FLIGHT INSTRUCTOR-STUDENT PILOT LEARNING STYLE SIMILARITY AND ITS EFFECT ON FLIGHT TRAINING EFFICIENCY

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CHAPTER I

INTRODUCTION

Learning to fly an airplane is a complex, relatively expensive, and somewhat hazardous form of education. In the 90 years of powered flight, pilot training has been improved upon dramatically. The "barnstorming" days of aviation with unlicensed pilots and instructors of questionable qualifications has evolved into a well-organized, carefully implemented curriculum process. Now we have certified flight instructors who have received a significant amount of training in aeronautics and learning principles.

However, that does not mean that the learning process could not be improved upon. Wilhelmsen (1994) noted that the national average of training time for new pilots has been between 70-80 hours. This author also stated that a key ingredient to finishing a private pilot's license in the least amount of time was the importance of regular training and that ". . . students who fly at least once a week are far more likely to finish their training close to the FAA 40-hour minimum than those who fly less."

These findings are supported by other research. The training records of 100 student pilots at the University of North Dakota (Kreienkamp, 1983) showed an average flight time to obtain a private pilot's license to be 50 hours. The range of flight time was from

40 to 91 hours. Another study of 46 student pilots at Oklahoma State University (Kreienkamp, 1993) found the average time to attain a private pilot's license was 47 hours with a range of flight time of 35-90 hours. The average time to first solo flight was 12.6 hours with a range of 5-35 hours. Almost nine percent of this pilot population was required to take the Federal Aviation Administration (FAA) final checkride two times. While the average flight time at these two university flight training establishments was significantly lower than the national average, the range of flight time required to obtain a private pilot's license is still excessive. In a standardized curriculum, teaching the same skills with the same methodology to a relatively homogeneous population, the range of flight time to acquire the private pilot's license should have been much smaller or closer to the mean.

Also of concern was the rate of completion for private pilot training. U. S. Civil Airmen Statistics (Federal Aviation Administration, 1992) showed an inefficient trend. The most recent data (1983-1992) presented student pilot original airmen certificates issued as well as private pilot airplane and helicopter certificates issued (among others) for each year. These data do not specifically indicate if a student certificate issued eventually becomes a private or helicopter pilot's license, and on a yearly basis, such an assumption would be questionable.

TABLE I

ORIGINAL AIRMEN CERTIFICATES ISSUED BY CATEGORY
CALENDAR YEARS 1983-1992

Certificate Category	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Student Pilot	92239	90085	86060	88699	85611	86193	87427	88586	82205	78946
Recreational Pilot								29	87	74
Airplane/Private	41210	36545	35402	34816	42278	39900	35360	41749	49580	39968
Helicopter	1932	1806	2105	2209	2217	1947	2240	2700	3344	2684

Source: U. S. Civil Airmen Statistics, 1992.

However, averaging these data over the ten year reporting period would appear to be a viable solution. Using this methodology, it appears as if there has been a 51 percent training dropout rate between obtaining a student pilot certificate and being awarded a private, recreational, or helicopter pilot's license.

Why would there be such a dramatic dropout rate in this seemingly glamorous hobby or vocation? Some might decide that aviation is just not for them. Others might run out of money or move to another part of the country where flight training is less

accessible. Or, perhaps the teacher-student relationship was less effective that it should have been and the student quit out of anger or fear of the learning environment.

There are approximately 600 pilot schools in the United States ranging from small independent fixed-base operators, the "Mom and Pop" aviation operations, to four-year baccalaureate and graduate degree-granting universities with aviation academic programs (Federal Aviation Administration, 1993). Most people who combine private pilot training and plans for a career in aviation do so through schools that meet training requirements of Federal Air Regulations (FAR) Part 141, Pilot Schools. These schools are certificated and reviewed regularly by the FAA for their academic structure and ability to meet and maintain specific curriculum requirements.

The FAA estimates that probably more than half of the private pilot certificates issued come from FAR Part 141 schools (FAA, 1993). One hundred and nineteen Part 141 schools grant 2-year associate's or 4-year bachelor's degrees in addition to flight training. The FAA notes: "Because of their academic orientation and the longer period of instruction they permit, these institutions are capable of producing well-trained and -disciplined pilots." In 1992 these degree-granting Part 141 schools produced approximately 5,500 private pilots.

This specialized learning environment is not without hazards. Accidents do happen, sometimes in the training setting and occasionally with deadly results. The general aviation accident

rate for 1992 was actually very good: 7.17 accidents per 100,000 flying hours, of which only 1.5 per 100,000 flying hours involved fatalities (Aircraft Owners & Pilots Association, 1993). However, 60 percent of those accidents were attributed to pilot error with 11.8 percent of them occurred during flight instruction. Ives (1993) noted that human judgment errors were the primary cause of over half of all pilot fatalities recorded by the FAA from 1970-74.

The flight training learning environment places the student under considerable stress. First, it is a new environment. It operates in a three dimensional world by taking the automobile-comparable "forward"-"backward" and "left"-"right" indices and compounds the complexity by adding "up" and "down". In addition, these motions occur at speeds up to 120 miles per hour in the private pilot training environment, and includes distractors such as a high noise environment, a vibrating or moving training platform, airsickness, and instructors with limited teaching experience.

Melton & Wicks (1967) suggested that heart rate is a physiological consequence of "flight stress". They compared heart rates of student pilots with other pilots in different flight situations and noted: ". . . it would appear that the private pilot training curriculum is about as stressful as combat flying, X-15 and lifting body flying, low altitude flying in high performance jets and, indeed, orbital flight." The cockpit of a airplane would not appear to be the best learning environment.

Stress has been shown to be an inhibiting factor in the learning process. Boyle (1987) contended that under stressful

conditions, interpersonal variables other than cognitive ability may be predominant in influencing academic achievement. The influence of emotion and stress on learning was suggested as being a very significant inhibition factor.

As long ago as World War I military psychologists tried to enhance the learning process and, correspondingly, reduce the attrition of flight training candidates by developing tests that would increase the accuracy of selection of candidates capable of completing flight training. With very few exceptions, testing and personality measures did not successfully predict primary flight training completion. North & Griffin (as quoted in Dolgin & Gibb, 1989) noted that between 1950-76 approximately 40 different personality inventories and scales were used for pilot selection with little success.

Other research has shown more promising results about the teaching-learning relationship. Dunn (1987) revealed that when students are learning or concentrating on difficult material, they exhibit individual learning styles or preferences. She also noted that children tend to obtain significantly higher achievement test scores and report better attitudes towards learning under instructional conditions that match their environmental preferences.

Other dyad relationships reflecting personality and verbal interaction similarities also showed increased levels of efficiency. Hunt & Joyce (1967) found a relationship between personality and teaching pattern. Carr (1970) noted that similar test scores on a differentiation compatibility examination taken by patients and

their therapists resulted in more symptom reduction than patients and therapists with more dissimilar scores.

Empirical observation has shown that pilots are a very enthusiastic, motivated group, very intent on their acquisition of flying skills. They are also profoundly influenced by their certified flight instructors (CFIs). This is especially true as student pilots have not yet acquired rudimentary flying skills and the accompanying self-confidence these skills bring. Flight instructors are taught that "the ability to analyze a student correctly and apply instruction in the manner in which the student is most receptive is essential to good instruction" (Federal Aviation Administration, 1977). This is true. Unfortunately flight instructors, for the most part, are part-timers, non-professionals, and many are just building flight time and waiting for better jobs to come along, such as airline crew members, executive pilots, et cetera (Horowitz, 1964).

Cook (1994) noted that not every CFI can successfully teach every student. A typical CFI can begin flight instruction with less than 300 hours of total flight time. Most give about 1,000 hours of instruction and then move on to a better job. The infrequent career CFI may have 10,000 hours of flight time and significant experience, but may specialize in advanced flight ratings or the administration of a flight program.

There are advantages to both types of instructors. The more experienced CFI will have a variety of experience, both flying and with many different students. The younger, low-time CFI has the

ability to identify and empathize with a student's needs and fears of the training process. Regardless, good two-way communication is essential in the learning process. Connolly (1990) noted that "attitudes, communication, and management styles must be considered to be integral parts of the formal pilot training process."

If the degree of variation in instruction time and student pilot dropout rates shown here are similar to other flight training establishments, then there would appear to be room for improvement in the teaching-learning process. While the learning environment of the student pilot is carefully structured with standardized curricula and certified flight instructors, there appears to be other factors involved in the learning process to account for the latitude of learning time and the dropout rate while acquiring a private pilot's license. Kreienkamp (1983) showed that by matching student pilots and flight instructors based on their degree of extroversion or introversion, as measured by the Myers-Briggs Type Indicator (MBTI), the students learned to fly in less time than those students and instructors who were dissimilar on this scale.

Purpose of the Study

The purpose of this study was to determine if a relationship existed between the learning style similarity of student pilots and their flight instructors, and the amount of time it takes to fly solo in the aircraft for the first time and also to pass the private pilot practical (flying) examination, also called the "checkride." Each student pilot-flight instructor dyad was

tested with the Myers-Briggs Type Indicator to determine their MBTI "type". Each pilot also filled out a questionnaire inquiring about their flying experience. MBTI type similarity of the student and his or her instructor was compared with time required to reach the first solo flight and the total flying time required for the student pilot to successfully complete the private pilot practical examination. According to the hypothesis the student pilots who were similar in MBTI type with their flight instructors on at least one of the MBTI indices also had the lower average flying time to the first solo flight and to pass the private pilot practical examination.

Significance of the Study

Flight instruction would appear to benefit from attempting to increase the degree of efficiency in the learning transfer process. If student pilots could be matched with their flight instructors based on their perception similarity or learning style similarity, average learning time might decrease and fewer students might switch to a different instructor. Students would benefit with lower training cost, stress, and dropout rates, increased safety margins, better motivation, and clearer communication.

Definition of Terms

Certified Flight Instructor. An individual certified by the FAA to teach persons to fly an aircraft.

Checkride. The FAA required practical performance flight test to determine if the student pilot has met all the curriculum

requirements to become a private pilot.

Federal Aviation Administration. The government agency that provides and enforces regulations concerning aircraft, pilots, and their operation in American airspace.

Flight Curriculum. The lesson plan or learning process involved in teaching students to fly aircraft.

Learning Style. How basic mental functions or processes are used to become aware of things, events, ideas, and concepts.

Myers-Briggs Type Indicator (MBTI). A learning style inventory.

Perceptive Similarity. The degree to which a student and his or her flight instructor are similar in the process of becoming aware as measured by the Myers-Briggs Type Indicator.

Private Pilot. An individual who has been licensed by the FAA to fly an airplane without the supervision of a flight instructor and may carry passengers.

Private Pilot Certificate. The Federal Aviation Administration document certifying that the individual named on the certificate has been found to be properly qualified to exercise the privileges of that certificate. This certificate is also known as a "license," e. g. private pilot's license.

Solo. When a student pilot flies alone in the aircraft.

Student Pilot. An individual who is learning to fly an aircraft.

Assumptions Underlying the Study

The flight training learning environment for private pilots is very specifically ordered. The curriculum is specific in the order in which it is presented and successful completion requires closely measured performance on the part of the student. Flight instructor training is similarly exacting. While the subjects of the study were from the flight training center utilized by Oklahoma State University, some students have taken flight training from other institutions. Only the results of training received at Oklahoma State University may be generalizable to all similar flight training institutions.

Limitations

The population sample consisted of student pilots enrolled in a 4-year college curriculum and who had received flight training in an FAA approved flight training center. As flight training is standardized by the FAA, other flight training institutions might utilize these data. Results may not be generalizable to flight training environments of dissimilar make-up.

Organization of the Study

This study reviewed the literature by describing the flight training process, first for a student pilot training to become a private pilot, then by a commercial pilot training to become a certified flight instructor. The review continued with discussion of pilots as a distinct personality profile group, the effects of

stress on performance, learning styles, and the results of matching and training strategies.

The methodology of the study describes the subjects, instruments used with the subjects, the reliability and validity data associated with the learning style instrument, data gathering procedures, and the design of the study.

CHAPTER II

REVIEW OF THE LITERATURE

A review of the literature to follow supports the notions that: (1) airplane pilots do, indeed, appear to be a distinct part of the population; (2) stress is a learning inhibition factor; (3) students exhibit specific learning styles and preferences; and (4) certain selection criteria can be useful in predicting success in aviation training.

The flight training process may begin at any age, however, a student pilot cannot fly an aircraft without an instructor present until his or her sixteenth birthday or receive a private pilot's license until his or her seventeenth birthday (FAR/AIM, 1994).

Many flight instruction programs operate from small airports, sometimes with a single flight instructor under Federal Air Regulations (FAR) Part 61: pilot and flight instructor certification. Some flight schools and colleges meet the criteria of FAR Part 141: flight schools. By meeting FAR Part 141 criteria, which includes training facilities, personnel, and course syllabi that meet certain standards, flight schools become FAA-approved (Glaeser, Gum & Walters, 1989).

The FAA minimum requirements to complete private pilot flight training are based on training taken under FAR Part 61 or

Part 141. FAR Part 61 flight training requires 40 hours of total flight time, 20 hours of dual instruction, and 20 hours of solo flight. FAR Part 141 requires 35 hours of total flight time, 20 hours of dual instruction, and 15 hours of solo flight. Glaeser, Gum, and Walters (1989) also noted that the average student will fly solo for the first time after 12 to 15 hours of flight instruction and will complete private pilot flight training after about 65 hours.

Student pilots are required to complete ground instruction in addition to flight training. There are formal ground schools which are offered by airport operators, technical schools, and some colleges. There are also home-study courses available so the students can work alone Finally, there are "weekend ground schools" that provide condensed ground school instruction over a two to three day period.

Following successful completion of ground school instruction, the student is eligible to take the private pilot written exam, a 60 question multiple-choice test of one's aviation knowledge. This examination must be successfully completed before the private pilot checkride can be taken.

Flight training consists of pre-solo dual instruction learning the principles of flight including taxiing the aircraft on the ground, flying straight and level, climbing, turning, descending, take-off and landing techniques, emergency procedures, two-way radio procedures, and ground-reference maneuvers.

Before a student can fly an aircraft solo, he or she must take a medical examination for a third class medical certificate to

insure good physical health; this certificate remains in effect for 24 months. It is issued to student pilots providing they are in good health, are at least 16 years of age, and able to read, speak, and understand the English language.

After the first solo flight the student receives more instruction in ground-reference maneuvers, additional take-off and landing practice, and preparation for long-distance cross-country flights. Within the prescribed minimum hours for the private pilot license, a student must also have at least 10 hours of solo cross-country flight and three hours of dual night flight instruction.

When all ground school and flight training requirements have been completed, the student is eligible to take the private pilot practical examination from an FAA designated flight examiner. This person will administer an oral and a flight examination. He or she will test the student's ability to fly the aircraft relative to established standards and to operate the aircraft in accordance with federal aircraft regulations. Upon successful completion of this examination, the new private pilot may fly with passengers without the supervision of a flight instructor.

FAR Part 61.183 (FAR/AIM, 1994) notes that to instruct students in an airplane, a certified flight instructor must be at least 18 years of age, read, write and converse fluently in English, and hold a commercial or airline transport pilot certificate and an instrument rating. In addition, he or she must pass a written test on the subjects in which ground instruction will be taught, and pass

a practical flying test demonstrating ability to teach flying skills to student pilots.

The certified flight instructor student much demonstrate proficiency aeronautical knowledge and teaching techniques acquired through ground or flight instruction (Kershner, 1993). The ground school instruction must include information on the learning process, effective teaching, evaluation and testing, course development, lesson planning, and classroom instructing techniques. In addition, the instructor student must

> . . . log ground instruction from an authorized ground or flight instructor in all of the subjects in which ground instruction is required for a private and commercial pilot certificate, and for an instrument rating, if an airplane or instrument instructor rating is sought (FAR/AIM, 1994 p. 61-52).

An instructor applicant must also demonstrate proficiency in the air. Applicants must demonstrate the ability to teach, demonstrate, evaluate, and correct errors in all aspects of student instruction. In addition to demonstrating the ability to instruct all required flight maneuvers to student pilots, airplane flight instructors must also verify their ability to perform and recover from spins and stalls. Stall awareness, spin entry, spins, and spin recovery techniques must be demonstrated satisfactorily.

Airplane Pilots as a Distinct Personality Profile Group

Effective, efficient supervision and training are necessary in the flying environment particularly because lives depend upon the

flight instructor's ability to teach the student pilot the myriad of things he or she is required to know to safely operate an aircraft. In addition to basic and advanced flying skills used in everyday flight operations, the student must learn to deal with a multitude of emergency conditions quickly and decisively should they occur.

The stereotypical image of the aviator as a super-man or -woman, supremely confident and rather dashing, may be fairly accurate. Retzlasff and Gilbertini (1988) indicated that airplane pilots are, indeed, a special group. They stated that Air Force white male pilots in undergraduate pilot training fall into a discernible personality type that is more affliative and is more desirous of recognition and approval from peers than non-flying male college students.

A study of 105 superior U. S. Navy jet aircraft pilots (Reinhardt, 1970) concluded that select population had traits in common with outstanding pilots. Two-thirds of the subjects were first-born children and had very close father-son relationships. When compared to seventy U. S. Navy aviator training failures, the outstanding pilots had a much lower incidence of sickness or compulsive risk-taking. Similar results were noted by Bucky & Ridley (1972). Their results suggested that U. S. Navy aviation trainees who completed flight training were more dependable and practical than those who dropped out of training. Bartram and Dale (1982) noted that successful military pilots had similar personality characteristics and concluded that personality was linked to military flight training achievement.

Ashman and Telfer (1983) studied U. S. Air Force pilots, trainee commercial pilots, and general population males. They concluded that trainee pilots may have personality characteristics distinct from the community, but there were relatively few differences. A similar study on U. S. Navy jet pilots and general population males (Fry & Reinhardt, 1969) yielded comparable results, but showed differences on almost all scales of the test instrument. They noted "compared to the general adult male, the jet naval aviator expresses greater manifest needs in the areas of Heterosexuality, Dominance, Change, Achievement, and Exhibition while expressing lower manifest needs in the areas of Nurturance, Abasement, Deference, Order, and Succorance."

Other research on civilian pilot populations yielded similar conclusions, though not as supportive as the military-oriented studies. Novello and Youssef (1974a) tested 170 male general aviation pilots with a battery of psychological tests. They concluded that general aviation pilots and U. S. Navy pilots had similar personality profiles and both were significantly different from U. S. adult male norms. While similar in profile, the general aviation pilots and U. S. Navy pilots were not equal. General aviation pilots fell in between the two other groups but were significantly closer to the U. S. Navy pilots than the U. S. adult male norms. He also noted that only about six percent of the general aviation pilot population had any previous military experience, indicating that military training experience was not a determining factor for the general aviation pilot population's personality attributes.

A similar study by these researchers (Novello & Youssef, 1974b) studied female general aviation pilots. Their results suggested that the personality profile of female general aviation pilots were comparable to the earlier study on general aviation male pilots (Novello & Youssef, 1974a). They noted ". . . the personality profile of female pilots has the greatest resemblance to the male pilot profile, second highest resemblance to U. S. adult males, and least resemblance to the U. S. adult female." This suggested that the "pilot personality," if it exists, is not gender specific.

Ferrara (1994) attempted to replicate the previously cited studies on pilot personality profiles with mixed results. His findings suggested that there were personality profile differences between college professional pilot students and collegiate norms, but they were not as significant as those demonstrated by Novello & Youssef (1974a). These findings must be considered in light of the researcher's use of different comparison group norms in the 1994 study than was used in the 1974 study.

In a study of personality/hazardous attitude relationships, Ives (1993) compared Myers-Briggs Type Indicator general population norm scores with that of the study's general aviation student pilots. While the researcher was unable to support the research hypothesis on attitude relationships, the MBTI scores suggested a "large disparity" between the student pilot scores and those of the MBTI general population norms. The author supported the idea of "an aggregate personality profile for the student civil pilot population that is considerably distinct from the general population at large."

While pilots are not a homogeneous group, there are significant similarities in pilot populations, both civilian and military, and female and male, from the general U. S. population. While differences exist, the research supports the existence of a pilot personality in some form that crosses gender and military/civilian lines.

The Effects of Stress on Performance

The effects of stress on performance goes well beyond the flight training environment. Stress is an inhibiting factor in most all aspects of learning, and the anticipation of stress appears to cause even more. Stress is purported to inhibit coping effectiveness and impede the brain's encoding and retrieval processes. Therefore, the greater the stress in the learning environment, the more effort required by both student and instructor to overcome this learning inhibitor.

Stress reduction in the learning environment is not just the obligation of the instructor; the student must accept some responsibility too. Rohrkemper & Corno (1988) noted that classrooms have stressful learning situations too, and students must learn to be adaptive to their environment and respond to changing learning situations and tasks. By taking control of their learning students can minimize tense educational experiences.

Methods for reducing stress in the learning environment include "stress inoculation" (Whitman, Spendlove, & Clark , 1987). These researchers suggested a preventative approach to avoid stress in the

classroom. This approach included stress awareness, good faculty-student communications, and a "professionally intimate" atmosphere. Stress reduction and avoidance was also suggested by Dixon (1992), and Herbster, Abel, & Prince (1988).

A study by Mefferd & Wieland (1966) suggested that the mere anticipation of stress caused a greater stress response than would otherwise have normally occurred. Using the students' pulse rate as a stress measurement indicator, subjects who anticipated the upcoming event as a stressful situation had significantly higher pulse rates than subjects who did not consider the event to be stressful. In addition, the stress anticipating subjects also scored lower on psychometric tests and had a higher error rate than their counterparts.

Horowitz (in Melton, Hoffman, & Delafield, 1969; Melton & Wicks, 1967) noted that "anxiety adversely affects perception, cognitive functioning, and motor responses and arises primarily in a student pilot from his uncertainties in a strange environment and his ego involvement about how well he is performing."

Similar findings were reached by Krahenbuhl et al. (1981). Instructor pilot behavior effects on student pilot stress levels were explored. Instructors were categorized as positive or negative depending on their use of praise behaviors and acceptance. Study results found that stress responses were significantly greater in negative instructor-student dyads than in positive instructor-student dyads.

The effects of stress on the learning environment has been

explored in medical research on the human brain. Robinson (1988) suggested that stress brings on hormonal changes that are capable of inhibiting certain types of neural activity called "downshifting." She further suggested that the part of the brain called the hippocampus, responsible for taking bits of data and using it to create a broader picture, is very sensitive to stress. Similar research was noted by Boyle (1987) mentioning the inhibition of the encoding and retrieval processes by anxiety.

Melton, McKenzie, Kelln, Hoffman, & Saldivar (1975) studied general aviation student pilots working toward a private pilot's license. Eight of these subjects received their first ten hours of instruction in a ground-based Link trainer. The other eight subjects received their first ten hours of instruction in a single-engine aircraft. The tension exhibited by the students in the aircraft, as measured by pulse rate and oxygen consumption, was significantly higher in this initial training period than the pulse rates of students in the Link trainer, both before and during the training periods.

Melton, Hoffman, & Delafield (1969) studied 11 male student pilots' stress reactions in private pilot training. The researchers administered a mild tranquilizer to half of the subjects and a placebo to the remainder. They concluded that physical fear was not a major stress factor in general aviation students as the tranquilizer had no observable effect on reducing stress or on flight training performance. The researchers noted that ". . . the human stress incident to flight training is generally equivalent to that

experienced by astronauts or pilots in actual combat." Melton and Wicks (1967) echoed these sentiments by suggesting that "the private pilot curriculum was as stressful as combat flying, X-15 and lifting body flying, low altitude flying in high performance jets, and, indeed, orbital flight."

Learning Styles

Learning styles, according to Smith & Renzulli (1984), referred to the range of instructional strategies which a student will typically use in learning. Learning styles of students and, correspondingly, the teaching styles of teachers have been examined very thoroughly. Many claims have been made about higher achievement and enhanced learning effectiveness through teaching style adaptation. Butt (1993) studied the cognitive styles and preferred instructional strategies of educators. This researcher discovered strong correlations between cognitive styles and preferred teaching methods. Fourqurean, Meisgeier, & Swank (1990) explored the link between Jungian psychological type and students' learning styles. They studied middle-school metropolitan students with several learning style inventories and found that knowledge of students' preferences could increase the effectiveness of the learning environment.

Hunt (1981) suggested that teachers' adaptation to students was very important, yet not well understood. He also noted that the teacher-student interaction process was not unidirectional. That is to say, the teaching-learning process is not one-way. Hunt suggested

that students have a significant effect on the teacher and can influence teaching behavior significantly. Gregorc & Ward (1977) stated that students too should be flexible and ". . . broaden themselves to accept other teaching styles than the one they prefer."

The effects of teaching style may depend significantly on the students' learning style, which may not be a constant (Bonham, 1989). Luh (1990) studied teacher education students and noted that there was no predominant learning style, or personality type among the sample population. Hyman & Rosoff (1984) recommended that teachers realize that the teaching-student relationship is constantly changing because students are also changing; learning style is not static. Gregorc (1979) urged caution in the use of teaching style adaptation. He noted "every environment places demands upon individuals for adaptation," and that "any idea that has the potential of doing great good, also has the potential for doing serious harm." It was suggested that some elements of learning cannot be measured and that personal judgment and intuition based on experience may be the most important tools in determining teaching style for a particular situation.

Other researchers (Campbell & Davis, 1988; Gregorc & Ward, 1977; Keefe, 1990) emphasized the necessity to relate teaching style to the learner. A personalized approach to teaching that emphasizes the learner's preference for acquiring information would be beneficial and learning transfer improved. Gregorc & Ward go on to suggest that a teacher many not be able to encompass the learning style preference

of all students and should vary presentation methods to ensure that all the learners' preference needs are met at least some of the time.

Certified flight instructors, while receiving some training on instructional methodology are, perhaps, inadequately prepared to teach students, especially compared to college-trained teachers. Cook (1994) discussed the problems associated with flight instruction and student pilots. He emphasized the need for instructors to increase the student comfort level as much as possible and stressed the importance of good two-way communication. Similarly, Horowitz (1964) discussed the need for the instructor to be aware of the sensitivities of the student pilot.

The research of Smith and Renzulli (1984) suggested that learning style matching does have a positive impact on achievement, maintaining interest, and motivation. They stated "this finding confirms what many experienced teachers have long believed -that students learn best when the style as well as the pace of instruction is varied within the classroom." In addition, these researchers believed that there was no one specific teaching approach that works well in all situations. Like Grauer (1985), Smith and Renzulli agreed that individual learning styles must be acknowledged and respected when possible.

The age or school level of the learner appeared to be an influencing factor in learning style preferences. Smith & Holliday (1987) and Jenkins (1991) agreed that middle school students have different learning styles and that matching student preferences for instruction and teaching style may have value. However, it appears

as if younger students are more flexible in their ability to adapt to teaching style than older students. Dorsey & Pierson (1984) studied adult undergraduate students' learning styles. Their research suggested that learning style type was influenced by the subjects' ages and prior work experience. These older students were not only concerned with learning content, but also desired to learn things that would help them with personal and career aspirations.

Learning style-teaching style similarity benefits go beyond personal preferences and academic comfort levels. Dunn (1987, 1990) reported that children learning under conditions that matched their preferences had better attitudes and significantly higher achievement test scores. Dunn & Griggs (1989) and Cafferty (1981) noted that the degree of closeness of learning-teaching styles was related to grades and grade point average (GPA). The closer the learning-teaching style, the higher the GPA, as well as the reverse. Dunn, Beaudry, & Klavas (1989) found similar results. Children had higher test and attitude scores when allowed to learn with their preferred styles. Similarly, Murray (1984) found that students were more productive when using their preferred learning style.

Results of Matching and Training Strategies

Cullen, Harper, & Kidera (1969) suggested that perceptual skills might be a prerequisite to becoming a successful pilot. They went on to note that the process of flying may contribute to the development of these perceptual skills. Their study of United Airlines' pilots and engineers noted that this airline emphasizes

a student-instructor relationship strong on sensitivity to the students' needs. Instructors were encouraged to be sensitive to the reactions of their students and, as necessary, modify their teaching techniques to try to make the learning process as efficient as possible. In a study of the impact of aircraft crew coordination training, Chidester, Helmreich, Gregorich, & Geis (1991) suggested that it may be beneficial to select individuals based on their personality characteristics to achieve desired performance parameters. They also noted that different subjects' personalities may require different training strategies for optimal effectiveness. An older study (Cobb, 1968) concluded that commercially published aptitude tests could effectively predict pass-fail status and performance grade of persons entering air traffic controller training.

Whitman, Spendlove, & Clark (1987) noted that many stress models found a "mismatch" between the student and the learning environment, and that the students' coping skills varied widely. These researchers noted that when students do not know what to expect they often feel out of control in learning situations. By considering students' feelings and fears of the learning environment, instructors help restore feelings of self-control and motivation to learn. They stressed a "professionally intimate" environment that encouraged class participation and good two-way communication.

Not all researchers agreed with these findings. Davis, Murrel, & Davis (1988), Blagg (1985), and West (1982) all found no

significant differences in matched or partially matched students and instructors, or by matching instructional techniques to learning style. Neither cognitive style variables, specialized teaching techniques, nor student-instructor opposition of styles were found to be significant in students' grade point averages or academic success.

Personality factors have also been used as predictors. Levine, Lee, Ryman, & Rahe (1976) studied U. S. Navy aircraft carrier accidents and the personnel injured in or associated with them. A questionnaire measuring behavioral attitudes was administered to all personnel on an aircraft carrier beginning a deployment cruise. Items of the questionnaire significantly predicted accidents in the research group.

Similar results were documented in a study by Sanders & Hoffman (1975). The administered personality factor questionnaire was able to correctly classify 86 percent of the subjects as to whether they had been involved in a military aviation accident and considered a causal factor. However, in another study (Sanders, Hofmann, & Neese, 1976), which attempted to validate the previous study of Sanders & Hoffman (1975), they were unable to replicate the findings. The personality factors of this second study did not significantly discriminate between the pilot-causal fact or accident groups.

There has been a long history of attempting to use psychological testing to enhance the selection process of military aviation trainees (Dolgin & Gibb, 1989; Siem, 1992). Several researchers (Koonce, 1982; Lambirth, Gibb, & Alcorn, 1986; Picano, 1991; Siem, 1992) all concluded that personality measures were not

an acceptable nor accurate method of predicting flight training success, reduced attrition, or initial applicant selection.

However, Siem (1992) did suggest that there was some evidence that personality characteristics had some predictive ability in job performance as opposed to training performance. The term "honeymoon effect" was used to describe the initial phases of training that might not be indicative of future performance.

Other studies concluded that training outcome might be predicted based on pre-testing. Bartram & Dale (1982), Delaney (1992), Gibb & Dolgin (1989), Retzlaff & Gilbertini (1988), and Turnbull (1992) all studied military aviator trainees and found that testing or tracking either predicted success or performance in flight training. In a study of general aviation student pilots (Kreienkamp, 1983) a testing measure accurately predicted student pilot flight training time.

Learning Style Inventories

The Myers-Briggs Type Indicator (MBTI) was used in this research because of its ease of use, self-scoring ability, low cost, satisfactory instrument validity and reliability, and extensive use (over 250,000 MBTI records exist since computer scoring began in 1971). The MBTI is based on the work of psychologist Carl Jung, who between 1920-1926 coined the term "psychological types." Jung believed that all people are different even though we have the same instinctual drives. One instinct is relatively equal to another, the significance is how we function in our daily lives. We all have preferences in how we function, that is to say,

characteristics of how we function. Through these characteristics or preferences Jung believed we can be grouped by "function types" or "psychological types" (Carlyn, 1977; Cox, 1968; Jung, 1970; Kiersey & Bates, 1985).

In the 1950s Isabel Myers reviewed Jung's work on psychological types and with the assistance of her mother, Katheryn Briggs, developed an instrument identifying 16 distinct personality or psychological types: the Myers-Briggs Type Indicator. Myers & McCaulley (1985, p. 1) noted:

> the aim of the MBTI is to identify, from self-report of easily recognized reactions, the basic preferences of people in regard to perception and judgment, so that the effects of each preference, singly and in combination, can be established by research and put to practical use.

The MBTI consists of four indices, each reflecting one of the four basic preferences or types based on Jung's 1920s research. The indices are Extraversion-Introversion (E-I), Sensing-Intuition (S-N), Thinking-Feeling (T-F), and Judgment-Perception (J-P).

The E-I index was designed to reflect the degree of extraversion or introversion in a subject. The extravert is outward centered and tends to focus perception and judgment on people and things-the physical "outer" world. The introvert is inwardly oriented and tends to focus perception and judgment upon concepts and ideas-the "inner" world.

The S-N index was designed to reflect the differences in one's ability to perceive, relying primarily on sensing (made aware of things directly through any number of the five senses) or by the process of intuition (or in direct perception by way of the unconscious).

The T-F index was designed to reflect a subject's preference about judging, whether they rely primarily on thinking (impersonally discriminating between true and false), or primarily on feeling (discriminating between valued and not-valued).

The J-P index was designed to reflect whether a person relied on a judging process (thinking or feeling) or upon a perceptive process (sensing or intuitive) in dealing with the outer world or extraverted part of their lives (Myers & McCaulley, 1985; Kierey & Bates, 1984; Myers, 1962).

A person taking the MBTI would receive information helping to determine four basic preferences. Each MBTI index, E-I, S-N, T-F, and J-P was designed to point in one direction, but not to reflect absolute behavioral patterns. Myers & McCaulley (1985, p. 2) also noted:

> according to theory, by definition, one pole of each of the four preferences is preferred over the other pole for each of the sixteen MBTI types. The preference on each index is independent of preferences for the other three indices, so that four indices yield sixteen possible combinations called 'types,' denoted by the four letters of the preferences (e.g. ESTJ, INFP).

This does not imply a rigid perceptive or learning orientation. Regardless of the strength of an index score, subjects also have strengths or abilities in the opposite index area. Just because a subject scores high on the Thinking index does not mean that he or she does not use the Feeling index. While most people are right- or left-handed, they still use both hands, however, they tend to use one hand more than the other. When a choice is available, people chose their dominant hand to perform tasks. Similarly, they use a dominant MBTI index to interact with their environment.

Myers & McCaulley (1985) suggested that the MBTI has value in many communications-oriented areas. They offered specific suggestions for use of the instrument in industry, communications, career guidance, situations requiring cooperation and teamwork, counseling, and education. They also proposed that the MBTI has educational value because of its ability to show that different types of students need different teaching styles and have different motivations for learning. The MBTI is offered as a tool to help teaching method development to meet the needs of different types of students, to understand type differences in the learning process, and to consider different types of students when selecting materials, media, methods, and curricula. Knowledge of perceptive differences and different learning needs might increase the efficiency of the teaching-learning process.

The Myers-Briggs Type Indicator (MBTI) has been used in cognitive research. The MBTI aims to ascertain people's basic preferences in regard to perception and judgment (Myers, 1962). In one study it was shown that when 72 clients and their counselors were administered the MBTI, the instrument indicated a significant relationship between client-counselor similarity and length of counseling (Mendelsohn & Geller, 1963). Research at the University of Florida indicated that there was a correlation between a student's score on the MBTI and his or her preference for college teaching methods.

Not all researchers agreed with these findings. For example, Blagg (1985), and Davis, Murrell, & Davis (1988) found no

significant relationship between learning styles or academic success and cognitive style variables, while Westerman (1989) found that learning inventory tests were not a good predictor of academic performance or achievement.

Other researchers involved in similar studies disagreed. Campbell & Davis (1988) noted that teaching may be improved by emphasizing learners' dominant ways of perceiving and judging. Keefe (1990) and Murray (1984) argued that cognitive style diagnosis gives a strong and rational basis to a personalized approach to education and presents opportunities to academic advisors, educators, and student personnel specialists.

Summary

Whatever a particular individual's perceptive style may be, other individuals with the same or similar style should be easier to understand and communicate with. On the other hand, individuals with different perceptive styles may be more difficult to communicate with, less predictable, and contrary on most personal opinions.

Flight training appears to be one of a select few training environments where the stress of learning is justified by a possible loss of life if the training is performed improperly. Accurate, understandable communication between student and instructor is essential for learning transfer as well as for survival. It is suggested that matching students and instructors on their ability to communicate with each other may be more important than in other less intense learning environments.

With these personality matching scenarios in mind, a portion of the substantial differences in flying hours needed to pass the private pilot license examination may possibly be attributable to differing perceptive styles. If such a relationship exists, flight curriculum efficiency might be improved significantly. In flight training schools prospective pilots could take a simple examination that would more effectively match them with their flight instructors and expect satisfactory completion of the flying curriculum in less time, on average, than if they were assigned an instructor at random. Perceptive style similarity appears to have an overall potentially significant effect on learning relationships. The following hypothesis was offered:

Student pilots who are matched with their flight instructors on the basis of perceptive similarity, as measured by a learning style inventory, will learn to fly in less time than student pilots who are not matched with their flight instructors.

CHAPTER III

METHODOLOGY

Introduction

The methodology chapter is divided into six areas: subjects, instruments, reliability, validity, procedures, and design. The subjects area describes the participants in the study, personal characteristics, qualifications, and the required participation activities. The instruments area describes the Myers-Briggs Type Indicator and the personal data questionnaire. This questionnaire included questions on demographic and pilot history data. The reliability area discusses MBTI internal consistency and split-half reliability of continuous scores. The validity area describes instant validity comparisons with the Jungian Type Survey. The procedures area discusses, chronologically, the methods used by the researcher to interact with the subjects and gather the data. The design area discusses the type of research design used in the study, the appropriateness of the choice of design, identifies the independent and dependent variables of the hypotheses, and describes the statistical procedures used to test each research hypothesis.

Subjects

Subjects for this study were 35 undergraduate college students from Oklahoma State University-Stillwater (OSU) taking aviation-related courses from the Aviation and Space Education Department (AVSED). They were tested in March and April, 1994. Only students who possessed a private pilot's license qualified for this study. The original population consisted of 117 students, but to ensure the homogeneous nature of the population only subjects who had taken all private pilot flight training at the Stillwater campus were included. The population was further reduced by eliminating all subjects who had not completed the private pilot flight training program utilizing only one CFI. Of the 35 subjects 32 were male, 3 were female, ranging in age from 18 to 33, with an average age of 22.4. These subjects were asked to participate in the research by taking the Myers-Briggs Type Indicator (MBTI), form G, self-scoring test, and by completing a researcher-designed questionnaire. All qualified subjects who were asked to participate in the study did so.

Instruments

Myers-Briggs Type Indicator (MBTI)

This instrument was chosen to determine, from self-report of easily reported reactions, individuals' basic preferences regarding perception and judgment. The self-scoring form G MBTI was utilized consisting of 94 2-choice questions. All necessary

instructions were included during testing. There was no time limit.

This instrument contains separate indices for determining each of the four basic preferences which structure the individual's personality based on Jung's theory of type. Basic preferences about perception and judgment tend to affect people's interests, values, and needs and consequently their motivations (Cox, 1968; Jung, 1970; Lawrence & McCaulley , 1982; McCaulley, 1990; Myers, 1962; Myers & McCaulley, 1985; Wheeley & Foley, 1987).

The subjects' answers to the 94 MBTI questions were counted and points grouped on the instrument in eight different indices. These eight indices were further grouped into four two-group indices representing the MBTI preference areas. These indices are designed to point one way or another; on each index scores run in either direction with zero at the center. The range of score possibilities for each scale are:

E 51 0 I57

S 67 0 N51

T 65 0 F 39 (Males)

T 65 0 F 43 (Females)

J 55 0 P 61

An example indices score-preference score-continuous score comparison might appear like this:

Indices Score				Preference Score		Continuous Score
E	23	I	8	E	29	71
S	19	N	11	S	15	71
T	5	F	27	F	45	145
J	12	P	10	J	3	95

The indices score consists of two letters on each index with a numerical score. This determines the direction of preference, E or I, S or N, T or F, and J or P, based on the number showing the strength of each preference. The dominant or preference direction consists of taking the largest number on each index and utilizing the associated letter on that index. For example, since the example E score of 23 is larger than the I score of 8, E, or extraversion, is the preference direction.

These dichotomous preference scores, in the form of a four-letter "type" such as ESFJ, describe the direction of a person's preference. The strength of the preference score is determined by subtracting the smaller score on each of the four indexes from the larger score. For example, on the E-I index, 8 is subtracted from 23. The product (15) is then converted to a preference score of 29 using a summary table (Myers & McCaulley, 1985). The preference scores indicate the relative strength of the type. For example, an E preference score of 50 would indicate a larger degree of extraversion than an E preference score of 29. It should be noted that MBTI instrument developer Isabel Briggs Myers believed that the preference direction was more important than the strength of the score.

These preference scores are not adequate for correlational research. Myers & McCaulley (1985) provided a table for statistical MBTI score analysis by converting these preference scores to continuous scores, a linear translation of preference scores. By establishing a range from 33 to 167 with 100 as the mean and division point on each MBTI scale, group correlational comparisons can be made. Using the same Myers & McCaulley table, preference scores can be converted directly into continuous scores for correlational research.

Each subject's continuous score on each scale of the MBTI (E-I, S-N, T-F, and J-P) was compared with the instructor's continuous score on the corresponding scale and the difference between them, the "difference score," constitutes the independent variable. For example, a student with an extravert-introvert scale continuous score of 115 (typed as Introvert), and a flight instructor continuous score on the same E-I scale of 85 (typed as Extravert) would translate into an E-I scale difference score of 30. Regarding extraversion or introversion, this student-instructor dyad would be more similar than a dyad with a difference score of 60. The difference scores on each scale of the MBTI would then be correlated with student pilot flying time required till the first solo flight and flying time to pass the FAA private pilot checkride. The time required till the first solo flight and the time to pass the FAA private pilot checkride are both dependent variables.

Questionnaire

The questionnaire was designed during February, 1994 by the researcher (See Appendix A), with input by the dissertation adviser, and received approval by the Oklahoma State University Institutional Review Board (See Appendix B). Its purpose was to gather personal subject data to be correlated with the MBTI for the researcher's dissertation. The questionnaire consisted of 20 items of data about the subject's flying history, plus an additional seven questions about the subject's flight instructor which were acquired and entered by the researcher.

The items used from the questionnaire answered by the subject were: subject's name, number of "dual" hours before the first solo flight, number of hours for the private pilot's license (including the hours for the final checkride), location of private pilot instruction, was all the private pilot instruction at one airport, was all private pilot instruction with only one certified flight instructor, and the name of the flight instructor used in private pilot training.

The subject's flight instructor was also asked to participate in the research by taking the MBTI and by providing data that could be compared with the data of the subject. The item used from the questionnaire supplied by the subject's flight instructor was the flight instructor's name which, which when linked to the subject's name was, assigned a random three-digit number. Both the subject's and the flight instructor's MBTI scores were entered onto the questionnaire in the "for researcher use only" portion of the form.

The similarity or dissimilarity of the student's and the flight instructor's MBTI results were compared with the subject's flight performance times while training for and acquiring the private pilot's license.

Reliability

Myers & McCaulley (1985) reported estimates of internal consistency and replicability of the MBTI. They used continuous score reliability for the four preference scales of the instrument, the major interest being the ability of the instrument to consistently report the same type.

A limitation for potential test subjects is that of a subject's achievement level and intelligence. Perception and judgment appear to be linked with achievement level, so more intelligent subjects may report their preferences more consistently than lower-achieving subjects. Higher intelligence and a more extensive vocabulary may limit the possibility of random responses and raise test consistency. When the Indicator is used with poor readers, scores should be interpreted with caution. The population for this study was four-year college students, thus that limitation did not appear to be of concern.

Myers & McCaulley reported split-half reliabilities for many different subject groups and noted that "reliabilities are consistent with those of other personality instruments." Results are reported about groups representative of this research population.

TABLE II

INTERNAL CONSISTENCY OF CONTINUOUS SCORES WITH SPEARMAN-BOWMAN PROPHECY FORMULA CORRECTION MBTI FORM G, MALES AND FEMALES

	N	E-I	S-N	T-F	J-P
Traditional college student	11,908	.82	.81	.82	.86
Nontraditional college student	1,708	.83	.84	.85	.92

Validity

Instrument validity is based on the MBTI's ability to show relationships and outcomes predicted by Jung's theory of psychological type. If Jung's theory of type does describe existing preferences and the MBTI is an instrument capable of indicating these preferences, instrument validity should be demonstrable. Myers (1962) noted that

> in-so-far as the type preferences are found to correlate, in appropriate directions, with interests, values and needs ascertained by other tests, or to correlate approximately with any other external evidence of internal differences, support is afforded for the validity of the theory and the Indicator (p. 21).

Correlation with the Gray-Wheelwright Psychological Type Questionnaire which has the same purpose as the MBTI, to identify the Jungian types (Myers, 1962) and the Jungian Type Survey (Myers &

McCaulley, 1985) were made. Correlations of E-I, S-N, and T-F indices with the corresponding Gray-Wheelwright scales are .79, .58, and .60 respectively; there is no J-P scale on the Gray-Wheelwright test.

Six variables were utilized in this study: E-I, S-N, T-F, and J-P difference scores between student pilots and their flight instructors, and the number of hours required to solo an aircraft for the first time and the number of hours to complete requirements for a private pilot's license. This study was designed to examine the potential relationship of student-instructor personality differences to student pilot performance. For example, a low extravert-introvert student-instructor score difference should indicate that the student will perform the first solo flight and acquire a private pilot's license in fewer hours than if the score difference were greater.

Procedures

Test administration occurred in March and April, 1994. Each AVSED classroom instructor volunteered one hour of his class time so that the researcher could gather the research data. One or two class periods before the data were to be gathered, students were asked to bring their flying logbooks to class on the day they met the researcher. This was done to assist the subjects in the accuracy of their recall of dates and number of hours required to obtain certain flying licenses.

Every subject who met the qualifications was asked to

participate. At the beginning of each tested class period students who did not possess a private pilot's license were dismissed from the class for that day. The remaining subjects were then asked again to confirm they were the holders of a private pilot's license and were willing to voluntarily participate in a research project for the remainder of the class period. A total of 117 subjects participated in the data gathering; no one declined to participate.

The test subjects were told by the researcher that he was gathering data for a study of the learning styles of people who are pilots. It was explained to each student that the MBTI was a learning style inventory that tells something about the subject, what the subjects like and dislike, and carries no positive or negative connotations. As the test cannot be "failed", the intent was to remove any pressure to perform or conform to expectations.

Before any data gathering began, the researcher carefully explained that the students were under no obligation to take the MBTI or fill out the questionnaire. Neither their in-class performance nor their final class grades would be affected in any way by participating or not participating in the research. It was also explained that if they found any of the questions on either the MBTI or the questionnaire offensive or too personal, they could terminate their participation at any time without penalty of any kind.

All subjects were informed that if the flight instructor they received private pilot instruction from could not be found and tested, their questionnaires would be immediately assigned a random three digit number and their names removed. These names and any

identifying data were then destroyed in the AVSED office shredder. After this had been accomplished, not even the researcher would be able to link any acquired data with any study participant.

Study participants who had flight instructors who could be located and tested were kept by the researcher until the MBTI results and questionnaire were received from that subject's instructor. These new data were entered onto the subject's questionnaire. The subject's name was then removed from the data and a random three digit number assigned. Flight instructor data, with the name attached, was kept until the end of the data gathering period to allow for other subjects who might have listed this instructor as their own. This did occur on many occasions. After all subject data gathering was completed, all flight instructor's names were removed from their questionnaires and random three digit numbers assigned. These names and other identifying data were then shredded in the same manner as other subjects.

No materials of any kind were presented to the subjects until after these statements were made. Each student or flight instructor volunteer took the test under supervision of the researcher and graded his or her own examination. The volunteer's test results were interpreted through a group lecture/discussion, and completed tests and questionnaires retained by the researcher.

Initial analysis of gathered data yielded 35 student-flight instructor pairs that met all research design requirements. To be selected for use in this study, subjects were required to have taken

all private pilot flight instruction at OSU-Stillwater, completed all training with one CFI, and have that CFI take the MBTI and the questionnaire for subject-instructor matching.

Design

The review of the literature showed that very limited research in aviation education had been performed. There was only one other study of pilot-instructor matching (Kreienkamp, 1983) and it was limited by sample size. An experimental design research project could not be justified based on this limited attention to the subject. Accordingly, the study was causal comparative in nature. Its purpose was to determine if further, perhaps experimental design, research should be undertaken. Its *ex post facto* design appeared the most appropriate because of its simplicity, limited cost, and ease of gathering data (Gay, 1992.)

The student-instructor personality difference scores on each MBTI scale were the interval-level independent variables. The number of hours till the first subjects' solo flight and the number of hours required to obtain the private pilot's license were the ratio-level dependent variables. Consequently, Pearson product moment correlations were used to examine the strength of the relationship between the two dependent and each of the four independent variables (Gay, 1992; Roscoe, 1975).

CHAPTER IV

FINDINGS

A Pearson correlation was used to compare the dependent and independent variables in this study. This statistical technique was used because of the interval-ratio nature of the two dependent and four independent variables. Significance was not found on any of the variables tested (see Tables III and IV). Therefore, the hypothesis that student pilots who are matched with their flight instructors on the basis of perceptive similarity, as measured by a learning style inventory, will learn to fly in less time was rejected.

The flying hour means were relatively consistent between males, females, and the entire tested population. Females differed significantly from males on standard deviation of hours and range of hours on both the dual before solo and the private license indices (See Table V).

TABLE III

PEARSON CORRELATIONS FOR THE MBTI DIFFERENCE SCORES AND FLYING TIME TO FIRST SOLO

Difference Scores	Correlation (R=)	Probability (P=)
Extraversion - Introversion	.105	.547
Sensing - Intuition	-.267	.120
Thinking - Feeling	.026	.884
Judging - Perceiving	.154	.337

The Extraversion - Introversion difference score correlation was .105 with a probability of .547. The Sensing - Intuition difference score was -.267 with a probability of .120. The Thinking -Feeling difference score was .026 with a probability of .884. The Judging - Perceiving difference score was .154 with a probability of .337.

The difference score correlation was highest (though negative) on the Sensing - Intuition difference score and lowest on the Extraversion - Introversion difference score. The Sensing - Intuition difference score probability of p=.12 was lowest for the indices, but still well below the more customary p=.05 level.

TABLE IV

PEARSON CORRELATIONS FOR THE MBTI DIFFERENCE SCORES AND FLYING TIME TO PRIVATE LICENSE

Difference Scores	Correlation (R=)	Probability (P=)
Extraversion - Introversion	.070	.691
Sensing - Intuition	.205	.238
Thinking - Feeling	-.271	.115
Judging - Perceiving	.083	.635

The Extraversion - Introversion difference score correlation was .070 with a probability of .691. The Sensing - Intuition difference score was .205 with a probability of .238. The Thinking -Feeling difference score was -.271 with a probability of .115. The Judging - Perceiving difference score was .083 with a probability of .635.

The difference score correlation was highest (though negative) on the Thinking - Feeling difference score and lowest on the Extraversion - Introversion difference score. The Thinking-Feeling difference score probability of p=.115 was lowest for the indices, but still well below the more customary p=.05 level.

TABLE V

MEANS, STANDARD DEVIATIONS, AND RANGES OF FLYING HOURS BY TRAINING LEVEL AND SEX (N=35)

Flying Hours	M	SD	Range
Dual before Solo	11.6	3.5	8-23
Males (N=32)	11.7	3.61	8-23
Females (N=3)	11.3	1.7	9-13
Private License	44.0	6.7	35-63
Males (N=32)	44.3	6.9	35-63
Females (N=3)	41.0	0.0	41-41

Subjects' average flying time before first solo flight (n=35) was 11.6 hours, the standard deviation was 3.5 hours, and the range of flight time was from 8-23 hours. Male subjects' average flying time before first solo flight (n=32) was 11.7 hours, the standard deviation was 3.61 hours, and the range of flight time was from 8-23 hours. Female subjects' average flying time before first solo flight (n=3) was 11.3 hours, the standard deviation was 1.7 hours, and the range of flight time was from 9-13 hours.

Subjects' average flying time to obtain the private pilot's license (n=35) was 44.0 hours, the standard deviation was 6.7 hours, and the range of flight time was from 35-63 hours. Male

subjects' average flying time to obtain the private pilot's license (n=32) was 44.3 hours, the standard deviation was 6.9 hours, and the range of flight time was from 35-63 hours. Female subjects' average flying time to obtain the private pilot's license (n=3) was 41.0 hours. All three female subjects took 41.0 hours to obtain the private pilot's license.

CHAPTER V

SUMMARY

The purpose of this study was to determine if a relationship existed between the learning style similarity of student pilots and their flight instructors, and the amount of time it takes to fly solo in the aircraft for the first time and also to pass the private pilot practical examination.

The population sample consisted of 35 four-year college students at a research-level university who had received private pilot flight training in an FAA Part 141 approved flight training center. Each subject had taken all private pilot flight training from one location and completed the training utilizing only one flight instructor.

The results of this study did not support the hypothesis: Student pilots who are matched with their flight instructors on the basis of perceptive similarity, as measured by a learning style inventory, will learn to fly in less time than student pilots who are not matched with their flight instructors. Correlations were not satisfactory between the MBTI difference scores and either flying time variable.

Findings

These results supported the findings of Blagg (1985), Davis,

Murrel, & Davis (1988), and West (1982) who all found no significant differences in matched or partially matched students and instructors, or by matching instructional techniques to learning style. These data disagreed with those of Kreienkamp (1983) on the extraversion-introversion scale, but support that study on the other three MBTI indices: sensing-intuitive, thinking-feeling, and judging-perceiving.

In addition, the average time to first solo flight, to obtain the private pilot's license, and the range of flight time on both parameters for the Oklahoma State University (OSU) population were somewhat better than noted in that earlier college-based research population. The OSU average and range of flight time to obtain the private pilot's license was significantly better than the national average as reported by Wilhelmsen (1994). Female pilots in this study had a much smaller range of flying hours on both the time to first solo and time to acquire the private pilot's license than did the male subjects.

This study took place in a very specialized flight training environment. Results may only be generalizable to similar flight training settings. Even with the specific training criteria, order of administration, instructor certification requirements, and well-defined pass/fail criteria of the private pilot training process, there was a marked amount of dissimilarity in training outcomes.

The researcher took great care to ensure the homogeneous nature of the research population, at a significant cost to the size of the

sample. Of the 117 pilots originally tested, all of whom were 4-year college students associated with an aviation education department, only 35 met the final criteria for the research population. They were young (average age 22), intelligent (four-year college students at a research-level university, and trained in a similar environment (all subjects took their entire flight training from one flight training department and did not switch instructors during the training).

However, even with this select population the range of flight training time was noteworthy. On the time-to-first-solo criteria, the range was from -1 to +3.3 standard deviations from the mean. On the time-to-private-license criteria, the range was from -1.3 to +2.8 stand deviations from the mean. Considering the similarity of the subject population and the training environment, there appeared to be other factors involved in the flight training process.

A limitation of this study may have been methodology-related. Since the data gathered for this study was based on a self-report questionnaire and a self-scoring learning style inventory, the gathered data may not be entirely accurate. The MBTI learning style inventory appeared to pose no threat to the subjects and was probably answered with complete honesty. However, the personal data questionnaire asked for data that, while not sensitive in itself, may have tempted some subjects who may not have been pleased with their personal flying performance, to modify the results to show a more favorable training performance record.

Recommendations

While these data results did not indicate a relationship between learning style similarity and flight training time, there are evidently some unknown factors that affect the training environment to manifest such dramatic ranges in flight training time at the student-private pilot level in a homogeneous population.

The level of experience of the flight instructor, student pilot-flight instructor age differences, or sex differences between instructor and student may be areas worthy of future investigation.

It is recommended that if future studies explore the flight instructor-student pilot learning relationship the methodology must include the safeguard of verified flight training performance data. This could be accomplished by verifying pilot logbook entries or having flight instructors report these data directly to the researcher upon completion of flight training. Researchers may have to consider a longitudinal study to ensure a statistically significant number of subjects while maintaining the homogeneous nature of the population.

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APPENDIXES

APPENDIX A

PILOT QUESTIONNAIRE

Pilot Questionnaire

The purpose of this questionnaire is to assist the researcher, Ronald A. Kreienkamp, (hereafter called the RESEARCHER) with a dissertation research project entitled: Flight Instructor-Student Pilot Learning Style Similarity and its Effect on Flight Training Efficiency. The researcher is investigating the relationship between the learning styles of flight instructors and their private pilot students as it relates to the flight training time to obtain the private pilot's license.

Your cooperation is requested by answering the questions listed below, and taking a learning style inventory. All questions refer to your experiences as a student pilot working toward your private pilot's license. These data will be grouped with other respondents. No individual names will be identified in the work-in-progress nor any final document. Names will only be used to match the student pilot with his or her instructor and then removed from the data.

Name (first, middle, last)_____

ID Number _____ Age_____ Sex _____ OSU or UCT? _____

Total flight time _____

Date Private license granted (mo/yr) _____

Number of "dual" hours before first solo flight _____

Number of hours for private license (including final checkride)_____

Number of attempts to pass the private checkride _____

Location of private pilot instruction _____

Tower-controlled airport? (Y/N) _____

Was all private instruction at one location? (Y/N) _____

Was all private instruction with one instructor? (Y/N) _____

Number of Hours for Instrument Rating _____
Multi-engine _____ CFI_____

Certificates/Ratings: Private Commercial ATP Instrument Multi-Engine
(Circle) CFI CFII CFIME Seaplane Glider Helicopter

Name of last private pilot flight instructor _____

FLIGHT INSTRUCTORS ONLY

Name (first, middle, last) _____ ID Number _____

Age _____ Sex ____ SWO or TUL? _____ Total flight time _____

Total flight time-DUAL GIVEN--Category _____

Certificates/Ratings (circle) CFI CFII CFIIME_____

(For researcher use only.)

MBTI Results _____ _____ ___ ___ ___ ___ ___ ___ ___ ___

Quadrant Designation E I S N T F J P

APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL FORM

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
FOR HUMAN SUBJECTS RESEARCH

Date: 02-07-94 **IRB#:** ED-94-052

Proposal Title: FLIGHT INSTRUCTOR-STUDENT PILOT LEARNING STYLE SIMILARITY AND ITS EFFECT ON FLIGHT TRAINING EFFICIENCY

Principal Investigator(s): Steven K. Marks, Ronald A. Kreienkamp

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

APPROVAL STATUS SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT NEXT MEETING.
APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL. ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

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

Signature: _____ Date: February 10, 1994
Chair of Institutional Review Board

VITA

Ronald A. Kreienkamp

Candidate for the Degree of

Doctor of Education

Thesis: FLIGHT INSTRUCTOR-STUDENT PILOT LEARNING STYLE SIMILARITY AND ITS EFFECT ON FLIGHT TRAINING EFFICIENCY

Major Field: Higher Education

Biographical:

Personal Data: Born in Washington, Missouri, August 2, 1949, the son of Robert A. and Alberta M. Kreienkamp.

Education: Graduated from Pacific High School, in May, 1967; received Bachelor of Science degree in Aviation Administration from University of North Dakota, in August, 1978; received Master of Arts degree in counseling from University of North Dakota, in May, 1983; completed requirements for the Doctor of Education degree at Oklahoma State University in December, 1994.

Professional Experience: U. S. Air Force--Forward Air Controller, Vietnam, Radio Operator and Administrative Specialist/ North Dakota and South Dakota, Radio Operations Supervisor-Germany, 1968-1976; Air Traffic Control Specialist, Grand Forks Flight Service Station, Grand Forks, North Dakota, Lecturer, Accident Prevention Program, Federal Aviation Administration, Flight Standards District Office, Fargo, North Dakota, 1978-1981; U. S. Customs Agent, Department of the Treasury, Grand Forks, North Dakota, 1981-1983; Air Traffic Control Specialist, Grand Forks Flight Service Station, Grand Forks, North Dakota, Lecturer, Accident Prevention Program, Federal Aviation Administration, Flight Standards District Office, Fargo, North Dakota; Drug and Alcohol Abuse Counselor, U. S. Air Force, 1983-1985; Flight Service Instructor at the FAA Academy, Oklahoma City, Oklahoma; Revision and Development Specialist for the Automated Flight Service Station program; FAA Academy Project Manager/

Modernized Direction Finder Network, and the Mode S Data Interface System; Accident Prevention Counselor, Federal Aviation Administration, Flight Standards District Office, Bethany, Oklahoma, 1985-1987; Area Supervisor and Training Specialist, Grand Forks Automated Flight Service Station, Grand Forks, North Dakota; Supervisor of 3-12 Air Traffic Control Specialists; Cooperative Education Instructor for 16 college CO-OP students, Accident Prevention Counselor, Federal Aviation Administration, Flight Standards District Office, Fargo, North Dakota, 1987-1991; Lecturer, Center for Aerospace Sciences, University of North Dakota, Grand Forks, North Dakota. Instructor of AVIT 303, Introduction to Air Traffic Control, August 1991-May 1992; Research Associate, Department of Aviation and Space Education, Oklahoma State University, Stillwater, Oklahoma, and Accident Prevention Counselor, Federal Aviation Administration, Flight Standards District Office, Oklahoma City, Oklahoma, August 1992 to present.

Personal Development: Commercial Pilot, Instrument and Multi-Engine rated; Advanced Ground School Instructor; Amateur Radio Operator, General Class.

Professional Memberships: Graduate Representative, Graduate Academic Advisory Council, Academic Standards and Curriculum Committee; Secretary and former President of Graduate Student Council, College of Education, Oklahoma State University; Membership Chairman and Proctor-Central Oklahoma Mensa. Founder of Ronald Kreienkamp Endowment Fund, University of North Dakota.

Professional Associations: Aircraft Owners and Pilots Association; Civil Air Patrol; Disabled American Veterans; Experimental Aircraft Association; Oklahoma Aerospace Educators Association Phi Delta Kappa; University Aviation Association.

Honors: Received U. S. Air Force Commendation Medal, 1972; recieved three North Dakota Board of Higher Education Scholarships, 1981-1982; Special FAA Achievement Award, 1990; FAA Exceptional Job Performance Ratings, 1986, 1989, and 1991; Ten FAA Letters of Commendation, 1985-1991; FAA National Air Traffic Facility Award, 1991; FAA Quality Management Award, 1991; Oklahoma State University Foundation Scholarship, 1992.