Researchers conducting current studies of learning styles have mainly chosen this second path, focusing on the cognitive processes of the learner (Sims & Sims, 1995).

The Myers-Briggs Type Indicator, field dependence/field independence, and brain hemispherocity studies are all examples of measures for cognitive based learning. Another example is the Kolb Learning Style Inventory. Many other approaches exist to measuring learning styles, with diverse terminology and measurement instruments. The common ground for all of these approaches, however, is that they attempt to describe the learning styles of the individual by measuring the behavior during the learning process. Through this measurement, each instrument attempts to describe how the individual takes in and processes information. Sims & Sims (1995) provide an apt summary, stating that ". . . regardless of how that process is described, it is dramatically different for each person" (p. 194).

Kolb's (1984) approach to measuring this learning process is through the experiential learning model. The experiential learning model proceeds from the assumption that all learning is influenced by the prior experiences of the individual learner. Because of this assumption that prior experience influences each new learning event, learning can be viewed as a continuous process. How the learner progresses through this process, or uses this process, becomes the focus for defining that learner's learning style.

The model of experiential learning describes four phases of the continuous learning process. Concrete experience is involvement with the learning event, absorbing the surroundings and activities as they happen. Reflective observation is reviewing the experiences and attempting to determine what is new and different about the experience, and what is similar to previous experiences. Abstract conceptualization is the process of integrating these experiences and reflections into a modified view of the learner's environment. Finally, active experimentation is the process of testing this new world view (Kolb, 1984).

The "perfect" learner would use all four modes of learning equally, and would shift around the learning model smoothly with each new learning situation. The "normal" learner, on the other hand, develops a preferred mode of learning. Whether this preferred style is adopted as the result of positive reinforcement in earlier, similar situations (Schmeck, 1988) or rises from deeper, personality based roots, the effect is that the learner tends to "specialize" in a specific style of learning. Identifying this preferred style of learning is the focus of learning style research.

Kolb's (1985) Learning Style Inventory uses twelve sentence stems with four endings each to measure preferred learning style. Each of the sentence endings indicates a preference for one of the four learning modes associated with the experiential learning model. Summing the responses for each of the twelve sentences yields a set of numbers between 12 and 48 which represents the degree to which the learner emphasizes each of the four learning modes. These scores provide an indication of the learner's balance between the learning modes.

Because the four stages of the experiential learning model represent polar opposites of two learning scales, it is possible to use the individual element scores to derive a number which represents the individuals position along each of these scales. In Kolb's (1985) Learning Style Inventory this is done by subtracting the score for concrete experience from the score for abstract conceptualization and subtracting the score for reflective observation from the score for active experimentation. Which quadrant of the graph formed by these two scales contains the combined score for the individual defines that learner's predominant learning style.

Within the experiential learning model the quadrant formed by concrete experience and reflective observation is called divergent learning. The divergent learner prefers being a part of the learning experience, and thinking about what has happened during that experience. The opposite preference lies in the quadrant formed by abstract conceptualization and active experience and is called convergent learning. The convergent learner takes multiple observations of many events and brings them together into the answer to a specific problem.

The other two quadrants produce assimilative and accommodative learners. The quadrant formed by reflective observation and abstract conceptualization is called assimilative learning. The assimilator is the inductive reasoner who can put together coherent theories based upon observations, integrating multiple observations into a cohesive explanation of the events. The active experimentation/concrete experience quadrant produces the accommodative learner. The accommodator gets things done and is part of the action.

Knowing which learning style the learner prefers provides important information for course design. Disagreement occurs among researchers over whether it is better to match the preferred learning style to ease the learning process, or to mismatch the style to force the learner to "stretch" into another style. Regardless of which method is preferred, however, agreement exists that this decision must be designed into the course as opposed to being the result of ignoring the possibility that differences in learning styles exist (Sadler-Smith, 1996).

Pilot Learning Styles

The emphasis in pilot training has followed the Pavlovian instead of the cognitive path. Courses for pilot training are based upon task lists which the student must master to successfully complete the training program. The task is presented, demonstrated, and then the student practices until the task is mastered. Appropriate feedback is provided by the instructor during the practice session. No effort is spent on determining the cognitive based learning style of the student.

In this age of technology and information an effort is underway to move some of this training into the classroom using computer based training and simulation (Thiesse, et al., 1992; Treiber, 1994). In this effort new technologies applied to pilot training that understanding learning styles can be helpful in course design. Once the learning style of pilots is understood, the decision to match, or mismatch, these styles can be a conscious one instead of being left to chance.

Currently, the predominant learning styles of pilots are not well understood. Three studies by Quilty (1995, 1996, 1997) have addressed the global versus analytical cognitive bias of pilots with differing levels of experience. Studies by the United States Air Force (Carretta & Seim, 1988) have focused on predicting the chances of a specific individual successfully completing the Undergraduate Pilot Training program. This study used Kolb's (1985) Learning Style Inventory to identify the predominant learning styles of pilots currently qualified to fly United States Air Force aircraft.

Summary of Findings

Analysis of the responses using the methods described by Kolb (1985) shows a statistically significant distribution among the learning styles of pilots currently qualified to fly United States Air Force aircraft. The convergent style is preferred by 44.2% of the pilots in the study. A further 23.6% preferred the assimilative learning style. Taken together this means that a significant proportion (67.8%) of the pilots prefer the abstract conceptualization mode of learning. Less than a third of the pilots prefer experience, with 15.9% as accommodators and 16.3% as divergers.

Whereas, the preference for abstract conceptualization over concrete experience was significant, the choice between active experimentation and reflective observation was not significantly different. The mean response for this axis fell amost exactly on the midpoint of the axis. This balance between careful observation an drick taking and between looking at problems from any angles and putting this information into action, forms the basis for sound decision making in the time-critical nature of aviation.

Conclusions

Several reasons explain the identification of convergence as the priary learning style of pilots currently qualified in United States Air Force aircraft. The predictive nature of the Learning Style Inventory suggests that convergence is preferred by those in technical and specialist fields (Kolb, 1985). The selection process for Undergraduate Pilot Training favors individuals with the characteristics of the convergent learner (Carretta & Seim, 1988). In addition, the balance along the reflective observation and active experimentation axis tends to support the finding of global versus sequential cognitive processes reported by Quilty (1995, 1996, 1997).

Understanding of these characteristics is necessary to match future course design with this learning style. Learners with the convergent style prefer to know how it works as opposed to who says it works. These learners want to do it themselves rather than being shown how to do it, but they would rather be shown that it works than take an expert's word that it works (Kolb, 2985). This will be especially important in the design of computer based training modules which introduce new equipment and technology to pilots during training courses. How the system fits together, and why it works, are more important to convergers than just being told that the system works.

Kolb (1985) identifies problem solving, decision making, and reasoning skills as strengths of the convergent learner. Hasty decision, solving the wrong problem, and lack of flexibility are identified as weaknesses. Understanding that these are the characteristics of a significant proportion of current pilots provides a training opportunity. Building on the strengths and highlighting the inherent problems within the convergent learning style can allow the individual to use the strengths to overcome the weaknesses. This element of understanding that a learning style is neither good nor bad, but that it does represent a method of goals of learning situations. This provides an opportunity for not just improving a learning environment, but for personal development and understanding at the individual level as well.

The secondary learning style for pilots currently qualified in United States Air Force aircraft is the assimilative style. This style is included as a secondary learning style because of the relationship convergent and assimilative learning styles have relative to concrete experience and abstract conceptualization. Both styles show a preference for abstract conceptualization over concrete experience. The sample mean was almost exactly equal to the median for active experimentation versus reflective observation. This choice between a preference for active experimentation over reflective observation is the difference which separates the converger from the assimilator. Although more individuals fell into the converger learning style than the assimilator learning style, the sample mean, s very close to the dividing point between these two styles, was used in considering the assimilative style as a secondary learning style for the pilots in this study.

The considerations for designing future courses for the assimilative learners in the class are similar to the considerations for convergent learners. The assimilator shares the converger's desire to know how something works rather than who says that it works. Their preference for reflective observation, however, can lead them to look for all the available alternatives and overlook that they have a workable solution already. Building into the training program justifications for limiting the scope of information will be important for the assimilative learner.

Taken together, the predominant converger learning style and the secondary assimilative learning style support the effectiveness of the current training program. The abstract conceptualization focus shared by these two learning styles works well with the demonstration/performance mode of teaching because of the focus of this mode on how things work as opposed to who says these things work. By seeing how things are done, and understanding the implications, the abstract conceptualizer can work from the individual parts to create a whole.

The very things which are used to predict successful completion of Undergraduate Pilot Training (Carretta & Seim, 1988) are the factors which appear in the predominant learning style of current United States Air Force pilots. The sorting process also coincides with two elements of the experiential learning model. The first element is socialization, where working in aviation tends to emphasize certain characteristics within the individual because of the requirements of the task. The second element is the tendency of an individual to gravitate towards a field where the requirements match personal characteristics of individuals. This process of specialization provides a basis for the predictive nature of the learning style inventory and the experiential learning model (Kolb, 1984).

One of the current areas of emphasis in aviation training is crew resource management. This training program emphasizes skills in relating to other individuals, both on the crew and in positions which interact with the crew, focusing on team coordination, attitudes, behaviors, and communications (Driskell & Adams, 1992). Addressing learning styles within crew resource management training courses can provide an additional approach to defining the issues for all crew members. Understanding individual differences provides a critical stepping stone toward improvement within these areas.

Pilots with the predominant converger learning style ". . . would rather deal with technical tasks and problems than with social and interpersonal issues" (Kolb, 1985, p. 7). The focus of crew resource management training is these very social and interpersonal issues. The characteristics of the convergent learner, as well as the other learning styles, should be incorporated into course design for crew resource management training. Analyzing the different learning styles, including the differences between the styles and the strengths and weaknesses of each style allows the group to make better use of the skills available through its individual members (Sims & Sims, 1995).

Incorporating learning styles into the design of crew resource management training provides an opportunity for better understanding that different approaches exist to the same problem. Understanding the differences in the approach and bias associated with each learning style, and focusing on the learning style instead of the individual, conflict over differences and misunderstandings are possible (Sharp, 1997). This approach to the interpersonal issues associated with functioning as an aircrew member provides an opportunity to address these issues in a way that is compatible with all four learning styles.

Implications and Recommendations for Further Study

This study identified the convergent learning style as the predominant mode of learning for a statistically significant portion of currently qualified pilots in the United States Air Force. A statistically significant distribution of learning styles among these pilots was also identified by this study. The information gained through this process provides a starting point into understanding how pilots learn. The convergent learning style is consistent with the technical nature of aviation, the decision making requirements of flying, and the necessity to process large amounts of information during a flight.

Further study of the relationship among these three areas is appropriate. Such studies would be useful in determining if correlations exist between learning styles, cognitive biases, and successful completion of aviation training programs. It would also be informative to know where, if anywhere, within the training process the sorting for learning styles and cognitive bias occur.

This study further examined only currently qualified United States Air Force pilots. A study comparing the learning styles of those individuals completing Undergraduate Pilot Training with the learning styles of those who failed to complete the course would be informative. Such a study would necessarily include observations of the cause for failure to complete the training program. Currently, qualified pilots exist who do not fall within the predominant learning style. Understanding why certain individuals do not successfully complete Undergraduate Pilot Training may provide information which will allow more individuals with these minority learning styles a greater chance of success in the training program.

The predominant learning style for all of the pilots in this study was convergence. This style held a statistically significant position regardless of gender, military rank, which is also an indicator of age, degree type, or total flying experience. Why pilots share a predominant learning style, regardless of other factors which indicate a tendency towards different preferred learning styles is a matter for further study. Information on what factors are shared by pilots, which become dominant factors in determining preferred learning style, could be correlated with success and failure rates for pilot training.

This study, and the above recommendations, investigate the training of pilots in the United States Air Force. With almost 150 colleges offering professional pilot degree programs (Schukert, 1995), and current interest in the requirements for a non-technical doctoral program in aviation (Johnson, 1997), the learning styles of students within these programs are appropriate for study. A study focusing on college and university participants would provide correlational data for comparison to pilots training in the United States Air Force training program.

In addition to the cognitive bias studies conducted by Quilty (1995, 1996, 1997) on college students in aviation, corporate, and airline pilots studies of the primary learning styles of these groups of pilots are also appropriate. Correlational studies among these groups would also then be possible. These groups of pilots would also provide an opportunity for longitudinal studies to determine the stability of learning styles over the career of a pilot. Such longitudinal studies would be useful when comparing career changes within aviation.

Understanding how pilots learn has significant implications for effective training of current and future pilots. While learning style research has investigated many learning situations, aviation students have not been studied to this point. The academic and personal benefits associated with matching, or intentionally not matching, learning styles have been identified in many areas. It is appropriate to bring this understanding to the aviation training and education community. Incorporating the findings of academic research into the training of pilots, academically and professionally, can provide this same opportunity to enhance the learning process in this field of study.

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APPENDIXES

APPENDIX A

COVER LETTER

OKLAHOMA STATE UNIVERSITY

OSU

Department of Aviation and Space Education
300 Cordell North
Stillwater, Oklahoma 74078-8034
405-744-5856 or 405-744-7015
FAX 405-744-7785

March 4, 1998

Dear Fellow Air Force Pilot

Within the academic community, how a student learns is critical to course design and delivery. During my years as an active duty pilot I completed numerous training programs, including several instructor upgrades and the academic instructor course. By analyzing the course syllabi I have noticed that none of these courses addressed how pilots learn. Pilots are expected to take whatever is handed to them and learn the material.

As a doctoral student at Oklahoma State University I have developed an interest in how pilots learn. By understanding how pilots learn, course syllabi can be tailored to meet the student's needs instead of the student having to adjust to the course. The first step in this process is to find out how current pilots learn. This survey is designed to gather data in this field of study of "The Learning Styles of Air Force Pilots."

Enclosed please find the "Learning Style Inventory." Instructions for completing the Learning Style Inventory are included. Please refer to a flight related learning experience as you complete the inventory. The demographic data will be used to validate the statistical sample. Your responses are strictly confidential, and will only be reported in the aggregate. Please take a few minutes to complete the survey and return it in the enclosed return envelope.

Please understand that participation is voluntary and there is no penalty for refusing to participate. If you do not wish to participate, please return the uncompleted survey in the enclosed return envelope. If you have any questions regarding this study, please do not hesitate to contact Craig A. Kanske at (405) 793-7048, Dr. Steven Marks (405) 744-7015, or Gay Clarkson, Institutional Review Board Executive Secretary (405) 477-5700.

Thank you for taking the time to complete the survey.

Sincerely,

Craig A. Kanske
Graduate Student
Aviation and Space Education

Steven Marks, EdD
Associate Professor
Aviation and Space Education

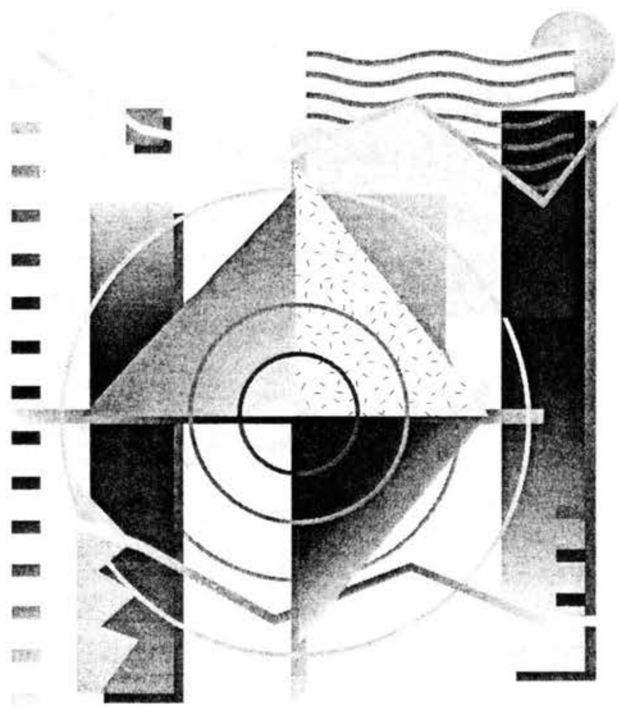
APPENDIX B

PILOT LEARNING STYLES RESEARCH QUESTIONNAIRE

TRG
Hay/McBer

Learning-Style Inventory

Test Sheet



LSI

Name:	
Position:	
Organization:	
Date:	

MCB200

HayGroup

Learning-Style Inventory: Instructions

The Learning-Style Inventory describes the way you learn and how you deal with ideas and day-to-day situations in your life. Below are 12 sentences with a choice of four endings. Rank the endings for each sentence according to how well you think each one fits with how *you* would go about learning something. Try to recall some recent situations where you had to learn something new, perhaps in your job. Then, using the spaces provided, rank a "4" for the sentence ending that describes how you learn *best*, down to a "1" for the sentence ending that seems *least* like the way you would learn. Be sure to rank all the endings for each sentence unit. Please do not make ties.

Example of completed sentence set:

When I learn:	4	I like to deal with my feelings	1	I like to watch and listen	2	I like to think about ideas	3	I like to be doing things

1. When I learn:	___	I like to deal with my feelings	___	I like to watch and listen	___	I like to think about ideas	___	I like to be doing things
2. I learn best when:	___	I trust my hunches and feelings	___	I listen and watch carefully	___	I rely on logical thinking	___	I work hard to get things done
3. When I am learning:	___	I have strong feelings and reactions	___	I am quiet and reserved	___	I tend to reason things out	___	I am responsible about things
4. I learn by:	___	feeling	___	watching	___	thinking	___	doing
5. When I learn:	___	I am open to new experiences	___	I look at all sides of issues	___	I like to analyze things, break them down into their parts	___	I like to try things out
6. When I am learning:	___	I am an intuitive person	___	I am an observing person	___	I am a logical person	___	I am an active person
7. I learn best from:	___	personal relationships	___	observation	___	rational theories	___	a chance to try out and practice
8. When I learn:	___	I feel personally involved in things	___	I take my time before acting	___	I like ideas and theories	___	I like to see results from my work
9. I learn best when:	___	I rely on my feelings	___	I rely on my observations	___	I rely on my ideas	___	I can try things out for myself
10. When I am learning:	___	I am an accepting person	___	I am a reserved person	___	I am a rational person	___	I am a responsible person
11. When I learn:	___	I get involved	___	I like to observe	___	I evaluate things	___	I like to be active
12. I learn best when:	___	I am receptive and open-minded	___	I am careful	___	I analyze ideas	___	I am practical

MCB200

Pilots' Learning Styles

Research Questionnaire

Demographic Data

Rank: 2Lt 1Lt Cpt Maj LtCol Col
(Circle One)

Year Completed Undergraduate Pilot Training:__________

Total Flying Hours:____
(To nearest 100 hours)

Type of Aircraft Flown and Hours in Each Type: (e.g. T-37/200, lump UPT as one block)

____

____

(To nearest 50 hours)

Current Crew Position:
Co-Pilot Aircraft Commander Instructor/Evaluator Flight Lead
(Circle Appropriate)

Gender: Male Female
(Circle One)

Ethnic Background:
American Indian/Alaskan Asian/Pacific Islander Black (Non-Hispanic)
Hispanic White (Non-Hispanic) Other
(Circle One)

Undergraduate College Degree:______________________________

APPENDIX C

SURVEY RESULTS

Rank	Gender	Grad Yr	Hrs	Degree	Ethnicity	AE	RO	AC	CE	AE-RO	AC-CE	Style
1Lt	Female	1997	300	Aerotech (Aviation Mgmt/Mx)	White (Non-Hispanic)	25	21	24	48	4	-24	Diverger
1Lt	Female	1997	300	Civil Engineering	White (Non-Hispanic)	28	22	31	39	6	-8	Accommodator
1Lt	Female	1997	500	Aerospace Engineering	White (Non-Hispanic)	37	22	34	27	15	7	Converger
1Lt	Male	1995	1200	Geography	White (Non-Hispanic)	34	21	24	41	13	-17	Accommodator
1Lt	Male	1996	1100	Aeronautical Engineering	White (Non-Hispanic)	14	36	27	43	-22	-16	Diverger
1Lt	Male	1996	1100	Aviation Management	White (Non-Hispanic)	46	29	27	18	17	9	Converger
1Lt	Male	1997	300	Astronautical Engineering	White (Non-Hispanic)	31	27	42	20	4	22	Assimilator
1Lt	Male	1997	300	Civil Engineering	White (Non-Hispanic)	34	21	48	17	13	31	Converger
1Lt	Male	1997	400	BS Astronautical Engineering	White (Non-Hispanic)	36	24	34	26	12	8	Converger
1Lt	Male	1997	400	Mechanical/Aerospace Eng	White (Non-Hispanic)	42	28	31	19	14	12	Converger
1Lt	Male	1997	500	Computer Science	White (Non-Hispanic)	41	31	30	18	10	12	Converger
1Lt	Male	1997	500	Electrical Engineering	White (Non-Hispanic)	42	33	30	15	9	15	Converger
2Lt	Female	1997	250	Business Mgmt - USAFA	White (Non-Hispanic)	16	31	38	35	-15	3	Diverger
2Lt	Male	1997	200	BS - Legal Studies	White (Non-Hispanic)	38	42	25	15	-4	10	Assimilator
2Lt	Male	1997	200	BS Mathematics -- Texas A&M	White (Non-Hispanic)	38	27	35	20	11	15	Converger
2Lt	Male	1997	200	Mechanical Engineering	White (Non-Hispanic)	22	30	45	23	-8	22	Assimilator
2Lt	Male	1997	300	Civil Engineering	White (Non-Hispanic)	32	37	38	13	-5	25	Assimilator
2Lt	Male	1997	300	Environmental Engineering	White (Non-Hispanic)	44	34	22	20	10	2	Accommodator
2Lt	Male	1997	400	Electrical Engineering	White (Non-Hispanic)	33	26	43	18	7	25	Converger
2Lt	Male	1997	3800	Plastics Engineering	White (Non-Hispanic)	38	40	26	16	-2	10	Assimilator
Cpt	Female	1988	3100	Aeronautical Engineering	White (Non-Hispanic)	40	27	30	17	13	13	Converger
Cpt	Female	1988	3200	BS Political Science - USAFA	White (Non-Hispanic)	44	24	31	21	20	10	Converger
Cpt	Female	1991	1500	Poli Sci/International Relations	White (Non-Hispanic)	40	28	27	25	12	2	Accommodator
Cpt	Female	1992	1900	BS - Political Science	White (Non-Hispanic)	42	24	30	24	18	6	Converger
Cpt	Female	1994	1100	Aerospace Engineering	White (Non-Hispanic)	38	28	35	19	10	16	Converger
Cpt	Female	1995	1500	BS - Aerospace Engineering	White (Non-Hispanic)	35	20	20	45	15	-25	Accommodator
Cpt	Female	1995	1600	Meteorology	White (Non-Hispanic)	39	34	30	17	5	13	Assimilator
Cpt	Male	1985	2800	Business/Economics	White (Non-Hispanic)	27	35	38	20	-8	18	Assimilator
Cpt	Male	1985	4600	Professional Aeronautics	White (Non-Hispanic)	26	45	36	13	-19	23	Assimilator
Cpt	Male	1986	2900	Engineering Physics	White (Non-Hispanic)	37	32	35	16	5	19	Assimilator
Cpt	Male	1987	2300	BA - History	White (Non-Hispanic)	38	25	35	22	13	13	Converger
Cpt	Male	1987	4000	Management	White (Non-Hispanic)	43	29	26	22	14	4	Converger
Cpt	Male	1988	1800	Aviation Administration	White (Non-Hispanic)	37	26	33	24	11	9	Converger

Rank	Gender	Grad Yr	Hrs	Degree	Ethnicity	AE	RO	AC	CE	AE-RO	AC-CE	Style
Cpt	Male	1988	2300	BA Sociology	White (Non-Hispanic)	41	28	30	21	13	9	Converger
Cpt	Male	1988	2500	BS USAFA	White (Non-Hispanic)	37	41	25	17	-4	8	Assimilator
Cpt	Male	1988	2600	BS Mechanical Engineering	White (Non-Hispanic)	41	27	27	25	14	2	Accommodator
Cpt	Male	1988	2900	Civil Engineering	White (Non-Hispanic)	15	33	36	36	-18	0	Diverger
Cpt	Male	1988	2900	Civil Engineering	White (Non-Hispanic)	15	33	37	36	-18	1	Diverger
Cpt	Male	1988	3000	Aerospace Engineering	White (Non-Hispanic)	27	29	42	22	-2	20	Assimilator
Cpt	Male	1988	3000	BA Computer Science	White (Non-Hispanic)	34	23	37	26	11	11	Converger
Cpt	Male	1988	3050	Aviation Management	White (Non-Hispanic)	42	23	34	21	19	13	Converger
Cpt	Male	1988	3100	History	White (Non-Hispanic)	23	20	34	43	3	-9	Diverger
Cpt	Male	1988	3200	Applied Math	White (Non-Hispanic)	39	25	36	21	14	15	Converger
Cpt	Male	1988	3200	BS	American Indian/Alaskan	44	27	24	26	17	-2	Accommodator
Cpt	Male	1988	3200	Computer Science	White (Non-Hispanic)	44	23	36	17	21	19	Converger
Cpt	Male	1988	3300	Aeronautical Studies	White (Non-Hispanic)	18	31	35	36	-13	-1	Diverger
Cpt	Male	1988	3500	Biochemistry	White (Non-Hispanic)	40	27	27	26	13	1	Accommodator
Cpt	Male	1988	3600	Psychology / Human Factors	White (Non-Hispanic)	32	26	38	24	6	14	Converger
Cpt	Male	1988	3800	Aviation Management	White (Non-Hispanic)	42	21	33	24	21	9	Converger
Cpt	Male	1989	1500	BS Engineering Mechanics	White (Non-Hispanic)	23	40	22	35	-17	-13	Diverger
Cpt	Male	1989	1700	Business Management	Hispanic	38	23	25	34	15	-9	Accommodator
Cpt	Male	1989	1800	BA Government	White (Non-Hispanic)	23	41	42	14	-18	28	Assimilator
Cpt	Male	1989	2500	Mathematics	White (Non-Hispanic)	41	26	36	17	15	19	Converger
Cpt	Male	1989	3100	BS	White (Non-Hispanic)	36	24	48	12	12	36	Converger
Cpt	Male	1989	3200	Aeronautical Engineering	White (Non-Hispanic)	43	22	38	17	21	21	Converger
Cpt	Male	1990	1700	BS Aeronautical Engineering	White (Non-Hispanic)	38	26	42	14	12	28	Converger
Cpt	Male	1990	2000	Aeronautical Science	White (Non-Hispanic)	27	44	31	18	-17	13	Assimilator
Cpt	Male	1990	2200	Aerospace/Computer Sci - ERAU	White (Non-Hispanic)	37	30	33	20	7	13	Converger
Cpt	Male	1990	2300	Marketing	White (Non-Hispanic)	48	30	28	14	18	14	Converger
Cpt	Male	1990	2400	Aviation Maint & Management	White (Non-Hispanic)	31	34	36	19	-3	17	Assimilator
Cpt	Male	1990	2400	Biology	White (Non-Hispanic)	24	44	40	12	-20	28	Assimilator
Cpt	Male	1990	2400	BS Math	White (Non-Hispanic)	37	25	31	28	12	3	Accommodator
Cpt	Male	1990	2400	Math	White (Non-Hispanic)	42	31	30	17	11	13	Converger
Cpt	Male	1990	2500	BA - Geology/Economics	White (Non-Hispanic)	46	29	30	16	17	14	Converger
Cpt	Male	1990	2500	History - USAFA	White (Non-Hispanic)	29	23	24	44	6	-20	Accommodator
Cpt	Male	1990	2700	Business Administration	White (Non-Hispanic)	32	38	34	16	-6	18	Assimilator

Rank	Gender	Grad Yr	Hrs	Degree	Ethnicity	AE	RO	AC	CE	AE-RO	AC-CE	Style
Cpt	Male	1990	2700	Electrical Engineering	White (Non-Hispanic)	38	24	46	12	14	34	Converger
Cpt	Male	1990	2700	International Affairs	White (Non-Hispanic)	14	29	35	42	-15	-7	Diverger
Cpt	Male	1990	2800	Physics	White (Non-Hispanic)	43	26	33	18	17	15	Converger
Cpt	Male	1990	2900	BS - Aeronautical Studies	White (Non-Hispanic)	43	28	26	23	15	3	Accommodator
Cpt	Male	1990	2900	General Studies	White (Non-Hispanic)	24	21	32	43	3	-11	Diverger
Cpt	Male	1990	3000	BS - Aeronautical Science	White (Non-Hispanic)	15	32	33	40	-17	-7	Diverger
Cpt	Male	1990	3000	Organizational Communications	White (Non-Hispanic)	26	38	37	19	-12	18	Assimilator
Cpt	Male	1990	3200	Economics & Political Science	White (Non-Hispanic)	30	30	44	16	0	28	Assimilator
Cpt	Male	1990	3400	Aeronautical Science - ERAU	White (Non-Hispanic)	26	24	26	44	2	-18	Diverger
Cpt	Male	1990	3400	Business (Finance)	White (Non-Hispanic)	39	25	43	13	14	30	Converger
Cpt	Male	1990	3600	BS - Operations Research	White (Non-Hispanic)	33	28	47	12	5	35	Assimilator
Cpt	Male	1990	3600	Civil Engineering	White (Non-Hispanic)	28	21	25	45	7	-20	Accommodator
Cpt	Male	1990	3900	Geography	White (Non-Hispanic)	18	23	37	42	-5	-5	Diverger
Cpt	Male	1991	1200	BS - Human Behavior	White (Non-Hispanic)	46	20	29	25	26	4	Converger
Cpt	Male	1991	1500	Biology	White (Non-Hispanic)	25	41	13	41	-16	-28	Diverger
Cpt	Male	1991	1500	General Studies - USAFA	Black (Non-Hispanic)	45	31	29	15	14	14	Converger
Cpt	Male	1991	1500	Mechanical Engineering	White (Non-Hispanic)	41	27	41	12	14	29	Converger
Cpt	Male	1991	1700	BS - Eng Sciences USAFA	White (Non-Hispanic)	17	29	26	48	-12	-22	Diverger
Cpt	Male	1991	1700	BS - Management	White (Non-Hispanic)	45	25	33	17	20	16	Converger
Cpt	Male	1991	1700	Civil Engineering	White (Non-Hispanic)	44	26	36	14	18	22	Converger
Cpt	Male	1991	1800	Aviation Management	White (Non-Hispanic)	12	29	35	44	-17	-9	Diverger
Cpt	Male	1991	2000	Business Management	White (Non-Hispanic)	33	45	27	15	-12	12	Assimilator
Cpt	Male	1991	2300	BS USAFA	White (Non-Hispanic)	28	42	38	12	-14	26	Assimilator
Cpt	Male	1991	2400	BS Geography	White (Non-Hispanic)	21	31	29	39	-10	-10	Diverger
Cpt	Male	1991	2400	Geography	White (Non-Hispanic)	40	32	30	18	8	12	Converger
Cpt	Male	1991	2700	Aeronautical Engineering	White (Non-Hispanic)	31	15	28	46	16	-18	Accommodator
Cpt	Male	1991	2700	Computer Science	White (Non-Hispanic)	38	25	31	26	13	5	Converger
Cpt	Male	1991	2700	Social Sciences - USAFA	White (Non-Hispanic)	48	26	25	21	22	4	Converger
Cpt	Male	1991	3000		White (Non-Hispanic)	42	36	21	21	6	0	Accommodator
Cpt	Male	1991	3000	BS Banking & Finance	White (Non-Hispanic)	45	27	31	17	18	14	Converger
Cpt	Male	1991	3300	Engineering	White (Non-Hispanic)	42	25	37	16	17	21	Converger
Cpt	Male	1991	3800	Cal State Fullerton	White (Non-Hispanic)	13	32	37	38	-19	-1	Diverger
Cpt	Male	1992	700	Government	White (Non-Hispanic)	15	29	36	40	-14	-4	Diverger

Rank	Gender	Grad Yr	Hrs	Degree	Ethnicity	AE	RO	AC	CE	AE-RO	AC-CE	Style
Cpt	Male	1992	1300	Management	White (Non-Hispanic)	31	25	48	16	6	32	Converger
Cpt	Male	1992	1300	Physics	White (Non-Hispanic)	40	28	32	20	12	12	Converger
Cpt	Male	1992	1500	Applied Physics	White (Non-Hispanic)	37	29	33	21	8	12	Converger
Cpt	Male	1992	1550	Aeronautical Eng (MS Mech Eng)	White (Non-Hispanic)	20	35	28	37	-15	-9	Diverger
Cpt	Male	1992	1600	Geography	White (Non-Hispanic)	26	29	44	21	-3	23	Assimilator
Cpt	Male	1992	1600	USAFA	White (Non-Hispanic)	44	27	37	12	17	25	Converger
Cpt	Male	1992	1700	Howard University	Black (Non-Hispanic)	25	46	37	12	-21	25	Assimilator
Cpt	Male	1992	1800	Economics	White (Non-Hispanic)	42	21	40	17	21	23	Converger
Cpt	Male	1992	1800	Ops Research/Mathematics	White (Non-Hispanic)	20	36	23	41	-16	-18	Diverger
Cpt	Male	1992	2300	Psychology	White (Non-Hispanic)	12	32	39	37	-20	2	Diverger
Cpt	Male	1993	500	Political Science	Other	22	31	26	41	-9	-15	Diverger
Cpt	Male	1993	800	Physics	White (Non-Hispanic)	39	25	44	12	14	32	Converger
Cpt	Male	1993	1571	Electronics Technology	White (Non-Hispanic)	43	37	21	19	6	2	Accommodator
Cpt	Male	1993	1700	Computer Science	White (Non-Hispanic)	37	23	37	23	14	14	Converger
Cpt	Male	1993	1700	Psychology	White (Non-Hispanic)	46	17	30	27	29	3	Accommodator
Cpt	Male	1993	1900	Civil Engineering	White (Non-Hispanic)	42	19	41	18	23	23	Converger
Cpt	Male	1993	2000	Human Factors/Behavioral Sci	Other	45	26	25	24	19	1	Accommodator
Cpt	Male	1993	2200	Geophysics	White (Non-Hispanic)	33	43	28	16	-10	12	Assimilator
Cpt	Male	1994	1100	European Area Studies	Other	34	26	47	13	8	34	Converger
Cpt	Male	1994	1200	BS - Biology	White (Non-Hispanic)	41	28	30	22	13	8	Converger
Cpt	Male	1994	1500	BS Meteorology	White (Non-Hispanic)	35	28	13	44	7	-31	Accommodator
Cpt	Male	1994	1700	Engineering Mechanics	White (Non-Hispanic)	40	22	35	23	18	12	Converger
Cpt	Male	1995	1000	BA - Economics	White (Non-Hispanic)	41	27	33	19	14	14	Converger
Cpt	Male	1995	1400	Criminal Justice	White (Non-Hispanic)	34	31	38	18	3	20	Assimilator
Cpt	Male	1995	1500	Biology	White (Non-Hispanic)	46	26	25	23	20	2	Accommodator
Cpt	Male	1996	400	Mechanical Engineering	Hispanic	44	26	35	17	18	18	Converger
Cpt	Male	1996	400	Military History	White (Non-Hispanic)	32	34	30	25	-2	5	Assimilator
Cpt	Male	1996	700	BA - Aviation Management	White (Non-Hispanic)	42	24	26	28	18	-2	Accommodator
Cpt	Male	1996	700	English	White (Non-Hispanic)	25	41	31	23	-16	8	Assimilator
Cpt	Male	1996	900	Mechanical Engineering	White (Non-Hispanic)	46	26	19	29	20	-10	Accommodator
Cpt	Male	1996	1300	Space Operations	Hispanic	28	42	27	23	-14	4	Assimilator
Cpt	Male	1997	400	Geography	White (Non-Hispanic)	39	21	42	18	18	24	Converger
Cpt	Male	1997	400	History	White (Non-Hispanic)	24	28	24	44	-4	-20	Diverger

Rank	Gender	Grad Yr	Hrs	Degree	Ethnicity	AE	RO	AC	CE	AE-RO	AC-CE	Style
Lt Col	Male	1970	5200	BS Agriculture	White (Non-Hispanic)	29	12	32	47	17	-15	Accommodator
Lt Col	Male	1974	4800	MS Industrial Technology	White (Non-Hispanic)	12	24	36	48	-12	-12	Diverger
Lt Col	Male	1975	9800	General Engineering	White (Non-Hispanic)	43	35	23	19	8	4	Converger
Lt Col	Male	1976	4000	BS Management	White (Non-Hispanic)	22	16	35	47	6	-12	Accommodator
Lt Col	Male	1978	2900	Criminal Justice	White (Non-Hispanic)	30	38	12	40	-8	-28	Diverger
Lt Col	Male	1978	6000	Management	White (Non-Hispanic)	47	32	22	19	15	3	Accommodator
Lt Col	Male	1979	3000	BS - Electrical Engineering	White (Non-Hispanic)	37	24	41	18	13	23	Converger
Lt Col	Male	1979	3000	BS Engineering Technology	White (Non-Hispanic)	38	31	34	17	7	17	Converger
Lt Col	Male	1979	3200	BS Admin	White (Non-Hispanic)	33	29	41	17	4	24	Assimilator
Lt Col	Male	1979	3200	BS Aeronautical Engineering	White (Non-Hispanic)	35	42	28	15	-7	13	Assimilator
Lt Col	Male	1979	3300	BS - Management - USAFA	White (Non-Hispanic)	31	34	42	13	-3	29	Assimilator
Lt Col	Male	1979	3300	BS Psychology	White (Non-Hispanic)	39	31	39	13	8	26	Converger
Lt Col	Male	1979	3400	Aeronautical Engineering	White (Non-Hispanic)	45	30	32	13	15	19	Converger
Lt Col	Male	1980	2600	BS Management	White (Non-Hispanic)	44	25	25	26	19	-1	Accommodator
Lt Col	Male	1980	2800	BA/AS - Occupational Ed	White (Non-Hispanic)	46	20	35	19	26	16	Converger
Lt Col	Male	1980	2850	M Ed MWOSU	American Indian/Alaskan	24	42	35	19	-18	16	Assimilator
Lt Col	Male	1980	3600	Engineering Mechanics	White (Non-Hispanic)	39	26	39	16	13	23	Converger
Lt Col	Male	1980	5000	Business Administration	Other	32	34	27	27	-2	0	Diverger
Lt Col	Male	1980	6000	History	White (Non-Hispanic)	38	21	39	22	17	17	Converger
Lt Col	Male	1981	3500	Engineering Mechanics	White (Non-Hispanic)	46	30	24	20	16	4	Converger
Lt Col	Male	1981	3600	International Relations	White (Non-Hispanic)	34	15	27	44	19	-17	Accommodator
Lt Col	Male	1981	4000	Geography	White (Non-Hispanic)	46	25	29	20	21	9	Converger
Lt Col	Male	1981	4300	Civil Engineering	American Indian/Alaskan	41	25	41	13	16	28	Converger
Lt Col	Male	1982	2600	BS - Operations Research	White (Non-Hispanic)	38	25	42	15	13	27	Converger
Lt Col	Male	1982	2700	Civil Engineering	Hispanic	24	41	34	21	-17	13	Assimilator
Lt Col	Male	1982	3200	Eng Sciences (MS-Comp Sci)	White (Non-Hispanic)	48	23	35	14	25	21	Converger
Lt Col	Male	1982	3300	Bus Administration (MBA)	White (Non-Hispanic)	27	27	47	19	0	28	Assimilator
Lt Col	Male	1982	3700	Business Admin	White (Non-Hispanic)	37	23	39	21	14	18	Converger
Lt Col	Male	1982	3700	Electrical Engineering	White (Non-Hispanic)	41	18	38	23	23	15	Converger
Lt Col	Male	1982	4200	Mathematics	White (Non-Hispanic)	48	31	14	27	17	-13	Accommodator
Lt Col	Male	1982	4800	BS - Criminal Justice	White (Non-Hispanic)	45	20	33	22	25	11	Converger
Lt Col	Male	1982	5200	Management/Accounting	White (Non-Hispanic)	48	26	31	16	22	15	Converger
Lt Col	Male	1983	2200	BS	White (Non-Hispanic)	43	21	26	30	22	-4	Accommodator

Rank	Gender	Grad Yr	Hrs	Degree	Ethnicity	AE	RO	AC	CE	AE-RO	AC-CE	Style
Lt Col	Male	1983	3000	Police Science	White (Non-Hispanic)	42	31	25	22	11	3	Accommodator
Lt Col	Male	1983	3300	BS Pub Admin/MS Bus Admin	White (Non-Hispanic)	48	31	26	15	17	11	Converger
Lt Col	Male	1984	3800	Aeronautical Engineering	White (Non-Hispanic)	32	27	41	17	5	24	Assimilator
Maj	Female	1990	2800	BA - Philosophy / Poli Sci	White (Non-Hispanic)	27	38	38	17	-11	21	Assimilator
Maj	Male	1976	4000	BS Geography	White (Non-Hispanic)	41	29	17	33	12	-16	Accommodator
Maj	Male	1980	1750	Civil Engineering	Black (Non-Hispanic)	23	33	16	48	-10	-32	Diverger
Maj	Male	1980	3000	Pre Law	White (Non-Hispanic)	36	23	38	23	13	15	Converger
Maj	Male	1980	4200	BS - Biomedical Science	White (Non-Hispanic)	33	41	26	20	-8	6	Assimilator
Maj	Male	1981	3000	Criminal Justice	White (Non-Hispanic)	38	26	32	24	12	8	Converger
Maj	Male	1982	2600	Aeronautical Engineering	White (Non-Hispanic)	27	32	41	21	-5	20	Assimilator
Maj	Male	1982	3200	BS USAFA	White (Non-Hispanic)	42	25	38	15	17	23	Converger
Maj	Male	1982	3200	Business Administration	White (Non-Hispanic)	43	27	28	22	16	6	Converger
Maj	Male	1982	3600	Business Administration	White (Non-Hispanic)	46	30	24	20	16	4	Converger
Maj	Male	1982	3600	Computer Science	White (Non-Hispanic)	21	28	33	39	-7	-6	Diverger
Maj	Male	1983	2100	Operations Research	White (Non-Hispanic)	41	34	27	18	7	9	Converger
Maj	Male	1983	2600	Mechanical Engineering	White (Non-Hispanic)	25	28	35	32	-3	3	Diverger
Maj	Male	1983	2800	General Studies	White (Non-Hispanic)	39	22	28	31	17	-3	Accommodator
Maj	Male	1983	3300	Industrial Relations/Mgmt	White (Non-Hispanic)	43	34	27	16	9	11	Converger
Maj	Male	1983	3500	Journalism	White (Non-Hispanic)	19	29	41	31	-10	10	Assimilator
Maj	Male	1983	3600	BS Management	White (Non-Hispanic)	42	37	25	15	5	10	Assimilator
Maj	Male	1983	3800	Management	White (Non-Hispanic)	43	30	28	19	13	9	Converger
Maj	Male	1983	3900	BS - Electrical Engineering	White (Non-Hispanic)	30	30	42	18	0	24	Assimilator
Maj	Male	1983	4000	Purdue	White (Non-Hispanic)	32	38	36	14	-6	22	Assimilator
Maj	Male	1983	4300	Business Administration	White (Non-Hispanic)	37	32	28	23	5	5	Assimilator
Maj	Male	1984	1500	Electronic Eng Technology	White (Non-Hispanic)	48	28	29	15	20	14	Converger
Maj	Male	1984	2500	Electrical Eng - USAFA	Other	43	28	33	16	15	17	Converger
Maj	Male	1984	2600	Mechanical Engineering	White (Non-Hispanic)	38	28	30	24	10	6	Converger
Maj	Male	1984	3000	Aerospace Engineering	White (Non-Hispanic)	43	32	30	15	11	15	Converger
Maj	Male	1984	3100	Business	White (Non-Hispanic)	44	20	35	21	24	14	Converger
Maj	Male	1984	3300	Journalism	White (Non-Hispanic)	28	20	24	48	8	-24	Accommodator
Maj	Male	1984	4000	BS - Engineering Mechanics	White (Non-Hispanic)	36	20	46	18	16	28	Converger
Maj	Male	1984	4200	Mechanical Engineering	White (Non-Hispanic)	25	34	47	14	-9	33	Assimilator
Maj	Male	1984	4980	General Engineering	Black (Non-Hispanic)	34	34	31	21	0	10	Assimilator

Rank	Gender	Grad Yr	Hrs	Degree	Ethnicity	AE	RO	AC	CE	AE-RO	AC-CE	Style
Maj	Male	1985	2100	Management	White (Non-Hispanic)	45	24	34	17	21	17	Converger
Maj	Male	1985	2400	Aerospace Engineering	White (Non-Hispanic)	36	32	36	16	4	20	Assimilator
Maj	Male	1985	2600	Engineering Management	White (Non-Hispanic)	38	26	40	16	12	24	Converger
Maj	Male	1985	3100	BS General Studies (USAFA)	White (Non-Hispanic)	21	26	34	39	-5	-5	Diverger
Maj	Male	1985	3100	Electrical Engineering	White (Non-Hispanic)	38	23	34	25	15	9	Converger
Maj	Male	1985	3500	BS	Other	33	32	37	18	1	19	Assimilator
Maj	Male	1985	4100	Management - USAFA	White (Non-Hispanic)	45	23	26	26	22	0	Accommodator
Maj	Male	1985	4500	BS Electrical Engineering	White (Non-Hispanic)	38	37	32	13	1	19	Assimilator
Maj	Male	1986	2500	BS Psychology	White (Non-Hispanic)	44	31	27	17	13	10	Converger
Maj	Male	1986	2500	Economics	White (Non-Hispanic)	18	30	30	41	-12	-11	Diverger
Maj	Male	1986	2900	Criminal Justice	White (Non-Hispanic)	36	41	28	15	-5	13	Assimilator
Maj	Male	1986	2900	Math	White (Non-Hispanic)	45	20	34	21	25	13	Converger
Maj	Male	1986	3000	BS - Environmental Eng	White (Non-Hispanic)	36	41	31	12	-5	19	Assimilator
Maj	Male	1986	3000	BS - Industrial Tech (SIU)	White (Non-Hispanic)	39	27	19	35	12	-16	Accommodator
Maj	Male	1986	3700	BS - Engineering USAFA	White (Non-Hispanic)	38	25	32	25	13	7	Converger
Maj	Male	1986	4000	Aviation Operations Mgmt	White (Non-Hispanic)	20	22	38	40	-2	-2	Diverger
Maj	Male	1987	2000	Economics	White (Non-Hispanic)	33	47	28	12	-14	16	Assimilator
Maj	Male	1987	2100	Management	White (Non-Hispanic)	36	24	42	18	12	24	Converger
Maj	Male	1987	2500	History	Asian/Pacific Islander	43	30	31	15	13	16	Converger
Maj	Male	1987	2600	Geology & Meteorology	White (Non-Hispanic)	42	35	20	23	7	-3	Accommodator
Maj	Male	1987	2600	Human Factors	White (Non-Hispanic)	43	26	36	15	17	21	Converger
Maj	Male	1987	2700	Mechanical Engineering	White (Non-Hispanic)	26	30	47	18	-4	29	Assimilator
Maj	Male	1987	2900	Physical Education	White (Non-Hispanic)	34	33	37	16	1	21	Assimilator
Maj	Male	1987	3200	Wholesale Marketing / Dist	White (Non-Hispanic)	48	30	29	13	18	16	Converger
Maj	Male	1987	3300	BS - USAFA	White (Non-Hispanic)	17	27	29	47	-10	-18	Diverger
Maj	Male	1987	3300	Economics	White (Non-Hispanic)	27	33	31	29	-6	2	Diverger
Maj	Male	1987	3500	BS - Mathematics	White (Non-Hispanic)	37	33	36	14	4	22	Assimilator
Maj	Male	1987	4000	Aviation Management (ERAU)	White (Non-Hispanic)	45	22	36	17	23	19	Converger
Maj	Male	1987	6700	Aviation Mgmt / Air Comm Transportation Tech	White (Non-Hispanic)	30	29	17	44	1	-27	Diverger
Maj	Male	1988	2300	Aviation Industrial Technology	White (Non-Hispanic)	41	32	28	20	9	8	Converger
Maj	Male	1988	3500	Accounting	White (Non-Hispanic)	43	34	25	18	9	7	Converger
Maj	Male	1988	3500	Business Administration	White (Non-Hispanic)	37	30	25	28	7	-3	Accommodator

Rank	Gender	Grad Yr	Hrs	Degree	Ethnicity	AE	RO	AC	CE	AE-RO	AC-CE	Style
Maj	Male	1989	2500	Biology - MBA	White (Non-Hispanic)	32	35	36	17	-3	19	Assimilator
Maj	Male	1989	3000	Finance	White (Non-Hispanic)	21	35	19	45	-14	-26	Diverger
Maj	Male	1991	3400	Meteorology	White (Non-Hispanic)	22	27	21	47	-5	-26	Diverger

APPENDIX D

INSTITUTIONAL REVIEW BOARD

APPROVAL FORM

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
HUMAN SUBJECTS REVIEW

Date: February 27, 1998 **IRB #: ED-98-078**

Proposal Title: THE LEARNING STYLES OF PILOTS CURRENTLY QUALIFIED IN U.S. AIR FORCE AIRCRAFT

Principal Investigator(s): Steven Marks, Craig A. Kanske

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

ALL APPROVALS MAY BE SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT NEXT MEETING, AS WELL AS ARE SUBJECT TO MONITORING AT ANY TIME DURING THE APPROVAL PERIOD.
APPROVAL STATUS PERIOD VALID FOR DATA COLLECTION FOR A ONE CALENDAR YEAR PERIOD AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL.
ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Disapproval are as follows:

Signature: John H. Wycoff

Chair of Institutional Review Board

Date: March 2, 1998

cc: Craig A. Kanske

VITA

Craig Arnold Kanske

Candidate for the Degree of

Doctor of Education

Thesis: LEARNING STYLES OF PILOTS CURRENTLY QUALIFIED IN U.S. AIR FORCE AIRCRAFT

Major Field: Applied Educational Studies

Biographical:

Personal Data: Born in St. Paul, Minnesota, on March 1, 1951, the son of Arnold and Bertha Kanske.

Education: Graduated from North High School, North St. Paul, Minnesota in June, 1969; received Bachelor of Science in Business Administration from the University of Minnesota, Minneapolis, Minnesota in June, 1973; received Master of Science in Systems Management from the University of Southern California, Los Angeles, California in January, 1978, completed requirements for the Doctor of Education degree in Applied Educational Studies, Oklahoma State University in December, 1998.

Experience: Entered the U.S. Air Force as a pilot in 1973. From 1974 to 1979 flew the KC-135 tanker as a copilot and aircraft commander. Moved to E-3 (AWACS) in October 1979. Upgraded to instructor pilot in 1981. Developed the academic and simulator portions of the aircraft commander and instructor pilot upgrade courses. Conducted acceptance and fidelity testing as test pilot and test coordinator for upgrade of E-3 simulator. In 1985 moved to Headquarters, Pacific Air Forces. Wrote, coordinated, and published Air Force contingency and support plans for units deploying to the Pacific region. Returned to E-3s in 1989 as an instructor pilot. After returning from Operation Desert Storm in 1991, supervised flight and training activities of over 120 instructors and over 900 students per year in

16 different crew specialties. Retired from the Air Force after 20 years, 16 years in training as an instructor pilot, course developer, and training supervisor. Crew Resource Management training facilitator for Hernandez Engineering, Inc. from 1993 to 1994. Flight Simulator Instructor Pilot in the E-3 Flight Crew Training Program, 1994 to present.

Professional Memberships: Order of Daedalians.