LEARNING AND TEACHING STYLES OF AIRLINE PILOTS

by

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ABSTRACT

Title of Dissertation: LEARNING AND TEACHING STYLES OF AIRLINE PILOTS

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Satisfaction of pilot-trainees with each of four distinct airline training experiences was measured for the perceived effect of individual learning style, demographic data, and instructional delivery using the 2000 Aviation Training Survey (ATS). The ATS was an adapted instrument that incorporated Kolb's Learning Style Inventory (LSI) and the researcher's Training Satisfaction Survey (TSS) adapted from Wheeler's and Marshall's Trainer Type Inventory (TTI). Instructor satisfaction and teaching style were measured using the Instructor Background Survey (IBS). The IBS was an adapted instrument that incorporated Wheeler's and Marshall's TTI, Kolb's LSI, and the researcher's questions for the collection of demographic and satisfaction data. Instructor trainer type was compared to respective learning style and tested for the effect on instructor satisfaction with teaching the same four aviation training programs. Statistical analysis showed that a pilot-trainee's learning style, as measured by Kolb's LSI, had no significant effect on the subject's satisfaction with any of the four training programs. However, a subject's perception of instructional delivery did have significant effects. Post-hoc multiple range tests further identified the effects of specific instructional delivery descriptors. Empirical review of the correlation between an instructor's trainer type and learning style showed no significant correlation, although some differences were notable and corroborated by personal interviews. Overall conclusion of the research was that deference to instructional delivery has a significant effect on the satisfaction with a training experience and that this satisfaction could be a factor in a pilot's desire to remain with the company.

DEDICATION

to

Henry G. Hamby, Jr.

my Dad,

who did the best he could for his family with the tools he had available, overcoming the perils of combat in World War II and a subsequent lifetime profound issues, to see his sons and grandchildren prosper, I offer this accomplishment in acknowledgement of his sacrifices.

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1-4-3!

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List of Abbreviations

ABS	Aviation Background Survey
AC	Abstract Conceptualization
ACES	Adult Classroom Environment Scale
AE	Active Experimentation
AFB	Air Force Base
ALPA	Airline Pilots Association
ANOVA	Analysis of Variance
ASTD	American Society for Training & Development
ATP	Airline Transport Pilot
CE	Concrete Experience
CEO	Chief Executive Officer
CFR	Consolidated Federal Regulations
CRM	Crew Resource Management
DOTFAC	U.S. Department of Transportation Federal Advisory Committee
DTIC	Defense Technology Center
FAA	Federal Aviation Administration
H1	Research Hypothesis Number 1
IBS	Instructor Background Survey
INDOC	Company Indoctrination Training
LSI	Learning Style Inventory
MBTI	Myers-Briggs Type Indicator
MRA	Multiple Regression Analysis
NOTAM	Notice to Airmen
PALS	Principles of Adult Learning Scale
Ph.D.	Doctor of Philosophy
PLPQ	Pilot Learning Process Questionnaire
RO	Reflective Observation
SIM	Flight Simulator Training
SPOTS	Student Perception of Teacher Style
SPQ	Study Process Questionnaire

SPSS®	Statistical Package for the Social Sciences
SPTE	Student Perceptions of Teacher Effectiveness
SYTEMS	Systems Ground School Training
TS	Training satisfaction
TSS	Training Satisfaction Survey
TTI	Trainer type Inventory
U.S.	United States
V1	Takeoff Decision Speed

Chapter I
Introduction

Statement of the Purpose.

No one is born an airline pilot. As with any career, a person must set out on a path of education and training to gain the knowledge, skills, and attitudes to become an airline pilot. As aviation technology becomes more complex and the airways become more congested, safety standards are becoming tighter and more defined. One way of enhancing aviation safety is by retaining experienced pilots with exemplary records. The purpose of this research is to explore the quality of airline pilot training from the perspective of the effect individual learning styles and teaching styles have on satisfaction with that training. By applying this insight to improving their pilot training programs, airline companies might be able to increase the retention of their pilot force.

In the introduction to Aviation Instruction and Training, a definitive book on aviation training, Telfer (1993a) states that theory and practice each have a contribution to make to aviation training. The days of regarding flight instruction as simply the transfer of the knowledge and skill of an experienced pilot to an inexperienced one are rapidly waning. Telfer states that learning today is perceived as a process and suggests that this perception should be fundamental in aviation training as well. Certain 'tensions', as Telfer terms them, between tradition and innovation, standardization and individualization, theory and

practice, the role and responsibility of aviation instructors and the recognition accorded them, are retardents to the progress of aviation training.

With a better understanding of how a pilot learns to fly an airliner, government regulators (specifically, the Federal Aviation Administration (FAA)), aviation training professionals, and airline pilots themselves, can affect improvements in aviation training programs to provide not only a more effective program, but also one that is more satisfying to the pilot-trainee.

Statement of the Problem – Retention of Qualified Pilots in a Pilot's Marke

The advantages of retaining qualified employees, especially airline pilots, are many, including reducing replacement costs and improving productivity through increased employee experience. The costs of losing qualified employees are extensive, including personnel costs, added replacement training costs, and loss of corporate knowledge. The problem is exacerbated when the demand for qualified employees exceeds the supply. This is especially true today in the United States where overall unemployment reached an all-time low of 4.2 percent in March, 1999. Airline companies, as well as others, are desperate to retain qualified employees.

The reasons employees leave are many. In a study by the Hay Group (Stum, 1997), significant considerations cited by employees for leaving or staying included:

- opportunities to learn new skills,
- coaching and feedback from the boss,
- type of work,
- ability of top management,
- recognition for a job well done,
- respectful treatment,
- training, and
- pay.

Not surprisingly, pay was not ranked the number one reason for staying. Surprisingly, however, was that so many of the other reasons ranked higher than pay. Of particular note is the emphasis employees gave on training and training-related areas as factors of their satisfaction or dissatisfaction with their current employment.

The Pilot Shortage. Today, a very real and major problem confronting the airlines worldwide is the relatively small field of qualified pilots from which to draw to meet increasing aviation demands. As airline travel continues to increase dramatically, so does the demand for competent and qualified airline pilots. Yet, the number of qualified pilots actively flying has decreased. As reported in Flying Magazine, the total number of active pilots has decreased from an all-time high of 827,071 in 1979 to fewer than 630,000 in 1996 (McClellan, 1997). To compound the problem, new entries into the commercial pilot field have also decreased. Since a peak of 159,399 new pilot entries in 1967, the number of persons starting pilot training (excluding military) has steadily declined to 111,531

in 1981, to only 56,107 in 1996, a steady and significant downward trend (McClellan, 1997). According to the U.S. Department of Transportation Federal Advisory Committee (DOTFAC) (1993), the major airlines will require over 30,000 pilots by the year 2004 and the regional airlines will require over 29,000. The DOTFAC report further estimated that over 90,000 new pilots would be required through 2010 to meet replacement and expansion needs. In a briefing in 1998, the chief of pilot recruitment at Southwest Airlines stated that Southwest expected to hire far fewer pilots over the next two years than would meet their requirements. The reason she cited was a marked downturn in the number of qualified applicants. Northwest Airlines disclosed in 1994 that the shortage of properly qualified pilots has impacted the company's pilot work and vacation schedules.

This means airline companies, especially the regional airlines, are being required to lower their entrance standards and train pilots beginning at a level lower than that to which they have been accustomed. Each airline company spends a great deal of money and time in training pilots to meet required standards and would prefer to retain those pilots as long as possible.

In the 1960s and 1970s, the majority of airline pilot recruits were already highly experienced, owing their experience to mostly military aviation. Today, as the U.S. armed forces cut back in personnel, including pilots, this pool of experienced pilots has grown considerably smaller. The U.S. Air Force

announced in the Air Force Times that it intends to increase pilot training in response to a decreasing pilot force (William, 1998). Simultaneously, the demand for commercial pilots has grown, in particular in the regional and corporate aviation operators. These operators typically pay considerably less than the major air carriers and are often used by pilots as stepping-stones toward the major air carriers. The result is a high turnover of pilots for the regional and corporate operators, requiring frequent replacement from a younger and considerably less experienced pilot population, and the lowering of entry qualification requirements.

Factors contributing to the exit of pilots from the career field include mandatory retirement at age 60 (as per Federal Aviation Regulations), changes in a pilot's career desires or personal life, and company-generated termination for various reasons. Beyond general categories for pilot termination, such as self-termination, health, retirement, or failure to meet company standards, airline companies keep few data regarding the reasons airline pilots leave a particular company. The majority of the reasons for termination in regional airlines is self-termination; for the major airlines it is retirement. The reason for the disparity is anecdotal but bears some credence. As mentioned, pilots entering the airline career field use the regional airlines as a stepping-stone to the major airlines much as many baseball players in the minor leagues yearn to play in the major leagues. Retention of qualified pilots in the regional airlines is of even more concern to the regional airlines than to the major airlines.

Retention and the Training Experience. For regional operators and some corporate operators, the problem of retaining experienced pilots is exacerbated by the need to operate on a very tight margin of capital. Not only is pilot pay generally low, but so is the pilot training budget. Many regional operators require the pilot-candidate to pay for his/her own initial qualification training program, making hiring contingent upon passing the program. The result of this action has been to discourage experienced pilots from even applying to the regionals, knowing they will probably be hired by the majors in due time. One step toward retention of pilots for any airline company might be to provide a rewarding and satisfying training experience.

Most anecdotal reasons for the attractiveness of the majors generally involve considerably better pay, greater esteem, and the excitement of flying big jets. These are considerations the regionals and corporates simply cannot afford or that do not fall within the scope of their missions. For example, it is not feasible to operate a Boeing 747 from Washington, D.C., to Roanoke, Virginia.

However, two specific anecdotes point to a retention consideration over which the regionals do have control. In the first case, several pilots in a captain upgrade course for a regional airline expressed how disappointed they were with their company's new in-house training program and also how delighted they were to be in the off-site, contractor training program. In the second case, pilots for a different regional airline expressed the same delight when they learned their

training was going to be contracted outside the company. In both of these cases involving different airlines, the training experience was the prime focus of their dissatisfaction. For the pilots under 40 years of age, providing a satisfactory training experience may not alone be sufficient to retain them. However, there are a substantial number of pilots over 50 years of age flying for the regionals who probably will never be hired by the majors because of their age, and who are content to remain on the regional airline level. If the training experience were satisfying, this might contribute to retaining these experienced pilots, many of whom are retired military and otherwise could simply leave the aviation career field and live on their military retirement benefits.

Factors Influencing the Problem.

As with any career, there are many factors that influence a pilot's satisfaction with training, including trainee-instructor rapport, psychomotor ability, and personal desire and ambition. The factors this research intends to explore are in the area of trainee-instructor rapport as influenced by:

- individual differences in learning style,
- individual differences in trainer type (teaching style),
- individual differences in aviation experience, and
- individual differences in demographic background.

Individual Learning Style. Individual learning style is an area that bears more consideration in aviation training. For decades, the stereotypical pilot was a

military male (Alexander and Stead, 1993). From the 1950s through the 1970s, airline training courses have tended to be rather homogeneous. In recent years, an increased demand created by expansion of the airlines and a reduction in military pilots, has opened the field of aviation to a more diversified population. With such a diversity of people in the pilot world, there must be a diversity of learning styles and abilities, as suggested by Kolb (1984b) in the author's citation of literature and his own research into how individuals learn. Karp (1996) bears this out in research on university-level students in an aviation program concluding that the students had a mixed composition of dominant learning styles (based on the categories of 'visual', 'aural', and 'hands-on') with over half indicating a hands-on preference.

In 1976, Kolb posited a model of how individuals learn, identifying a cycle of four steps – Concrete Experience ('Feeling'), Reflective Observation ('Watching'), Abstract Conceptualization ('Thinking'), and Active Experimentation ('Doing'). After further research and validation, Kolb identified four learning styles based upon the degree to which an individual perceives information and then processes it – 'Diverger', 'Assimilator', 'Converger', 'Accommodator' (Kolb, 1996). One of the purposes of this study is to determine whether there is a link between an individual pilot's learning style and that individual's satisfaction with the training he or she experienced.

Trainer Type (Teaching Style). For the purposes of this study, 'trainer type' is used synonymously with 'teaching style'. Conti defines teaching style as "a hypothetical construct which is associated with various identifiable sets of teacher behavior" (Conti, 1986a, p. 7). Essentially, teaching style is the way a teacher teaches. The preponderance of the literature reviewed seems to regard teaching style as one dimensional along a single scale with didactic (authoritarian, teacher-centered, pedagogy, traditional, etc.) at one end and collaborative (permissive, learner-centered, andragogy, progressive, etc.) at the other.[1]

An interesting perspective of this perception is suggested by Wheeler and Marshall (1986) who developed a Trainer Type Inventory (TTI) to be congruent with Kolb's learning styles. The TTI identifies four trainer types – 'Listener', 'Director', 'Interpreter', and 'Coach'. The four trainer types represent varying degrees to which an instructor is didactic or collaborative. The TTI theorizes that a specific learning style as identified by Kolb will have a corresponding style of teaching – Diverger ↔ Listener; Assimilator ↔ Director; Converger ↔ Interpreter; Accommodator ↔ Coach. Further discussion of this follows in Chapter II. One of the purposes of this study is to determine whether there is a link between an individual instructor's preferred teaching style and pilot-trainee satisfaction with the training. Another purpose of this study is to determine if there is a homogeneity or heterogeneity of learning styles among pilot-trainees and teaching styles among instructors.

[1] Each term was taken in context directly from the literature regarding teaching style.

Research in the field of education shows significant connections between a student's learning style and his/her teacher's teaching style, though most of it has been done in an academic environment. That is to say, in many settings, a teacher's deference to student learning style has been correlated to an improvement in student performance. However, most instructors do not truly alter their style of teaching to fit the student or the course objectives. Quoting research done by Curry, Rudowski (1996) states that "the present bulk of adaptations [deference to a student's learning style] made by teachers tend to be only quantitative adjustments in time ... but these rarely involve qualitative change in the nature of interactions" (p. 12). In aviation training, Karp (1996) substantiates this notion in his research, stating that instructors "tended to instruct by addressing that learning style which aligned with their personal learning style" (p. 174). Karp further suggests that this is probably attributed to the instructor not recognizing that there were other learning styles or did not consider addressing them. Of the few instructors who did feel an obligation to address learning style, "most felt that time was the major constraint" (Karp, 1996, p. 173). To explore this question, personal interviews with a sample of instructors were conducted to gain insight into how much and in what way an instructor defers to student learning style.

Another interesting question raised in the literature review for this study is the relationship an instructor's trainer type has with his/her learning style. Research

in this area has indicated mixed conclusions. This study intends to provide more insight into the existence of this relationship.

In the field of airline pilot training, learning objectives vary among specific courses to the extent that a specific course might be better oriented to a specific learning style and, therefore, teaching style. For example, the learning objectives and course delivery in Crew Resource Management (CRM) training required of all airline pilots are of a collaborative nature, while those of flight simulator training require very specific performance criteria and are of a didactic nature.

The literature review in this study has revealed a dearth of research done on teaching style in commercial aviation. Considerable inquiry into the U.S. Air Force has revealed no research, written documentation of data, nor even a proposal to measure or identify trainer types or teaching styles in flight training or any other training field. Given that there are significant differences between academic education and aviation training, disclosure of any connection between how instructors teach pilots and how pilots learn would, indeed, be beneficial to improving aviation training. This is especially true knowing the Air Force has expressed a keen interest in measuring training effectiveness.[2] One of the benefits of this study will be to help fill that void of research into learning style and teaching style in aviation training.

[2] Summarization of several conversations with personnel at the U.S. Air Force's Human Effectiveness Laboratories in Mesa, Arizona, and Randolph AFB, Texas, and a review of the research publications posted on the Defense Technology Information Center (DTIC) website, http://www.DTIC.mil, Dec 8, 1999.

Individual Differences in Aviation Experience. Commensurate with Kolb's theory that adults learn based upon experience (Kolb, 1984b), the major effect upon a pilot's learning style would be a pilot's experience in aviation. This would include not only how much flying time the pilot has had, but also the type of flying (for example, military, commercial, private, etc.) and the type of training program to which he/she has been exposed. A major difference between civilian and military aviation training is the variety of instruction available to civilians. Even though all instruction must meet FAA performance criteria, there exists a great variety in its delivery, ranging from private instructors to small flight schools with part-time instructors to airline flight schools with instructors on permanent staff.

An interesting question would be how much does experience influence one's learning style and vice versa, that is, how much does learning style influence one's experience? This study is a preliminary step to establish a relationship between learning style and aviation experience in order to lay a foundation for further research into a causal relationship.

Individual Differences in Demographic Background. Based on previous social research, factors that would intuitively have a bearing on performance include age, gender, education, and family situation (Abraham, 1976). Diversity distinctions do not appear to have any significant effect on aviation performance or learning style (Telfer, 1993a). The airline pilot career field has been a

traditionally male occupation, and with the influx of many women into the field in the last decade, gender differences would be interesting to explore.

Statement of the Need – Providing a Satisfying Training Experience. A pilot's satisfaction with a training experience may not necessarily be driven by his/her performance as much as the quality of training. A key factor in training quality is recognition of individual differences. The approach to pilot training has traditionally been compartmentalized with the methodology and philosophy of the airlines in one camp, the military in another, aero clubs in another, and private business flying schools in still another. The methods and philosophies of these camps differ greatly. In his book Aviation Instruction and Training, Telfer (1993a) states that this difference is not just a function of the nature of the aviation requirements of each, but more a matter of pilot availability, demand, and economic survival.

We are only now beginning to appreciate that not all people learn their best in the same environment – that there is a significant difference in an individual's learning style. Deference to a pilot-trainee's learning style may go a long way toward increasing satisfaction with the training experience. Retention of experienced pilots may depend, in part, on providing a satisfying training experience. For a proprietary training company providing contract training to an airline company, economic survival may depend on providing a satisfying training experience.

Relationship Between Performance and Satisfaction. The measure of successful completion of practically all airline training programs is pass or fail with no degree qualification. Either the pilot meets minimum standards or not. Some pilots, for whatever reason, perform better than others. For example, the criteria for successful performance of a steep turn during the evaluation are to maintain assigned altitude within 100 feet, airspeed within 5 knots, and roll out on heading within 5 degrees. Some pilots are able to accomplish this with tighter tolerance than others. Also, regardless of how well a pilot performs the maneuver, there is a wide range of effort expended by individual pilots. Some pilots are able to maintain tight tolerances with seeming ease and others expend a great deal of effort. The same is true with those pilots who do not hold tight tolerances. That is, some pilots do not have the superior control to maintain tight tolerances and expend a great deal of effort endeavoring to do so, while others who do have the psychomotor skill simply accept loose tolerances in order to reduce physical stress. Thus, the validity of a measure of actual performance would not be robust.

However, regardless of the validity, for the purpose of this study, a measure of actual performance is irrelevant for two reasons. First, as demonstrated by a recent study by the Human Factors Laboratory at George Mason University (Holt, 1999), there is negligible difference between the performances of individual pilots of over a year's employment with the same company. An earlier study by Moore and Telfer (1993) also demonstrated a negligible relationship between how pilots

learn and how well they ultimately perform. Second, the causal relation between how satisfied a pilot was with his/her training experience and how well the pilot performed in training is not strong. Informal interviews with pilot-trainees reveal that some pilots who completed training with a great deal of effort were pleased with the training program and others who performed well with relatively minimal effort were disappointed with the training. However, there may be a stronger relation between the pilot's expressed satisfaction or dissatisfaction with the training and the degree to which instructor teaching style matched his/her individual learning style.

Mayberry and Carey (1997) found a significant predictive effect of previous job experience (as indicated by time in service) on certain job performance criteria in Marine Corps mechanics, though not to the extent that aptitude testing results showed. However, time in service was a much stronger predictor of mechanical performance for helicopter mechanics than for vehicle mechanics. This indicates that specialized knowledge and ability gained through work experience has a significant impact on performance in a specialized field.

Furthermore, Shimko (1992) found that even though prior job-specific experience correlated significantly to job performance, it decreased in importance after initial impact whereas intellectual ability increased in influence on job performance. These observations also support the notion that performance of airline pilots is relatively equal after a year's employment with the respective airline.

Research Hypotheses.

This research study consists of four basic hypotheses (all to be tested at the $p<.05$ significance level):

H1: A pilot-trainee's learning style, perception of instructional delivery, and individual demographic background have an effect on a pilot-trainee's perception of satisfaction with a training experience. The null hypothesis, then, is that neither learning styles nor teaching styles nor background have a significant ($p<.05$) effect on how pilots perceive their satisfaction in training.

H2: There is a correlation between an individual instructor's trainer type and his/her learning style. The null hypothesis in this case would be that there is no significant ($p<.05$) correlation between how instructors teach and how they learn.

H3: An instructor's trainer type, learning style, and demographic background as an instructor have an effect on his/her satisfaction with teaching a particular type of training program. The null hypothesis is that neither trainer type, nor learning style, nor demographic background has a significant ($p<.05$) effect on an individual instructor's satisfaction with teaching a particular program.

H4: There is a correlation between an instructor's satisfaction with having taken a particular training program as a trainee and the satisfaction that instructor feels with teaching that same program. The null hypothesis is

that there is no significant ($p<.05$) correlation between satisfaction with teaching a program and having taken the program.

Assumptions of this Study.

In pursuing this research, several assumptions are made:

1. The appropriate literature reviewed is assumed to accurately reflect current learning style theory, teaching style theory, experiential learning theory, and aviation training theory.
2. Construct validity and reliability for the five instruments used – Learning Style Inventory (LSI), Trainer Type Inventory (TTI), Training Satisfaction Survey (TSS), 2000 Aviation Training Survey (ATS), and Instructor Background Survey (IBS) – is assumed to be adequate.
3. The subjects included in the data analysis are assumed to have responded truthfully and in good faith.
4. The population sample of those pilots actively employed by an airline is assumed to be relevant and appropriately indicative for the research.
5. Results and significant conclusions of the stated hypotheses for this study are based on statistical analysis of the data collected.

Limitations of this Study.

The following limitations are imposed upon this study:

1. The population for this study is limited to pilots actively employed as pilots for a specific airline company operating under 14 CFR Part 121[3].
2. The sample from the population represents approximately 20 percent of the population.
3. Statistical conclusions are based entirely on the sample collected.
4. The learning styles and teaching styles identified by Kolb's LSI and Wheeler's and Marshall's TTI, respectively, are treated as discrete variables, although their definitions and descriptions can overlap.

Statement of Procedure.

Following is a statement in itemized format of the procedure in conducting this research:

1. An area of interest in aviation training was identified and explored for its relevance to current aviation training needs and trends and possible problems in the area. A problem in aviation training was identified and defined, specifically, the role of a satisfying training experience in retention of pilots.
2. A preliminary review of the literature was conducted to focus the study.
3. The problem and research topic were discussed with the research advisory committee, who offered further guidance in focus and literature review.

[3] 14 CFR Part 121 – Operating Requirements: Domestic, Flag, and Supplemental Operations, is the U.S. Consolidated Federal Regulation (CFR) that governs major commercial air carriers. Typical companies operating under this regulation are United Airlines and American Airlines, although neither of these were the company under study.

4. A focused literature review was conducted to provide substantial foundation for the proposed hypotheses. Specifically reviewed was literature in the field of learning style theory, teaching style theory, experiential learning (the effect of experience on learning), the effect of demographics on job performance, and the correlation of self-perception of performance to actual performance (i.e., performance measured by an independent evaluation source). The literature offered sufficient foundation to believe that employee retention is an integral goal of training and that deference to learning style and teaching style is a significant variable in the effectiveness of training and therefore employee retention.

5. Based on the review of the literature and guidance from the research committee, the research assumptions, limitations, hypotheses, and hypotheses tests were further defined.

6. Five research instruments – Kolb's Learning Style Inventory (LSI), Wheeler's and Marshall's Trainer Type Inventor (TTI), an original 2000 Aviation Training Survey and Training Satisfaction Survey, and Instructor Background Survey (IBS) – were chosen or developed based upon literature regarding research design in the specific area under study and presented to the research committee. Validity and reliability of the instruments were checked and the instruments were further refined. The instruments were field-tested for validity and reliability using a small group of pilots and instructors.

7. Appropriate statistical measurements and tests were selected. Multiple Regression Analysis (MRA), Analysis of Variance (ANOVA), and post-hoc multiple range tests and paired comparisons were determined to be the most appropriate statistical procedures for this study.

8. Permission from the University of Maryland to use human subjects was obtained and the proposal was approved by the research committee.

9. The sample of research subjects was selected and permission was obtained from appropriate authorities at the subject airline company under study and the Airline Pilots Association (ALPA) to administer the instruments.

10. For the pilot-trainees, three sections of the instrument – demographic survey (one page), TSS (two pages), and LSI (one page) – were combined onto one 11x17 inch form (to insure no sections would be lost and that all sections of the instrument would be completed) entitled Aviation Training Survey, enclosed in an envelope, and given to the chief pilot of the airline company under study to distribute to the pilot force. The packages also included a self-addressed, stamped envelope in which to return the completed instruments. The form was to be completed individually at the respondent's convenience. Total time to complete the instrument was approximately 15 minutes. Two incentives for completion and return of the instrument were provided to the respondents – first, a letter explaining the need for the study and its relevance to the subject's

career, and second, a lottery, upon completion of the study, for a monetary reward for the return of the surveys.

11. For the instructors, an instrument composed of a demographic survey (one page), a survey of instructor satisfaction (one page), the TTI (one page), and the LSI (one page), were combined onto one 11 x 17 inch form entitled Instructor Background Survey, and distributed at random to instructors at the respective airline companies under study, along with a return envelope for their return. The form was number coded for identification of a subject. Time required to complete the instrument was approximately 15 minutes. Incentive provided for completion was a letter explaining the need for the study and its relevance to the subject's career field. No monetary award was offered to the instructors.
12. A sample of two pilot-trainee subjects and three instructors were selected randomly to provide qualitative insight into the study. The pilot-trainees were each administered an LSI, an ABS, and a TSS. The LSIs were scored and the subjects were interviewed to provide more detail into the nature of their satisfaction or dissatisfaction. The instructors were not administered another series of instruments.
13. As each package of completed instruments was received, the data were recorded onto a computer database for later statistical manipulations in the Statistical Package for the Social Sciences (SPSS®).

14. Once sufficient time had elapsed to permit return of an adequate amount of instruments (at least 20 percent of the population), statistical manipulations on the data using SPSS® were accomplished to test the stated hypotheses.
15. Statistics results were corroborated by five personal interviews with pilot-trainees and instructors. The questions asked of the interview subjects were inspired from the statistics results.
16. Findings, interpretations, conclusions, and recommendations for further study were made and documented in Chapters IV and V.

Definition of Terms.

Airline pilot – a pilot with a minimum of a commercial pilot's certificate with instrument rating who is employed by a company operating under 14 CFR Part 135 or 121.

Commercial aviation – aviation operations involved in the transport of people, cargo, or property for compensation or hire as a major enterprise (from 14 CFR Part 1: Definitions and Abbreviations).

Corporate aviation – aviation operations involved in the transport of people, cargo, or property not for compensation or hire as an incidental part of corporate administration, such as transporting the corporate CEO to a meeting.

Descriptors – words or phrases used in the survey instruments to describe an effect or behavior of the item in question.

Chapter II – Literature Review. Chapter II presents an overview of the literature regarding the development of learning style theory and experiential learning theory. This chapter also presents a detailed description of aviation training, demographic criteria, pilot training performance measurement, and self-perception of performance as they relate to this research, including justification for their use in developing the survey instruments and a foundation for testing the hypotheses.

Chapter III – Research Methodology. Chapter III includes a description of the research method and the research design, research population and sampling, development and validity of the survey instruments, procedures for obtaining and processing data, and justification and description of hypotheses testing statistics applied.

Chapter IV – Findings. Chapter IV restates the hypotheses, presents the data collected from the 2000 Aviation Training Survey and Instructor Background Survey, lists and describes the specific statistics obtained from testing and analysis of the data, and presents significant links and relationships among the data sets.

Chapter V – Summary, Conclusions, Implications, and Recommendations for Further Study. Chapter V restates the research hypotheses, summarizes Chapters I, II, III, and IV, presents conclusions about the research topic based on the data and statistics obtained from the research, and offers implications of the results. Finally, this chapter offers recommendations for further research.

Chapter II
Literature Review

Introduction.

This chapter will present an overview of the current literature regarding teaching styles, learning styles, teacher effectiveness, and student satisfaction. Specifically, Kolb's Learning Style Inventory and Wheeler's and Marshall's Trainer Type Inventory will be discussed as congruent measures of learning style and respective teaching style. The literature regarding student satisfaction will also be discussed to provide a foundation for the development of an original instrument, the Training Satisfaction Survey (TSS), as an appropriate instrument to measure the effect that learning style and teaching might have on satisfaction with a training situation.

Retention of Employees Through Effective Training.

Retention of good employees is a primary consideration of any business. Most authors (Wood, 1994; Franklin, 1997; Taylor, 1997; Murakami, 1999) suggest that of the many reasons why employees work, financial compensation is not always number one. Abraham (1976) suggests that often the reasons an employee gives for quitting are not always the most significant ones to him/her, but only a convenient excuse. The author further states that an examination of the 'predeterminative' variables in employee turnover would be in order, along with an investigation of the effect of employee background on employment tenure. Abraham reported that 82 percent of the responses of reasons for

staying in the current job were family responsibilities and proximity of the neighborhood to work and school.

An important reason for employee retention is linked to the training experience. Franklin (1997) and others suggest that an investment in employee training enhances retention by developing the employee's confidence and offering a sense of accomplishment and value. Most people work to gain a feeling of personal worth and accomplishment. Dobbs (1999) found that extensive training and career development programs were cited as significant reasons employees stay on. Stum (1998) cites the 1998 Hay Group Retention Study, which found that training was cited as a significant retention motivator by 59 percent of the employees queried who planned to stay with their respective employers, and a stated reason for leaving by 32 percent of those employees planning to leave.

Wood (1994) states that to keep good people, a company must start by identifying an employee's measure of success and assuring that employee succeeds in his or her work. As one of the ingredients for an employee retention formula, Stum (1998) lists opportunities for personal growth and suggests an action plan to provide a valuable learning experience. He further suggests that companies "think creatively about types of experiential learning opportunities . . ." (Stum, 1998, p. 10).

In research into Myers-Briggs Type Inventory (MBTI) learning style and teaching style incongruency, Cooper and Miller state "The match or mismatch between the way that professors teach and the way that students learn may have important ramifications for levels of satisfaction with a given school, and with retention of both students and teachers" (Cooper and Miller, 1991, p. 699).

Training for an airline pilot is a perpetual endeavor. When properly administered, the variety of training programs airline pilots must undertake can go far toward satisfying the need for personal development or they can become extremely tiresome or aversive. If a particular training experience is perceived as denigrating and difficult, a pilot employee is not likely to wish to continue with that company. However, if the experience is challenging but builds self-confidence and a sense of accomplishment, then that pilot is more likely to look forward to the next training event.

Airline Pilot Training.

One of the major characteristics of airline training is its iterative nature. That is, once initial qualification training is completed, the pilot must anticipate an ongoing schedule of training courses. Given the rapid turnover of employees and influx of new aircraft, it is not uncommon for an airline pilot to undergo four or more training programs a year. Each of these programs lasts from three days to four weeks, depending upon the type of training.

Scope of Knowledge. Training an airline pilot is an awesome task. The scope of learning in aviation has increased exponentially since the days of the Wright Brothers, yet the method of conveying that learning has not kept pace. When the Wright Flier first flew at Kill Devil Hills, North Carolina, in 1903, virtually the only requirement for flying was basic psychomotor skills – just how do I get this machine off the ground and return in to earth without much damage? Today, the crew of a Boeing 747 in transit over the North Atlantic must cope with so much more than the Wright Brothers could have imagined. A typical international jetliner flight involves not only the application of psychomotor skills of maneuvering the airplane, but draws upon an immense field of applied knowledge. Lehrer (1993) writes that in aviation training, the "primary goal of an educational experience is to transmit knowledge, skills, concepts, attitudes, or habits. Such ... educational events take place in many different aeronautical settings ... as varied as a ground school class, an aircraft simulator, an engine maintenance laboratory exercise, or a cross-country training flight" (p. 271).

Certification Prerequisites for Pilots Applying for Employment as an Airline Pilot. To meet the prerequisites for employment as an airline pilot, a pilot must undergo extensive and intensive training. In accordance with Federal Aviation Regulation Part 61: Certification of Pilots and Instructors, all pilots must pass a knowledge examination and a practical flight proficiency examination for each level of pilot certificate sought. For example, the knowledge examination for the

Airline Transport Pilot (ATP) certificate lists a multitude of knowledge areas including[4]:

- regulations,
- meteorology,
- weather and Notices to Airman (NOTAM) collection and dissemination,
- windshear and microburst,
- interpretation and use of weather charts, forecasts, reports, abbreviations and symbols,
- National Weather Service functions,
- principles of air navigation,
- air traffic control procedures and pilot responsibilities,
- aircraft loading, weight and balance computation, use of charts, graphs, tables, and formulas,
- aerodynamics,
- human factors,
- aeronautical decision making, and
- crew resource management.

The flight proficiency portion of the ATP examination requires demonstrated proficiency in:

- preflight preparation,
- takeoff and departure procedures,
- in-flight maneuvers,
- landings and approaches,
- normal and abnormal procedures,
- emergency procedures, and
- post-flight procedures.

[4] Title 14, Consolidated Federal Regulations (CFR), Part 61: Certification of Pilots and Instructors, Subpart G – Airline Transport Pilots, 1998.

These requirements are for the initial receipt of the ATP certificate. Prior to this, a pilot will have accomplished many of the same requirements for a private pilot certificate, commercial certificate, and instrument rating. Once the certificate is acquired, learning and training continues throughout employment as an airline pilot.

Types of Training Required for All Airline Pilots.[5] Following is a list of the types of training each airline pilot must undergo at some point during his/her employment as an airline pilot. This training is frequently repeated in some form, depending upon the number of times the pilot changes aircraft qualification or airline company.

Indoctrination Training – training required for all newly hired crewmembers. Normally, the syllabus requires 40 hours of classroom instruction on regulations, company policies and operations, and crewmember duties and responsibilities. This requirement is a one-time, company-specific event accomplished immediately after hiring. If the pilot leaves the company for another, he/she must undergo Indoctrination Training with the new company.

Initial Qualification Training – training required for a flight crewmember who has not qualified and served in the same capacity on another airplane of the same group. Normally, this syllabus requires 80 hours of classroom instruction and up to 24 hours in the flight simulator. This training is required each time a flight crewmember goes into a new aircraft, regardless of how frequently he/she moves from one aircraft to another.

[5] Taken from Title 14, consolidated Federal Regulations (CFR), Part 121: Air Carrier and Commercial Operators, 1998.

Recurrent Training – training required for the review of aircraft systems, emergencies and normal and abnormal procedures. Normally, this syllabus requires 20 to 25 hours of classroom instruction (depending upon the airplane involved) and eight hours in the flight simulator. This training is required annually for every flight crewmember, regardless of which airplane he/she is flying at the time.

Transition Training – training required for a crewmember who has qualified and served in the same capacity on another airplane of the same group. Normally, this syllabus requires 80 hours of classroom instruction and 24 hours of flight simulator. This training is required whenever a crewmember moves to a new aircraft, regardless of having been previously qualified.

Upgrade Training – training required for a crewmember who has qualified and served as second in command on a particular airplane type before he/she serves as pilot in command. Normally, this syllabus requires 40 hours of classroom instruction and 24 hours in the flight simulator. This training is required whenever a crewmember upgrades his/her position, regardless of having been previously qualified.

Differences Training – training required for a flight crewmember in the particular variations of the airplane in which he/she has qualified. Normally, this syllabus is four hours of classroom instruction and accomplished after initial qualification.

Crewmember Emergency Training – training required for a crewmember in the use of emergency equipment and duties. Normally, this syllabus requires eight hours of classroom instruction that includes hands-on practical experience with the equipment. Training is required annually and actual use of the equipment is required each 24 months.

Crew Resource Management (CRM) Training – training required for all flight crewmembers in communications, crew coordination, human factors, and decision making. Normally, this syllabus is 16 hours of instruction and is accomplished prior to initial qualification training.

Frequency of Training. As can be derived from the previous descriptions, after company Indoctrination Training, an airline pilot can be required to experience anywhere from a minimum of two training programs per year (Initial Qualification Training and Recurrent Training) to several per year, depending upon how frequently he/she rotates between airplanes or upgrades. For example, one particular pilot for a major airline company had experienced six training programs in one year – Recurrent Training in the Boeing 737, Initial Qualification Training in the Fokker 28, Recurrent Training in the Fokker 28, Transition Training back to the B737, then Captain Upgrade Training in the B737, then Initial Qualification Training in the B757. Much of this was driven by the company's acquisition of new aircraft and changing route structure.

Nature of Flight Simulator Training. Typically, the 24 hours of flight simulator training for Initial Qualification Training involves the demonstration and practice of specific flight maneuvers, such as takeoff, landing, stalls, emergencies, and instrument approaches. Pilot-trainees usually go through as a crew, meaning a captain flying in the left seat and a first officer flying in the right seat of the cockpit. Their instructor is also a pilot fully qualified in the specific aircraft, and sits behind the pilot-trainees to instruct the pilot-trainees and to operate the flight simulator. Upon successful completion of the syllabus, the instructor

ecommends each pilot-trainee for an evaluation, or checkride, to be dministered by an independent examiner. Performance of each flight maneuver s evaluated according to criteria specified by the FAA. Performance is pass or ail with no degree of performance indicated. Though not specified by the FAA, irline companies typically require pilot-trainees to complete the syllabus of nstruction within the time allotted by the syllabus. Companies very rarely extend xtra training time to a pilot-trainee who is having difficulty meeting the erformance criteria. Should a pilot-trainee fail the evaluation, additional training an be offered with another evaluation. However, this, too, is rarely offered. In his context, airline training can be quite stressful.

cope and Depth of Knowledge. A final point regarding the extensive training equirements for an airline pilot is that this training is not merely on the omprehension, but must ascend to a much higher level. The performance of an irline pilot during practical operations demands a good deal of problem solving, nalytical thinking, interpersonal relations, and customer relations. If the pilot oes not already have this level of knowledge and skills when hired, then the irline company must train that individual to achieve those levels.

he Relevance of Training Types to this Study. Even a cursory view of the ariety and depth of these subject areas implies a significant variety in the way ey must be taught. This study focuses on pilot-trainees in a particular training uation that stands out in their minds as satisfying or dissatisfying. These data

will provide further insight into the nature of the relationship between learning style and teaching style.

Differences Between Aviation Training and Scholastic Instruction. Telfer (1993a) points out several significant differences between theory of instruction in a 'scholastic' [sic] setting (such as high schools or universities) and an aviation setting, and lists them in a table, presented in Table 2.1 – Aviation Instruction versus Public Education. "The mission of aviation instruction is more immediate", writes Telfer, "requiring prompt accommodation of any changes in employment requirements. Their [flight instructors] focus is squarely upon the transfer of their instruction to real-life situations, while the teacher [scholastic] has the luxury of delayed transfer. Accountability for the teacher is less immediate" (Telfer, 1993a, p. 212).

Table 2.1 – Aviation Instruction versus Public Education

AVIATION INSTRUCTION versus PUBLIC EDUCATION [scholastic]		
VARIABLE	**AVIATION**	**PUBLIC [scholastic]**
Structure	Centralized with instructors in the loop	Decentralized with teacher autonomy
Mission	Knowledge and skills	Transmit culture and socialization
Focus	Transfer of learning	Delayed performance
Budget	Efficiency	Effectiveness
Flexibility	Limited	Choice available
Teacher	Temporary or transient, rarely a career	Career, method, and content

Taken from Telfer, 1993, p. 212.

A second difference is that budgetary forces for aviation instruction emphasize maximum trainee competency at minimum cost to the company. The teacher, maintains Telfer, is not constrained by time and therefore "effectiveness is more important than efficiency" (Telfer, 1993a, p. 212).

A third and rather interesting difference is that Telfer feels "professionalization of teaching [in the scholastic setting] has occurred, but the flight instruction is still perceived as a transitory role rather than as a career path. Flight instructors are usually temporary experts, anxious to get back to the line. Career teachers in the scholastic setting have the advantage of specified periods of preparation in both method as well as subject content" (Telfer, 1993a, p. 212).

This last difference is of particular note in the context of teaching styles. Observationally, few flight instructors, either with the airlines, professional flight instruction service companies, or as independent instructors, have any substantial background or education in instructional theory or technique beyond having gone through the same training course they are teaching. The extent of their education in instruction theory and practice is a 50-question written examination, The Fundamentals of Instruction, required by the FAA.[6] Although the test questions are valid and reflect current teaching and learning theory, the results are not reliable indicators of content knowledge in that the questions and their respective answer choices are published (as mandated by federal public

[6] FAA Handbook (1998). Fundamentals of Instruction. Federal Aviation Administration, U.S. Government Printing Office.

law) and exam candidates simply memorize the questions and answers without understanding the theory.

Learning Style and Teaching Style Theory.

Research has demonstrated that learning is influenced by a multitude of variables with a wide range of effects. One of these variables is an individual's learning style. A primary objective of research into learning styles is to improve the efficiency and effectiveness of an individual's learning by improving the teaching method. Intuitively, understanding how an individual learns should help us to develop a better way of teaching. Marshall (1990) summarizes the application of learning style theory by saying, "If students don't learn the way we teach them, then we will teach them the way they learn" (p. 12). This notion is particularly poignant in light of Karp's (1996) research finding that 39 percent of aviation instructors he interviewed stated they did not feel an obligation to address all of their students' learning styles.

According to Curry-Swann (1990), three general problems pervade learning style theory: confusion in definition; identification of relevant characteristics in learners and instructional settings; and weakness in reliability and validity measurements. The latter is a ubiquitous problem with any research while the first two are more esoteric.

Curry-Swann (1990) states that there is a "bewildering array of definitions surrounding learning style conceptualizations" (p. 69). Even so, the author further suggests that there is some convergence toward using the term learning style in three general contexts: information processing routines that function in a trait-like manner at the personality level; a strategy to refer to cross-situational consistency in how students approach learning; and a tactic to describe the specific observable activity of learners in a specific learning situation.

Writing during the genesis of learning style theory, Norris (1977) summarized learning style from the literature at the time as "(1) the individual's preferred way of perceiving information offered to him from his environment, (2) the individual's preferred way of interpreting this information, (3) the individual's preferred way of organizing this information, and (4) the individual's preferred mechanism of reporting his interpretation of the information he has processed" (p. 17). Kolb, whose concepts and research seem to be the most current and extensive and whose instrument – the Learning Style Inventory (LSI) – is used in this study, does not define learning style so much as conceptualize about it. For example, Kolb (1996) states, "As a result of our unique set of experiences, we each develop preferred styles of learning. These learning styles are simply the way we prefer to absorb and incorporate new information" (p. 9). However, Gremli (1996) defines learning style as the way an individual "begins to process, internalize, and concentrate on new material," (p. 43). In any case, the various definitions seem congruent.

Gremli (1996) states that an individual's learning style is as unique as his/her fingerprint. Based upon this premise, Gremli advocates determining student and teacher learning styles prior to teaching and then designing the teaching activity in congruence with the learning styles. Assuming learning style has some significant a=effect on how effectively an individual absorbs and retains knowledge, this method would have some advantage in small training settings with heterogeneous population of learning styles. Difficulty arises as the group of students becomes larger and attention to individual learning styles becomes less practical, unless the group is relatively homogenous in learning styles. It is this notion that is of interest in this research study. That is, even though the pilot population appears to be getting more heterogeneous in its demographics and aviation background, it may be relatively homogeneous in its individual learning styles. If this is true, then current methods of training pilots may not be as well suited to a particular learning style as perhaps another, and therefore, a re-evaluation of the assumptions of pilot training methods may be in order.

Learning Theory Outside of Aviation Training. As humans exhibit significant individual differences in physical, mental, and emotional states, it stands to reason that there are also individual differences in the way humans learn. A great deal of research has already been accomplished in the theory of how people learn and several models have been proposed.

Karp (1996) summarizes his review of the literature on learning theory by offering four major orientations: behaviorist, in which learning is observable behavior shaped by the environment; cognitive, in which learning is the way an individual experiences, processes, organizes, stores, and retrieves information and is controlled by the learner; humanistic, in which learning is shaped by human nature, potential, and growth; and social learning, in which learning is achieved by observing others in a social setting, accounting for both the learner and the environment.

Grasha (1990) identified three fundamental learning styles in his work with college students: dualism (thinking in terms of 'either-or'), multiplicity (acknowledging multiple perspectives), and relativism (knowledge is situational). Much has been written on the implications to learning of these traits. Cooper and Miller (1991) applied the MBTI to individual learning styles and posit that "one's learning style is operationalized in terms of the interaction of Introversion (I) – Extroversion (E) scale score with Sensing (S) – Intuition (N) scale scores yielding four possible styles: (a) abstract-reflective (IN), (b) abstract-active (EN), (c) concrete-reflective (IS), and (d) concrete-active (ES)" (p. 37).

Dunn and Dunn (Dunn, Dunn, and Price, 1989) developed a model of learning styles in terms of individual reactions to 23 elements in five basic strands that include each person's environmental, emotional, sociological, physiological, and psychological preferences. This model has reported an expected improvement

of three-quarters of a standard deviation for students whose learning styles were accommodated over those whose learning styles were not. Joining with Price, the authors developed the Dunn, Dunn, and Price Learning Style Inventory.

Learning Theory in Aviation Training. The literature regarding learning and teaching in aviation training is scant and deals mostly with training effectiveness. A review of all articles published in The International Journal of Aviation Psychology since its beginning has disclosed no literature on learning styles or teaching styles. However, one source proved interesting regarding learning in an aviation training setting. Besco (1992) states that "learning is enhanced, improved, and less costly if there are personal involvement and interaction with the learning process" (p. 66). Besco further states that the instructor's attitudes towards the students are significant factors in the quality of training. The author warns to "be certain to select instructors who have a positive attitude toward themselves, the piloting profession, individual pilots, and the importance of quality training. If pilots are being instructed by people who relish a superior position over students, the whole learning program will suffer," (p. 67).

The major portion of research in aviation training theory has been done by Ross Telfer and associates and published in the book Aviation Instruction and Training. Indeed, the director of the Human Factors Laboratory at George Mason University involved in FAA directed research into airline pilot training has stated that Telfer's book is his primary reference. Little else in the realm of

learning style and teaching style in aviation training seems to have been published. The same is true of research into teaching style in aviation training.

Based upon the Study Process Questionnaire (SPQ) developed by Biggs (1987) from research involving university students, Telfer (1993a) developed the Pilots Learning Process Questionnaire (PLPQ), founded in Biggs' three approaches to learning – surface, deep, and achieving. For example, Telfer describes the three approaches thusly:

> "Learners with a surface approach are motivated to meet minimal course requirements and achieve their goals by rote learning ... learners using a deep approach are more intrinsically motivated, seek to personalize their goals and undertake meaning-oriented learning activities. Finally, learners with an achieving approach are motivated to seek high grades ... and to organize themselves for learning" (Telfer, 1993a, p. 121).

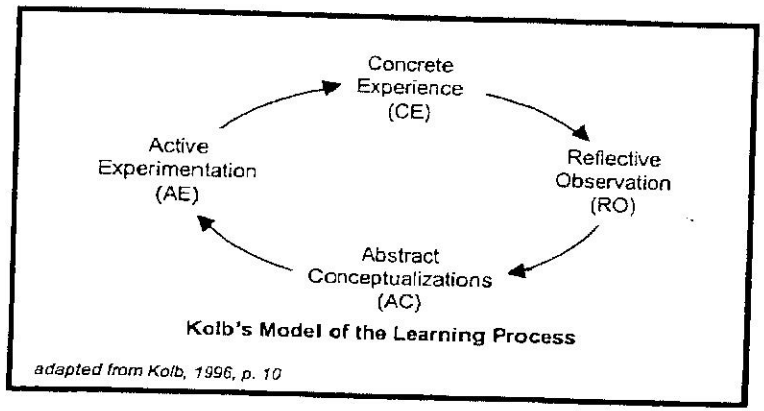
The PLPQ developed by Telfer measured relationships between the performance n ground school topics of differing degrees of difficulty and the three approaches - surface, deep, and achieving. However, this perception of the learning process seems to be oriented more toward the *level* of the learning outcome than toward ıow the knowledge and skill is actually absorbed or transferred.

Karp (1996) performed a qualitative study of student preference for teaching style mong university-level aviation students in a theoretical- [academic-] based ourse, concluding that the students preferred a "well-structured lecturer as their ıstructor, with only a fifth of the students preferring a facilitator," (p. 164). Karp ırther states that "no students indicated they wanted a co-working equal as an

instructor" (p. 164). Unlike Telfer, who explored the level of learning, Karp's research was oriented toward how a trainee learns.

Kolb's Model of the Learning Process. Depicted in Figure 2.1 – Kolb's Model of the Learning Process, Kolb envisions a four-stage learning cycle "where experience is translated into concepts which in turn are used as guides in the choice of new experiences" (Kolb, 1996, p. 8). The cycle begins with immediate, concrete experience (CE). Stage 2 is reflective observation (RO) upon those experiences.

Figure 2.1 – Kolb's Model of the Learning Process



In Stage 3, the learner forms abstract conceptualizations and generalizations (AC) based on his/her observations and reflections and then progresses to Stage 4.

In Stage 4, the learner tests the implications of the new concepts in new situations through active experimentation (AE). The results of testing in Stage 4 form new concrete experiences and the process repeats.

For the learning process to be effective, Kolb (1996) postulates the need for these four different abilities and summarizes this theory thus:

> From concrete experiences, "[the learner] must be able to involve himself fully, openly, and without bias in new experiences from many perspectives (RO); to create concepts that integrate his observations into logically sound theories (AC); and to use these theories to make decisions and solve problems (AE)" (p. 8).

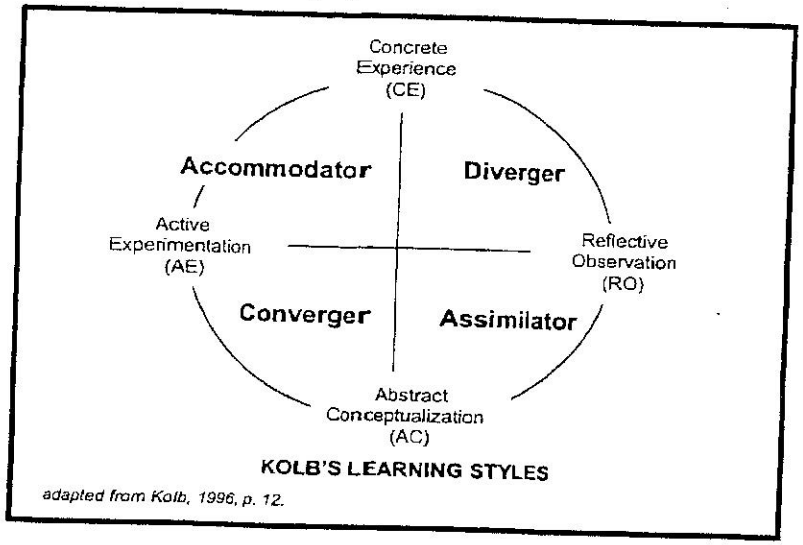
For the experiential learning cycle to be effective and long lasting, the cycle must be completed. That is, regardless of a learner's preferred style of learning, the learner must go through each stage of the cycle. Kolb's theory, suggest Wheeler and Marshall (1986), is why it is necessary for teachers to be able to lead students skillfully through all aspects the learning cycle.

Kolb observes two polarities in his model – one between concrete experiences and abstract conceptualization, and the other between active testing of concepts and reflection. He theorizes that as individuals grow, we become stronger in one pole over the other, stating that "over time, accentuation forces operate on individuals in such a way that the dialectic tensions between these dimensions are consistently resolved in a characteristic fashion" (Kolb, 1996, p. 9). As an example, Kolb suggests that a mathematician may come to place greater emphasis on abstract concepts than a poet who may value concrete

experiences. A manager may focus more on active application of concepts than a naturalist who is preoccupied with observation. Kolb does not suggest that one pole dominates in every situation, but that there is a tendency for individuals to employ one pole more than the other in most situations. Kolb calls this tendency an individual's learning style.

Kolb's Learning Styles. Kolb has identified four basic learning styles congruent with the polar nature of the stages of the learning process: Converger, Diverger, Assimilator, and Accommodator. These learning styles are a synthesis of two learning abilities in the learning process, as depicted in Figure 2.2 – Kolb's Learning Styles, and further explains the Kolb's perception of the learning process.

Figure 2.2 – Kolb's Learning Styles



adapted from Kolb, 1996, p. 12.

Diverger. The Diverger perceives or takes in new information concretely and processes or transforms it reflectively. The Diverger's strength lies in the ability to view concrete situations from many perspectives and to organize many relationships into a meaningful 'gestalt'. Kolb derives the term Diverger from the ability to perform better in situations that call for generation of alternative, or divergent, ideas, such as brainstorming. Typical Divergers include liberal arts and humanities backgrounds such as counselors and organization development consultants.

Assimilator. The Assimilator perceives or takes in new information abstractly and processes or transforms it reflectively. The Assimilator has a strong ability to create theoretical models and excels at inductive reasoning, that is, assimilating disparate observations into an integrated explanation. Like the Converger, the Assimilator's interest tends to be away from people. Unlike the Converger, the Assimilator is more interested in abstract concepts than concrete things or the practical use of theories. This learning style favors pure science over applied science, and in organizations the Assimilator tends to be found in research and planning departments.

Converger. The Converger perceives or takes in new information abstractly and processes or transforms it actively. According to Kolb, the Converger's strength lies in practical application of ideas. Summarizing other research in the field, Kolb states that Convergers are relatively unemotional and prefer to deal with things rather than people, tending to specialize in physical science. Engineers are characteristically Convergers, according to Kolb. The term Converger derives from the ability to reason hypothetically and deductively to arrive at a single best solution. Convergers perform best on tests where there is a single correct answer or solution.

Accommodator. The Accommodator is the polar opposite of the Assimilator and perceives or takes in new information concretely and processes or transforms it actively. The Accommodator's strength lies in carrying out plans and experiments and becoming directly involved in new experiences. The term Accommodator derives from the ability to adapt to specific immediate circumstances and situations. Where theory does not readily fit the circumstances, the Accommodator tends to discard the plan or theory and solve problems intuitively by trial and error. The Accommodator's educational background tends to be in technical or practical areas such as business. In organizations, Accommodators are usually found in 'action' type jobs such as sales.

Forces that Shape Learning Style. Kolb (1984b) states that external forces factor significantly into shaping one's learning style provides a substantive discussion of five:

- personality type,
- education specialty,
- professional career,
- current job role, and
- adaptive competencies.

According to Kolb, these forces can vary greatly in their degree of impact. For example, one's career goals and ability to adapt may inspire one to change or adapt his/her learning style to achieve certain learning outcomes, resulting in a different learning style than that which he/she normally prefers.

Kolb's Learning Style Inventory. In 1976, Kolb posited the Learning Style Inventory (LSI) as a way to identify the individual learning styles derived from

experiential learning theory. His hypothesis was that individuals use and prefer different learning styles that correspond to how effective and comfortable they are when learning. The most efficient and preferred learning method should be one that corresponds to the individual's primary learning style. Kolb theorized that learning is a four-stage process involving concrete experience (feeling), reflective observation (watching), abstract conceptualization (thinking), and active experimentation (doing). Kolb further stated that individuals can be categorized along two bipolar dimensions of active-to-reflective (defined as doing-watching) and concrete-to-abstract (defined as feeling-thinking). Individuals classified as being more active than reflective and more concrete than abstract are labeled Accommodators, whereas those more abstract than concrete are labeled Convergers. Reflective individuals preferring concrete experience are labeled Divergers, and abstract-reflective individuals are labeled Assimilators.

Kolb's LSI instrument is a questionnaire of 12 items with an ipsative scoring format requiring the subject to respond by rank ordering the four styles according to preference. For example, question 1 asks:

"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"

Respondents rank the endings to the sentence stem according to how well they think each one fits with how he/she would go about learning something with a 4 for the most appropriate ending, down to a 1 for the least appropriate. The total score for the 12 items is then plotted on a graph that identifies the respondent's

strength in each of the four dimensions – Diverger, Assimilator, Converger, Accommodator.

Practical Application of the LSI. According to most of the literature on the LSI (Curry-Swann, 1990), the primary objective of the LSI is to improve immediate and long-term results of general teaching. Applying the LSI can take many forms, including using the LSI to refer to information processing routines and developing teaching strategies. Gremli (1996) divides his choral students into two basic styles of learners, global and analytic, and suggests integrating a student's learning style into strategies for teaching music. Gremli offers an intuitively simple procedure starting with testing yourself (the teacher) to identify your own learning style, then testing each student using the LSI, then sharing the results with the students and their parents, and finally adjusting choral rehearsal techniques to accommodate both global and analytic learning preferences. This last step, in essence the implementation of the results, could present some problems in more formalized aviation training situations such as airline simulator training.

Although learning style philosophy carries an intuitive validity, its results in improved learning have yet to be well tested. Grasha (1990) suggests that few instructional procedures have been offered toward actually applying the philosophy. Grasha also states that his research has yielded relatively small effects in student achievement and satisfaction.

Mathews (1996) observed that Kolb's LSI showed a significant relation to how high school students perceived their own academic achievement. Specifically, students who scored a Converger style on the LSI tended to rate themselves as higher academic achievers than those who scored the other three styles (Diverger, Assimilator, and Accommodator). Mathews concluded that this result was not surprising in that Convergers (those who best organize knowledge to solve specific problems through hypothetical-deductive reasoning) exhibit the strengths most valued by high schools. Even though this was a self-measure of achievement and not an experimental measure, Mathews had the self-measures validated by the teachers of the particular respondents and demonstrated a positive relationship between the respondents' self-measure and an independent evaluator's (their teacher) measure.

The Effect of Demographics on Learning Style. Lavigna (1992) suggests there is no correlation of educational level beyond the Bachelor's degree as having an effect on performance rating. However, as Kolb (1986) theorizes learning style is affected by one's experience, especially throughout one's education, education level will be an interesting variable to consider.

Gender differences appear to have some effect in some of the research (Norris, 1977) and will be identified in the background questionnaire as the distinction in gender is of general interest.

Age seems to have no significant effect in much of the research. Miglietti and Strange (1989) found no significant effect of age on course outcomes when considering the overall teaching style of instructors in their research on adult students at a two-year college. However, age is often an indicator of experience, which Kolb (1984b) has shown to have a significant effect in his theory of experiential learning, and thus age will be identified in this study.

Family situation has shown some effect in learning outcomes. Moore and Telfer (1993) state that they found differences in the strategies toward learning pilots employed based on management of their time as dictated by the various demands of their respective families.

Teaching Style Theory.

The Effect of Teaching Style. Many researchers agree that teaching style has a significant affect on student achievement. Conti's (1991) research in 1984 involving teachers and their students using the Principles of Adult Learning Scale (PALS) concluded that teaching style had a significant influence on student academic gain. Using the PALS, Miglietti and Strange (1989) also found significant differences in course grades, sense of accomplishment, and total experience perception where a learner-centered, collaborative teaching style, versus a teacher-centered, authoritative teaching style, was employed. Cai's (1997) investigation of college students in a karate class revealed a significant preference for one teaching style over another.

Teaching Style. Norris (1977) defines teacher style as the degree of structure or directiveness that a teacher characteristically provides in the classroom. Conti (1986b) defines teaching style as "a hypothetical construct that is associated with various identifiable sets of teacher behavior" (p. 7). Conti further states that the teaching styles are a useful tool to understand and perhaps explain certain important aspects of the teaching-learning process.

Several approaches to identifying teaching styles have been identified by various authors. Sieber and Wilder (1967) described four teaching styles – content-oriented, control-oriented, discovery-oriented, and sympathy-oriented – based on the two dimensions of authoritative versus permissive and high versus low emphasis on subject matter. According to Kaplan and Kies (1995), these include Flanders' 'initiating' and 'responsive' behaviors, Bennet's 'progressivism' and 'traditionalism' behaviors, and Knowles 'andragogy'[7] and 'pedagogy' behaviors. Mosston and Ashworth (1994) identify three teaching styles in physical education: 'command', 'reciprocal', and 'inclusion'. Hudak and Anderson (1984) divide teaching styles into 'didactic' (teacher centered), 'heuristic' (problem solving approach), and 'philetic' (mentoring approach). Karp (1996) identified three basic teaching styles (referring to them as 'instructional' styles) as 'lecturer', 'facilitator', and 'co-worker'. Wheeler and Marshall (1986) developed a Trainer Type Inventory (TTI) based upon Kolb's experiential learning cycle, identifying

[7] Defined by Jarivs (1987) as adult learning characterized by different self-concepts, a reservoir of experience as a learning source, a readiness to learn, and an intrinsic source of motivation.

four basic teaching styles – 'Listener', 'Director', 'Interpreter', and 'Coach'. For this study, the TTI was selected to measure teaching style based on its development to be congruent with Kolb's LSI. Although there are differences in the terminology and their respective interpretation, the common theme of all the literature reviewed seems to favor teaching style as one dimension along a single scale with didactic (authoritarian, teacher-centered, pedagogy, traditional, etc.) at one end and collaborative (permissive, learner-centered, andragogy, progressive, etc.) at the other. The literature also suggests that the nature of the subject taught and student learning style dictate an appropriate teaching style. This notion is implicit in the research by Kaplan & Kies (1995), who identify the role of the classroom teacher to include subject matter expert, motivator, evaluator of student performance, modifier of learner goals, and exemplar.

Conti (1991) suggests that most of the literature in adult education supports a collaborative mode as the most effective and appropriate style for teaching adults. The following quote from Conti summarizes the collaborative mode of teaching:

> "The collaborative mode refers to a learner-centered method of instruction in which authority for curriculum formation is jointly shared by the learner and the practitioner... The collaborative mode is a process-oriented approach to teaching. The emphasis is upon what the learner is doing. The teacher's primary task is to organize and maintain an environment which facilitates student learning. In this way, adult education is a cooperative venture in which the learner is a full partner. It is assumed in this way that adults are seeking increased self-direction ... The collaborative mode depends on active student participation" (Conti, 1986b, p. 7).

This collaborative style is diametrically opposed to the traditional approach to teaching that Marshall (1991) identified as being the most common approach, that is:

- students in rows,
- quiet learning environment,
- formal classroom design,
- teacher dominant,
- whole-group instruction,
- textbook/lecture format,
- learning by looking and listening,
- low or no mobility, and
- paper and pencil emphasis.

Marshall further states that "the assumption was that this formula for instruction was right for all students, that students who were not successful 'had a problem' [sic] ..." (p. 225). Marshall's research found teaching by textbook/lecture and looking and listening style to be dominant among secondary school teachers.

Marshall (1990) summarizes the teaching style philosophy by stating, "If students don't learn the way we teach them, then we will [should] teach them the way they learn." Marshall also states that teaching to style represents a philosophical change from the tradition. This change, however, implies an earnest desire from the teacher to see an improved performance in student learning and can meet with resistance from teachers too comfortable with their own teaching style to explore new styles.

Wheeler's and Marshall's Trainer Type Inventory. The most appropriate measure of teaching style for this study disclosed during the review of the literature was the Trainer Type Inventory (TTI). Developed by Wheeler and Marshall (1986) and based upon Kolb's experiential learning cycle, the TTI attempts to relate a measure of teaching style to a measure of learning style. Wheeler and Marshall (1986) state the TTI was designed to "help trainers identify their preferred training methods in order to:

- identify the areas in which they have the greatest skill and expertise, which they can share with other trainers; and
- identify the areas in which they can attempt to increase their skills, thereby increasing their ability to address all aspects of the adult learning cycle" (p. 87).

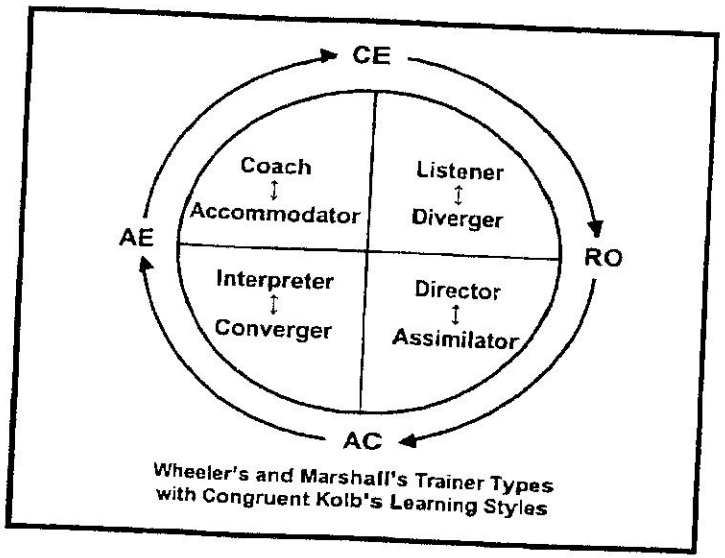
According to Wheeler and Marshall, the TTI was originally designed in the belief that trainers train others most comfortably using or emphasizing their own preferred learning styles. However, the authors state that during that research they found no significant relationship between a trainer's own learning style and his/her training style preference (Wheeler and Marshall, 1986, p. 89).

The TTI identifies four training types – Listener, Director, Interpreter, and Coach. The TTI theorizes that a specific learning style (as identified by Kolb) will have a corresponding style of teaching, or 'trainer type'. Wheeler and Marshall summarize this congruency thus:

- "The Listener trains the Concrete Experiencer most effectively and is very comfortable in the activity and publishing steps of the Experiential Learning Cycle [of Kolb];
- ... the Director obtains the best results from the Reflective Observer ... ;
- ... the Interpreter trains in the style favored by the Abstract Conceptualizer; and
- ... the Coach trains in the style favored by the Active Experimenter" (Wheeler and Marshall, 1986, p. 90).

These relationships are depicted in Figure 2.3 – Trainer Types with Learning Styles.

Figure 2.3 – Trainer Types with Congruent Learning Styles



Trainer type characteristics and their relationships with specific facets of teaching are presented in table form in Table 2.2 – Comparison of Trainer Types, taken from Wheeler and Marshall. This table is an adaptation from Wheeler's and

Marshall's original table printed in their article (1986) with three changes in wording (indicated by asterisks) to make the behaviors more congruent with Wheeler's and Marshall's characteristics of the trainer types listed in their article. In this table are listed the teaching behaviors characteristic of the four trainer types in nine respective facets of learning.

Table 2.2 – Comparison of Trainer Types

COMPARISON OF TRAINER TYPES				
Trainer Type / Teaching Facet	LISTENER	DIRECTOR	INTERPRETER	COACH
Learning Environment	Affective	Perceptual	Symbolic	Behavioral
Dominant Learning Style	Concrete Experiencer	Reflective Observer	Abstract Conceptualizer	Active Experimenter
Means of Evaluation	Immediate personal feedback	Discipline based; objective criteria*	Subjective criteria*	Learner's own judgment
Means of Learning	Free expression of personal needs	New ways of seeing things	Memorization; knowing terms and rules	Discussion with peers
Instructional Techniques	Real-life Applications	Lectures	Case studies, theory, reading	Activities, homework, problems
Contact with Learners	Student-directed; autonomous	Little participation	Offers opportunity to think alone	Active participation
Focus	"Here and now"	"How and why?"	"There and then"	"What and how"
Transfer of Learning	Involves People	Mostly Instructions*	Mostly Symbols	Mostly Actions
Sensory Perception	Touching	Seeing and hearing	Perceiving	Motor skills

Adapted from Wheeler and Marshal, 1986, p. 90.

** Depicts wording from Wheeler's and Marshall's original table modified to make the behaviors more congruent with those characteristics listed in their article.*

A similar table was developed by Wheeler and Marshall for use in TTI seminars to stimulate discussion among participants and is presented in Appendix F, Trainer Type Inventory Interpretation.

Construction of the TTI. Congruent with Kolb's LSI, the TTI consists of 12 sets of four words or phrases that correspond to one of the four training types. These four teaching dimensions are congruent with Kolb's four basic learning styles – Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). Consistent with the method in Kolb's LSI, respondents rank the four choices in each set with a 4 to indicate the strongest preference, down to a 1 to indicate the least preference. The highest total score indicates the respondent's preferred style of teaching and the lowest score indicates the style the respondent prefers the least. According to Wheeler and Marshall, a score substantially higher for one trainer type than the other three might indicate that "the respondent might be using this training style to excess and may need to develop skills in other training approaches in order to be able to present training that will make sense or transfer to a greater range of participants" (Wheeler and Marshall, 1986, p. 91).

The practical application of knowing one's own teaching style and the learning style of one's students is that by doing so a trainer could identify a more effective teaching strategy. For example, if a trainer or teacher has a student identified as an Assimilator, then a Director type teaching style might prove more effective.

A most interesting conclusion from Wheeler's and Marshall's research was that there was no significant relationship between a trainer's own learning style and his/her particular teaching style. That is, the way a teacher teaches is not necessarily the way that teacher prefers to learn. However, Rudowski (1996) used this instrument in research into the relationship of learning styles and teaching styles of extension educators and reached a contradictory conclusion, finding that many teachers in the study tended to teach (as indicated on the TTI) the way they preferred to learn (as indicated by the LSI), with about a third indicating a preference to teaching opposite of the way the LSI indicated they preferred to learn.

Historical Application of the TTI. According to Wheeler and Marshall (1986), the TTI has been applied to over 500 respondents in various applications, including workshops for the public, surveys of college students, in-house seminars for business and industry personnel, and seminars conducted by the American Society for Training & Development (ASTD). Wheeler and Marshall further state that they have revised the TTI instrument to incorporate feedback and results from these various uses, thereby improving its validity and usefulness.

Other Measures of Teaching Style. Like the Trainer Type Inventory, other measures of teaching style disclosed in the review of the literature were based on descriptions of behaviors observed in teachers. The TTI was selected as it

was the only one specifically designed to be congruent with Kolb's learning styles, thus providing a common basis for comparing teaching styles and learning styles. Extensive inquiries to the U.S. Air Force research laboratories, including the Human Studies Laboratory in Mesa, Arizona, Air Training Command at Randolph AFB, Texas, the Defense Technology Information Center at Wright-Patterson AFB, Ohio, and the websites of the Air Research Laboratories, Defense Technology Information Center (DTIC), and the Air Force Occupational Measurements Squadron, have disclosed no measuring instruments, publications, written data, abstracts, or even proposals of studies regarding teaching styles of instructors in flight training or any other type of Air Force training. The nearest relevant information was from an authoritative source who stated the Air Force is proposing a study on training effectiveness, but had no knowledge of the inclusion of teaching style in the study.

Research into the Link Between Learning Style and Teaching Style. Summarizing his research in adult learning behavior, Malcolm Knowles (1984) stated that adults will learn "no matter what" – with or without books, visual aids, inspiring teachers, or classrooms. The difference a teacher can make is in what an adult learns and in how well he/she learns it.

In aviation research applications, Karp (1996) cites Kreienkamp's study of the relationship between the learning style of student pilots and their flight instructors in the undergraduate aviation program at Oklahoma State University using the

MBTI. The author concluded that learning style similarity between student and instructor as indicated by the MBTI did not show significant increase in how fast the student learned, but did result in improved student success in other areas.

Miglietti and Strange (1989) applied Conti's Principles of Adult Learning Scale (PALS) and Darkenwald and Valentine's Adult Classroom Environment Scale (ACES) to a group of community college faculty and students, respectively, to determine if "varying levels of academic achievement, sense of accomplishment, and overall course satisfaction were a function of the interactions of differing teaching styles, classroom environments, and learning styles" (p.2). The PALS instrument was administered to the faculty to measure instructor teaching style while the ACES instrument was administered to the adult students to measure their ideal perceptions of the classroom environment in general. The authors concluded that adult students in this study "expressed a stronger preference for a teacher-centered mode of instruction" (p. 7). They further concluded that "a learner-centered approach, with concomitant emphases on learner-centered activities, personalizing instruction, relating course materials to student experiences, assessing student needs, climate building, participation in the learning process, and maintaining flexibility for personal development related significantly, in whole or in part, to the greater sense of accomplishment and more positive total experience of these older students" (p. 7). These conclusions led the authors to foresee implications pertinent to this research by stating, "The finding that learner-centered classes were related to higher grades,

a greater sense of accomplishment, and greater overall satisfaction among these under-prepared students suggests that faculty can improve the outcomes of their efforts by systematically assessing and implementing these dimensions of teaching style" (p. 7).

Research by Carol Grout (1990) into the relationship between teaching style and student learning style in high school English courses revealed a significant improvement in attendance and academic achievement when the respective styles were matched. Of interest was the conclusion that teachers were not able to predict individual learning styles with much accuracy.

June Poon (1996) investigated the effect of matching training methods to the learning styles of MBA students. The author identified two treatment groups as a 'didactic-based' teaching method and an 'experiential-based' method and measured each on the cross-cultural attitudes, self-efficacy, and trainee reaction of the MBA students. The author concluded that cross-cultural attitudes and trainee reaction were more positive when the training method matched the trainee's learning style than when it did not, and attributed this result to the trainee's perception of having control over the training process.

Mamie Kennedy (1995) researched the effect of matching teaching styles and learning styles on tennis students at Waycross College in Georgia. For the study, the author identified 'teacher-directed' instruction and 'individualized'

instruction as teaching style variables and measured the performance of tennis students under each teaching style with a pre-test, post-test structure. Although the author found all methods of teaching and learning tennis were effective, the author concluded that instructional strategies that are designed, developed, and implemented in accordance with student learning preference can serve as a means of improving psychomotor performance.

Implications of Learning Styles and Teaching Styles in Aviation Training Programs.

The implication of learning styles for aviation training could be significant. Aviation is an 'action' type of occupation that tends to focus on concrete situations. Although airline training program content covers conceptual and theoretical topics such as crew resource management, these programs emphasize the recognition of specific situations and the application of specific procedures. For example, although the syllabus for the British Aerospace Jetstream aircraft calls for safely performing a takeoff with an engine failure at Takeoff Decision Speed (V1), the procedure for performance is quite specific, with very little allowance for conceptualizing a solution. Emphasis is on reaction rather than forming an abstract concept and subsequently applying it. The obvious question would be, do Accommodators, who tend to prefer transforming abstract concepts into concrete experiences through active experimentation, tend to learn better in aviation training programs than other learning styles? A recent study conducted by Dr. Robert Holt and Jeff Hansbrucker at the George Mason

University Human Factors Laboratory indicated no significant difference in pilot performance after having been fully operational for over a year as a pilot with the respective company.

Although the performance outcome is virtually the same, there may be a significant difference in *how* the individual pilot-trainee *learns* to perform at that level. Expert observation strongly suggests this to be true within airline training as exemplified by the following anecdote:

> "Often, a pilot-trainee will have two or more instructors throughout his/her simulator training. On one occasion, I took over the training of a pilot-trainee from another instructor on session 3. This pilot-trainee expressed an intense dissatisfaction with the previous instructor, indicating that the instructor was overbearing and didactic. As expressed to me, the pilot-trainee's feelings were that the personality conflict with the former instructor was a major cause of that pilot-trainee's poor performance and subsequent dissatisfaction. The trainee's rapport with me seemed to be better than with the first instructor and the trainee performed well for the rest of the program." [8]

Was the primary cause of this pilot-trainee's dissatisfaction with the first instructor a function of a learning style-teaching style mismatch? Likewise, was the primary cause of the feeling of overall satisfaction with the program a function of resolving the teaching-learning style match? Indicative of this question of a possible mismatch is Karp's (1996) qualitative research quoting one aviation instructor as having said "Students should adapt to the instructor, not the instructor to the student" (p. 173.) In either case, this particular pilot-trainee's perception of satisfaction with the training program had changed.

[8] Interview with a simulator instructor at Pan Am International Flight Academy, August, 1999.

Perceptions of Satisfaction with the Training Experience.

Student Satisfaction and Teacher Effectiveness. The dependent variable in this study is the pilot-trainee's perception of satisfaction with his/her training experience. An extensive review of the literature has revealed few instruments for measuring student satisfaction with training or instruction appropriate to the aviation context. However, there are several instruments that measure student perception of teaching effectiveness. According to Burdsal and Bardo (1986), teacher effectiveness is a "complex theoretical referent", or multifaceted phenomenon, involving a great deal of subjectivity and many phenomena contribute to the perceived quality of a class or the instructor. Burdsal and Bardo (1986) summarize the literature by stating that teaching effectiveness includes the following general criteria:

- communication skills,
- attitudes toward the students,
- subject matter knowledge,
- subject matter organization,
- enthusiasm for the subject,
- fairness in grading,
- flexibility,
- encouragement of the students to think for themselves, and
- speaking ability.

Ancillary to a student's perception of the efficacy of his/her teacher is a feeling of satisfaction or dissatisfaction. Although student perception of teaching quality may not be robust as an indicator of actual teaching quality, it certainly is an

indication of student satisfaction with the learning experience. That is, if a student rates his/her teacher as highly effective, then it stands to reason that the student was satisfied with the learning experience.

Measuring Student Perception of the Training Experience. Other instruments designed to measure satisfaction with a learning environment or situation proved inappropriate for this research. For example, Darkenwald and Valentine (1986) developed the Adult Classroom Environment Scale (ACES) to measure adult students' perceptions of the classroom environment, which dealt more with a scholastic environment where course learning outcomes are much more flexible than aviation training objectives.

Two other instruments reviewed appear to have some relevance to pilot-trainees involved in aviation training – Burdsal's and Bardo's (1986) Student Perceptions of Teaching Effectiveness (SPTE), and Tuckman's (1970) Student Perception of Teacher Style (SPOTS). The SPTE was designed to measure student perceptions of teacher attitudes toward students, work load, value of the course to the students, course organization and structure, grading quality, and level of learning materials. Norris (1977) employed the SPOTS to measure teacher 'directiveness' in research into the relationship among learning style, teaching style and student perception of teacher effectiveness at a high school in Idaho. Norris concluded that there was an observable difference in how students from different classroom structures (teacher-centered versus student-centered activities) rated the effectiveness of their teachers, observing that students in the

student-centered structure tended to rate their teachers higher than those from the teacher-centered structure. This research suggests there might be an observable difference in the way pilot-trainees of varying learning styles (as measured by Kolb's LSI) would perceive their respective aviation instructors, thus indicating a significant learning style-teaching style match.

Overall Satisfaction. Although the SPOTS and SPTE are validated measures of student satisfaction, they did not contain a question of overall satisfaction with the training experience. To measure perceived satisfaction of students with their courses and their instructors, Cooper and Miller (1991) employed a questionnaire in which they asked the students to rate only two statements along a 5 point Likert scale, thus:

"The course was (1) very poor (2) poor (3) fair (4) good (5) very good.
The instructor was (1) very poor (2) poor (3) fair (4) good (5) very good."

Their conclusion was that learning style-teaching style congruence in the context of the MBTI predicted levels of satisfaction with the course and instructor. Further, students in total congruence with their professor generally had higher ratings of satisfaction with the learning experience.

Training Satisfaction Survey. In the absence of an appropriate instrument to measure student perception of satisfaction with an aviation training experience, the Training Satisfaction Survey (TSS) was adapted from the aforementioned instruments, with some additions. Like Cooper's and Miller's questionnaire, the

TSS employs a Likert-type scale to measure subject perception of specific items of interest. For example:

"My experience with Crew Resource Management Training was: *(circle one)*
VERY SATISFYING SATISFYING NEUTRAL UNSATISFYING VERY DISSATISFYING"

The other items on the TSS are designed to gain insight into the teaching style of the instructor who delivered the training to the pilot-trainee respondent. Items were an ipsative form asking the respondent to identify the word or phrase that best described his/her perception of the instructional delivery in five areas – instructional techniques, instructor involvement, means of teaching, nature of instructor, and means of evaluation. For example:

"Circle the word that best describes your perception of Crew Resource Management Taining:

Nature of Instructor LISTENER DIRECTOR INTERPRETER COACH"

Summary.

This chapter presented an overview of the current literature regarding teaching styles, learning styles, teacher effectiveness, and student satisfaction. Specifically, Kolb's Learning Style Inventory and Wheeler's and Marshall's Trainer Type Inventory were discussed as congruent measures of learning style and respective teaching style. The literature regarding student satisfaction was discussed to provide a foundation for the development of the Training Satisfaction Survey as an appropriate instrument to measure the effect that learning style and teaching style might have on satisfaction with a training situation.

Although revealing a great deal of research of learning style and teaching style in childhood, elementary, secondary, and college education contexts, a review of the literature has revealed very little research concerning learning style and teaching style in aviation training. What literature there was suggested a preference of aviation students toward a hands-on learning style and a preference among instructors for a lecturer teaching style with a reluctance to modify teaching styles to meet student learning styles. The literature supports a substantial link between learning style and teaching style in the context of scholastic education and could, therefore, offer some significant insights into aviation training. Although much has been done regarding learning styles, the review of literature has revealed virtually no instruments developed for measuring satisfaction with training in aviation and few validated instruments for measuring teaching style. This study will extend the research of teaching styles into the field of aviation training and provide further validation data for measuring instruments.

Chapter III

Research Methodology

Introduction.

This chapter contains a description of the research methods used in this study and includes a detailed description of the research design, research population, and sampling. Development and validity of the survey instruments are also discussed, as well as procedures for collecting and processing data. Justification and description of hypotheses testing statistics is discussed.

Research Hypotheses.

This research study consists of four hypotheses to be tested (all tests were at the $p<.05$ significance level):

H1: A pilot-trainee's learning style, perception of instructional delivery, and demographics have an effect on a pilot-trainee's perception of satisfaction with a training experience. The null hypothesis, then, is that neither learning style nor teaching style nor background make a difference in how pilots perceive their satisfaction in training.

H2: There is a correlation between an instructor's trainer type and his/her learning style. The null hypothesis is that there is no correlation between how instructors teach and how they learn.

H3: An instructor's trainer type, learning style, and demographic background as an instructor have an effect on his/her satisfaction with teaching a particular type of training program. The null hypothesis is that neither trainer type, nor learning style, nor demographic background has an effect on an individual instructor's satisfaction with teaching a particular program.

H4: There is a correlation between an instructor's satisfaction with having taken a particular training program as a trainee and the satisfaction that instructor feels with teaching that same program. The null hypothesis is that there is no correlation between satisfaction with teaching a program and having taken the program.

Research Design.

The research design was a non-experimental statistical analysis of nominal, ordinal, and scale (continuous) data collected from standardized survey instruments (i.e., each subject received the same instrument for his/her respective group – trainees or instructors) from a random sample of a specific population. Nominal data consisted of learning style, perception of instructional delivery, trainer type, and demographic variables (specifically, gender, educational institution, and aviation program completed). Ordinal data consisted of perception of satisfaction with each of four types of training programs (the dependent variable) and demographic variables (specifically, education level and type of pilot certificate held). Scale data consisted of certain demographic variables (specifically, age, years since acquiring private pilot certificate, and flying hours by category). A combination of Multiple Regression Analysis (MRA) and Analysis of Variance (ANOVA) was used for statistical analysis of the data.

Data Collection Instruments.

Two data collection instruments were developed and used – the 2000 Aviation Training Survey (ATS) and the 2000 Instructor Background Survey (IBS). Each instrument was printed double-sided on an 11"X17" sheet of paper and folded so

as to provide a particular order of questions for the respondent to answer. Except for two variables not used in the statistical analysis[9], data were coded in quantifiable form for use in the Statistical Package for the Social Science (SPSS®) MRA.

2000 Aviation Training Survey (ATS). This instrument was composed of three sections designed to collect data on three distinct subjects. The complete instrument is provided in Appendix D. The first section consisted of nine general questions for the collection of certain demographic data including:

1. age (scored as continuous data),
2. gender (scored as a dichotomous dummy nominal variable, male=0, female=1),
3. level of education (scored as ordinal data, HS Diploma=1, College=2, Bachelor=3, Master=4, Doctoral=5),
4. types of educational institutions attended (scored as nominal data, Public HS=1, Private HS=2, State College=3, Private College=4, Military Academy=5),
5. number of years since receiving a private pilot certificate (scored as continuous data),
6. kind of certificates and ratings held (scored as ordinal data, Commerical=1, ATP=2),
7. total flying hours (scored as continuous data), and
8. flying hours in specific categories of aircraft (scored as continuous data); and
9. types of aviation training programs completed (scored as dummy nominal variables, 0=absence of the variable, 1=presence of the variable).

[9] 'Specialty College' on the ATS and question number 8, "What is your avocation?" on the IBS.

The format of the questions were adapted from other validated research on learning styles and aviation training, including Telfer (1993b), Spier (1974), and Kolb (1984b).

The second section, Training Satisfaction Survey (TSS), was an original instrument intended to gather data on how the individual pilot-trainee perceived his/her satisfaction with each of four specific training situations and to identify perceived satisfaction with instructional delivery. This section consisted of six items for four different training programs. The first item used a Likert scale to identify the respondent's satisfaction with that program. This item was scored as ordinal data to reflect the higher the score, the greater the level of satisfaction (specifically, Very Satisfying=5, Satisfying=4, Neutral=3, Unsatisfying=2, Very Dissatisfying=1). The next five items used descriptive terms or phrases to identify the respondent's perception of the nature of the delivery of the instruction in each of five categories. These data were scored as nominal data for use in two applications:

1. In the MRA, each descriptor was scored as a dummy nominal variable, i.e., 0=absence of the variable, 1=presence of the variable.
2. In ANOVA as nominal data, descriptors were scored as integers from 1 to 4 in each category, from left to right on the survey form. For example, in instructional delivery category 'Instructional Techniques', Free Discussion=1, Lecture Based=2, Theory Based=3, Activity Based=4.

These descriptors were taken verbatim from Wheeler's and Marshall's (1986) Trainer Type Inventory, which the authors had previously validated.

The third and last section used Kolb's Learning Style Inventory (LSI). This instrument had already been developed and validated, however, it had never been applied to pilots prior to this research project. The instrument requires the respondent to rank, on a four-point scale, four different endings for 12 sentences matched to learning style. The final score was plotted against a graph to reveal the respondent's learning style tendencies in Kolb's four learning styles – Diverger, Assimilator, Converger, and Accommodator. These data were scored for use in two statistical procedures:

1. In the MRA, the four learning styles were scored as dummy nominal variables, 0=absence of the variable, 1=presence of the variable.
2. In ANOVA as nominal data, the learning styles were scored as dummy variables, Diverger=1, Assimilator=2, Converger=3, Accommodator=4.

Due to the proprietary nature of the LSI, permission to publish the instrument in this study was denied. However, a reference to the source of the instrument and where to obtain it is provided in Appendix C. Reliability coefficients for the LSI as determined by of the Spearman-Brown prophecy formula range from .76 to .89.

A summary of the data collected by the 2000 ATS, including variable labels, is presented in Appendix H.

2000 Instructor Background Survey (IBS). The IBS instrument consisted of four sections designed to gather demographic data on the subjects, identify their perceptions of satisfaction with teaching and participation in a training program,

identify their trainer types, and identify their learning styles. Demographic items of the IBS differed from those on the ATS according to their relevancy to the stated hypotheses for instructors in this study. The complete instrument is provided in Appendix E.

The first section consisted of eight questions, including:

1. age (scored as continuous data),
2. gender (scored as a dichotomous dummy nominal variable, male=0, female=1),
3. level of education (scored as ordinal data, HS Diploma=1, College=2, Bachelor=3, Master=4, Doctoral=5),
4. number of years experience as a teacher (scored as continuous data),
5. type of formal teacher training (scored as nominal data, College Courses in Education=1, Military Instructor Training Courses=2, Corporate Sponsored Teacher Training=3, Certified Flight Instructor=5),
6. total flying hours (scored as continuous data),
7. type of aviation training programs experienced as a trainee (scored as dummy nominal data, 0=absence of the variable, 1=presence of the variable), and
8. self-description of respondent's avocation (scored as a string variable).

As with the 2000 ATS, the format of the questions was adapted from other validated research on learning styles and aviation training, including Telfer (1993b), Spier (1974), and Kolb (1984b).

In the second section, eight Likert scale items asked the respondent instructor to identify his/her perception of satisfaction with teaching and with experiencing four

specific types of training programs – Crew Resource Management Training (CRM), Company Indoctrination Training (INDOC), Systems Ground School (STSENS), and Simulator Training (SIM). These training programs corresponded to the four training programs on the ATS administered to the pilot-trainees. This item was scored as ordinal data to reflect the higher the score, the greater the level of satisfaction (specifically, Very Satisfying=5, Satisfying=4, Neutral=3, Unsatisfying=2, Very Dissatisfying=1).

The third section consisted of Wheeler's and Marshall's (1986) Trainer Type Inventory (TTI). The complete instrument is provided in Appendix E. The TTI was based upon Kolb's experiential learning cycle, is designed to be congruent with Kolb's LSI, and attempts to relate a measure of teaching style to a measure of learning style. Wheeler and Marshall theorize that a specific learning style (as identified by Kolb) will have a corresponding style of teaching, or 'trainer type'. Thus, the TTI identifies four training types matched to Kolb's learning styles – Listener (Kolb's Diverger), Director (Kolb's Assimilator), Interpreter (Kolb's Converger), and Coach (Kolb's Accommodator). As with the LSI, respondents were required to rank four choices in each of 12 sets with a 4 to indicate the strongest preference, down to a 1 to indicate the least preference. The scores for each response corresponding to each of the four trainer types were totaled. The highest total score indicates the respondent's preferred style of teaching and the lowest score indicates the style the respondent preferred the least. As with Kolb's LSI, trainer type was scored as dummy nominal data for the MRA

(i.e., 0=absence of the variable and 1=presence of the variable) and for ANOVA, scored as Listener=1, Director=2, Interpreter=3, and Coach=4.

The TTI was developed and validated by Wheeler and Marshall (1986). Specific validation statistics were not available at this writing. However, Wheeler and Marshall (1986) state that the TTI has been applied to over 500 respondents in various applications, including workshops for the public, surveys of college students, in-house seminars for business and industry, and in seminars conducted by the American Society for Training & Development (ASTD). Wheeler and Marshall further state that they have revised the TTI instrument to incorporate feedback and results from these various uses, thereby improving its validity and usefulness. Actual level of validity was not available.

The fourth section of the IBS used Kolb's LSI, designed to identify the instructor's preferred learning style so as to compare it to his/her trainer type as identified by the TTI. This LSI was identical to the one on the ATS taken by the pilot-trainees.

A summary of the data collected by the IBS, including variable labels, is provided in Appendix H.

Pilot-trainee Interview Guide. As a qualitative verification of the results from the 2000 ATS and the 2000 IBS, personal interviews of two pilot-trainees from the population under study were conducted using an interview guide. Questions

on the guide were based on survey results so as to gain further insight into why certain programs were satisfying or dissatisfying. Interviewer notes were summarized and key words and phrases exemplifying recurring themes were extracted and encoded for use as descriptive data. The complete guide is provided in Appendix G.

Instructor Interview Guide. As a qualitative verification of the results of the ATS and IBS, personal interviews from three of the instructor population under study were conducted using an interview guide. Questions on the guide were developed to gain further insight into individual learning style preference and trainer type, to identify specific perceptions and feelings about deferring to student learning style, and to explore why the respondent is involved in the aviation training field. Interviewer notes were summarized and key words and phrases exemplifying recurring themes were extracted and encoded for use as descriptive data.

Research Population and Sample Size.

The population of pilot-trainees under study was limited to full-time pilots employed by a regional airline company operating under 14CFR Part 121[10], numbering over 1,200 pilots. Subjects included males and females ranging in ages from 21 to 58 with a wide background in aviation. Diversity data were not

[10] 14 CFR Part 121 – Operating Requirements: Domestic, Flag, and Supplemental Operations, is the U.S. Consolidated Federal Regulation (CFR) that governs major commercial air carriers. Typical companies operating under this regulation are United Airlines and American Airlines, although neither of these were the company under study.

collected. An ATS was sent to each pilot in the population. Approximately 250 instruments out of 1,200 sent out were returned. As will be discussed later in this chapter, this provided an adequate random sample for the regression procedure to be used.

The population of instructors under study was employed by the same company as that of the pilot-trainees in order to provide some correlation between the pilot-trainee's perceptions of instructional delivery and the actual instructors who delivered the training. The population of instructors included approximately 50 instructors from which a sample of 26 surveys were returned.

Anonymity and Protection of Human Subjects. As this research focuses on human subjects, appropriate procedures were followed to guarantee the protection of those subjects in accordance with University of Maryland policy, 45 CFR Part 46: Protection of Human Subjects, and the policies of the airline company under study. There was no physical risk to any subject. As the subject's identity was not relevant to this study, every effort was made to protect the subject's privacy. The survey instruments contained no directly identifying data such as name, address, employee number, or social security number. However, a unique number code was placed on the upper right corner of the first page of each instrument for data encoding. In an introductory letter, anonymity and confidentiality were promised. As this research was exempt from a requirement for informed consent from the subjects for the reason of normal

ducational practices, no signed consent form was required or used. The letter introduction, survey instrument (ATS or IBS), lottery redemption card, and a amped return envelope with the address of the principle researcher were serted in an envelope which was placed in the personal distribution file of each the pilots at his/her respective home base operations center. Prior to stribution, the envelopes were shuffled to enhance anonymity.

ıta Collection and Follow-up.

rticipation in the study was voluntary and was enlisted through the introductory :er describing the research and requesting their support. The subjects were ked to complete the survey form, place it in the enclosed envelope, and to drop ı any U.S. Postal Service collection box. As an incentive to respond, fifteen sh prizes were offered to be awarded by random lottery of the completed veys returned. The award could be redeemed by sending in a Lottery demption Coupon pre-printed with the corresponding survey number. An mple of the coupon is provided in Appendix B. Two weeks after initial ribution of the forms to the pilot-trainees, a follow-up letter from the Chief of ining of the airline company was distributed to encourage expeditious return ne surveys.

a were encoded for use in the SPSS® statistical computer program.

Data Processing and Statistical Procedures.

Data Processing. The returned ATS and IBS instruments were analyzed for their completeness and correctness. Incomplete or incorrect data were eliminated from the data base and accounted for less than 3 percent of all the data returned. The principle researcher scored the LSI and recorded the scores and data from the ATS and IBS in a database designed for use in the SPSS® Base 9.0 application. Quantitative data, such as age and flying hours, were coded as that specific number (for example, Age = 41 and Total Flight Hours = 3550). Ordinal data, such as satisfaction (the dependent variable), education level and types of pilots certificates held, were coded as integers in ascending order from '1' with each higher integer assumed to have a greater effect than the previous (for example, High School = 1, College = 2, Masters = 3, etc.).

Nominal data were determined as belonging to pre-determined categories or groups (for example, learning styles 'Converger', 'Accommodator', 'Diverger', 'Assimilator', trainer type 'Listener', ' Director', 'Interpreter', 'Coach', and demographics 'Female' or 'Male'). This, according to Norusis (1988), is called Factor Analysis, or the "unifying concepts or labels that characterize responses to related groups of variables." (p. 381). This implies the appropriateness of qualitative data if they can be categorized into descriptive groups such as 'Converger', 'Assimilator' or 'Diverger', or Accommodator', as on the LSI with 'Listener', 'Director', 'Interpreter', and 'Coach' on the TTI, and the 20 descriptive

terms on the instructional delivery survey. These nominal data were coded in two ways according to their use:

- In the multiple regression analysis, nominal variables were coded as dummy variables, that is, 1 representing the 'presence' of that variable, and 0 representing the absence of that variable.
- In the analysis of variance and post-hoc analysis, nominal variables were coded with an integer representing that respective category or group (for example, "Converger' = 1, 'Accommodator' = 2, etc.), but were not treated as continuous owing to the nature of the ANOVA and post-hoc procedure.

Descriptive statistics were derived, including means, standard deviations, and ranges. The MRA was then run to obtain statistics R^2 (regression coefficient) and F (ratio of mean square for the regression to the mean square for the residual) for the hypotheses. Where the F was significant ($p<.05$), Tukey's HSD (Honestly Significant Difference) post-hoc test was run to obtain insight into the effect of specific variables. The statistics were run and results summarized in Chapters IV and V.

Multiple Regression Analysis (MRA). As this study is more of a predictive and non-experimental nature, MRA was chosen as the most appropriate statistical procedure. To get at the principle question of the effect of learning style and teaching style on satisfaction, a stepwise regression analysis was run for each of the categories of instructional delivery in each of the four categories of training,

beginning with the effect of learning style on satisfaction, then adding teaching style, and then the interactive effects.

According to Shavelson (1988), "the purposes of MRA are to help the researcher to predict some criterion or dependent variable from a set of predictor or independent variables and to test hypotheses about alternative models of the relationship between [the independent variable] and the set of [dependent variables] or to do some combination of these two things". (p. 585.) The MRA employs a correlational design in which one group of subjects is measured on three or more continuous, individual-difference variables (Shavelson, 1988, p. 592.) An advantage to using the MRA in this study is that causal interpretations are not warranted. Shavelson (1988) lists the design requirements for the MRA as:

1. *There is one dependent variable and two or more independent variables.* For this study, the dependent variable is the respondent's perception of satisfaction with the training experience, and the independent variables were Learning Style (LS), Trainer Type (TT) (for instructors), perception of instructional delivery (for pilot-trainees), and demographic background.
2. *All variables are continuous.* Shavelson (1988, p. 605) qualifies this requirement by stating that one or more variables can be nominal, but require a modified treatment to make them behave as if they were continuous or at least ordinal. In the case of this study, the nominal variables LS, TT, perception of instructional delivery and certain nominal demographic variables (specifically, gender, educational institution, aviation training programs completed, and type of instructor training experienced) were coded as 'dummy variables'.

3. *The minimal sample size needed to provide adequate estimates of the regression coefficients should be 10 times as many cases as independent variables, no fewer than 50* (p. 593). For the pilot-trainees in this study, there were three general variables – LS, perception of instructional delivery, and demographics. In this context, the returned sample size was adequate as 250 was greater than 10 x 3 variables. In the context of accounting for the 9 demographic variables for the pilot-trainees, the sample size of 250 was greater than 10 x (9 + 3). For the instructor respondents, there were three general variables – LS, TT, and demographics. As the sample size of 26 was less than the minimum of 50 stated by Shavelson, the results of the instructor MRA were arguably not robust. However, some meaningful insights from the analysis were gained and are discussed in Chapter IV – Findings, and Chapter V – Summary, Implications, Conclusions, and Recommendations for Further Study.

Shavleson (1988) also lists certain assumptions in order to use the MRA to test hypotheses. These are:

- *Independence.* The scores for any particular subject are independent of the scores of all other subjects. The data can be assumed to be independent if the procedures for collecting the data ensure independence of scores. In the case of this study, the scores can be assumed to be independent as the subjects responded independently.
- *Normality.* In the population, the scores on the dependent variable are normally distributed for each of the possible combinations of the levels of the independent variables. The test of this assumption is demonstrated in a tight clustering of the residual points in the center of a scatterplot at each level of the predicted score of the independent variable.
- *Homoscedasticity.* In the population, the variances of the dependent variable for each of the possible combinations of the levels of the dependent variable are equal. The test for this assumption is if the

residuals about the center of the scatterplot are the same at each value of the predicted score of the independent variable.

- *Linearity.* In the population, the relation between the dependent variable and an independent variable is linear when all other independent variables are held constant. The test for this assumption is demonstrated by a horizontal scattering of residuals on a scatterplot.

MRA Statistics Used. The following statistics were used to interpret the results of the regressions:

- The overall mean for the level of satisfaction in the respective training program. The mean for satisfaction in each of the four training programs was on a scale of 1 to 5, 1 being 'Very Dissatisfying', 2 being 'Unsatisfying', 3 being 'Neutral', 4 being 'Satisfying', and 5 being 'Very Satisfying'. For example, a mean of 3.68 represents a mean level of satisfaction above Neutral and just below Satisfying.
- The adjusted R^2 as a measure of the percentage of the total variation in satisfaction explained by the respective independent variable[11]; the higher the number, the greater the effect of that variable on satisfaction.
- The change in the regression *F* statistic as an indication of the strength and significance of the effect on satisfaction added by the new variable[12], for $p<.05$[13] ($p > .05$ were not considered)[14]; the higher the number, the greater the effect of that variable on satisfaction.

[11] "*R* square is the square of [Pearson's correlation *R*] and often is interpreted as the proportion of the total variation in [the dependent variable] accounted for by [the dependent variable]. If there is no linear relationship between the dependent variable and the independent variable, R square is zero or very small," (SPSS© Base 9.0 Applications Guide, 1999, p 197).

[12] "The *F* statistic is used to test the hypothesis that the slope *b* is 0, or for multiple linear regression, that $b_1 \ldots b_n = 0$. *F* is large when the independent variables help to explain the variation in the dependent variables," (SPSS© Base 9.0 Applications Guide, 1999, p 197). For nominal variables, the 'slope' *b* is meaningless and the *F* statistic indicates significance of an effect, but not the nature of the effect.

[13] SPSS uses the term 'Sig.' to represent α in its table outputs; also commonly used is '*p*'.

Dummy Variables Used in the MRA. To properly account for the effect of nominal groups or variables, the nominal independent variables have been set up as dummy variables. That is, each nominal variable has been encoded as 1to indicate its presence, or 0 to indicate its absence. The result of the regression equation is that the slope for the dummy variable will equal the mean of the Y for the category coded '1' on dependent variable X, minus the mean of Y for the category coded '0' on X (McClendon, 1994, p.204). For multiple groups of nominal independent variables, that is, polychotomous nominal variables, one of the categories to be considered must be a reference group and is not included in the regression. If all categories were included in the regression, there would be perfect multicollinearity among the groups of nominal variables and thus an estimation of each group's effect on Y would not be possible (McClendon, 1994, p. 209). The reference category should be the one that has the greatest normative support for the regression prediction and thus would be of particular interest in comparing each of the deviant categories to the reference group. However, as the choice of reference group has little effect on the outcome of the regression, and therefore could be chosen arbitrarily, the reference groups selected were:

- Learning Style 'Accommodator' (LS4).
- Perceived Teaching Style (TS) – the last response in each of the five instructional delivery categories listed on the survey form for each of the four training programs.

[14] "If the calculated *F* is greater than or equal to the critical F for the specified alpha level, the null hypothesis ($b = 0$) is rejected," (McClendon, 1994, p. 168).

- Interactive Effects (IE) between learning style and teaching style – LS4* (* denotes 'multiplied by') the last response in each of the five categories of instructional delivery listed on the survey form for each of the four categories of training.
- For demographic data, the variable 'gender' is a dichotomous nominal variable and was treated as a dichotomous dummy variable – that is, males were coded '0' and females were coded '1'. This treatment, then, held males, as the reference group as they were the majority of respondents. Therefore, any effect from the female variable would be appropriately noticeable.

The other groups were then included in a regression as 1indicating the respondent had identified that group in the respective category, or 0 to indicate the respondent had not identified that group. A different regression equation for each category of instructional delivery was then computed using SPSS. The resulting B value (SPSS), or Y intercept, represented the mean of the selected reference group for the respective category of instructional delivery.

The variable 'SEX' was a dichotomous nominal variable and was treated as a dichotomous dummy variable – that is, males were coded 0 and females were coded 1. This treatment held males as the reference group, as they were the majority of respondents. Therefore, any effect from the female variable would be appropriately noticeable.

The variables P141ATP, MILBASIC, MILINSTR, FE, ATPTYPE, COMBAT, INITQUAL, and CAPTUPGR were nominal variables and were also coded as

dummy variables, that is a 1 indicated the presence of the variable and a 0 indicated the absence of the variable. As the effect of these variables is interrelated, they were entered as a group. INITQUAL was selected as the reference group as it was the majority of responses (100 percent) and was therefore omitted in the regression.

All other variables were ordinal or scale and entered as a 'group' of one in order to facilitate partialing out their effects.

Analysis of Variance (ANOVA) and Post-Hoc Tests. For nominal variables, the slope *b* of a regression would not be indicative of an actual effect on the mean of the dependent variable satisfaction. However, as this knowledge is fundamental to this research in determining just how teaching style effects the level of satisfaction, a post-hoc test of significant independent nominal variables identified in the regression was made. The multiple range comparison further discerns which of the nominal variables within each instructional delivery (perceived teaching style) category had the greatest effects. Using Tukey HSD (Honestly Significant Difference), each of the four responses within each instructional delivery category was compared to the other to determine a significant difference between their means. For a pair of responses showing a significant difference (i.e., $p<.05$), a positive sign indicated an improvement in satisfaction of the variable held in comparison over the variable to which it was compared. As expected, when the order of comparison is flipped, a negative sign

appears indicating the original variable being compared (now being held in comparison) diminishes satisfaction.

According to Shavelson (1988), ANOVA is used to test hypotheses about differences between two or more population means and may be obtained from true experiments or from criterion group designs (p. 341). As this study was non-experimental in nature, the criterion group design would apply to learning styles, trainer types, and perception of instructional delivery. The purpose of ANOVA is to "compare the means of two or more groups in order to decide whether the observed differences between them represent a chance occurrence or a systematic effect" (Shavelson, 1988, p. 342). The ANOVA in this study was a 'one-way' in that it compared groups which differ on one independent variable (e.g., perception of instructional delivery) with two or more levels (e.g., the four descriptive terms for each category of instructional delivery). Assumptions for ANOVA are (SPSS® Base 9.0 Applications Guide, 1999, p. 121):

- *Independence* – the observations are independent;
- *Nomality* – the population is normally distributed; and
- *Homogeity of variances* – the variances within populations is equal. The test for this is the Levene statistic.

However, the ANOVA itself was not as important to the statistical analysis as the post-hoc multiple range tests. These tests are termed 'post-hoc' in that they are based on significant differences between means derived from the ANOVA *F* statistic. Whereas the ANOVA alone indicates only that a difference between means does or does not exist, the Tukey HSD multiple range test identifies which

means differ. For example, assuming the ANOVA for the effect of 'Instructor Involvement' indicated significance, then a post-hoc test would be of interest in determining just which descriptive term – 'Student Directed', 'Little Involvement', 'Gave Time to Think Alone', or 'Active Participation' – seemed to have the greatest effect.

Personal Interviews. Results of the data analysis inspired certain follow-up questions to be asked of the population as a qualitative corroboration of the statistical results. Personal interviews were conducted with two pilot-trainees and three instructors selected at random. The pilot-trainee subjects were asked to complete the ATS instrument and the instructors were asked to complete the IBS instrument. The instruments were scored for learning style and trainer type, and the subjects were interviewed using a prepared questionnaire as a guide. Subject participation was voluntary and anonymous. The interview guides and a summary of the results is provided in Appendix G.

Results.

The results of this research are presented in Chapters IV and V.

Chapter IV

Findings

Introduction.

The findings of this study are presented in this chapter in two major parts:

- results of the effects of pilot-trainee learning style, perceived teaching style, and demographics on satisfaction with training, described according to their effects in each of the respective four training programs (CRM, INDOC, SYSYEMS, and SIM), and
- results of the effects of Instructor learning style, trainer type, and demographics on satisfaction as an instructor.

Results of the Effects of Pilot-trainee Learning Style, Perceived Teaching Style, and Demographics on Satisfaction with Training.

Regression Models for the Effects on Satisfaction. To analyze the effect of learning style, perceived teaching style, and individual demographics on a pilot-trainee's perceived satisfaction with a training program, four regression models were formulated.

Model 1. Regression Model 1 represents the effect learning style as measured by Kolb's Learning Style Inventory (LSI) has on satisfaction with each of the training programs. Each respondent was scored as one of the four learning styles.

Model 2. Regression Model 2 represents the effect perceived teaching style as measured by the Training Satisfaction Survey (TSS) has on satisfaction with each of the four training programs. The variables of teaching style were descriptors from Wheeler's and Marshall's four Trainer Types (Listener, Director, Interpreter, and Coach, respectively) in each of five categories of instructional delivery – 'Instructional Techniques', 'Instructor Involvement', 'Means of Teaching', 'Nature of Instructor', and 'Means of Evaluation'.

Model 3. Regression Model 3 represents the interactive effect between learning style and perceived teaching style on satisfaction with each of the four training programs.

Model 4. Regression Model 4 represents the effect of individual demographic data from the 2000 Aviation Training Survey (ATS) on satisfaction with each of the four training programs. Summaries of these data are provided in Appendix H.

Summary of Satisfaction Means for Training Programs and Instructional Delivery Descriptors. Satisfaction means (Mn) and standard deviations (SD) for pilot-trainees in each of the four training programs under study are depicted in Table 4.1. The 'Regression Mean' for each program represents the overall mean for each program taken as a whole. All other means are the specific means for satisfaction for the descriptors in each of the respective five instructional delivery categories – 'Instructional Techniques', 'Instructor Involvement', 'Means of Teaching', 'Nature of Instructor', and 'Means of Evaluation'.

Table 4.1 – Satisfaction Means for Pilot-Trainees

SATISFACTION MEANS FOR PILOT-TRAINEES												
	CRM			INDOC			SYSTEMS			SIM		
Descriptor	*n*	Mn	SD	*n*	Mn	SD	*n*	Mn	SD	*n*	Mn	SD
Regression Means*	*241*	*3.68*	*.82*	*235*	*3.32*	*.93*	*234*	*3.65*	*1.08*	*235*	*3.68*	*1.01*
Instructional Techniques												
Free Discussion	57	3.93	.59	15	3.60	.77	8	4.25	.71	12	3.58	.90
Theory Based	114	3.55	.87	212	3.28	.92	203	3.63	1.06	21	3.00	1.05
Lecture Based	30	3.43	.82	4	2.75	1.71	13	3.62	1.33	14	3.36	.84
Activity Based	41	3.85	.85	5	4.20	.45	10	3.70	1.34	187	3.79	.98
Instructor Involvement												
Student Directed	18	3.83	.51	28	3.14	.93	28	3.61	1.13	26	3.31	1.19
Little Involvement	31	2.84	1.00	80	2.83	.95	55	2.80	1.04	33	2.79	.99
Gave Time Think	15	3.87	.74	8	3.50	.76	13	3.69	.75	13	4.00	.41
Active Participation	178	3.81	.71	117	3.71	.74	137	4.01	.91	163	3.90	.88
Means of Teaching												
Got Us Involved	131	3.92	.64	37	4.05	.62	62	4.42	.64	81	3.98	.94
Mostly Instructions	94	3.33	.94	184	3.21	.89	152	3.43	1.05	86	3.35	1.03
Mostly Symbols	3	3.33	.58	8	2.63	.92	15	2.93	1.10	2	4.00	.00
Mostly Actions	11	3.82	.75	7	3.43	1.4	6	3.17	1.47	66	3.76	.93
Nature of Instructor												
Listener	11	4.36	.67	8	3.75	.89	12	4.33	.89	9	3.44	1.24
Director	130	3.42	.86	168	3.21	.95	144	3.49	1.06	69	3.14	1.03
Interpreter	36	3.83	.70	34	3.53	.66	43	3.74	.93	16	3.56	1.03
Coach	65	3.98	.62	26	3.65	.75	33	4.09	1.13	140	3.99	.84
Means of Evaluation												
Immediate Fdback	109	3.85	.74	10	4.20	.63	13	4.46	.88	107	4.06	.75
Objective Tests	35	3.60	.88	170	3.42	.89	176	3.65	1.09	47	3.70	.95
Subjective Tests	25	3.40	.96	46	2.98	.91	45	3.51	.94	37	3.70	.88
Person. Judgment	66	3.64	.74	9	2.44	.88	ND	ND	ND	44	2.75	1.08

n – sample size; Mn – mean; SD – standard deviation; ND – No Data
Values: 5 = Very Satisfying, 4 = Satisfying, 3 = Neutral, 2 = Unsatisfying, 1 = Very Dissatisfying
** overall mean obtained during regression procedure for models 1, 2, 3, and 4. All other means were obtained from ANOVA during post-hoc tests.*

The regression means for overall satisfaction indicate a neutral effect depicted by a narrow range between 3.32 and 3.68, that is, above 'Neutral' (3.00) and below 'Satisfying' (4.00). None of the four programs (CRM, INDOC, SYSTEMS, SIM) is different in satisfaction.

However, the individual means of the descriptors of instructional delivery are more discerning. Descriptor means above 4.00 indicate an increase in satisfaction. These include (by instructional delivery category):

- Instructional Techniques – 'Free Discussion' (SYSTEMS – 4.25) and 'Activity Based' (INDOC – 4.20),
- Instructor Involvement – 'Gave time to think' (SIM – 4.00) and 'Active participation' (SYSTEMS – 4.01),
- Means of Teaching – 'Got us involved' (INDOC – 4.05, SYSTEMS – 4.42) and 'Mostly symbols' (SIM – 4.00),
- Nature of Instructor – 'Listener' (CRM – 4.36, SYSTEMS – 4.33) and 'Coach' (SYSTEMS – 4.09), and
- Means of Evaluation – 'Immediate feedback' (INDOC – 4.20, SYSTEMS – 4.46, SIM – 4.06).

Descriptor means below 3.00 indicate a decrease in satisfaction. These include (by instructional delivery category):

- Instructional Techniques – 'Lecture Based' (INDOC – 2.75),
- Instructor Involvement – 'Little Involvement' (CRM – 2.84, INDOC – 2.83,
- SYSTEMS – 2.80, SIM – 2.79), Means of Teaching – 'Mostly Symbols' (INDOC – 2.63, SYSTEMS – 2.93), and
- Means of Evaluation – 'Subjective Tests' (INDOC – 2.98) and 'Personal Judgment' (INDOC – 2.44, SIM – 2.75).

Notable is the descriptor 'Mostly Symbols', which appeared as decreasing satisfaction in INDOC (2.63) and SYSTEMS (2.93) but increasing satisfaction in SIM (4.00). These means were used in the post-hoc paired comparison tests to

determine the significant effects of specific descriptors on satisfaction and are discussed later in this chapter.

Effects on Crew Resource Management (CRM). The mean for satisfaction in CRM training was 3.68 (Table 4.1). Table 4.2 – Summary of Regressions for Pilot-trainees, Crew Resource Management Training (CRM) depicts the statistical effects on satisfaction with CRM of Models 1, 2, and 3 in all five categories of instructional delivery, and for Model 4 for CRM overall. Learning style (Model 1) showed no significant effect on satisfaction with CRM training in any of the five instructional delivery categories, as indicated by low F statistics with no p <.05. However, perceived teaching style (Model 2) did show significant effects on the satisfaction with CRM in all five categories of instructional delivery.

For instructional delivery category 'Instructional Techniques', perceived teaching style (Model 2) resulted in a modestly large F = 5.308 (p<.001), though only 6 percent of the variance was explained (adjusted R^2 = .06).

For instructional delivery category 'Instructor Involvement', perceived teaching style (Model 2) had a significant effect on satisfaction, indicated by a large F = 15.571 (p<.0005), with a relatively substantial 16 percent of the variance being explained (adjusted R^2 = .163).

For instructional delivery category 'Means of Teaching', perceived teaching style (Model 2) had a significant effect on satisfaction, indicated by a large F = 11.996 (p<.0005), with a relatively substantial 13 percent of the variance being explained (adjusted R^2 = .130).

Table 4.2 – Summary of Regressions for Pilot-trainees, Crew Resource Management Training (CRM)

SUMMARY OF REGRESSIONS FOR PILOT-TRAINEES, CREW RESOURCE MANAGEMENT TRAINING (CRM) n = 241								
Model	R	R square	Adjusted R square	R square Change	F Change	df1	df2	F Change Significance
Instructional Delivery Category 'Instructional Techniques'								
1	.146	.021	.009	.021	1.723	3	237	.163
2	.289	.084	.060	.062	5.308	3	234	.001*
3	.316	.100	.065	.016	1.360	3	231	.256
Instructional Delivery Category 'Instructor Involvement'								
1	.146	.021	.009	.021	1.723	3	237	.163
2	.429	.184	.163	.163	15.571	3	234	.000*
3	.484	.235	.184	.050	1.646	9	225	.103
Instructional Delivery Category 'Means of Teaching'								
1	.146	.021	.009	.021	1.723	3	237	.163
2	.390	.152	.130	.130	11.996	3	234	.000*
3	.401	.161	.117	.009	.403	6	228	.876
Instructional Delivery Category 'Nature of Instructor'								
1	.146	.021	.009	.021	1.723	3	237	.163
2	.358	.150	.129	.129	11.853	3	234	.000*
3	.453	.205	.152	.055	1.720	9	225	.035
Instructional Delivery Category 'Means of Evaluation'								
1	.146	.021	.009	.021	1.723	3	237	.163
2	.259	.067	.043	.046	3.819	3	234	.011*
3	.330	.109	.049	.042	1.169	9	225	.316
Demographics for CRM								
4	.154	.024	-.037	.024	.393	14	226	.976

** Significant at the p<.05 level*

For instructional delivery category 'Nature of Instructor', perceived teaching style (Model 2) had a significant effect on satisfaction, indicated by a large F = 11.853

(p<.0005), with a relatively substantial 12.9 percent of the variance being explained (adjusted R^2 = .129).

For instructional delivery category 'Means of Evaluation', perceived teaching style (Model 2) showed a significant effect on satisfaction, indicated by a small F = 3.819 (p <.011), with a relatively small portion of the variance (less than 5 percent) being explained (adjusted R^2 = .043).

Neither learning style (Model 1) nor interactive effects (Model 3) returned significant results in any of the five instructional delivery categories. The effect of demographics (Model 4) returned no significant results for CRM training.

Effects on Indoctrination Training (INDOC). The mean for satisfaction in INDOC training was 3.32 (Table 4.1). Table 4.3 – Summary of Regressions for Pilot-trainees, Company Indoctrination Training (INDOC) depicts the statistical effects on satisfaction with CRM of Models 1, 2, and 3 in all five categories of instructional delivery, and for Model 4 for INDOC overall. Perceived teaching style (Model 2) showed significant effects on satisfaction in four of the five instructional delivery categories.

For instructional delivery category 'Instructional Techniques', perceived teaching style (Model 2) had no significant effect on satisfaction. For instructional delivery category 'Instructor Involvement', perceived teaching style (Model 2) had a

significant effect on satisfaction, indicated by a large F = 19.034 (p <.0005), with a relatively large 18.9 percent portion of the variance being explained (adjusted R^2 = .189).

Table 4.3 – Summary of Regressions for Pilot-trainees, Company Indoctrination Training (INDOC)

SUMMARY OF REGRESSIONS FOR PILOT-TRAINEES, COMPANY INDOCTRINATION TRAINING (INDOC) n = 235								
Model	*R*	*R* square	Adjusted *R* square	*R* square Change	*F* Change	df1	df2	*F* Change Significance
Instructional Delivery Category 'Instructional Techniques'								
1	.108	.012	-.001	.012	.901	3	231	.442
2	.172	.030	.004	.018	1.411	3	228	.240
3	.263	.069	.015	.040	1.352	7	221	.227
Instructional Delivery Category 'Instructor Involvement'								
1	.108	.012	-.001	.012	.901	3	231	.442
2	.458	.210	.189	.198	19.034	3	228	.000*
3	.489	.239	.187	.030	.945	9	219	.437
Instructional Delivery Category 'Means of Teaching'								
1	.108	.012	-.001	.012	.901	3	231	.412
2	.370	.137	.115	.126	11.069	3	228	.000*
3	.432	.186	.131	.049	1.466	9	219	.162
Instructional Delivery Category 'Nature of Instructor'								
1	.108	.012	1.001	.012	.901	3	231	.442
2	.219	.048	.023	.036	2.912	3	228	.035*
3	.267	.072	.012	.024	.696	8	220	.695
Instructional Delivery Category 'Means of Evaluation'								
1	.108	.012	-.001	.012	.901	3	231	.442
2	.364	.133	.110	.121	10.616	3	228	.000*
3	.419	.173	.121	.041	1.354	8	220	.218
Demographics for CRM								
4	.190	.036	-.025	.036	.558	14	220	.873

** Significant at the p<.05 level*

For instructional delivery category 'Means of Teaching', perceived teaching style (Model 2) had a significant effect on satisfaction, indicated by a modestly large F = 11.069 (p <.0005), with a modestly large 11.5 percent portion of the variance being explained (adjusted R^2 = .115).

For instructional delivery category 'Nature of Instructor', perceived teaching style (Model 2) had a significant effect on satisfaction, indicated by a small $F = 2.912$ ($p < .05$), with a relatively small portion of the variance (less than 3 percent) being explained (adjusted $R^2 = .023$).

For instructional delivery category 'Means of Evaluation', perceived teaching style (Model 2) had a significant effect on satisfaction, indicated by a modestly large $F = 10.616$ ($p < .0005$), with a modestly large 11 percent portion of the variance being explained (adjusted $R^2 = .110$).

Neither learning style (Model 1) nor interactive effects (Model 3) returned significant results in any of the five instructional delivery categories. The effect of demographics (Model 4) returned no significant results for INDOC training.

Effects on Systems Ground School (SYSTEMS). The mean for satisfaction in SYSTEMS training was 3.65 (Table 4.1). Table 4.4 – Summary of Regressions for Pilot-trainees, Systems Ground School (SYSTEMS) depicts the statistical effects on satisfaction with SYSTEMS of Models 1, 2, and 3 in all five categories of instructional delivery, and for Model 4 for SYSTEMS overall. Perceived teaching style (Model 2) showed significant effects on satisfaction with SYSTEMS in four of the five categories of instructional delivery.

Table 4.4 – Summary of Regressions for Pilot-trainees, Systems Ground School (SYSTEMS)

SUMMARY OF REGRESSIONS FOR PILOT-TRAINEES, SYSTEMS GROUND SCHOOL (SYSTEMS)
n = 234

Model	*R*	*R* Square	Adjusted *R* square	*R* Square Change	*F* Change	df1	df2	*F* Change Significance
Instructional Delivery Category 'Instructional Techniques'								
1	.142	.020	.007	.020	1.572	3	230	.197
2	.206	.043	.017	.023	1.782	3	227	.151
3	.296	.088	.029	.045	1.351	8	219	.220
Instructional Delivery Category 'Instructor Involvement'								
1	.142	.020	.007	.020	1.572	3	230	.197
2	.491	.241	.221	.221	22.075	3	227	.000*
3	.534	.285	.236	.044	1.491	9	218	.152
Instructional Delivery Category 'Means of Teaching'								
1	.142	.020	.007	.020	1.572	3	230	.197
2	.481	.213	.192	.193	18.516	3	227	.000*
3	.493	.243	.194	.030	1.081	8	219	.378
Instructional Delivery Category 'Nature of Instructor'								
1	.142	.020	.007	.020	1.572	3	230	.197
2	.267	.071	.047	.051	4.160	3	227	.007*
3	.308	.095	.033	.024	.641	9	218	.761
Instructional Delivery Category 'Means of Evaluation'								
1	.142	.020	.007	.020	1.572	3	230	.197
2	.272	.074	.050	.054	4.421	3	227	.005*
3	.334	.111	.055	.037	1.144	8	219	.335
Demographics for CRM								
4	.243	.059	-.001	.059	.982	14	219	.472

* *Significant at the p<.05 level*

For instructional delivery category 'Instructional Techniques' showed no significant effects. For instructional delivery category 'Instructional Techniques', perceived teaching style (Model 2) had no significant effect on pilot-trainee satisfaction indicated by a small $F = 1.782$ ($p > .05$), with a small portion of the variance (less than 2 percent) being explained (adjusted $R^2 = .017$).

For instructional delivery category 'Instructor Involvement', perceived teaching style (Model 2) had a significant effect on satisfaction, indicated by a large

F = 22.075 (p <.0005), with a relatively large 22.1 percent portion of the variance being explained (adjusted R^2 = .221).

For instructional delivery category 'Means of Teaching', perceived teaching style (Model 2) had a significant effect on satisfaction, indicated by a large F = 18.516 (p <.0005), with a relatively large 19.2 percent portion of the variance being explained (adjusted R^2 = .192).

For instructional delivery category 'Nature of Instructor', perceived teaching style (Model 2) had a significant effect on satisfaction, indicated by a modest F = 4.160 (p <.007), with a relatively small portion of the variance (less than 5 percent) being explained (adjusted R^2 = .047).

For instructional delivery category 'Means of Evaluation', perceived teaching style (Model 2) had a significant effect on satisfaction, indicated by a small F = 4.421 (p <.005), with a relatively small 5 percent portion of the variance being explained (adjusted R^2 = .005).

Neither learning style (Model 1) nor interactive effects (Model 3) returned significant results in any of the five instructional delivery categories. The effect of demographics (Model 4) returned no significant results for SYSTEMS training.

Effects on Simulator Training (SIM). The mean for satisfaction in SIM training was 3.68 (Table 4.1). Table 4.5 – Summary of Regressions for Pilot-trainees, Simulator Training (SIM) depicts the statistical effects on satisfaction with SIM of Models 1, 2, and 3 in all five categories of instructional delivery, and for Model 4 for SIM overall. Perceived teaching style (Model 2) showed significant effects on satisfaction in all five instructional delivery categories.

Table 4.5 – Summary of Regressions for Pilot-trainees, Simulator Training (SIM)

SUMMARY OF REGRESSIONS FOR PILOT-TRAINEES, SIMULATOR TRAINING (SIM) n = 235								
Model	R	R square	Adjusted R square	R square Change	F Change	df1	df2	F Change Significance
Instructional Delivery Category 'Instructional Techniques'								
1	.065	.004	-.009	.004	.322	3	231	.809
2	.225	.051	.026	.046	3.721	3	228	.012*
3	.305	.093	.031	.042	1.130	9	219	.343
Instructional Delivery Category 'Instructor Involvement'								
1	.065	.004	-.009	.004	.322	3	231	.809
2	.405	.164	.142	.160	14.508	3	228	.000*
3	.435	.189	.134	.025	.765	9	219	.649
Instructional Delivery Category 'Means of Teaching'								
1	.065	.004	-.009	.004	.322	3	231	.809
2	.277	.077	.057	.073	9.032	3	229	.000*
3	.313	.098	.053	.021	.859	6	223	.526
Instructional Delivery Category 'Nature of Instructor'								
1	.065	.004	-.009	.004	.322	3	231	.809
2	.344	.118	.095	.114	9.837	3	228	.000*
3	.372	.138	.079	.020	.566	9	219	.824
Instructional Delivery Category 'Means of Evaluation'								
1	.065	.004	-.009	.004	.322	3	231	.809
2	.378	.144	.121	.140	12.387	3	228	.000*
3	.519	.269	.219	.125	4.179	9	219	.000*
Demographics for CRM								
4	.259	.067	.008	.067	1.127	14	220	.335

significant at the p<.05 level

For instructional delivery category 'Instructional Techniques', perceived teaching style (Model 2) had a significant effect on satisfaction, indicated by a small $F = 3.721$ ($p < .012$), with a relatively small portion of the variance (less than 3 percent) being explained (adjusted $R^2 = .026$).

For instructional delivery category 'Instructor Involvement', perceived teaching style (Model 2) had a significant effect on satisfaction, indicated by a small $F = 14.508$ ($p < .0005$), with a relatively large 14.2 percent portion of the variance being explained (adjusted $R^2 = .142$).

For instructional delivery category 'Means of Teaching', perceived teaching style (Model 2) had a significant effect on satisfaction, indicated by a modest $F = 9.032$ ($p < .0005$), with a small portion of the variance (less than 6 percent) being explained (adjusted $R^2 = .057$).

For instructional delivery category 'Nature of Instructor', perceived teaching style (Model 2) had a significant effect on satisfaction, indicated by a modest $F = 9.837$ ($p < .0005$), with a modest 9.5 percent portion of the variance being explained (adjusted $R^2 = .095$).

For instructional delivery category 'Means of Evaluation', perceived teaching style (Model 2) had no significant effect on satisfaction, indicated by a relatively large $F = 12.387$ ($p < .0005$), with a modest 12.1 percent portion of the variance being explained (adjusted $R^2 = .121$).

Learning style (Model 1) showed no significant effects in any of the five categories of instructional delivery. However, the interactive effects of learning style and perceived teaching style (Model 3) did show a significant effect in instructional delivery category 'Means of Evaluation', indicated by a change of $F = 4.179$ ($p < .0005$), with a relatively large portion (21.9 percent) of the variance being explained (adjusted $R^2 = .219$). The effect of demographics (Model 4) returned no significant results for SYSTEMS training.

Multiple Comparisons of Teaching Style Descriptors.

For each of the five categories of instructional delivery in each of the four training programs, post-hoc multiple comparisons of the descriptors of perceived teaching style within each category were run using Tukey HSD (Honestly Significant Difference). Significant statistical data results are presented in table form in Appendix J.

Table 4.6 – Significant Instructional Delivery Descriptors depicts the descriptive terms from the 2000 ATS found in the Tukey HSD post-hoc tests to have statistical significance on the pilot-trainee respondent's perception of satisfaction with a specific training program. Common to all four programs was the effect of Immediate Feedback' from the instructor as increasing satisfaction and 'Little nvolvement' from the instructor as decreasing satisfaction. The multiple ppearances of 'Got Us Involved' also suggest a strong increasing effect.

Table 4.6 – Significant Instructional Delivery Descriptors

SIGNIFICANT INSTRUCTIONAL DELIVERY DESCRIPTORS				
Effect on Satisfaction	Descriptive Terms			
	CRM	INDOC	SYTEMS	SIM
Increases	'Got Us Involved' 'Immediate Feedback'	'Got Us Involved' 'Immediate Feedback' 'Active Participation'	'Got Us Involved' 'Immediate Feedback'	'Immediate Feedback' 'Coach'
Decreases	'Little Involvement'	'Little Involvement' 'Mostly Symbols'	'Little Involvement' 'Mostly Symbols'	'Little Involvement'

Comparison of Descriptors in CRM Training. For instructional delivery category 'Instructional Techniques', Tukey HSD showed significant differences between 'Free Discussion' and 'Lecture Based' (mean difference (m.d.) = .38, $p<.020$), and 'Free Discussion' and 'Theory Based' (m.d. = .50, $p<.032$), indicating that 'Lecture Based' and 'Theory Based' tended to improve satisfaction over 'Free Discussion'. For instructional category 'Instructor Involvement', Tukey HSD shows significant differences between 'Little Involvement' and 'Student Directed' (m.d. = -.99, $p<.0005$), and 'Gave Time to Think Alone' (m.d. = -1.03, $p<.0005$) and 'Active Participation' (m.d. = -.97, $p<..0005$), indicating that 'Little Involvement' tended to decrease satisfaction over the other three responses. For instructional category 'Means of Teaching', Tukey HSD shows significant differences between 'Got Us Involved' and 'Mostly Instructions' (m.d. = .59, $p<.0005$), indicating that 'Got Us Involved' tended to increase satisfaction while 'Mostly Instructions' tended to decrease satisfaction. For instructional category 'Nature of Instructor', Tukey HSD shows significant differences between 'Director'

and 'Listener' (m.d. = -.94, $p<.001$), 'Interpreter' (m.d. = .41, $p<.025$), and 'Coach' (m.d. = -.56, $p<.0005$) indicating that 'Director' tended to decrease satisfaction. For the category 'Means of Evaluation', Tukey HSD shows mildly significant differences between 'Immediate Feedback' and 'Subjective Tests' (m.d. = .45, $p<.047$), indicating that 'Immediate Feedback' tended to increase satisfaction while 'Subjective Tests' tended to decrease satisfaction.

Comparison of Descriptors in INDOC Training. For the instructional delivery category 'Instructional Techniques', Tukey HSD showed no significant differences between any of the four descriptors. For the instructional delivery category 'Instructor Involvement', Tukey HSD showed a significant difference between 'Active Participation' and 'Student Directed' (m.d. = .57, $p<.008$), and 'Little Involvement' (m.d. = .88, $p<.0005$), indicating that 'Active Participation' had a considerable effect on increasing satisfaction while 'Student Directed' and 'Little Involvement' tended to decrease satisfaction. For the category 'Means of Teaching', Tukey HSD showed a significant difference between 'Got Us Involved' and 'Mostly Instructions' (m.d. = .85, $p<.0005$), and 'Mostly Symbols' (m.d. = 1.43, $p<.0005$), indicating that 'Got Us Involved' had a considerable effect on increasing satisfaction while 'Mostly Symbols' and 'Mostly Instructions' tended to decrease satisfaction, with 'Mostly Symbols' having the greatest negative effect. The instructional delivery category 'Nature of Instructor' showed no significant difference among any of the four descriptors. For the instructional delivery category 'Means of Evaluation', Tukey HSD showed a significant

difference between 'Immediate Feedback' and 'Objective Tests' (m.d. = .78, $p<.035$), and 'Subjective Tests' (m.d. = 1.22, $p<.0005$) and 'Personal Judgment' (m.d. = 1.76, $p<.0005$), indicating that 'Immediate Feedback' had a considerable effect on increasing satisfaction. 'Personal Judgment' had the greatest effect in decreasing satisfaction.

Comparison of Descriptors in SYSTEMS Training. For instructional delivery category 'Instructional Techniques', Tukey HSD showed no significant differences among any of the four the descriptors. For instructional delivery category 'Instructor Involvement', Tukey HSD showed a significant difference between 'Little Involvement' and 'Active Participation' (m.d. = -1.21, $p<.0005$), and 'Gave Time To Think Alone' (m.d. = -.89, $p<.014$) and 'Student Directed' (m.d. = -.81, $p<.002$), indicating that 'Little Involvement' had a considerable effect on decreasing satisfaction. For instructional delivery category 'Means of Teaching', Tukey HSD showed a significant difference between 'Got Us Involved' and 'Mostly Instructions' (m.d. = .99, $p<.0005$), and 'Mostly Symbols' (m.d. = 1.49, $p<.0005$) and 'Mostly Actions' (m.d. = 1.25, $p<.014$), indicating that 'Got Us Involved' had a considerable effect on increasing satisfaction over the other three descriptors. 'Mostly Symbols' had the greatest difference with 'Got Us Involved' and a negative effect indicated by a satisfaction mean of 2.93 ($p<.05$) (just below 'Neutral') in Tukey Homogeneous Subsets. For instructional delivery category 'Nature of Instructor', Tukey HSD showed a significant difference between 'Director' and 'Listener' (m.d. = -.85, $p<.033$) and 'Coach'

(m.d. = -.60, $p<.013$), indicating that 'Director' had a decreasing effect on satisfaction. For instructional delivery category 'Means of Evaluation', Tukey HSD showed a significant difference between 'Immediate Feedback' and 'Objective Tests' (m.d. = .81, $p<.019$) and 'Subjective Tests' (m.d. = .95, $p<.011$), indicating that 'Immediate Feedback' had a considerable effect on increasing satisfaction. 'Personal Judgment' was eliminated from the ANOVA as there were fewer than two records with this response. Tukey Homogeneous Subsets showed all four responses for satisfaction to be 'Neutral' or above.

Comparison of Descriptors in SIM Training. For instructional delivery category 'Instructional Techniques', Tukey HSD showed a significant difference between 'Activity Based' and 'Lecture Based' (m.d. = .79, $p<.003$), indicating 'Activity Based' had a significant effect on increasing satisfaction. For the category 'Instructor Involvement', Tukey HSD showed a significant difference between 'Little Involvement' and 'Gave Time To Think Alone' (m.d. = -1.21, $p<.0005$) and 'Active Participation' (m.d. = -1.11, $p<.0005$), indicating that 'Little Involvement' had an effect on decreasing satisfaction, corroborated by Tukey Homogeneous Subsets mean for 'Little Involvement' to be 2.79 ($p<.05$), slightly less satisfied than 'Neutral'. The effects were appreciable as indicated by a relatively large ANOVA $F = 15.606$ ($p<.0005$).

For instructional delivery category 'Means of Teaching', Tukey HSD showed a significant difference between 'Mostly Instructions' and 'Got Us Involved'

(m.d. = -.63, p<.0005) and 'Mostly Actions' (m.d. = -.41, p<.048), indicating that 'Mostly Instructions' had a mild effect on decreasing satisfaction. Even so, Tukey Homogeneous Subsets depicted the mean of all four descriptors to be above Neutral' in satisfaction. For instructional delivery category 'Nature of Instructor', showed a significant difference between 'Coach' and 'Director' (m.d. = .84, p<.0005) indicating that 'Coach' had a considerable effect on increasing satisfaction. Tukey Homogeneous Subsets depicted the mean of all four descriptors to be above 'Neutral' satisfaction. For the instructional delivery category 'Means of Evaluation', showed a significant difference between 'Personal Judgment' and 'Immediate Feedback' (m.d. = -1.31, p<.0005), 'Objective Tests' (m.d. = -.95, p<.0005), and 'Subjective Tests' (m.d. = -.95, p<.0005), indicating that 'Personal Judgment' had a considerable effect on decreasing satisfaction over the other three responses, corroborated by Tukey Homogeneous Subsets depicting the mean for 'Personal Judgment' to be 2.75, below 'Neutral' satisfaction.

Summary of Results of the Effect of Learning Style, Teaching Style, and Demographics on Satisfaction. The regressions for the effect of learning style on satisfaction (Model 1) showed little overall effect on the level of satisfaction with any of the four training programs, as indicated by their resulting low value F statistic with levels of significance p >.05, and explained little of the resulting satisfaction as indicated by their low R^2 values. However, the effect of perceived teaching style on satisfaction (Model 2) showed significant effects in all five

categories of instructional delivery in CRM training and SIM training, and in four of the five instructional delivery categories in SYSTEMS training and SIM training. The interactive effects of learning style and teaching style (Model 3) showed a significant effect in only SIM training in instructional delivery category 'Means of Evaluation'. The effect of individual demographics on satisfaction with training (Model 4) showed no significant results in any of the four training programs. Post-hoc tests of teaching style descriptors showed several significant paired comparisons with commonalties among the training programs.

2000 Aviation Training Survey (ATS) Validation.

Kolb's data on the 1985 LSI were collected from a heterogeneous population of career backgrounds that did not, however, include airline pilots or any sort of pilot career field. In contrast, all respondents in this 2000 ATS and the Instructor Background Survey (IBS) were actively employed as airline pilots or instructors in a highly specialized and technical field. As a test of validity of the 2000 ATS, data means and standard deviations were compared to those from Kolb's 1985 LSI. The largest difference between standard deviations on the 2000 ATS scores and Kolb's 1985 LSI scores is less than 2 percent, suggesting there is no significant difference between the population norms of pilots in the 2000 ATS and those of Kolb's population. A summary of the data is presented in Appendix I.

structor Survey Results.

ackground. As the thrust of this research was to gain insight into the lationship between learning style and teaching style, a survey of instructors

was important. As mentioned in Chapter III, this survey included a scoring of the respondent's Trainer Type as obtained by Wheeler's and Marshall's Trainer Type Inventory (TTI) (1986), a scoring of the respondent's learning style as obtained by Kolb's LSI, an indication of the respondent's satisfaction with teaching the four types of training programs as well as their satisfaction with each program as trainees themselves, and certain aviation-related demographics. These instructors were all employed by the same airline company as the pilot-trainee population, thereby establishing a direct connection between the perceived delivery of the instruction by the trainee and the actual delivery of the instruction from the instructor. Though no match was actually made between a trainee and his/her instructor (due to the promise of anonymity), there is a high degree of probability that each instructor had trained at least one, if not several, of the trainees in the sample. Therefore, a degree of correlation between the responses by the trainees of perceived instructional delivery and trainer type of the instructors may be assumed. The sample size of the instructor population was 26 from a population of about 50.

Correlation Between Instructor's TTI and LSI. The nominal score values of the four trainer types on the TTI were assigned to be congruent with the four learning styles on the LSI, as depicted in Table 4.7 – Trainer Type Inventory (TTI) – Learning Style Inventory (LSI) Coding Congruency. That is, each trainer type was assigned the same value number as it's corresponding learning style.

Table 4.7 – Trainer Type Inventory (TTI) – Learning Style Inventory (LSI) Coding Congruency

TRAINER TYPE INVENTORY (TTI) – LEARNING STYLE INVENTORY (LSI) CODING CONGRUENCY	
LSI Type and Value Code	Congruent TTI Type and Value Code
Diverger – 1	Listener – 1
Accommodator – 2	Director – 2
Converger – 3	Interpreter – 3
Assimilator – 4	Coach – 4

Table 4.8 – Instructor TTI - LSI Score Comparison depicts a comparison of each instructor's trainer type as scored by the TTI to his/her learning style as scored by Kolb's LSI.

Table 4.8 – Instructor TTI – LSI Score Comparison

INSTRUCTOR TTI – LSI SCORE COMPARISON								
Case #	TTI	LSI	Case #	TTI	LSI	Case #	TTI	LSI
1	3	3	10	4	4	19	3*	2
2	3	3	11	2	2	20	4*	3
3	4	4	12	3*	2	21	4*	2
4	4*	3	13	4*	2	22	4	4
5	4*	1	14	2*	3	23	2	2
6	4*	2	15	1*	4	24	4*	3
7	4*	2	16	3	3	25	4*	3
8	4	4	17	4*	3	26	4	4
9	4*	3	18	1*	3			

** indicates TTI different from LSI (16 total)*

)f the 26 instructor respondents, 16 indicated a TTI different from the espondent's LSI as indicated by the asterisk. An empirical comparison of

instructor TTI to respective LSI suggests no correlation between respondent's TTI and LSI. This observation supports the observation by the developers of the TTI, Wheeler and Marshall (1986), that there was "no significant relationship between a trainer's own learning-style and training-style preferences," (p. 90). However, an empirical review of these data suggests some difference, perhaps even supporting Rudowski's (1996) study that indicated about a third of the respondents tended to teach opposite of the way they learned. Chapter V contains a discussion of possible interpretations of these data.

Effect of TTI, LSI, and Demographics on Satisfaction. None of the regression runs returned a significant *F* statistic (i.e., $p<.05$). An empirical review of the means and standard deviations (σ) as depicted in Table 4.9 – Means for Instructor Satisfaction, shows all score means above 'Neutral' toward 'Satisfying', and differences between the programs with SIM score means substantially above 'Satisfying' toward 'Very Satisfying'. The lowest satisfaction score as a teacher was 3.42 and as a trainee was 3.42, both of which were for INDOC.

Table 4.9 – Means for Instructor Satisfaction

MEANS FOR INSTRUCTOR SATISFACTION Sample size n=26				
	CRM	INDOC	SYSTEMS	SIM
As a Teacher	3.74 (S.D. = 1.01)	3.42 (S.D. = 1.06)	3.60 (S.D. = .87)	4.40 (S.D. = 1.00)
As a Trainee	3.96 (S.D. = .66)	3.42 (S.D. = .76)	3.77 (S.D. = .86)	4.23 (S.D. = .65)

5 = 'Very Satisfying, 4= Satisfying, 3= Neutral, 2 = 'Unsatisfying, 1= Very dissatisfying

However, a paired sample *t*-test, depicted in Table 4.10 – Paired Sample *t* - Test of Instructor Satisfaction, between satisfaction as a teacher and satisfaction as a trainee, was run for each of the four training programs and returned no significant results (i.e., $p < .05$) and only one significant correlation – CRM ($p < .017$).

Table 4.10 – Paired Sample *t* - Test for Instructor Satisfaction

PAIRED SAMPLE *t* - TEST FOR INSTRUCTOR SATISFACTION						
Pair	Correlation & Sig.	Mean	Std. Dev.	*t*	df	Sig. (2-tail)
CRM – Satisfaction as Instructor and as Trainee *(n = 23)*	.494 Sig. .017	-.22	.19	-1.155	22	.260
INDOC – Satisfaction as Instructor and as Trainee *(n = 24)*	.251 Sig. .236	-.004	.23	-.182	23	.857
SYSTEMS – Satisfaction as Instructor and as Trainee *(n = 25)*	.385 Sig. .057	-.24	.19	-1.297	24	.207
SIMULATOR – Satisfaction as Instructor and as Trainee *(n = 25)*	.163 Sig. .435	.16	.22	.723	24	.476

According to Shavelson's (1988) criteria for sample size discussed in Chapter III, the sample size of 26 instructor respondents was too small ($n < 50$) for robust results from a regression of LSI, TTI, and demographics on instructor satisfaction with teaching and taking a training program. A larger sample of instructors might return significant results.

Self-perception of Instructor Avocation. Item 8 of the IBS stated, "If you were asked 'What is your avocation?' how would you respond in one or two words?" These responses are presented in Table 4.11 – Instructor Avocation Responses. Most responses contained the word 'pilot', 'flight', or some word that directly identified piloting, such as 'Check Airman' (Case 10) and 'Captain' (Case 7).

Table 4.11 – Instructor Avocation Responses

INSTRUCTOR AVOCATION RESPONSES		
The following is a list of responses to Item 8 of the Instructor Background Survey (IBS): *"If you were asked 'What is your vocation?' how would you respond in one or two words?"*		
Case No. & Response	Case No. & Response	Case No. & Response
1 – "Airline Pilot" 2 – "Instructor Pilot" 3 – (no response) 4 – "Pilot Instructor" 5 – "Pilot" 6 – "Teacher" 7 – "CL-65 Instructor/Captain" 8 – "Flight Instructor" 9 – "Professional Pilot" 10 – "Instructor/Check Airman"	11 – "Instructor Pilot" 12 – "Professional Aviation Person" 13 – "Golfer/Airline Pilot" 14 – "Good Teacher" 15 – "Pilot" 16 – "Pilot Instructor" 17 – "Check Airman" 18 – "Instructor Pilot" 19 – "Pilot" 20 – "Pilot"	21 – (no response) 22 – "Transportation Modeler" 23 – (no response) 24 – "Professional Pilot" 25 – "Flight Instructor" 26 – "Pilot"

Even within the 11 responses that contained the word 'instructor' or 'teacher', eight of them qualified the term with the word 'flight' or 'pilot'. Only two responses were solely 'teacher'. Subsequent personal interviews with three instructors revealed that they preferred the SIM program because they considered themselves pilots first and preferred performing more as a pilot than as an instructor.

Interpretations of the Findings.

Conclusions about the statistical results and interpretations of the results are presented in Chapter V.

Chapter V

Summary, Conclusions, Implications, and Recommendations for Further Study

Dissertation Summary.

Chapter I presented a problem facing aviation today – specifically, the retention of qualified and experienced pilots in a pilot's market. The focus of this research was in providing a satisfying training experience as an inducement for an airline pilot to remain with a particular company. This established four basic hypotheses for the research, specifically (as stated in Chapter I):

H1: A pilot-trainee learning style, perception of instructional delivery, and individual demographic background have an effect on a pilot-trainee's perception of satisfaction with a training experience.

H2: There is a correlation between an individual instructor's trainer type and his/her learning style.

H3: An instructor's trainer type, learning style, and demographic background as an instructor have an effect on his/her satisfaction with teaching a particular type of training program.

H4: There is a correlation between an instructor's satisfaction with having taken a particular training program as a trainee and the satisfaction that instructor feels with teaching that same program.

The study was limited to a random sample of the population of airline pilots employed with one airline company. The sample represented 20 percent of the population. Statistical conclusions were based solely from the sample.

Chapter II defined and described airline pilot training, learning style and teaching style, presented current theories and research into the measurement and correlation of learning style and teaching style, and laid a foundation for the use of an individual's perception of satisfaction as an indication of training effectiveness. Kolb's Learning Style Inventory (LSI) and Wheeler's and Marshall's Trainer Type Inventory (TTI) were selected as primary focus for this research to be measured for their effect on satisfaction with a training experience.

Training for an airline pilot is a significant part of employment as an airline pilot. This training is an ongoing event involving a variety of training programs, including Crew Resource Management training (CRM), Company Indoctrination training (INDOC), Systems Ground School (SYSTEMS), and Flight Simulator training (SIM). Studies suggest that pilot-trainees, like other students, tend to have individual preferences in their style of learning. As well, aviation instructors, like other teachers, tend to have individual preferences in their respective style of teaching.

A great deal of research has been done regarding learning style and how individuals learn. One prominent researcher, David Kolb, theorizes a cycle of learning whereby an individual begins learning with a concrete experience, then progresses to reflective observation on that experience, then abstract conceptualization, and then active experimentation, leading to more concrete experiences and thus repeating the cycle. Kolb further suggests that even though individuals progress through a cycle of learning, they tend to prefer to learn in a style characteristic of one of the phases of the cycle. Kolb terms an individual who prefers a learning style characteristic of the phase between concrete experience and reflective observation a Diverger. The phase between reflective observation and abstract conceptualization he terms an Assimilator. The phase between abstract conceptualization and active experimentation he terms a Converger. Finally, the phase between active experimentation and concrete experiences, he terms an Accommodator. To measure one's preference for a particular style of learning, Kolb developed his Learning Style Inventory (LSI), a questionnaire in which the individual is asked to rank order four descriptive phrases or words in 12 areas. Each of the four descriptive phrases is characteristic of a specific learning style for that facet of learning.

In the field of teaching style, two other researchers, Wheeler and Marshall, described four categories of teaching style, or trainer type, based upon the best way to deliver instruction to each of Kolb's suggested learning styles. Wheeler's and Marshall's trainer types are the Listener, Director, Interpreter, and Coach,

and are intended to be congruent with Kolb's learning styles Diverger, Assimilator, Converger, and Accommodator, respectively. To measure and identify an individual's style of teaching, Wheeler and Marshall developed the Trainer Type Inventory (TTI). Like Kolb's LSI, the TTI asks the individual to rank order four descriptive phrases or words in each of 12 areas of teaching. Each phrase was intended to be characteristic of a specific trainer type identified as being congruent with each of Kolb's four learning styles.

Research into employee retention suggests that satisfaction with company-sponsored training is a substantial motivation for an employee to remain with the company. One way to improve satisfaction with training may be to orient teaching style to learning style. Hence, satisfaction with each of four distinct training experiences was chosen to measure the effect of Kolb's LSI and Wheeler's and Marshall's TTI.

Chapter III restated the research hypotheses and presented two instruments to examine the stated hypotheses. The 2000 Aviation Training Survey (ATS) instrument was developed to collect pilot-trainee demographic data and to measure their respective satisfaction with each of four training programs required in airline pilot training – Crew Resource Management training, Company Indoctrination training, Aircraft Systems Ground School, and Flight Simulator training. Added to this instrument was Kolb's LSI to indicate the respondent's learning style.

To examine the effect of teaching style, the Instructor Background Survey (IBS) instrument was developed to collect instructor demographic data and measure their satisfaction with teaching the four training programs. Wheeler's and Marshall's TTI and Kolb's LSI were added to the instrument to indicate the respondent's trainer type and learning style.

The statistical procedures of Multiple Regression Analysis (MRA) and Analysis of Variance (ANOVA) with post-hoc tests were chosen for data analyses. As the effect of learning style and teaching style on satisfaction is of a predictive nature, MRA was chosen as the best procedure for predicting their effects. However, as the variables within the category of instructional delivery were nominal, Tukey's HSD (Honestly Significant Difference) post-hoc paired and multiple comparison tests was chosen to indicate just what specific variables were significant in their effect on satisfaction.

A description of the process for soliciting subject response and collecting and processing data was discussed. Subjects were solicited through an introductory letter with a cash award lottery as an incentive. Participation was voluntary and anonymous.

Chapter IV presented an overview of the statistical procedures, specific regressions models, and hypothesis tests used in the specific context in which they were employed. Statistical results were presented.

Research Conclusions.

Effect of Learning Style on Satisfaction (H1). The absence of any significant regression *F* statistic for the effect of LSI on satisfaction with any of the four training programs in the research is interpreted as LSI has no effect and therefore the null hypotheses (i.e., that LSI has no effect) is accepted. Also, the distribution of learning styles among the pilots in this study appears to be heterogeneous, as depicted in Appendix H, Frequencies of Pilot-trainee LSI (2000 ATS).

Effect of Instructional Delivery on Satisfaction (H1). Some descriptors of instructional delivery showed significant regression *F* statistics for their effect on satisfaction with certain training programs in the research. Specifically, 'Immediate Feedback', 'Got Us Involved', and 'Active Participation' showed significant ($p<.05$) effect in increasing the score of satisfaction and 'Little Involvement' showed a significant ($p<.05$) effect in decreasing the score of satisfaction. These specific descriptor variables are interpreted as having an effect and therefore the null hypotheses (i.e., that instructional delivery has no effect) is rejected. Likewise, as these descriptors within the overall variable of instructional delivery have demonstrated an effect, the interpretation is that instructional delivery, in general, has an effect on satisfaction with training.

Effect of Demographics on Satisfaction (H1). The absence of any significant regression *F* statistic for the effect of demographics on satisfaction with any of

the four training programs in the research is interpreted as pilot-trainee demographics (as contained on the 2000 ATS) have no effect and therefore the null hypotheses (i.e., demographics have no effect) is accepted.

Correlation of Instructor Trainer Type to Learning Style (H2). An empirical comparison of instructor TTI scores and LSI scores indicates that some instructors prefer to learn in one style but prefer to teach in a style different from the respective congruent LSI. However, in the absence of statistical test of correlation sufficiently robust to produce a significant level, the null hypothesis (i.e., there is no correlation between an instructor's TTI and LSI) is accepted.

Effect of TTI, LSI, and Demographic Background on Instructor Satisfaction (H3). The absence of any significant regression *F* statistic for the effect of TTI, LSI, or any demographic variable for instructors on satisfaction with any of the four training programs in this research implies that neither TTI, nor LSI, nor any demographic variable tested has an effect and therefore the null hypotheses (i.e., a significant difference does not exist) is accepted. As the paired sample *t*-tests returned no significant results (i.e., $p < .05$) between satisfaction as a teacher and as a trainee in any of the four respective training programs, the null hypothesis (i.e., there is no correlation) is accepted.

Correlation Between Satisfaction as a Teacher and as a Trainee (H4). In the absence of a robust statistical procedure to compare instructor satisfaction in four

different programs as a teacher with satisfaction in the same four types of programs as a trainee, the null hypothesis (i.e., that no correlation exists) cannot be rejected for this study. However, an empirical review of the IBS means for satisfaction and the subsequent interviews with three instructors suggest a tendency of pilots to prefer to teach SIM and to take SIM as a trainee over the other three programs (CRM, INDOC, and SYSTEMS).

Implications of this Research.

Effect of Learning Style on Airline Pilot Training. In this research, Kolb's learning styles show no effect on satisfaction with any training program. The implication of the research conclusion regarding the effect of learning style on satisfaction with training is that an airline pilot's preferred learning style has no appreciable effect upon satisfaction with a training program. Several factors might explain this conclusion.

Effect of Instructional Delivery. Although Kolb's learning styles showed no effect on satisfaction with any training program, a subject's perception of how the instruction was delivered remains a significant factor. Subsequent interviews with pilot-trainees corroborated the effect of certain perceptions on satisfaction.

Common to all four programs was the effect of 'Immediate Feedback' from the instructor as enhancing satisfaction and 'Little Involvement' from the instructor as diminishing satisfaction. The multiple appearances of 'Got Us Involved' suggest

a strong enhancing effect of the instructor's ability to get he trainee involved in the training. The enhancing effect of 'Active Participation' from the instructor is notable as it only appears significant in INDOC training. Within the airline industry, and as corroborated by subsequent interviews with pilot-trainees, INDOC training is generally anticipated as being tedious and dry. The overall mean for satisfaction in INDOC training in this study was 3.32, only slightly about Neutral. For those pilots who found INDOC relatively satisfying, "Active Participation' from the instructor may have been a sufficiently unexpected departure from the programs' traditionally dry manner of presentation as to be notable, corroborated by personal interviews. Two personal interviews also suggested that high subject-matter expertise on the part of the instructor enhanced satisfaction. The interviews also indicated that overuse of the Powerpoint presentation (considered 'Mostly Symbols' by the interviewees) tended to diminish satisfaction.

The diminishing effect on satisfaction of the term 'Personal Judgment' was surprising at first. As used in the ATS, 'Personal Judgment' was intended to mean the trainee's judgment. As such, an enhancing effect would have been expected as this implied a desirable control of the means of evaluation by the trainee rather than by the instructor. However, subsequent interviews with pilot-trainees indicated that the term 'Personal Judgment' was interpreted by the respondent to mean the personal judgment of the evaluator or instructor and not

of the respondent. In that context, as corroborated by the interviews, 'Personal judgment' would be undesirable.

When asked in the personal interviews how the terms 'Got Us Involved', 'Immediate Feedback', and 'Active Participation' affected their satisfaction, subjects responded that it definitely enhanced satisfaction, corroborating the survey results. Likewise with the terms 'Little Involvement', 'Mostly Symbols', and 'Personal Judgment', subjects seemed to concur that they diminished satisfaction.

These data provide strong indications of how an instructor should teach. Specifically, more involvement from the instructor, more student involvement and active participation, and immediate feedback from the instructor to the student increases the student's satisfaction with the training. Conversely, little involvement from the instructor and overuse of symbols as opposed to actively involving the student tends to decrease a student's satisfaction.

Instructor Satisfaction and Professional Self-image. The results from the IBS indicate that the instructors tend to prefer to teach SIM more than teaching the other three types of training programs. An empirical review of the data from the IBS also indicates that although most instructors have had training as flight instructors, they have not had a formal college education in teaching or education.

Initially, one might infer that most flight instructors engage in teaching not because they prefer to teach, but more because they prefer to fly. A personal interview with one instructor indicated that she entered the instructor field from a desire to build flight time, recognizing that the fastest way was to be a flight instructor. However, another personal interview indicated that the subject had already enjoyed "helping people learn" in a previous, non-aviation related job, and after becoming an airline pilot, the same desire got him involved as a flight instructor. In still another interview, the subject indicated teaching simulator was a default occupation in the absence of being able to actually 'fly'. This same subject also indicated that he had thoroughly enjoyed his experience as a math teacher in high school. Two of the three personal interview respondents indicated that they would probably continue as a teacher in some other field even if they could not fly. The third interview subject stated a desire to become a professional poker player and indicated no great desire to continue in teaching if flying were not an option. Even with this last case, all respondents indicated a preference of engagement in the training department over line flying, stating that flying the line was too routine and monotonous and teaching added a great deal of variety and challenge.

Differences Between Instructor Learning Style and Teaching Style. An empirical comparison of instructor TTI scores and LSI scores indicates that some instructors prefer to learn in one style prefer to teach in a style different from the respective congruent LSI. This difference may be attributable, in part, to the

varying degree of subject-matter expertise an instructor feels he/she possesses. The four training programs in this study were fundamentally different in content and learning objectives. One instructor interview subject attributed his relatively lower level of satisfaction in teaching SYSTEMS to a lack of confidence in being able to explain the subject matter to the depth he thought was required. He indicated he very much enjoyed teaching SIM and felt he had a high level of expertise in that area.

Another explanation for a difference between one's learning style and teaching style may be in a relationship between one's preferred teaching style and one's preferred style or level of performance. After someone has learned a behavior in his/her preferred learning style, that learning is translated to performance. As the learning progresses through Kolb's Cycle of Learning, performance would presumably progress as well until that person settles into a style of performance most comfortable. These instructors who prefer to learn in a style different from the way they teach may actually prefer to learn the behavior in the context of a one learning style, but after having learned a behavior, are most comfortable performing the behavior in the context of a trainer type not congruent with that learning style. This is corroborated by a personal interview with an instructor who stated, "I prefer to teach in the same way I do it." The subject added, "I just jump in and go," explaining that she was a "doer" and did not care to spend time teaching cognitive skills, but preferred the psychomotor activities of flight instruction.

Another explanation for the difference between one's preferred teaching style and one's learning style might be the validity of the TTI and LSI measuring instruments. Validation of TTI congruency to the LSI has been limited and in a general context. Rigorous validation testing of this congruency in a specific life experience context, such as airline pilot training, might demonstrate significant shortcomings in the congruency between trainer type and learning style.

Significance of the Instructor in the Training. A current trend in airline pilot training is to replace the stand-up instructor with computer-based training. The results of this study demonstrate a significant contribution to satisfaction of the personal contact between the student and instructor. Removing this contact could appreciably diminish that satisfaction and possibly have repercussions on learning effectiveness as well.

Benefit to the Airline Industry. This study has demonstrated a definite link between instructional delivery and a pilot-trainee's satisfaction with the training. Although none of the four teaching styles, as described by Wheeler and Marshall, appears to have an effect when taken as a whole, there are certain descriptors of teaching behaviors within each description that appear to have a universal effect upon satisfaction. Regardless of the trainer type, when teaching, instructor deference to these universal descriptors, such as 'Active Participation', 'Immediate Feedback', and 'Got Us Involved', would probably result in a more satisfying experience for the pilot-trainee and ultimately lead to improved

retention of not only the pilot, but also the instructor. This is especially significant for contract training companies whose product is solely the training of airline pilots (as opposed to airline companies whose product is the transportation of passengers and cargo) and whose customer base is dependent upon the satisfaction of the contracting airline company. If a number of pilots from the customer company complain about an unsatisfying experience with the training they received, then the customer company will seek its training elsewhere. Therefore, airline companies and contract training companies should emphasize these universal teaching behaviors, their effects, and their application in formal instructor training programs.

Recommendations for Further Study.

The Link between Training Satisfaction and Employee Retention. This study has explored the link between learning style and teaching style and their effects on satisfaction with a training experience, and has concluded that although learning style seems to have no effect on satisfaction, instructional delivery does have an effect. The next step would be to explore the effect satisfaction has on actual retention. A survey similar to the 2000 Aviation Training Survey should be modified to collect data regarding a pilot-trainee's career desires along with his/her perception of satisfaction with specific training programs. For example, the subject should be asked to rate the level of satisfaction with specific aspects of his/her employment with the company, such as training, pay, benefits, management style, schedule, and compare these to

the subject's overall satisfaction with the company. Assuming that satisfied employees tend to remain longer with a company, results from such a survey could help discern just which aspects of employment have the greatest impact upon overall satisfaction, and therefore, retention.

Research Summary.

According to this research study, one's individual learning style seems to have little to do with shaping one's satisfaction with training in any specific context. One's teaching style seems to be driven by factors other than the way one learns. However, there are certain commonalties in instructional delivery that appear to universally enhance satisfaction or diminish satisfaction and that should be considered by all teachers regardless of the content of the training. This study also suggests that professional self-image as an airline pilot is independent from one's self-image as a teacher/instructor. Finally, although deference to instructional delivery would probably improve an individual's satisfaction with a training experience, further research is needed to establish an actual link between satisfaction and the retention of experienced airline pilots.

Appendix A

Reference Search Sources

The search for supporting literature in this study was extensive. Resources employed included the University of Maryland library search engine and the World Wide Web. Direct sources included:

- Buros Tests in Print
- Dissertation Abstracts
- EBSCOHost
- Education Abstracts
- ERIC
- ERICAE (tests and measurements)
- George Mason University library catalogues
- Mental Measurements Yearbook (MMY)
- Microform catalogues
- Periodical catalogues
- St. John's University Center for Teaching and Learning
- U.S. Air Force websites
- University of Maryland library catalogues
- Worldcat
- WWW keywords

Keywords used that returned relevant resources included 'Kolb learning style inventory', 'teaching style', 'teaching effectiveness', 'learning style', experiential learning', self-efficacy', 'retention' (job, employee), 'aviation training', 'test and measurements', 'human factors', 'perception', and 'performance'. Practically all references returned for the keyword 'pilot' were in the context of an initial, exploratory program and not referring to an airplane pilot. However, these searches did return sufficient relevant references for the study, over 200 of which were pulled or printed out in full text.

Appendix B

Request Letter to the Airline Company to do Research

Letter of Introduction (Instructors)

Letter of Introduction (Pilots)

Lottery Redemption Coupon

Miles M. Hamby
6505 Hillside Lane, Alexandria, VA 22306
703-768-1353 • ATCMiles@aol.com

January 21, 2000

(To Director
name & address
removed to protect
anonymity of company
under study)

Dear XXXX,

I am a candidate for a Ph.D. at the University of Maryland engaged in research into the learning styles of airline pilots. Capt. Randy Hamilton, with whom I have been working, suggested I contact you to set up a meeting regarding [company's] possible participation.

My thesis is that a difference in the way pilots learn and the way they are taught results in a difference in the satisfaction and effectiveness of the training. This research has never before been applied to aviation training, nor in particular to airline pilots.

The study involves the completion of a questionnaire by a randomly selected sample of pilots and instructors at your company. The questionnaire is specifically oriented toward the pilot-trainee or the instructor. (Examples of the questionnaires are attached for your review.) Participation would be voluntary and the returned questionnaires would be anonymous and confidential. The research topic and methodology has been approved by the University of Maryland Graduate School.

As this dissertation might be published, there will be no mention of your company by name and a copy of the dissertation will be forwarded to you for your review. The findings from this study should provide an excellent foundation for improving aviation training.

I am asking only that my questionnaires be distributed randomly to the pilot and instructor forces, probably via their individual crew distribution files/boxes. The individual may complete the form and return it in the attached self-addressed, stamped envelope as he/she chooses. There will be no record of who received or returned the surveys.

I look forward to talking with you soon.

Miles M. Hamby
Principle Researcher

Letter of Introduction
for
A Research Project on the Learning Styles of Airline Pilots

Dear fellow Aviation Instructor,

I am a candidate for a Ph.D. at the University of Maryland engaged in research into the learning styles and teaching styles of airline pilots. The research I am doing has never before been applied to aviation training, nor in particular to airline pilots. The FAA and [your airline company] have expressed interest in this research as it could provide some substantial foundation toward effecting positive changes in the way airline training is conducted and delivered.

All I ask is that you complete the enclosed survey and return it in the pre-paid, addressed envelope. This should take less than 30 minutes of your time.

The enclosed survey form is designed to identify your background in aviation training, your preferred teaching style, and your preferred style of learning. The survey is completely anonymous. The number at the top only distinguishes the data from one survey from the data of the others. The survey is also sufficiently general so as to preclude identification of the respondent. Prior to distribution, the survey packages were shuffled and then distributed completely randomly. There is no record of which number went to which respondent. The survey will be mailed to me, the researcher, in a self-addressed, stamped envelope, provided for your convenience. To preserve anonymity, please do not place any identifying marks on or in the envelope or on the survey. Your specific data will be entered into a database and remain confidential.

There will be no request or requirement for any physical experimentation or mental examination outside of your opinions on the surveys and you will not be placed at any sort of physical risk.

Your participation is completely voluntary and has been approved by the Human Resources Department and Chief of Training of [your company], and the University of Maryland.

As another incentive, the results and meaning of your Learning Style Inventory will also be posted on my website according to survey number of those returned. Be sure to visit my website after March 30 to find out what it all means to you!

As a professional in aviation, I know you have many ideas about improving your training experience. Your input on this survey will be very helpful. Thanks for your generous consideration.

Miles M. Hamby
Researcher
ATCMiles@aol.com

Letter of Introduction
for
A Research Project on the Learning Styles of Airline Pilots

Dear fellow pilot,

I am a candidate for a Ph.D. at the University of Maryland engaged in research into the learning styles and teaching styles of airline pilots. The research I am doing has never before been applied to aviation training, nor in particular to airline pilots. The FAA and [your airline company] have expressed interest in this research as it could provide some substantial foundation toward effecting positive changes in the way airline training is conducted and delivered.

All I ask is that you complete the enclosed survey and return it in the pre-paid, addressed envelope. This should take less than 30 minutes of your time.

The enclosed survey form is designed to identify your background in aviation, your perception of satisfaction with several training programs, and your preferred style of learning. The survey is completely anonymous. The number at the top only distinguishes the data from one survey from the data of the others. The survey is also sufficiently general so as to preclude identification of the respondent. Prior to distribution, the survey packages were shuffled and then distributed completely randomly. There is no record of which number went to which respondent. The survey will be mailed to me, the researcher, in a self-addressed, stamped envelope, provided for your convenience. To preserve anonymity, please do not place any identifying marks on or in the envelope or on the survey. Your specific data will be entered into a database and remain confidential.

There will be no request or requirement for any physical experimentation or mental examination outside of your opinions on the surveys and you will not be placed at any sort of physical risk.

Your participation is completely voluntary and has been approved by the Human Resources Department and Chief of Training of [your company], and the University of Maryland.

As another incentive, fifteen cash awards will be awarded from a drawing of the surveys returned and the results will be posted on my website according to survey number of those returned. Be sure to visit my website http://members.aol.com/milesflight after March 30!

As a professional in aviation, I know you have many ideas about improving your training experience. Your input on this survey will be very helpful. Thanks for your generous consideration.

Miles M. Hamby
Researcher
ATCMiles@aol.com

LOTTERY REDEMPTION COUPON
DO NOT LOSE THIS COUPON

Survey No. _____

After March 30, visit website
http://members.aol.com/milesflight
to see if you have won a cash award for returning a research survey. The award winners will be posted by survey number, along with the amount won. If the Survey No. above matches one of the numbers on the list of award winners, then you have won an award. To redeem your award, write in any name and address you choose (to preserve anonymity as you desire) in the space provided, affix a stamp on the other side, and mail this coupon. A check will be sent to that name and address. THANKS FOR PARTICIPATING!

NAME _____

ADDRESS _____

CITY/STATE/ZIP _____

Warning --This form has been specially treated to insure authenticity! Evidence of tampering or forgery will result in immediate disqualification!

Appendix C

Kolb's Learning Style Inventory

As a proprietary instrument, permission to print Kolb's Learning Style Instrument in this dissertation was not granted. However, the complete instrument may be obtained by contacting the Hay Group on the internet at www.trgmcber.haygroup.com/products/learning/lsius.htm or telephoning at 800-729-8074 or 617-927-5080.

Appendix D

2000 Aviation Training Survey

Training Satisfaction Survey

Learning Style Inventory

2000 AVIATION TRAINING SURVEY

(Please answer ALL the items on this survey to the best of your knowledge.)

1. Write in your current age *(e.g. '37')* _____

2. Circle your gender/sex. MALE FEMALE

3. Circle your highest educational level.

   HS DIPLOMA COLLEGE BACHELOR MASTER DOCTORAL

4. Circle all the types of educational institutions you have attended.

   PUBLIC HS PRIVATE HS STATE COLLEGE PRIVATE COLLEGE

   MILITARY/SERVICE ACADEMY SPECIALTY COLLEGE *(specify, e.g. Embry Riddle)* _____

5. Write in the number of years it has been since you first acquired your private flying/airmen's certificate. _____years

6. Circle all certificates and ratings that apply to you:

   ATP COMMERCIAL TYPE RATINGS *(circle one)* → NONE 1 2 3 >3

7. Write in your TOTAL flying hours *(approximate to nearest 100)* _____hours

8. Write in your approximate flying hours *(to nearest 100)* in the following categories:

   LARGE TRANSPORT (over 12,500 lbs) _____ hours

   JET TRANSPORT _____ hours

   CORPORATE _____ hours

   PART 135 _____ hours

   PART 121 _____ hours

   MILITARY _____ hours in *(circle →)* ARMY NAVY AF MARINES CG

   CIVILIAN FLIGHT INSTRUCTOR _____ hours

9. Check all the types of aviation training programs you have completed as a ***trainee*** *(not as an instructor)*:

   - ☐ PART 141/142 ATP (non-type rating)
   - ☐ MILITARY BASIC PILOT TRAINING
   - ☐ MILITARY INSTRUCTOR PILOT
   - ☐ PART 121 AIRLINE FLIGHT ENGINEER
   - ☐ PART 141/142 ATP TYPE RATING
   - ☐ MILITARY COMBAT CREW TRAINING
   - ☐ AIRLINE COMPANY INITIAL QUAL.
   - ☐ PART 121 AIRLINE CAPTAIN UPGRADE

Training Satisfaction Survey

In each of the four aviation training programs below, circle the most appropriate response.

1. CREW RESOURCE MANAGEMENT TRAINING

My experience with Crew Resource Management Training was: *(circle only one)*

VERY SATISFYING SATISFYING NEUTRAL UNSATISFYING VERY DISSATISFYING

In each of the five sets below (A through E), circle the word or phrase that describes your perception of the instruction you received in Crew Resource Management Training.

A	*Instructional Techniques*	FREE DISCUSSION	LECTURE BASED	THEORY BASED	ACTIVITY BASED
B	*Instructor involvement*	STUDENT-DIRECTED	LITTLE INVOLVEMENT	GAVE TIME TO THINK ALONE	ACTIVE PARTICIPATION
C	*Means of Teaching*	GOT US INVOLVED	MOSTLY INSTRUCTIONS	MOSTLY SYMBOLS	MOSTLY ACTIONS
D	*Nature of Instructor*	LISTENER	DIRECTOR	INTERPRETER	COACH
E	*Means of Evaluation*	IMMEDIATE FEEDBACK	OBJECTIVE TESTS	SUBJECTIVE TESTS	PERSONAL JUDGMENT

2. COMPANY INDOCTRINATION TRAINING

My experience with Company Indoctrination Training was: *(circle only one)*

VERY SATISFYING SATISFYING NEUTRAL UNSATISFYING VERY DISSATISFYING

In each of the five sets below (A through E), circle the word or phrase that describes your perception of the instruction you received in Company Indoctrination Training.

A	*Instructional Techniques*	FREE DISCUSSION	LECTURE BASED	THEORY BASED	ACTIVITY BASED
B	*Instructor involvement*	STUDENT-DIRECTED	LITTLE INVOLVEMENT	GAVE TIME TO THINK ALONE	ACTIVE PARTICIPATION
C	*Means of Teaching*	GOT US INVOLVED	MOSTLY INSTRUCTIONS	MOSTLY SYMBOLS	MOSTLY ACTIONS
D	*Nature of Instructor*	LISTENER	DIRECTOR	INTERPRETER	COACH
E	*Means of Evaluation*	IMMEDIATE FEEDBACK	OBJECTIVE TESTS	SUBJECTIVE TESTS	PERSONAL JUDGMENT

3. GROUND SCHOOL TRAINING

My experience with Crew Resource Management Training was: *(circle only one)*

VERY SATISFYING SATISFYING NEUTRAL UNSATISFYING VERY DISSATISFYING

In each of the five sets below (A through E), circle the word or phrase that describes your perception of the instruction you received in Crew Resource Management Training.

A	*Instructional Techniques*	FREE DISCUSSION	LECTURE BASED	THEORY BASED	ACTIVITY BASED
B	*Instructor involvement*	STUDENT-DIRECTED	LITTLE INVOLVEMENT	GAVE TIME TO THINK ALONE	ACTIVE PARTICIPATION
C	*Means of Teaching*	GOT US INVOLVED	MOSTLY INSTRUCTIONS	MOSTLY SYMBOLS	MOSTLY ACTIONS
D	*Nature of Instructor*	LISTENER	DIRECTOR	INTERPRETER	COACH
E	*Means of Evaluation*	IMMEDIATE FEEDBACK	OBJECTIVE TESTS	SUBJECTIVE TESTS	PERSONAL JUDGMENT

4. SIMULATOR TRAINING

My experience with Simulator Training was: *(circle only one)*

VERY SATISFYING SATISFYING NEUTRAL UNSATISFYING VERY DISSATISFYING

In each of the five sets below (A through E), circle the word or phrase that describes your perception of the instruction you received in Simulator Training.

A	*Instructional Techniques*	FREE DISCUSSION	LECTURE BASED	THEORY BASED	ACTIVITY BASED
B	*Instructor involvement*	STUDENT-DIRECTED	LITTLE INVOLVEMENT	GAVE TIME TO THINK ALONE	ACTIVE PARTICIPATION
C	*Means of Teaching*	GOT US INVOLVED	MOSTLY INSTRUCTIONS	MOSTLY SYMBOLS	MOSTLY ACTIONS
D	*Nature of Instructor*	LISTENER	DIRECTOR	INTERPRETER	COACH
E	*Means of Evaluation*	IMMEDIATE FEEDBACK	OBJECTIVE TESTS	SUBJECTIVE TESTS	PERSONAL JUDGMENT

Learning Style Inventory

(The fourth page of the 2000 Aviation Training Survey administered to the pilot-trainees was Kolb's LSI. As a proprietary instrument, permission to print Kolb's LSI was not granted. See Appendix C.)

Appendix E

Instructor Background Survey

Instructor Satisfaction Survey

Trainer Type Inventory

Learning Style Survey

INSTRUCTOR BACKGROUND SURVEY

Please complete ALL items in the survey.

1. Write in your current age *(e.g. '51')* _____

2. Circle your gender/sex. MALE FEMALE

3. Circle your highest educational level.

   HS DIPLOMA COLLEGE BACHELOR MASTER DOCTORAL

4. Write in the number of years experience you have as a teacher/instructor.

   _____ years

5. Circle all the types of *formal* teacher or instructor training you have experienced.

   COLLEGE CREDIT COURSES IN EDUCATION

   MILITARY INSTRUCTOR TRAINING COURSES

   CORPORATE/COMPANY SPONSORED TEACHER/INSTRUCTOR TRAINING

   CERTIFIED FLIGHT INSTRUCTOR (CFI) TRAINING

   OTHER *(specify)* _____

6. Indicate your TOTAL flying hours *(approximate to nearest 100)* _____hours

7. Circle all the types of aviation training programs you have experienced as a ***trainee*** *(not as an instructor).*

   PART 141/142 ATP TYPE RATING

   MILITARY PILOT TRAINING

   MILITARY INSTRUCTOR PILOT TRAINING

   PART 121/135 AIRCREW QUALIFICATION FOR AN AIRLINE OR COMMERCIAL OPERATOR

   CORPORATE ADMINISTERED AIRCRAFT QUALIFICATION

   OTHER *(please specify)* _____

8. If you were asked "What is your avocation?" how would you respond in one or two words?

   I am a(n) _____.

Instructor Satisfaction Survey

As an instructor:

I find teaching COMPANY INDOCTRINATION TRAINING: *(circle one)*

VERY SATISFYING SATISFYING INDIFFERENT UNSATISFYING VERY UNSATISFYING

I find teaching CREW RESOURCE MANAGEMENT TRAINING: *(circle one)*

VERY SATISFYING SATISFYING INDIFFERENT UNSATISFYING VERY UNSATISFYING

I find teaching SYSTEMS GROUND SCHOOL: *(circle one)*

VERY SATISFYING SATISFYING INDIFFERENT UNSATISFYING VERY UNSATISFYING

I find teaching SIMULATOR TRAINING: *(circle one)*

VERY SATISFYING SATISFYING INDIFFERENT UNSATISFYING VERY UNSATISFYING

As a trainee:

As a trainee, I found COMPANY INDOCTRINATION TRAINING: *(circle one)*

VERY SATISFYING SATISFYING INDIFFERENT UNSATISFYING VERY UNSATISFYING

As a trainee, I found CREW RESOURCE MANAGEMENT TRAINING: *(circle one)*

VERY SATISFYING SATISFYING INDIFFERENT UNSATISFYING VERY UNSATISFYING

As a trainee, I found SYSTEMS GROUND SCHOOL: *(circle one)*

VERY SATISFYING SATISFYING INDIFFERENT UNSATISFYING VERY UNSATISFYING

As a trainee, I found SIMULATOR TRAINING: *(circle one)*

VERY SATISFYING SATISFYING INDIFFERENT UNSATISFYING VERY UNSATISFYING

Trainer Type Inventory

The purpose of this inventory is to gain insight into the way you prefer to teach. Below are 12 sets of 4 words or phrases that describe a range of teaching styles. There is no correct or incorrect style of teaching – no right or wrong answers – no style more effective that another.

In each of the sets, please rank each word or phrase by assigning a "4" to that which *best* describes or reflects the way you prefer to teach, a "3" to the word or phrase that next applies to your preferred teaching style, a "2" to the one that next applies to your preferred teaching style, and a "1" to the word or phrase that *least* describes your preferred teaching style. Please insure each word or phrase is uniquely scored with a 4, 3, 2, or 1. Upon completion, please place the form in the mailer envelope provided and post.

1. When I teach, I prefer:

____ subgroups ____ lectures ____ readings-study questions ____ lecture-discussion

2. When I teach, I prefer:

____ showing ____ perceiving ____ helping ____ hearing

3. When I teach, I like to use:

____ symbols ____ actions ____ people ____ instructions

4. When I teach, I prefer:

____ small groups ____ free expression ____ observing ____ think and apply

5. When I teach, I prefer:

____ immediate personal feedback ____ objective tests ____ subjective tests ____ personal evaluation

6. When I teach, I regard myself as a(n):

____ expert ____ scholar ____ advisor ____ friend

7. When I teach, I prefer:

____ using practical theory ____ practical skills ____ application to real life ____ to evaluate information

8. When I teach, I regard myself as a(n):

____ facilitator ____ senser ____ organizer ____ interpreter

9. When I teach, I prefer:

____ seeking whom ____ telling how ____ finding why ____ asking what

10. When I teach, I prefer:

____ analyzing information ____ integrating observations and theory ____ doing ____ describing

11. When teaching my students, I prefer to:

____ lead them to understand it ____ leave them to do it ____ let them enjoy it ____ get them to think about it

12. When I teach:

____ its yours ____ its ours ____ its mine ____ its theirs

Learning Style Inventory

(The fourth page of the Instructor Background Survey administered to the instructors was Kolb's LSI. As a proprietary instrument, permission to print Kolb's LSI was not granted. See Appendix C.)

Appendix F

Trainer Type Inventory Score Sheet

Trainer Type Inventory Interpretation

Trainer Type Inventory Score Sheet *for Subject No. ____*

Place the numerical score indicated by the respondent on the TTI next to the respective item on the TTI Score Sheet. Total each column to obtain a total score for each of the four teaching styles. The highest score indicates the respondent's preferred teaching style.

LISTENER	DIRECTOR	INTERPRETER	COACH
1. ____	____ lectures	____ readings-study questions	____ lecture discussion
2. ____ hearing	____ showing	____ perceiving	____ helping
3. ____ people	____ instructions	____ symbols	____ actions
4. ____ free expression in	____ observing	____ think and apply	____ small group discussions
5. ____	____ objective tests	____ subjective tests	____ personal evaluation
6. ____ friend	____ expert	____ scholar	____ advisor
7. ____	____ evaluate information	____ using theory	____ practical skills
8. ____ senser	____ organizer	____ interpreter	____ facilitator
9. ____ seeking whom	____ telling how	____ finding why	____ asking what
10. ____	____ analyzing information	____ integrating observations and theory	____ doing
11. ____ let them enjoy it	____ get the to think about it	____ lead them to understand	____ leave them to do it
12. ____ its ours	____ its mine	____ its theirs	____ its yours
____ TOTAL	____ TOTAL	____ TOTAL	____ TOTAL

TRAINER TYPE INVENTORY INTERPRETATION

COACH

- Trains the Active Experimenter most effectively
- Creates a behavioral learning environment
- Allows learners to evaluate their own progress
- Involves learners in activities and discussions
- Puts learners in touch with one another
- Draws on the strengths of the group
- Uses the learners as resources
- Helps learners to verbalize what they already know
- Acts as facilitator to make the experience more comfortable and meaningful
- Is clearly in charge
- Employs activities, projects, and problems based on real life
- Encourages active participation

LISTENER

- Trains the Concrete Experiencer most effectively
- Creates an affective learning environment
- Encourages learners to express personal needs freely
- Assures that everyone is heard
- Shows awareness of individual group members
- Reads nonverbal behavior
- Want learners to be self-directed and autonomous
- Exposes own emotions and experiences
- Shows sympathy
- Feels comfortable with all types of expression
- Does not seem to 'worry' about the training
- Stays in the 'present'
- Is practical
- Appears relaxed and unhurried

INTERPRETER

- Trains the Abstract Conceptualizer most effectively
- Creates a symbolic learning environment
- Encourages learners to memorize terms and rules
- Connections past to present
- Integrates theories and events
- Separates self from learners, prefers to observe
- Acknowledges others' interpretations as well as own
- Uses theory as a foundation
- Encourages generalizations
- Presents well-constructed interpretations
- Listens for thoughts, often overlooks emotions
- Wants learners to have thorough understanding of facts and terminology
- Uses case studies, lectures, readings
- Encourages learners to think independently
- Provides information based on objective data
- Evaluates from subjective criteria

DIRECTOR

- Trains the Reflective Observer most effectively
- Creates a perceptual learning environment
- Takes charge
- Gives directions
- Prepares notes and outlines
- Appears self-confident
- Is well organized
- Evaluates with objective criteria
- Is the final judge of what is learned
- Based mostly in lectures
- Is conscientious (sticks to agenda)
- Concentrates on single item at a time
- Tells participants what to do
- Is conscious of time
- Develops contingency plans
- Provides examples
- Limits and controls participation

From Wheeler and Marshall, 1986, p. 96.

Appendix G

Pilot-Trainee Personal Interview Guide

Instructor Personal Interview Guide

Personal Interview Summaries

Pilot-trainee Personal Interview Guide

Purpose. The purpose of this interview is to qualitatively verify the respondent's quantitatively identified learning style and to identify the specific areas of satisfaction and dissatisfaction with aviation training and the effect this has or might have on his/her employment retention.

Method. Have respondent complete an ATS. Score the LSI portion and identify the respondent's preferred Learning style. Ask the respondent to read the descriptions of the learning styles, then to state which one he/she feels best suits. Compare this to the one scored on the LSI. Ask the respondent the following questions and take notes:

Questions.

1. How well do you feel the results of the LSI match your learning style?
2. How well do you feel your instructors met your style of learning and your learning needs?
3. Do you feel you had to adapt your style of learning more than usual to get through the training?
4. Looking at the Satisfaction Survey, how do interpret these descriptors for instructional delivery? (point to a specific descriptor)
5. How do you feel this (specific descriptor) effects your satisfaction of dissatisfaction?
6. What was your most memorable experience in training?
7. How long have you been employed by this company?
8. What would be the major consideration for your staying with or leaving this company?
9. What effect did this training experience have on your outlook toward continued employment with this company?
10. How would you improve the training experience?

Instructor Personal Interview Guide

Purpose. The purpose of this interview is to qualitatively verify the respondent's quantitatively identified learning style and trainer type and to identify the respondent's perceptions of deferring to student learning style and why the respondent is involved in aviation instruction.

Method. Have respondent complete an LSI, TTI, and IBS. Score the instruments and identify the respondent's preferred learning style and trainer type (attach them to this form). Using the written descriptions of Kolb's learning styles and Wheeler's and Marshall's trainer types, explain the results to the respondent. Ask the respondent the following questions and take notes:

Questions.

1. How did you get into teaching?
2. What do you like most about teaching?
3. What do you like the least about teaching?
4. What benefit or reward do you derive from teaching flying?
5. Which type of teaching do you prefer—flight instruction or ground school? Why?
6. What do you look for you when are teaching?
7. How well do you think the LSI and TTI match your learning style and teaching style?
8. When you teach, do you try to match your style of teaching to the way your students learn? Why not? (or) How do you do this?
9. In one or two words, how would you describe your vocation?
10. If you were no longer permitted to teach simulator, how would this effect your career goals? With this company specifically?

Personal Interview Summaries

The following is a summary of the recorded personal interviews of two pilot-trainees and three instructors. Subjects were asked to complete an Aviation Training Survey or Instructor Background Survey, as appropriate. As the LSI and TTI were being scored, the subjects were asked to identify their learning style and trainer type from the written descriptions. Subjects were then asked questions following the Personal Interview Guides. The text presented below is a paraphrasing of the responses from the tapes and therefore does not appear in quotes except where it is the word or phrasing actually used. Text appearing in italics are the questions.

PILOT-TRAINEE INTERVIEW 1

LSI score -- 'Converger'
From descriptions – 'Converger'

What does the term 'Lecture Based' mean to you? Mostly the instructor telling us information with no feedback from student or questions from the student.

Is that satisfying? If it is relevant, but I prefer more lecture based.

You indicated you prefer lecture based in SYSTEMS training? Yes, it tended to work well to take in the information.

How would you define 'Student-directed'? It seemed focused on students, getting to get them to understand about themselves, rather than the instructor being more into what the instructor felt the student need.

Do you prefer 'Mostly Instructions' in CRM ? No, I prefer more illustrations.

Do you prefer more symbols? Yes.

How do you define 'Director'? He's not listening or one who is more open – a director is more definitive, as "this is the right answer!"

For INDOC, you noted 'Neutral' satisfaction and noted the Instructor as 'Interpreter'. Yes, I think an 'Interpreter' is more satisfying because more open to other ideas, but the material and efficiency in INDOC class was less satisfying. The 'Director' term seemed more closed-minded.

You note SIM as 'Satisfying' and note 'Immediate Feedback' for means of evaluation. Yes, in CRM the instructor was quick to tell us when something wasn't the best answer. We knew right away she didn't agree. SIM was the same – the instructor told us right away if we were going down the wrong path.

Is there a difference between 'Immediate Feedback' in SIM and CRM ? They were both appropriate, but less satisfying in CRM. The instructor was more 'Director', had a more definite right answer than was open for discussion.

You note SYSTEMS as 'Satisfying'. Yes, I definitely preferred the 'Lecture based' approach. There was a lot of information to convey and has to be done that way.

What is your preference in CRM? I would prefer more 'Free Discussion'. 'Theory based' implies scenarios, go to each person and ask "how would you handle this?"

You note SIM as 'Satisfying'. Was this due in part to 'Activity Based' as your preference? Yes.

Regards 'Instructor Involvement', was there a difference in satisfaction between 'Active participation' and 'Gave Time to Think Alone'? Yes, 'Active Participation' was appropriate for SIM, but in SYSTEMS it would have been more satisfying if it had been more student-directed, making sure students understand how it would benefit them. 'Time to Think Alone' seemed to be isolated and detached in SYSTEMS. I preferred more student-directed in SYSTEMS.

In SIM, you indicated 'Coach". This is preferred? Yes, my preference. Also, 'Immediate Feedback' was most appropriate means of evaluation for the most satisfaction.

How would you define 'Personal Judgment'? It is the instructor's feelings or opinions.

How long have you been with this company? About two years. This is my second training experience.

What is you most memorable training experience? Simulator checkrides. They were so hard, I remember in detail what I did well and what I did poorly. Very intense and remains an intense memory. A lot of stress. Healthy amount of stress – helped me perform better. Too much stress would have been detrimental.

What would be major consideration of yours to remain with company? Pay and benefits.

How important is your training experience in your retention? Training is important. Something I guess I took for granted. If I went to a company with bad training, I guess it would make me appreciate a company with good training more.

What is your perception of training in a major airline? I would expect it to be organized, thorough, and intense. I would expect it to be more stressful, which would be less satisfying. But I also believe that is necessary.

Why would you expect it to be more stressful? I guess I think a larger company, larger aircraft, more complicated, I would put a little more pressure on myself, and their expectation would be to bring everybody up to a higher standard and push a little more.

How would an unsatisfying experience affect you? I certainly wouldn't look forward to it. I would come into it defensively. It might be a consideration to leave the company, even if flying the line was satisfying.

How would you improve this training experience? Better communication in the training schedule. A few times I haven't been able to contact somebody with a problem – don't always know ahead of time what I'm doing and had to chase down somebody.

How do you feel the instructors adapted to your learning style? For SYSTEMS, she did not adapt to my preferred style. Probably because I detached myself.. Would have preferred more benefit to us to be explained. But, I just let her go on.

Do you feel you had to adapt more in the program than you would have liked in order to meet the objective? For INDOC, had to study with others when I preferred to study alone. Living in the same house as my classmates, I couldn't find a place to study alone. It was difficult to find quiet time.

How about SIM? That has more to do with other people, but would have preferred to have more time with my partner.

How about SYSTEMS? Prefer to do it alone.

[Interviewer's note: Upon conclusion of the interview, the subject was shown how she tested on the LSI and compared it to her response from reading the learning style descriptions. The interviewer also compared the training program of the company for which she worked to those of the major airlines, indicating that they were comparable in intensity but her current one was arguably more oriented toward the trainee, based upon the in-depth expertise of the interviewer. The subject expressed surprise and added that this gave her a heightened appreciation of the training programs of regional airlines.]

PILOT-TRAINEE INTERVIEW 2

LSI score – 'Accommodator'
From descriptions – 'Assimilator'

Why did you indicate 'Assimilator'? I tend to pull in all information. It seems I project to what needs to happen and then carry out the thing. Works best if I have a problem drawn out in my mind. That sounded like the 'Assimilator' to me.

Please reread the 'Accommodator' description and tell me if it is any different. Actually, that does seem a little more like me.

You noted SIM as 'Very satisfying'. Yes.

You noted CRM as 'Satisfying' and noted 'Free Discussion'. Yes, it was a more satisfying aspect. At any moment, you may ask a question and I prefer that.

You noted INDOC as only 'Satisfying' and noted 'Lecture Based'. Would it have been more satisfying if it had been 'Free Discussion'? Yes, but we had a limited amount of time to absorb a lot of information. It was more of a case of 'sit there and take notes', and tended away from satisfying.

You noted SYSYEMS as 'Satisfying' and noted 'Lecture Based'. Did this lend to satisfaction? No, it actually moved away from it. There was not enough free discussion.

You noted SIM as 'Very satisfying' and noted 'Director' for the instructor. Yes, I am new, have little knowledge, and needed someone with an exact idea of what I should do, and being directed to do it. I don't have enough knowledge to interject any ideas of my own. A 'Director' was a favorable word.

Was 'Director' different from 'Coach'? A 'Coach' is more like the high school days – an inspirer. Very encouraging. I don't think I had a coach type feeling, just telling me what I need to do. However, I wanted more direction in my training.

For 'Means of Evaluation', you noted 'Immediate Feedback'. Yes, I was thinking of the debriefs after the SIM event. Open discussion, developing ideas. I like that.

You noted SYSTEMS as 'Satisfying' and noted 'Objective Tests'. We just had class each day, and at the end of the week, we took a test. That way, I had an idea of how well I was doing, and only had the test at the end to see how we had finally finished. It was my expectation to have objective tests. In the SYSTEMS context, it was appropriate. I would have preferred more tests to get a better

idea of how I was doing. SYSTEMS was concrete. But in SIM, I need immediate feedback to work with ideas and ways of doing things.

What does the term 'Personal Judgment" mean to you? The instructor's personal judgment.

You noted 'Active Participation' in CRM. How did this differ with INDOC and SIM. Did this lend to satisfaction? INDOC and SYSTEMS were rote information. INDOC, we had a really good instructor who knew her stuff, she was able to answer questions quickly. I called her 'Active Participation' versus the SYSTEMS experience where the instructor put it up on the board, explained it and moved on. That instructor was 'Gave time to think alone', which I interpreted as time away from class. I think that was just the way it was. I was neutral about it. 'Active participation' lends more to satisfaction for me.

You noted 'Means of teaching' as 'Mostly Instructions' on all four training programs. Yes, it was brand new training to me, so just needed to learn, not many ideas or my own experience to go from. CRM was 'Mostly Instructions'. I think getting people more involved would have been more helpful. It would have been nice to try doing some scenarios rather than just watch the videos. INDOC was mostly instructions, too. We had a lot of info to get through and the instructions were from the sense of interpreting what the regulations and company procedures mean. I don't know enough, so I was just taking it all in. CRM is more personal, and needed a more active participation approach than INDOC. In SYSTEMS, I would like to have seen more 'Got us involved'.

What does 'Mostly Symbols' mean to you? Charts, figures, diagrams.

How about the Powerpoint media? Was it overused? No, not really.

You noted SIM as 'Mostly Instructions' but also 'Very satisfying'. Yes, that's the way I preferred it.

How long have you been with this company? This is my first airline and I've been with company for nine months. I've had a lot a lot of training programs in nine months.

What would be your greatest consideration for staying or leaving? Scheduling operations. They just went to a new system where you had days on duty for 13 hours with only three hours flying time and a lot of sitting around doing nothing.

How about training as retention factor? As long as I feel the training is satisfactory, I'm assured of the safety of myself and the other pilots on the line, I don't go to the point where the training has to be satisfying. I am very frustrated with having had a different instructor for every SIM ride, causing different interpretations and confusion. I tend to define 'Satisfying' from the aspect of

safety and correctness rather than from how good I feel emotionally about it. I want to know others going through the program are meeting the standards as well.

What was your most memorable training experience? In the SIM, I misidentified an engine failure and crashed. I've never crashed a SIM before. For the first two days I was very disappointed in myself. Disappointed with the training also, because we had had our third instructor and I got a different instruction on setting power and altitude calls.

How would you improve your training experience? Put a videotape recorder in the SIM so I can see right away how I did.

How well did the instructor match your learning style? Actually, I tend to learn well from books.

[Interviewer's note: The subject seemed to look to the instructor as a guide toward the right direction and preferred immediate feedback as a check on his progress.]

INSTRUCTOR INTERVIEW 1

LSI score – 'Converger'
From descriptions – 'Accommodator'

TTI score – 'Coach/Listener'
From descriptions – 'Coach'

Why did you pick 'Accommodator'? Well, sales is not a job I would pick. [Interviewer's note: reference to description of 'Converger'.]

Why did you pick 'Coach'? I feel I can read non-verbal behavior. Like to have them tell me what it is they don't understand so I can rephrase it.

How did you get into teaching? My first experience was as a Cub Scout leader. I liked teaching them. Then I became a Navy ground school instructor and flight instructor. I like being in front of the room and have people listen to me.

What do you like most about teaching? I like to see someone 'get it' or understand something they've been puzzled by.

What do you like the least? Well, it's not about teaching so much as the stuff going on outside it. Like the environment. Some things go on that unnecessarily complicate the process. Administration.

What benefit do you derive from teaching flying? For me, it's a substitute, having lost my medical and can't fly as a pilot. I would prefer flight instruction. Flying itself, especially the big jets, would have gotten boring, so I would have been involved in teaching or as a SIM instructor or check airman at some point in my career.

What would you do if you couldn't teach any kind of flying? I'd teach math and science or physics. I actually got a teaching certificate in high school and taught in high school. I think its really fun to see somebody get it, especially math.

What do you look for when teaching? If they don't understand, I try to find out just what it is they don't get and then try to rephrase or somehow help them get it.

How well do you feel you adjust your teaching style to student learning style? I like to think I do it fairly well. In many cases I do well. I think that is one of my strong points, to be able to pick up on the kind of question someone asks and figure out how to best teach it to him.

Are you more satisfied teaching CRM and SIM? Probably both are satisfying, but very satisfying with SIM. I teach company INDOC once every eight months and find it frustrating catching up on the changes. If I would have to teach it today, I would have to talk to our local authority about it. The content of INDOC is not as satisfying to me as SYSTEMS or SIM.

As a trainee, why did you indicate your found SIM more satisfying than the other three programs? INDOC as a trainee, was not well organized. Also, SIM was 'doing stuff', hands-on, activity.

How would you define yourself? Aviator first or teacher first? An aviator.

[Interviewer's note: Although the subject stated he defined himself as an aviator first, the body of his interview indicated an equal desire and interest in teaching.]

INSTRUCTOR INTERVIEW 2

LSI score – 'Accommodator'
From descriptions – 'Diverger'

TTI score – 'Coach'
From descriptions – 'Coach'

How did you get into teaching? I became a flight instructor because it was the best way to build flying hours.

What do you like most about teaching? The process of taking someone who knows nothing and helping him achieve a major goal.

What do you like the least? – Being put in a position where I don't know the information I'm teaching. Not being prepared for the class.

What benefit do you derive from teaching flying? I've taught all four programs. I really enjoy the flying, manipulating the aircraft, radios, understanding aerodynamics, pulling everything together to perform. It requires very high skill and it's challenging. I enjoy other aspects of teaching that don't involve flying, but I prefer flight instruction.

You noted SYSTEMS as 'Very satisfying'. Yes, I find SYSTEMS very satisfying, because it was always a weak point. But, I have recently come to master it, having had to teach it. As I gain mastery of a subject, I enjoy teaching it more. Better prepared.

What do you look for in students when teaching? I look for interaction with the student – eye contact, nodding, are they lost, bored. If they are not connected, I talk about scenarios or some way to get them actively involved.

Do you feel you adapt your teaching style to your student's learning style? I do, but I usually teach in a way that's most comfortable for me. Some teachers like to give lots of reading, some like more doing. I'm a doer. If I find a student is flying and having difficult doing it right away, then I spend more time on the ground working with him. I understand there are different learning styles, but maybe I'm not so good in integrating some of them into teaching. When I started instructing, I used to jump right into the airplane, but now understand some people need more ground instruction or preparation. When I was learning and had stumbling blocks, I would remember those blocks and figure others would have the same stumbling blocks and try to clarify it for others.

What would you do if you could not be involved with aviation? – I'd be a professional poker player. I like the strategy, thinking about what other people have in their hand, figuring out their strategy.

How would you describe yourself? Aviator or Instructor? I usually say I'm an instructor-pilot, which puts instructor first. I had the option of flying the line. I did fly the line, but found it boring, not challenging myself much. I think you learn more from your students than you actually teach them. The first time teaching is frustrating because of the need for preparation, but it gets better as you go along.

You noted INDOC as 'Neutral'. Yes, it is not very satisfying. I didn't put much into it because it is not my normal job. I'm only teaching it in the interim. I've actually been thinking of how to make it better for me and my students. If I had more ownership, I probably would put more into it. But it's not my class or program. It would be more satisfying if there were something other than tape after tape.

How about CRM? I think I could do a better job with the CRM course than the current way. When I was a student, I had an instructor who wasn't comfortable with the course. It was too basic and could have been at a higher, more in-depth level to be more satisfying.

INSTRUCTOR INTERVIEW 3

LSI score – 'Converger'
From descriptions – 'Converger'

TTI score – 'Coach'
From descriptions – 'Listener/Coach'

How did you get into teaching? As a flight instructor. I also taught junior programmers. I really enjoyed that. The work [programming] interested me, just as aviation does. I was always glad to help out, help others learn the system. It was a duty, on the side. I was asked to help others get up to speed. I liked the part where I could learn on my own and share with others what I've learned. If they took teaching away as part of my job, I'd probably find other ways to do it.

What if they took teaching away and put you strictly on the line? I'd find other ways to teach or help people, give them a tip on flying.

Define 'teacher'? Someone who genuinely wants to help others, cares about their profession, open minded and take what they've learned along the way and pass it on so it gets better and better as it goes.

What would you do if taken out of aviation? I'd look for a profession where I would be technically challenged but where I could work with people, such as a peer on projectt work, where each has a role, we are all counting on each other.

What do you like most about teaching? I like to see people benefit from it and progress.

What do you like the least? Students who don't prepare well, who aren't as interested as they should be.

What benefit do you derive from flying? I learn a lot about flying. Even when I teach, I am learning.

Are you an aviator or instructor? Well, it's the synergy of the two combined. I love to fly, but I really love working with the crews out on the line and knowing I've been a part of helping them improve.

How satisfied are you with teaching CRM? I haven't taught CRM. CRM seems a bit ambiguous to me. I wouldn't really like to teach a generic course. I'd probably find it more satisfying if it was very specific to our operations, had specific examples. If I understood the content, and was prepared, I would find it more satisfying. It's not necessarily the subject matter, but my mastery of the subject, my preparedness. I'd want to feel I was helping them and, if I came up to the plate unprepared, I wouldn't feel I was giving them anything. I like the SIM because it's the closest thing to flying. You get to help people out when they are most challenged. You get to correct things more proactively. SYSTEMS was satisfying. If I had been an A&P mechanic, it would probably be more satisfying. I'm mechanically inclined and like to explain how things work. But there are systems I don't know anything about and I can't convey in detail and have to go back to the theoretical, general explanations. It's just not as good as really knowing the system. I feel proficient with the systems of the airplane, but if someone wanted an in-depth knowledge, I couldn't do it. SYSTEMS is more a directive type of teaching, more a classroom lecture. I like a more interactive type. I really prefer small groups of people, like two or three.

How well do you feel you adapt your teaching style to your students? I was awkward at first, trying to figure out my own style for each type of training event. You learn a best fit to what crews are thinking and I try to apply my teaching process to build up to it. I know the areas crews are generally weakest on and offer them some practical tips. I use the building block approach, having them fly on paper and describing to me what they would be doing.

What do you look for when teaching? I ask them for feedback all the time. Ask them questions, why they would do this or that.

[Interviewer's note: The subject seemed to enjoy teaching as well as and apart from flying. The interviews and TTI score of the three instructor subjects suggest different teaching styles, yet they all suggest that adaptation to student learning needs, if not styles, is a natural and integral part of teaching.]

-- End of interviews --

Appendix H

Summary of Survey Data

Table H.1 – FREQUENCIES OF PILOT-TRAINEE LSI (2000 ATS)

	Diverger	Assimilator	Converger	Accommodator
n =	55 (21.8 %)	69 (27.4%)	87 (34.5%)	40 (15.9%)

Table H.2 – SUMMARY OF INSTRUCTOR BACKGROUND SURVEY (IBS) DEMOGRAPHIC DATA

ITEM – Frequency (total sample size *n* =26)	MEAN	MODE	STD. DEV.	RANGE
1. Age (years)	39.42	32	11.91	21 to 64
2. Gender Male – 25 Female – 1	NA	NA	NA	NA
3. Highest Education Level *(ordinal data)* (1) High School – 2 (2) College – 7 (3) Bachelor – 9 (4) Master – 8	2.88	3	.95	1 to 4
4. Years as a Teacher	8.88	5	7.37	2 to 31
5. Formal Teacher Training *(nominal data)* College Education Course – 3 Military Instructor Training – 8 Company Sponsored Teacher Training – 13 Certified Flight Instructor – 20	NA	NA	NA	NA
6. Total flight Hours	6530.8	6000	4165.65	700 to 17,100
7. Programs Experienced as a Trainee *(nominal data)* Part 141/142 ATP Type Training – 13 Military Pilot Training – 7 Military Instructor Training – 7 Part 121 Aircrew Qualification Training – 25 Corporate Administered Aircraft Qualification –1	NA	NA	NA	NA
8. Instructor Avocation Responses (*See Table 4.11*)	NA	NA	NA	NA

Means for nominal data were irrelevant and therefore listed as NA — Not Applicable.
For means of Satisfaction Survey, see Table 4.9.

Table H.3 – SUMMARY of 2000 AVIATION TRAINING SURVEY (ATS) DEMOGRAPHIC DATA

ITEM – Frequency (Total sample size *n* = 252)	MEAN	MODE	STD. DEV.	RANGE
1. Age (years) (AGE)	34.2	29	7.91	21 to 58
3. Gender *(SEX)* Male – 231 Female – 21	NA	NA	NA	NA
3. Highest education level *(ordinal data)* (EDUCLVL) (1) High School Diploma – 6 (2) College – 32 (3) Bachelor Degree – 170 (4) Master Degree – 40 (5) Doctoral Degree – 3	3	3	.68	1 to 5
4. Types of educational institutions attended *(nominal data)* Public High School – 3 Private High School – 3 State College – 146 Private College – 55 Military/Service Academy – 24 Embry Riddle – 43	NA	NA	NA	NA
5. Years since acquiring private pilot certificate (YRSSINCE)	12.2	10	7.23	1 to 40
6. Certificates held *(ordinal data)* (CERTHELD) (1) Commercial – 73 (2) ATP – 179	NA	NA	NA	NA
5a. Number of type ratings held (TYPENUM)	1.2		1.32	0 to 8
7. Total flight hours (TOTALHRS)	4550.8	3000	3065.9	1200 to 20,000
8. Flight hours per category				
Large transport (LARGEHRS)	2228.7	0	2703.29	0 (n=45) to 16,000
Jet transport (JETHRS)	254.9	0	538.46	0 (n=179) to 3300
Corporate (CORPHRS)	143.6	0	486.5	0 (n=197) to 4000
Part 135 (P135HRS)	970.4	0	3090.94	0 (n=129) to 43,500
Part 121 (P121HRS)	1646.3	1000	1904.51	0 (n=39) to 7000
Military (MILHRS)	619.25	0	1324.12	0 (n=191) to 20,000
Civilian Flight Instructor (CIVINSTR)	776.9	1000	901.56	0 (n=62) to 8800
9. Programs experienced as a trainee *(nominal data)* Part 141/142 ATP Type Training (P141ATP) – 114 Military Pilot Training (MILBASIC) – 54 Military Instructor Pilot (MILINSTR) – 38 Part 121 Airline Flight Engineer (FE) – 21 Part 141/142 ATP Type Rating (ATPTYPE) – 48 Military Combat Crew Training (COMBAT) – 47 Airline Company Initial Qualification (INITQUAL) – 251 Part 121 Airline Captain Upgrade (CAPTUPGR) – 122	NA	NA	NA	NA

Means for nominal data were irrelevant and therefore listed as NA — Not Applicable.
Where flight time range is '0', 'n' represents the number of respondents who indicated they did not have time in that category.

Appendix I

2000 ATS – 1985 Kolb LSI Data Comparison

To examine the possibility of significant differences between the population samples in the absence of Kolb's original data, the four LSI category scores (CE, RO, AC, and AE) on the 2000 ATS were plotted by percentile over Kolb's original sample. Tables I.1 and I.2 contain the survey data. Figures I.1 and I.2 are graphical representations of the survey data.

Table I.1 – COMPARISON OF 2000 ATS TO KOLB'S 1985 LSI

LSI CATEGORY	2000 PILOT SURVEY	KOLB's 1985 LSI
Concrete Experience (CE)	Mean = 24.37 S.D. = 9.57	Mean = 26.00 S.D. = 6.80
Reflective Observation (RO)	Mean = 30.48 S.D. = 6.44	Mean = 29.94 S.D. = 6.50
Abstract Conceptualization (AC)	Mean = 30.46 S.D. = 7.05	Mean = 30.28 S.D. = 6.70
Active Experimentation (AE)	Mean = 34.43 S.D. = 8.58	Mean = 35.37 S.D. = 6.90
AC-CE	Mean = 6.09 S.D. = 14.32	Mean = 4.28 S.D. = 11.40
AE-RO	Mean = 3.94 S.D. = 12.31	Mean = 5.92 S.D. = 11.00

Table I.2 – COMPARISON OF 2000 ATS TO KOLB'S 1985 LSI

DEMOGRAPHIC	2000 (ATS)	KOLB's 1985 LSI
Sample Size (n)	n = 251	n = 1,446
Age	Mean = 33.9 S.D. = 8.46 Range = 21 – 58	Mean = unknown* S.D. = unknown* Range = 18 – 60
Gender	Male = 231 Female = 21	Men = 638 Female = 801
Education Level	Mean = 'Bachelor' (4 years of college)	Mean = 2 years college
Ethnic Diversity	No data taken	"Ethnically diverse" (as stated by Kolb, Learning style User's Guide, p. 74)*
Range of Career Fields	Homogeneous *(all sample members were active professional airline pilots at time of sample. However, many members have had career experience outside of aviation)*	*As listed by Kolb, Learning Style User's Guide, p. 77:* Accounting, Arts, Business, Computer Science, Data Processing, Dentistry, Education, Engineering, History, Journalism, Languages, Medicine, Nursing, Nutrition, Physical Sciences, Psychology, Secretarial, Sociology, Technical Trades

** Specific data not available at this writing*

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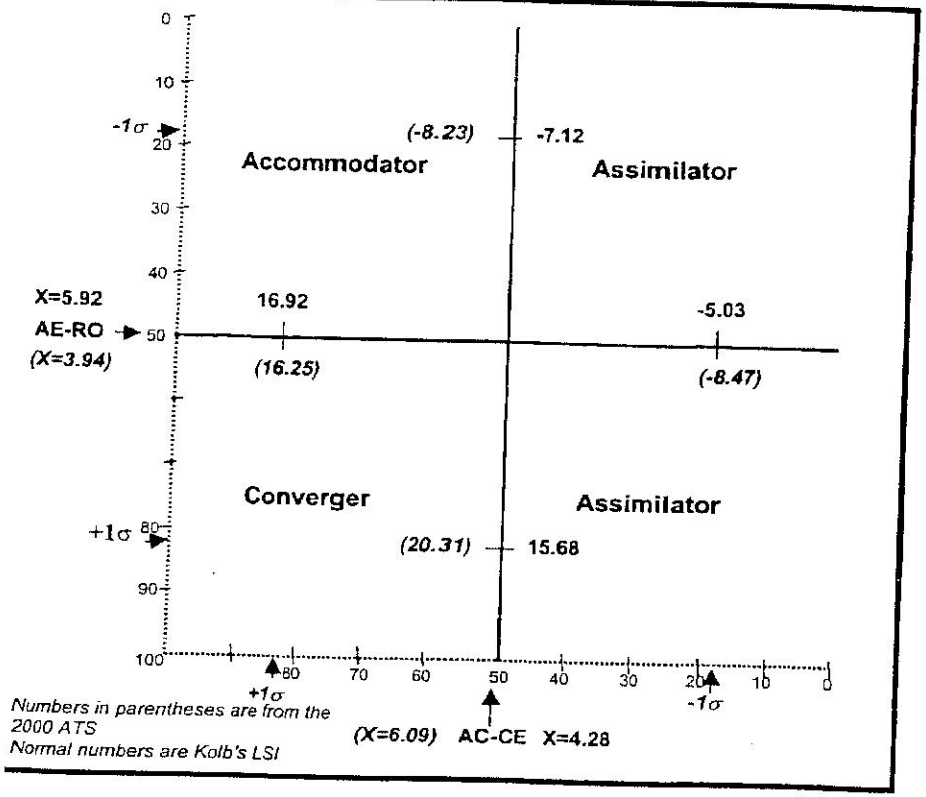
* *Specific data not available at this writing*

Figure I.2 – Learning Style Type Grid Comparisons



ure I.2 – Learning Style Type Grid represents the 2000 ATS and Kolb's LSI scores for -CE and AE-RO. The point at which the vertical scale (AC-CE) and the horizontal ıle (AE-RO) cross represents the mean value for each, respectively. The horizontal ı vertical lines represent the respective percentiles. 2000 ATS score norms are in entheses and Kolb's LSI score norms are not enclosed. Percentiles for (+) and (-) ɜ standard deviation (σ) are depicted.

Appendix J

Summary of Teaching Style Descriptor Comparisons

Table J.1 – ANOVA for CRM TRAINING

	Sum of Squares	df	Mean Square	F	Sig. (p)
Instructional Techniques					
Between groups	8.467	3	2.822	4.351	.005
Within groups	154.392	238	.649		
Total	162.860	241			
Instructor Involvement					
Between groups	25.944	3	8.648	15.571	.000
Within groups	131.239	236	.556		
Total	157.183	239			
Means of Teaching					
Between groups	19.876	3	6.625	10.940	.000
Within groups	142.316	235	.606		
Total	162.192	238			
Nature of Instructor					
Between groups	20.599	3	6.866	11.487	.000
Within groups	142.261	238	.598		
Total	162.860	241			
Means of Evaluation					
Between groups	5.416	3	1.805	2.910	.035
Within groups	143.324	231	.620		
Total	148.740	234			

Table J.2 – TUKEY HSD POST-HOC PAIRED COMPARISONS* for CRM TRAINING

Dependent Variable – Satisfaction with CRM Training

Descriptors** in Category of Instructional Delivery		Mean Difference	Std. Error	Sig. (p)
I	J			
Instructional Techniques *(n = 242)*				
Free Discussion	Lecture Based	.38	.13	.020
	Activity Based	.50	.18	.032
Lecture Based	Free Discussion	-.38	.13	.020
Theory Based	Free Discussion	-.50	.18	.032
Instructor Involvement *(n = 240)*				
Student Directed	Little Involvement	.99	.22	.000
Little Involvement	Student Directed	-.99	.22	.000
	Gave Time to Think Alone	-1.03	.23	.000
	Active Participation	-.97	.15	.000
Gave Time to Think Alone	Little Involvement	1.03	.23	.000
Active Participation	Little Involvement	.97	.15	.000
Means of Teaching *(n = 239)*				
Got Us Involved	Mostly Instructions	.59	.11	.000
Mostly Instructions	Got Us Involved	-.59	.11	.000
Nature of Instructor *(n = 242)*				
Listener	Director	.94	.24	.001
Director	Listener	-.94	.24	.001
Interpreter	Director	.41	.15	.025
Coach	Director	.56	.12	.000
Means of Evaluation *(n = 235)*				
Immediate Feedback	Subjective Tests	.45	.17	.047
Subjective Tests	Immediate Feedback	-.45	.17	.047

* *Extracted from SPSS data outputs.*
** *Only significant (p<.05) paired comparisons depicted.*

Table J.3 – ANOVA for INDOC TRAINING

	Sum of Squares	df	Mean Square	*F*	Sig. (p)
Instructional Techniques					
Between groups	8.908	3	2.969	3.533	.016
Within groups	194.969	232	.840		
Total	203.877	235			
Instructor Involvement					
Between groups	38.455	3	12.818	17.998	.000
Within groups	163.098	229	.712		
Total	201.554	232			
Means of Teaching					
Between groups	26.244	3	8.748	11.425	.000
Within groups	177.633	232	.766		
Total	203.877	235			
Nature of Instructor					
Between groups	7.736	3	2.579	3.050	.029
Within groups	196.141	232	.845		
Total	203.877	235			
Means of Evaluation					
Between groups	21.804	3	7.268	9.312	.000
Within groups	180.306	231	.781		
Total	202.111	234			

Table J.4 – TUKEY HSD POST-HOC PAIRED COMPARISONS* for INDOC TRAINING

Dependent Variable – Satisfaction with INDOC Training

Descriptors** in Category of Instructional Delivery		Mean Difference	Std. Error	Sig. (p<.05)
I	J			
Instructional Techniques *(n = 236)*				
(No significant differences found in this category)				
Instructor Involvement *(n = 233)*				
Student Directed	Little Involvement	-.57	.18	.008
Little Involvement	Active Participation	-.88	.12	.000
Active Participation	Student Directed	.57	.18	.008
	Little Involvement	.88	.12	.000
Means of Teaching *(n = 236)*				
Got Us Involved	Mostly Instructions	.85	.16	.000
	Mostly Symbols	1.43	.34	.000
Mostly Instructions	Got Us Involved	-.85	.16	.000
Mostly Symbols	Got Us Involved	-1.43	.34	.000
Nature of Instructor *(n = 236)*				
(No significant differences found in this category)				
Means of Evaluation *(n = 235)*				
Immediate Feedback	Objective Tests	.78	.29	.035
	Subjective Tests	1.22	.31	.000
	Personal Judgment	.176	.41	.000
Objective Tests	Immediate Feedback	-.78	.29	.035
	Subjective Tests	.45	.15	.013
	Personal Judgment	.98	.30	.007
Subjective Tests	Immediate Feedback	-1.22	.31	.000
	Objective Tests	-.45	.15	.013
Personal Judgment	Immediate Feedback	-1.76	.41	.000
	Objective Tests	-.98	.30	.007

** Extracted from SPSS® data outputs.*
*** Only significant (p<.05) paired comparisons depicted.*

Table J.5 – ANOVA for SYSTEMS Training

	Sum of Squares	df	Mean Square	F	Sig. (p)
Instructional Techniques					
Between groups	2.994	3	.998	.857	.464
Within groups	267.968	230	1.165		
Total	270.962	233			
Instructor Involvement					
Between groups	57.292	3	19.097	20.509	.000
Within groups	213.241	229	.931		
Total	270.532	232			
Means of Teaching					
Between groups	52.875	3	17.625	18.659	.000
Within groups	218.206	231	.945		
Total	271.081	234			
Nature of Instructor					
Between groups	16.224	3	5.408	5.021	.002
Within groups	245.552	228	1.077		
Total	261.776	231			
Means of Evaluation					
Between groups	9.366	2	4.683	4.248	.015
Within groups	254.634	231	1.102		
Total	264.000	233			

Table J.6 – TUKEY HSD POST-HOC PAIRED COMPARISONS* for SYSTEMS TRAINING

Dependent Variable – Satisfaction with SYSTEMS Training

Descriptors** in Category of Instructional Delivery		Mean Difference	Std. Error	Sig. (p)
I	J			
Instructional Techniques *(n = 234)*				
(No significant differences found in this category)				
Instructor Involvement *(n = 233)*				
Student Directed	Little Involvement	.81	.22	.002
Little Involvement	Student Directed	-.81	.22	.002
	Gave Time to Think Alone	-.89	.30	.014
	Active Participation	-1.21	.15	.000
Gave Time to Think Alone	Little Involvement	.89	.30	.014
Active Participation	Little Involvement	1.21	.15	.000
Means of Teaching *(n = 235)*				
Got Us Involved	Mostly Instructions	.99	.15	.000
	Mostly Symbols	1.49	.28	.000
	Mostly Actions	1.25	.42	.014
Mostly Instructions	Got Us Involved	-.99	.15	.000
Mostly Symbols	Got Us Involved	-1.49	.28	.000
Mostly Actions	Got Us Involved	-1.25	.42	.014
Nature of Instructor *(n = 232)*				
Listener	Director	.85	.31	.033
Director	Listener	-.85	.31	.033
	Coach	-.60	.20	.013
Coach	Director	.60	.20	.013
Means of Evaluation *(n = 234)*				
Immediate Feedback	Objective Tests	.81	.30	.019
	Subjective Tests	.95	.33	.011
Objective Test	Immediate Feedback	-.81	.30	.019
Subjective Tests	Immediate Feedback	-.95	.33	.011

** Extracted from SPSS® data outputs.*
*** Only significant (p<.05) paired comparisons depicted.*

Table J.7 – ANOVA for SIM Training

	Sum of Squares	Df	Mean Square	F	Sig. (p)
Instructional Techniques					
Between groups	13.387	3	4.462	4.717	.003
Within groups	217.575	230	.946		
Total	230.962	233			
Instructor Involvement					
Between groups	39.215	3	13.072	15.606	.000
Within groups	193.483	231	.838		
Total	232.698	234			
Means of Teaching					
Between groups	17.091	3	5.697	6.104	.001
Within groups	215.607	231	.933		
Total	232.698	234			
Nature of Instructor					
Between groups	33.545	3	11.182	12.944	.000
Within groups	198.682	230	.864		
Total	232.226	233			
Means of Evaluation					
Between groups	53.225	3	17.742	22.835	.000
Within groups	179.473	231	.777		
Total	232.698	234			

Table J.8 – TUKEY HSD POST-HOC PAIRED COMPARISONS* for SIM TRAINING

Dependent Variable – Satisfaction with SIM Training

Descriptors** in Category of Instructional Delivery		Mean Difference	Std. error	Sig. (p)
I	J			
Instructional Techniques *(n = 234)*				
Lecture Based	Activity Based	1.79	.22	.003
Activity Based	Lecture Based	.79	.22	.003
Instructor Involvement *(n = 235)*				
Student Direct	Active Participation	-.59	.19	.011
Little Involvement	Gave Time to Think Alone	-1.21	.30	.000
	Active Participation	-1.11	.17	.000
Gave Time to Think Alone	Little Involvement	1.21	.30	.000
Active Participation	Little Involvement	1.11	.17	.000
Means of Teaching *(n = 235)*				
Got Us Involved	Mostly Instructions	.63	.15	.000
Mostly Instructions	Got Us Involved	-.63	.15	.000
	Mostly Actions	-.41	.16	.048
Mostly Actions	Mostly Instructions	.41	.16	.048
Nature of Instructor *(n = 234)*				
Director	Coach	-.84	.14	.000
Coach	Director	.84	.14	.000
Means of Evaluation *(n = 235)*				
Immediate Feedback	Personal Judgment	1.31	.16	.000
Objective Test	Personal Judgment	.95	.18	.000
Subjective Tests	Personal Judgment	.95	.20	.000
Personal Judgment	Immediate Feedback	-1.31	.16	.000
	Objective Tests	-.95	.18	.000
	Subjective Tests	-.95	.20	.000

** Extracted from SPSS® data outputs.*
*** Only significant (p<.05) paired comparisons depicted.*

REFERENCES

Abraham, Y. T. (1976). Employee tenure: a study of employee turnover and retention involving employee background, job satisfaction, and reasons for staying. Ph.D. dissertation, University of Oklahoma, Norman, OK.

Air Force Occupational Measurements Squadron website, http://www.omsq.af.mil, Dec 9, 1999.

Air Force Research Laboratory website, http://www.afrl.af.mil/he.html, Dec 9, 1999.

Alexander, K. and Stead, G. (1993). Aptitude assessment in pilot selection. Aviation Instruction and Training, Ashgate Publishing Co., Brookfield, VT.

Anonymous (1989). Pilot turnover prompts regional airlines to expand, improve training programs. Aviation Week & Space Technology, Oct., p. 91.

Besco, R. (1992). Analyzing knowledge deficiencies in pilot performance. The International Journal of Aviation Psychology, Vol. 2, Issue 1, p. 53-74.

Biggs (1987). Student approaches to learning and studying. Australian Counsel for Educational Research, Hawthorn, Victoria, Australia.

Blanchard, B. E. (1967). Illinois ratings of teacher effectiveness: manual. Western Psychological Services, Los Angeles, CA.

Bloom, B. S. (1956). Taxonomy Of Educational Objectives: The Classification Of Educational Goals. Handbook I: Cognitive Domain. David McKay Company, New York.

Burdsal, C. A. and Bardo, J. W. (1986). Measuring student perceptions of dimensions of evaluation. Educational and Psychological Measurement, Vol. 46, No. 1, p. 63-79.

Cai, S. X. (1997). College student attitude toward three teaching styles in physical education classes. College Student Journal, Jun., Vol. 31.

Conti, G. J. (1979). Principles of adult learning scale (PALS). Paper presented at the annual Adult Education Research Conference, 20th, Ann Arbor, MI, April 4.

Conti, G. J. (1985). The relationship between teaching style and adult student learning. Adult Education Quarterly, Vol. 35, Issue 4, p. 220-228.

Conti, G. J. (1986a). Teaching-learning styles and the adult learner. Lifelong Learning, Jun., Vol. 9, No. 8.

Conti, G. J. (1991). Assessing teaching style in adult education: how and why. Lifelong Learning. Mar/Apr, Vol. 64, Issue 4.

Cooper, S. E. and Miller, J. A. (1999). MBTI learning style-teaching style discongruencies. Educational & Psychological Measurement, Fall, Vol. 51, Issue 3.

Curry-Swann, L. (1990). A critique of the research on learning styles. Educational Leadership, Oct., Vol. 48, Issue 2.

Darkenwald, G. G. and Valentine, T. (1986). Measuring the social environment of adult education classrooms. Paper presented at the Adult Education Research Conference, Syracuse, NY.

Defense Technology Information Center (DTIC), http://www.dtic.mil, Dec. 8, 1999.

Dobbs, K. (1999). How smart companies are using training to hold on to their best people in a job-hopper's market. Training, Sep.

Dunn, R., Dunn, K., and Price, G. E. (1989). Learning Styles Inventory, Price Systems, Lawrence, KS.

FAA Handbook (1998). Fundamentals of Instruction. Federal Aviation Administration, U.S. Government Printing Office.

Franklin, H. (1997). Keeping the best employee retention in the '90s. Journal of Property Management, May/Jun, Vol. 62, Issue 3.

Grasha T. (1990). The naturalistic approach to learning styles. College Teaching, Summer, Vol. 38, Issue 3.

Gremli, J. (1996). Tuned in to learning styles. Music Educators Journal, Nov., Vol. 83, Issue 3.

Grout, C. M. (1990). An assessment of the relationship between teacher teaching style and student learning style with relation to academic achievement and absenteeism of seniors in a rural high school in north central Massachusetts. Ph.D. dissertation, University of Massachusetts.

Holt, R. and Hansbucker, J. (1999). Human factors research in the advanced qualification program (AQP). Unpublished, George Mason University, Fairfax, VA.

Hudak, M. A. and Anderson, D. E. (1984). Teaching style and student ratings. Teaching of Psychology, Vol. 11, No. 3, p. 177-178.

Jarvis, P. (1987). Adult Learning in the Social Context, Croom Helm, London.

Kaplan, J. and Kies, D. (1995). Teaching styles and learning styles: which came first? Journal of Instructional Psychology, Mar., Vol. 22, Issue 1.

Karp, M. R. (1996). Theoretical aviation training for future airline pilots: a look to the future. Ph.D. dissertation, Walden University.

Kennedy, M. D. (1995). The effects of an individual's learning style preference on psychomotor achievement for college students. Ph.D. dissertation, Florida State University.

Knowles, M. (1984). The Adult Learner: A Neglected Species (3rd edition), Gulf Publishing, Houston, TX.

Kolb, D. A. (1984a). Individuality in learning and the concept of learning styles. Experiential Learning, Prentice-Hall, Inc., Englewood Cliffs, NJ.

Kolb, D. A. (1984b). Experiential Learning: Experience as the Source of Learning and Development, Prentice-Hall, Inc., Englewood Cliffs, NJ.

Kolb, D. A. and Smith, D. M. (1996). User's guide for the learning-style inventory: a manual for teachers and trainers. McBer & Company, Boston, MA.

Kurschmer, D. (1994). Pilot dearth vexes NWA, Minneapolis-St. Paul City Business, Jun., Vol. 11, Issue 52.

Lam, S. K. (1998). Organizational performance and learning style in Hong Kong. Journal of Social Psychology, Jun., Vol. 138, Issue 3.

Lavigna, R. J. (1992). Predicting job performance from background characteristics: more evidence from the public sector. Public Personnel Management, Fall, Vol. 21, Issue 3, p. 347-352.

Lehrer, H. H. (1993). Instructional design and curriculum development in aviation. Aviation Instruction and Training, Ashgate Publishing, Brookfield, VT.

Lintern, G. (1991). Instructional strategies, in Morrison, J. E., Training for Performance, Wiley Publishing, New York.

Marshall, C. (1990). The power of the learning styles philosophy. Educational Leadership, Oct., Vol. 48, Issue 2.

Marshall, C. (1991). Teachers' learning styles: how they affect student learning. Clearing House, Mar/Apr, Vol. 64, Issue 4.

Mathews, D. B. (1996). An investigation of learning styles and perceived academic achievement for high school students. Clearing House, Mar/Apr, Vol. 69, Issue 4.

Mathews, W. (1998). Despite more training, pilot shortage will grow. Air Force Times, June 22, 1998, Vol. 58, Issue 46, p. 14.

Mayberry, P. W., and Carey, N. B. (1997). The effect of aptitude and experience on mechanical job performance. Educational & Psychology Measurement, Feb., Vol. 57, Issue 1.

McClellan, J. (1997). We need more pilots. Flying, Jul., Vol. 124, Issue 7, p. 11.

McClendon, M. J. (1994). Multiple Regression and Causal Analysis, F. E. Peacock Publishers, Inc., Itasca, IL.

Miglietti, C. L. and Strange, C. C. (1989). Learning styles, classroom environment preferences, teaching styles, and remedial course outcomes for under-prepared adults at a two-year college. Community College Review, Summer, Vol. 26, Issue 1.

Moore, P. J. and Telfer, R. A. (1993). Pilots' approaches to learning. Aviation Instruction and Training, Ashgate Publishing, Brookfield, VT.

Mosston, M. and Ashworth, S. (1994). Teaching Physical Education (4th ed.), MacMillan College Publishing Company, New York.

Murakami, P. (1999). Employee retention in tight times. Journal of Property Management, Jul/Aug, Vol. 64, Issue 4.

Norris, R. A. (1977). The relationships among learning style, teaching style, and student perception of teacher effectiveness. Ph.D. dissertation, University of Idaho.

Norusis, Marija J. (1988). SPSS/PC+ Studentware™, SPSS Inc., Chicago, IL, p. 381.

Poon, J. M. (1996). Effects of matching learning style and training method on cross-cultural attitudes, self-efficacy, and trainee reaction. Ph. D. dissertation, University of Maryland, College Park, MD.

Rudowski, R. M. (1996). Kolb's learning theory and the relationship of learning style preferences and teaching style preferences of extension educators. Ph.D. dissertation, Pennsylvania State University, p.12, quotation from Curry, L. (1990), Learning styles in secondary schools: a review of instruments and implications for their use.

Shavelson, R. J. (1988). Statistical Reasoning for the Behavioral Sciences, Allyn and Bacon, Inc., Needham Heights, MA.

Shimko, B. W. (1992). Pre-hire assessment of the new work force: finding wheat (and work ethic) among the chaff. Business Horizons, May/Jun, Vol. 35, Issue 3, p. 60-61.

Sieber, S. D. and Wilder, D. E. (1967). Teaching styles: parental preferences and professional role definitions. Sociology of Education, Fall.

Spier, M. S. (1974). S-C (student-content) teaching inventory. The 1974 Annual Handbook for Group Facilitators, University Associates, Tuscon, AZ.

Stum, D. L. (1997). 10 thoughts on employee retention. HR Focus, Sep, Vol. 75, Issue 9.

Stum, D. L. (1998). Five ingredients for an employee retention formula. HR Focus, Sep., Vol. 75, Issue 9.

Taylor, S. (1997). 10 thoughts on employee retention. HR Focus, Oct., Vol. 74, Issue 10.

Telfer, R. A. (1993a). What makes aviation instruction different? Aviation Instruction and Training, Ashgate Publishing, Brookfield, VT.

Telfer, R. A. (1993b). Pilot approaches to learning. Aviation Instruction and Training, Ashgate Publishing, Brookfield, VT.

Telfer, R. A., (1993c), Introduction. Aviation Instruction and Training, Ashgate Publishing, Brookfield, VT.

Title 14, Consolidated federal regulations (CFR), Part 61: Certification of pilots & instructors, Subpart G – Airline transport pilots, 1998.

Tuckman, B. W. (1970). A technique for the assessment of teacher directiveness. Journal of Educational Research, Vol. 63, No. 9.

U.S. Department of Transportation Federal Advisory Committee (1993). Pilots and aviation maintenance technicians for the twenty-first century: assessment of availability and quality. U.S. Government Printing Office, Washington, D.C.

Wheeler, M. and Marshall, J. (1986). The trainer type inventory (TTI): identifying training style preferences. The Annual: Developing Human Resources, University Associates, Inc., San Diego, CA, 87-97.

Whitmore, J. R. (1974). Teacher attitude inventory: identifying teacher positions in relation to educational issues and decisions. Research and development memorandum no. 118, ED0950159.

William, M. (1998). Despite more training, pilot shortage will grow. Air Force Times, Jun. 22, Vol. 58, Issue 46, p. 14.

Wood, A. (1994). Employee retention. Manage, Nov, Vol. 46, Issue 2.