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A Replication Study of Personality Types of Students in a Professional Pilot Baccalaureate Degree Program

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A REPLICATION STUDY OF
PERSONALITY TYPES OF STUDENTS IN A
PROFESSIONAL PILOT BACCALAUREATE DEGREE PROGRAM

by

Stephanie Gill Fussell

A Thesis Submitted to the College of Aviation,
Department of Graduate Studies, in Partial Fulfillment
of the Requirements for the Degree of
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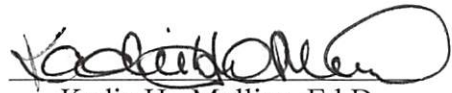PROFESSIONAL PILOT BACCALAUREATE DEGREE PROGRAM

by

Stephanie Gill Fussell

This Thesis was prepared under the direction of the candidate's Thesis Committee Chair, Dr. Andrew R. Dattel, Assistant Professor, Daytona Beach Campus, and Thesis Committee Members Dr. Kadie H. Mullins, Director of Undergraduate Research, Daytona Beach Campus; Dr. Michael E. Wiggins, Department Chair of Aeronautical Science, Daytona Beach Campus; Dr. Kenneth P. Byrnes, Flight Chair, Daytona Beach Campus; and has been approved. It was submitted to the Department of Graduate Studies in partial fulfillment of the requirements for the degree of
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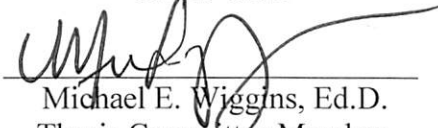
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Abstract

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The personality types and learning styles of students have been studied in several

populations, yet the research analyzing aviation students is lacking. A replication study

assessed the distribution of personality types of students enrolled in the aeronautical

science baccalaureate degree program at Embry-Riddle Aeronautical University (ERAU).

In addition, this study assessed aviation student learning styles. The Myers-Briggs Type

Indicator (MBTI) Form M and the Kolb Learning Style Inventory (KLSI) were used to

analyze the personality types and learning styles, respectively. Selection ratio type tables

compared the distribution of personality types of aviation students to the traditional

college student sample and to a sample collected by Wiggins at ERAU in 1998. In the

sample data, the personality type of ISTJ was found to be significantly different from

both baselines ($I = 4.36, p < .001$ and $I = 1.96, p < .01$). The distribution of learning

styles of the aviation students were compared to the traditional college student sample

using Chi-square goodness-of-fit tests revealed an overrepresentation of divergent

learners, $\chi^2 (3) = 7.40, p = .002$, in the sample. A Pearson Chi-square test for

independence examined if personality type is a predictive factor of aviation student

learning preference and found no evidence support a relationship in the sample.

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Chapter I

Introduction

Researchers have studied personality types of students in different academic fields, such as education, engineering, medicine, and pharmaceuticals (Kutz, Brown, Carmichael, & Shandiz, 2004). In aviation, the personality types of pilots have been examined and compared to other populations (Callister, 1999; Gao & Kong, 2016; Kanske & Brewster, 2001; Kutz, Brown et al., 2004; Robertson & Putnam, 2008). However, research provides less information as to how the personality types of aviation students relates to their learning styles.

Wiggins (1998) assessed personality types of students enrolled in a professional pilot program (i.e., an aeronautical science baccalaureate degree program) at Embry-Riddle Aeronautical University (ERAU). The study (hereafter referred to as *Wiggins Study*) also assessed the students' attitudes toward different teaching methods used by instructors within the program. Wiggins compared the learning preferences of the students to their personality types. This study will replicate *Wiggins Study*; however, a validated learning style inventory (LSI) was used to compare the learning styles of aviation students to population norms.

Significance of the Study

It is important to understand the role learning styles play in education. Adapting a more pedagogical approach to individual learning styles could improve learning and achievement. Understanding the relationship between student personality and learning style can lead to more efficient and effective curricula design for aviation education programs and flight training schools. This study utilized the Myers-Briggs Type

Indicator (MBTI) and the Kolb Learning Style Inventory (KLSI) to analyze both the personality types and learning styles, respectively, of aviation students enrolled in a professional pilot program. The study examined the relationship of the two factors to determine if any personality types or learning styles in the aviation student population differ from the traditional college population. Knowledge of how aviation students learn will provide administrators, faculty, and flight instructors the ability to adjust teaching methods and optimize learning.

Statement of the Problem

As a result of how learning styles and personality styles intersect, aviation students may not be receiving the most beneficial training from the current curricula. There are many ways to learn, and the traditional lecture method may not be the best method of teaching for all aviation subject matter. Although there have been several studies analyzing the personality types of pilots, there have been few studies analyzing the personality types of aviation students. In addition, there have been even fewer studies of the learning styles of aviation students. The results of the study provide an analysis of these styles and may present educators with teaching alternatives better suited for the aviation student.

Purpose Statement

It is important to investigate how personality type and learning style intersect within aviation students. Using this information, results were compared to the traditional college population norms and analyzed the relationship between student personality type and learning style. Additionally, results were compared to those of the *Wiggins Study* by

analyzing both personality type and learning style of aviation students in a professional pilot program.

Hypotheses

The following hypotheses were tested.

H1: The distribution of MBTI types of students enrolled in a professional pilot program will not be significantly different from the distribution of the MBTI types of students found in the traditional college population.

H2: The distribution of MBTI types of students currently enrolled in a professional pilot program will not be significantly different from the distribution of the MBTI types of students found by Wiggins in 1998.

H3: There is no significant difference in MBTI types between the class standings of freshman, sophomore, junior, and senior.

H4: The distribution of the KLSI preferences for students enrolled in a professional pilot program will not be significantly different from the distribution of the KLSI preferences of students found in the traditional college population.

H5: There is no significant difference in KLSI preferences between the class standings of freshman, sophomore, junior, and senior.

The following related research question was examined.

R1: Is personality type a predictive factor of aviation student learning preference?

Delimitations

A delimitation of this study is the scale used to assess personality style; the MBTI Form M was chosen for its popularity and reliability, and because it was used in *Wiggins Study*. A second delimitation is the scale used to evaluate learning style, the KLSI

Version 3.1, also chosen for its popularity and reliability. Finally, the assessments were conducted via computer.

Limitations and Assumptions

The sample for this study was limited to aviation students enrolled in the aeronautical science baccalaureate degree program at Embry-Riddle Aeronautical University during the spring semester of 2017. To be eligible, the students must have completed a solo flight in their private pilot training. It was assumed that the population of students at ERAU is representative of students enrolled in aeronautical science baccalaureate degree programs at other universities.

Definitions of Terms

Abstract conceptualization   A stage in the Kolb learning cycle focused on logic, thinking as opposed to feeling, and systematic planning. It is the traditional third stage in the experiential learning model, in which new ideas are formed (Kolb, 1984).

Accommodator   A Kolb learning style dominant in those who prefer to learn through action and experience, who will adapt to the environment, and may use trial and error to solve a problem; it is primarily found in those who favor concrete experience and active experimentation (Kolb, 1984).

Active experimentation   A stage in the Kolb learning cycle focused on actively changing situations and applying practical solutions. It is the traditional fourth stage in the experiential learning model, in which the experience is applied to the outside world (Kolb, 1984).

Assimilator   A Kolb learning style dominant in those who use reasoning,

theoretical models, and disparate observations to form an

explanation; it is primarily found in those who favor abstract

conceptualization and reflective observation (Kolb, 1984).

Class standing   The delineation of students by academic year: freshman,

sophomore, junior, and senior.

Concrete experience   A stage in the Kolb learning cycle focused on feeling,

intuition, and being involved in an experience. It is the traditional

first stage in the experiential learning model, when an experience

is encountered or reinterpreted (Kolb, 1984).

Converger   A Kolb learning style dominant in those who organize knowledge

for deductive reasoning and prefer a practical approach to decision

making; it is primarily found in those who favor abstract

conceptualization and active experimentation (Kolb, 1984).

Dichotomy   The separate indices used in the MBTI designed to reflect direction

of a preference rather than a measurement. In MBTI type theory, it

is assumed that each person utilizes the preferences in some way;

the inventory identifies the strength of each preference (Myers &

McCaulley, 1985).

Diverger   A Kolb learning style dominant in those who observe a situation

before acting and prefer to seek alternatives before organizing

information; it is primarily found in those who favor concrete

experience and reflective observation (Kolb, 1984).

Experiential learning A learning theory that assumes knowledge is shaped by accumulated life experiences, that adaptation and cognitive incorporation lead to more effective processing, and that the cycle of learning may begin at any time (Kolb, 1984).

Extroversion The attitude dichotomy in Jungian type theory that refers to how an individual draws energy to the outer world, such as people and events (Myers & McCaulley, 1985).

Feeling The judgment dichotomy in Jungian type theory that refers to the way a person draws conclusions about what they have perceived; the relative values and the merits of issues are considered before a decision is made (Myers & McCaulley, 1985).

Intuition The perceiving dichotomy in Jungian type theory that refers to how an individual becomes aware of events and people around them; insight is used to establish meanings and possibilities (Myers & McCaulley, 1985).

Introversion The attitude dichotomy in Jungian type theory that refers to how an individual draws energy to within, such as memories, ideas, and reactions (Myers & McCaulley, 1985).

ISTJ A Myers-Briggs type personality type, which was the prevailing type in this study – *I*ntroverted, *S*ensing, *T*hinking, *J*udging.

Judging The orientation dichotomy in Jungian type theory that refers to the way a person way an individual orients to the outer world; these

individuals are decision makers and planners (Myers &

McCaulley, 1985).

Jungian type theory   A theory developed by Carl Jung (1921) based on total

personality utilizing four basic mental processes, believed to be

used by everyone in daily life; it was the basis of the MBTI (Myers

& McCaulley, 1985).

Learning stages   In the Kolb experiential learning model, the four phases

required for effective learning. Although the model may be

entered at any stage, the traditional sequence is concrete

experience, reflective observation, abstract conceptualization, and

active experimentation (Kolb, 1984).

Learning style   How a learner orients to and interacts with the learning

environment, taking into account the learner's cognitive abilities,

psychological behaviors, and how they choose to learn (Dunn,

DeBello, Bennan, Krimsky, Murrain, 1981; Keefe, 1979). Kolb

(1984) asserts that learning preferences are formed from genetic

predisposition, prior experience, and the present environment.

Perceiving   The orientation dichotomy in Jungian type theory that refers to the

way a person way an individual orients to the outer world; these

individuals are attuned to incoming information (Myers &

McCaulley, 1985).

Preference   How an individual orients to a given situation and draws

conclusions about the surrounding environment.

Personality type   Also referred to as type; in this paper, it is how a person

relates to the world around them, receives information, forms

decisions, and orients to their type preferences (Myers &

McCaulley, 1985).

Reflective observation   A stage in the Kolb learning cycle focused on

understanding through observation, considering other perspectives,

and intuiting the meaning of situations. It is the traditional second

stage in the experiential learning model, in which the learner

reflects upon the experience (Kolb, 1984).

Selection ratio type table   A table created by the Center for Applications of

Psychological Type, used to compare Myers-Briggs type study

sample distribution to a baseline distribution. Cells of the tables

include the number of the type in the sample, the percentage of the

population represented, and the self-selection ratio (also known as

the self-selection index).

Self-selection index   A figure generated by the Center for Applications of

Psychological Type that compares the percentage of a sample

distribution to a baseline sample for significance. An index (I) of

1.0 and greater in the study sample means a higher percentage of

type for a college major than in the baseline sample.

Sensing   The perceiving dichotomy in Jungian type theory that refers to how

an individual becomes aware of events and people around them;

these individuals observe through the senses to establish what

exists (Myers & McCaulley, 1985).

Thinking   The judgment dichotomy in Jungian type theory that refers to the

way a person draws conclusions about what they have perceived;

these individuals bring ideas together through logical connections

(Myers & McCaulley, 1985).

List of Acronyms

AC	Abstract conceptualization
AC-CE	Abstract conceptualization – concrete experience
AE	Active experimentation
AE-RO	Active experimentation – reflective observation
CAPT	Center for Applications of Psychological Type
CE	Concrete experience
CPP	CPP, Inc.
E	Extroversion
ERAU	Embry-Riddle Aeronautical University
F	Feeling
I	Introversion
IRB	Institutional Review Board
ISTJ	Introvert, sensing, thinking, judging
J	Judging
KLSI	Kolb Learning Style Inventory
LSI	Learning style inventory

MBTI   Myers-Briggs Type Indicator

N   Intuitive

NEO PI-R   Revised NEO Personality Inventory

P   Perceiving

RO   Reflective observation

S   Sensing

SRTT   Selection ratio type tables

T   Thinking

USAF   United States Air Force

VARK   Visual, Aural (or Auditory), Read/Write, Kinesthetic Model

Chapter II

Review of the Relevant Literature

Personality characteristics of aviation students have received limited study; fewer studies still have assessed the learning styles of aviation students. Literature was explored in the following areas: personality type, learning style, the personality type and learning style of aviation students, and the intersection of a learning style and a personality type.

Personality Types

Personality has been a topic of debate for psychologists as well as lay people, and personality theory has evolved with the understanding of human cognition and early childhood development (Ford, 2013). Although the theories surrounding personality vary widely, Ryckman (2013) presents a general definition of personality as "the dynamic and organized set of characteristics possessed by a person that uniquely influences his or her cognitions, motivations, and behaviors in various situations" (p. 4). There are four categories of personality theories that have developed: psychodynamic, humanistic, trait, and social cognitive. A thorough examination of all theories is beyond the scope of this study. Among the many who have analyzed personality, Sigmund Freud, Carl Jung, and Hans Eysenck laid much of the ground work for understanding personality types.

For much of the early 20th century, Freud was the leader in psychodynamic theory (Ryckman, 2013). Freud assumed the human mental life is comprised of the conscious, the preconscious, and the unconscious, and rooted in the unconscious are driving instincts influencing behavior. Additionally, Freud's theory has three constructs of how the mind is organized and interacts to influence behavior: the id, ego, and

superego. Freud's theory culminates in psychosexual development through five stages, with the unsuccessful transition through any stage resulting in an abnormality in personality (i.e., a "fixation").

Freud's work was both groundbreaking and controversial. Carl Jung, a student of Freud's who eventually disagreed with Freud's emphasis on psychosexual development (Ryckman, 2013), developed a theory based on total personality utilizing four basic mental processes. Jung believed these were used by everyone in daily life. The processes symbolize an individual's orientation to consciousness (Myers & McCaulley, 1985). Jung's four processes are categorized by perception (sensing and intuition) and judgment (thinking and feeling). Jung also categorized attitude (extraversion and introversion) as part of this theory. The type theory work of Jung became the foundation Myers-Briggs Type Indicator (Myers & McCaulley).

Trait theory assumes that individuals have innate characteristics that influence behavior, and these characteristics predispose an individual to act in a certain way regardless of a situation (Heffner, 2014). A person does not have a single defining trait; rather, it is the combination of traits that forms individual personality. Eysenck identified three biological (i.e., inherited) factors of personality, which are found in each person: extraversion, psychoticism, and neuroticism (Heffner, 2014). The degree to which each trait manifests in a person is quantifiable through factor analysis, which classified several identified behaviors under the three biological factors. Eysenck's trait theory paved the way for the Five Factor Model.

Five Factor Model. Although Eysenck's model was accepted based on the fact that it included common personality traits, many researchers and psychologists found it

lacking (Heffner, 2014). The Five Factor Model incorporated Eysenck's character traits and identified five personality traits found in different areas of research, although the terminology may vary among researchers. The traits are openness to experience, conscientiousness, agreeableness, extroversion/introversion, and neuroticism (Heffner, 2014). All five traits are measured on a continuum and represent numerous personality traits that follow under them. The Five Factor Model and its many versions have been used to assess success in specific career paths, the military, and college majors.

Although the Five Factor Model is praised for its objectivity, in that it uses factor analysis and statistical data, a core tenet of trait theory is that it does not predict future behavior (Heffner, 2014). How a person reacts in a given situation is not addressed in trait theory, as only personality characteristics are taken into considerations. Additionally, trait theory does not consider that personality may change as the individual develops and encounters new life experiences.

Myers-Briggs Type Indicator. Unlike the Five Factor Model, the Myers-Briggs Type Indicator (MBTI) uses type theory, which assumes that children are born with a predisposition to certain preferences over others (Myers & McCaulley, 1985). As they use the dominant process through maturity, the preference becomes more differentiated. Here, preference refers to the way an individual uses their mind to perform a task by orienting themselves in a favored manner. The MBTI, based on Carl Jung's theory of psychological types (Jung, 1921), identifies specific type preferences of an individual to determine someone's personality type.

The MBTI utilizes four dichotomies to reflect the preferences used by an individual to perceive the world and orient themselves appropriately. The preferences

affect what the individual focuses on in a given situation, as well as how they draw

conclusions about the situation (Myers & McCaulley, 1985). According to MBTI type

theory, individuals prefer each dichotomy at some level. Understanding each preference

allows the individual insight into how they perceive and judge their environment. The

dichotomies and how they influence the behaviors they encompass are depicted in Table

1.

Table 1

The MBTI Preferences

Preference Dichotomy	Affects the Following
Extroversion (E) – Introversion (I)	Attitude: where energy is drawn from (i.e., internally or externally)
Sensing (S) – Intuitive (N)	Perception: how the individual becomes aware of the environment or ideas
Thinking (T) – Feeling (F)	Judgment: how conclusions are drawn based on what was perceived
Judging (J) – Perceiving (P)	Orientation: how the outer world is met and oriented to

Attitude. This preference describes how an individual draws energy from their

environment. In type theory, extraversion (E) refers to energy drawn from the outer

world, including people, objects, and events. Introversion (I) refers to energy drawn from

within, often by working with ideas, memories, and reactions within the mind.

Perception. Perception describes the ways a person becomes aware of people,

events, things, or ideas. Sensing (S) perceivers observe through the senses to establish

what exists; they have acute observational powers and a memory for details. The

intuitive (N) perceiver uses insight to establish meanings and possibilities, often unconsciously as a "hunch" or a sudden realization.

Judgment. Judgment describes the way a person draws conclusions about what they have perceived, including evaluation and decision making. Thinking (T) judgment refers to the process that brings ideas together through logical connections; these individuals tend to be analytical and objective. Feeling (F) judgment refers to the way an individual weighs relative values and the merits of issues to come to a decision.

Orientation. Myers and Briggs (Myers & McCaulley, 1985) developed a last category based on Jung's work, which describes how an individual orients to the outer world. An individual with a perceptive (P) attitude is attuned to incoming information and is often open to change and new experiences. Individuals with the judging (J) attitude preference are decision makers, planners, and activity organizers.

The purpose of the MBTI is to identify the specific preferences of an individual to determine their personality type. It is important to note that each dichotomy is designed to point in a direction of a preference and not as a scale of measurement; every person is assumed to use each of the four categories in some way, and the inventory identifies the strength of each preference (Myers & McCaulley, 1985). The MBTI combines the preferences to create 16 personality types, as depicted in Table 2.

Table 2

The 16 MBTI Types

ISTJ	ISFJ	INFJ	INTJ
ISTP	ISFP	INFP	INTP
ESTP	ESFP	ENFP	ENTP
ESTJ	ESFJ	ENFJ	ENTJ

The MBTI has gone through several iterations since its first development in 1942. Internal consistency analyses were performed at each stage of development to further define how each question related to the four dichotomies (Myers & McCaulley, 1985). Despite the MBTI's popularity in many fields of research, Pittenger (1993) argues that the scoring of the MBTI, which classifies data into dichotomies based on answers given by the participant, are too rigid: people with very similar scores may be classified as very different personalities due to how each dichotomy is scaled.

Keirsey Temperament Sorter. Often compared to the MBTI, the Keirsey Temperament Sorter assesses personality type by focusing on four temperaments inherent in humans (Keirsey, 1998). In this model, temperament accounts for an individual's patterns of action, personal needs, communication style, and the role they play in society. The four temperaments are identified as the Guardians, the Artisans, the Idealists, and the Rationals. Keirsey developed his study of four temperaments on the works of Hippocrates and Plato (Keirsey, 1998) as opposed to Jung's cognitive functions. Recognizing the similarities between his model and the MBTI model, Keirsey identified four MBTI preference combinations that resulted in dissimilar personality types, but aligned with the four temperaments identified in his theory based on their attitudes and actions, as depicted in Table 3. The four temperaments were correlated to the MBTI personality types based on the intersection of communication style (i.e., concrete or abstract) and pattern of action (i.e., utilitarian or cooperative).

Table 3

Keirsey's Four Temperaments

Temperament	MBTI Combination
Guardian	Sensing, Judging (SJ)
Artisan	Sensing, Perceiving (SP)
Idealist	Intuition, Feeling (NF)
Rational	Intuition, Thinking (NT)

Keirsey's four temperaments are anchored by two of the dichotomous traits recognized from the MBTI (i.e., SN, JP, TF). Due to the similarities of the dichotomy preferences, MBTI types can matched to the Keirsey Temperament Sorter. For example, the MBTI types of ESTJ, ISTJ, ESFJ, and ISFJ are all categorized as Guardians. The temperaments have observable traits and behaviors, generally defined by how they achieve goals, work in a group, and communicate. Guardians are characterized as cooperative, logistical, and tend toward concrete communications. The Artisan is tactical, utilitarian, and concrete in communication. An Idealist is diplomatic, cooperative, and works with abstract communication. Rationals are also utilitarian, strategic, and abstract in communication (Neal & Neal, 2009).

Personality Type Studies

Analyzing how personality type affects different aspects of life has been the subject of research for academics, psychologists and sociologists, and others. These studies underline the importance of understanding how students perceive and interface with the world around them. Additionally, the assessment of personality type allows for further analyzing of the interactions among tasks, the environment, and potential actions of people in a situation (Fretwell, Lewis, & Hannay, 2013).

There are many ways to assess personality type, and a familiar dichotomy is the "Type A - Type B" behavior pattern. Type A individuals are generally associated with competitive and achievement-focused action; potentially aggressive and hostile reactions when facing a frustrating task; having a sense of urgency; and ambitious and work-oriented mentality (Watson, Minzenmayer, & Bowler, 2006). Type B individuals are more relaxed; may be ambitious and motivated but are more even-keeled in their methods; encourage teamwork; and set goals for the team as well as themselves (Watson et al., 2006). Fretwell et al. (2013) assessed the MBTI types and Type A-B personality types of university students, and found that Type A personality type students had a strong tendency for the judging preference. Individuals who prefer to orient to the world with a judging attitude are decision-makers, seek to plan and organize their surroundings, and may use logic and observations to reach conclusions (Myers & McCaulley, 1985). How personality assessments match are subjective, but parallels can be found when appropriate models are aligned.

In a longitudinal study on the change of personality in young adulthood, Robins, Fraley, Roberts, and Trzensniewski (2001) analyzed the stability of personality in college student over a four-year period. Previous studies of adolescents and young adults revealed an increase in openness to experience, conscientiousness, and agreeableness, and a decrease in neuroticism as people mature. The findings of Robins et al. were consistent in that aspects of personality change in moderate degrees over a given time period: specifically, during the college years students may become more conscientious, agreeable, and emotionally stable. Students may also become more open to new experiences as their view of the world expands; interestingly, extraversion did not change

significantly in this study or others. Although there was an increase, the authors found that there were no normative shifts or mean-level changes. The results of the study point to the ability of a person to adapt to surroundings and to social norms while maintaining the fundamental aspects of individual personality.

Riaz, Riaz, and Batool (2012) studied personality type as a predictor of decision-making styles. The personality types of university students were examined with results indicating that personality contributes 15.4% - 28.1% of variance in decision-making styles. Students more open to experience, agreeable, and conscientious were found to have significant positive effect on rational and intuitive decision-making style, whereas neuroticism has significant negative effect on these styles. Decision-making may be inherent and remain consistent across a variety of situations (Scott & Bruce, 1995); thus, understanding the personality type of an individual and how they react in a given situation is an important component to the decision-making process and style.

When considering academic success, the MBTI has been used to explore the relationship between personality type and scholastic success. DiRienzo, Das, Synn, Kitts, and McGrath (2010) considered the choice in major and subsequent performance across all disciplines at a medium-sized, private university using 9 years of student data. The goal of the study was to determine if certain MBTI types achieved a higher grade point average (GPA) in specific majors or in comparison to other MBTI types. The study also analyzed the MBTI types that were most prevalent in areas of academic study. DiRienzo et al. (2010) found that although some types were significantly more attracted to specific academic areas, those students did not necessarily outperform other types. This finding is

important for both teachers and learners to appreciate, so as not to advise students based on type as opposed to passion and interest.

Advisors at universities may utilize personality assessments to determine if a student has chosen an appropriate major (Neal & Neal, 2009): the MBTI and Keirsey Temperament Sorter, among others, have been used for this very purpose. The MBTI website specifies that knowing and understanding personality preferences will be a helpful advantage when deciding a college or career path, and may offer a prediction or preferred academic major/career options based on the strengths of the type (Personality and Careers, n.d.). Neal and Neal (2009) used the Keirsey Personality Temperament model to assess aerospace electronics and avionics students and determine if the findings aligned with the predicted type fit. For the academic field, the Keirsey model predicted Rational types to be most prevalent in the sample due to the association with technology, strategic analysis, and abstract communication style. Instead, Neal and Neal found this type to be the minority; the Guardian type was most prevalent. These Rational type individuals are skilled in logistics, use concrete communication, and are responsible by nature. Neal and Neal conclude that although assessing personality and temperament can provide valuable insight what drives a student, it should not be used to match a student to a college major.

Personality studies related to aviation. Researchers have studied the personality types of professional pilots and military pilots using the Revised NEO Personality Inventory (NEO-PI-R) (Callister, 1999; Campbell, Castaneda, & Pulos, 2009). However, the use of the MBTI in the field of aviation is limited (Kutz, Brown et al., 2004). Research analyzing the personality types of student pilots, and the

implications thereof (e.g., academic success, attrition of types that do not have the "right stuff"), are even more limited.

A non-empirical study of commercial pilots conducted by NASA (Fitzgibbons, Davis, & Schutte, 2000) found that most participants scored low on the neuroticism scale, high on the extraversion scale, and high or very high on the conscientiousness scale. The factors of openness and agreeableness were near normal levels. Fitzgibbons et al. (2000) developed a pilot personality profile based on the results: emotionally stable, low in anxiety and depression, deliberate in their actions, competent, active, assertive, dutiful, and trusting.

Tieger and Barron-Tieger (2001) assessed the personality types of instructors, flight engineers, and commercial helicopter pilots and found the majority to fit the ESTP profile. Individuals with the ESTP type are characterized as enjoying the moment and adaptable; they make decisions through logical analysis and reasoning.

Military pilots have been studied using different assessments; however, Campbell et al. (2009) state that the recognized pilot stereotype has yet to be translated into a reliable assessment to predict training success. Callister (1999) used the NEO-PI-R to find the personality types of U.S. Air Force (USAF) student pilots and found the average student pilot to be more extroverted, more assertive, and more competitive than the average person. Female student pilots had higher levels of openness of experience and lower levels of agreeableness when compared to the female population norms. Devlin and Singh (2010) analyzed the personality types of USAF officers and enlisted personnel who utilize computers and highly technical pieces of equipment in their daily work routine. The study, which used the MBTI, revealed a prevailing type of ISTJ. The ISTJ

individual is characterized as hardworking, practical, logical in approaching problems, and able to thrive in a structured organization. A meta-analysis by Campbell et al. (2009) found that military pilots scored low in neuroticism. Further analysis revealed that pilots with low neurotic tendencies and high extroversion were better suited for the stresses associated with military aviation training.

The personality types of students enrolled in a university flight program were compared the results to the general population (Robertson & Putnam, 2008). There was a statistically higher percentage of four personality types relative to the general population, all of which are characterized as alert and quick to see patterns or possibilities (Myers & McCaulley, 1985). The study also analyzed type combinations; the population of the study showed statistically significant preference for NP, NJ, and SJ combinations. These traits in the represented personality types may speak to the preferences of the pilots' population on a larger scale.

The Australian Personality Inventory has also been used to measure the Five Factor Model of personality styles of students enrolled aviation baccalaureate programs in Australia (Gao & Kong, 2016). The results indicated that agreeableness was the most dominant personality scale, followed by conscientiousness. Neuroticism was lowest in the sample, which was significantly different compared to a sample of non-aviation students from the same university. The difference in results in agreeableness could indicate a difference in selection criteria between military pilots and university programs, or in the training environment.

Comparisons among college majors have been made. Kutz, Carmichael, Shandiz, and Brown (2004) compared the MBTI types for undergraduate and graduate aviation

management, professional pilot, and technical services students to the MBTI types of undergraduate and graduate business students. The study found a statistically significant difference in the way the students orient themselves to the environment (JP). The aviation students identified as preferring the perceiving (P) attitude; this indicates that they are open and attuned to changing information, adaptable, and able to change goals as new details emerge. The business students preferred the judging (J) attitude, indicating that they prefer a structured course with definite goals to accomplish (Kutz, Brown et al., 2004).

The research indicates that aviation students are adaptable and attuned to changing environments, resourceful and practical, and tend to use logic to solve problems. On average, aviation students are agreeable, responsible, and emotionally stable. They are achievement oriented and competitive but will to adapt to new goals as situations change.

Learning Theories and Styles

Learning theories use conceptual frameworks to present how knowledge is absorbed, processed, and preserved during the learning process (Illeris, 2004). The three basic learning theories are behaviorist, cognitive constructivist, and social constructivist. Behaviorism asserts that knowledge is derived from behavioral responses to the environment. Cognitive constructivism uses actively constructed systems of knowledge based on pre-existing cognitive structures. The theory of social constructivism emphasizes that knowledge is formed in social contexts.

There are many definitions and understandings of learning styles that are based on the researcher, theory, or measurement being used (Dunn, DefBello, Bennan, Krimsky, &

Murrain, 1981). Learning styles serve as generally stable indicators of how a learner perceives, interacts with, and responds to their learning environment; it encompasses the cognitive characteristics as well as affective and psychological behaviors of the learner (Keefe, 1979). Several learning style inventories have evolved through research on the way a student chooses to work, such as in silence or with music, in a group or alone, and other controlled stimuli (Dunn et al., 1981).

In recent history, psychologists and sociologists have paved the way for research in learning and behavior (Workman, 2012). John B. Watson and B. F. Skinner are often given credit for being the first to study how the learning process affects behavior (Heffner, 2014). Now known as Behaviorism, Watson and Skinner believed that only observable behaviors should be studied, as other behaviors (e.g., mood, thought) were subjective. Skinner also believed that the internal state of the individual could influence behavior. The research of Watson and Skinner began the study of behavioral psychology, which led to the studies of internal and external stimuli as sources of influence on behavior, how new behaviors are learned, and the motivation to change or remain the same in a given situation (Heffner, 2014).

A widely-used and recognized model of learning styles is Fleming and Mills' Visual, Aural (or Auditory), Read/write, Kinesthetic (VARK) model (The VARK Modalities, n.d.). In this model, individuals use these preferences, or modalities, to process and retain information in a learning environment. Fleming and Mills emphasize that there are many instances in learning that a combination of the modalities may be used. The model provides learners and educators with tools to enrich the learning

environment by understanding how the learner processes information at a fundamental level.

Active learning developed from the work of several researchers and has foundations in constructivism (Brame, 2016). The theory emphasizes that students learn best when learning is active as opposed to passive. Although many definitions have been used, active learning is the connection of new ideas and experiences to existing knowledge and past experiences, to form new patterns of understanding in mental models (Brame). Active learning promotes higher-order thinking and activities in the classroom, such as in-class discussions, presentations of case studies, and demonstrations.

The experiential learning model is a cognitive constructivist theory and assumes that learning is influenced by the individual's accumulated experiences; every past experience is built upon as the individual learns something new. Adaption is an essential component of experiential learning, as it leads to the effective incorporation of cognitive and affective processes within the learner (Kolb, 1984). Thus, learning is a continuous process in the experiential learning model. The defining learning style depends on how the individual progresses through the learning process. At the heart of experiential learning theory is the emphasis on personal development and self-direction. Experiential learning theory integrates knowledge, activity, and reflection (Kolb, 1984).

Kolb Learning Style Inventory. Kolb uses the experiential learning model to measure an individual's behavior throughout the learning process (Kolb, 1984). The Kolb model describes four stages for effective learning, and the Kolb Learning Style Inventory (KLSI) assesses an individual's emphasis on each of the four stages of the learning process. The process is mutually supportive and each stage feeds into the next;

thus, the learner may enter the cycle at any area. However, Kolb stressed that effective learning will occur only when the learner passes through all four stages of the model.

Although the model may have any stage labeled as the first stage, concrete experience (CE) is often the first stage; this is when the learner encounters a new situation or experience, or when an experience is reinterpreted. The next stage is reflective observation (RO), in which the learner observes and reflects upon the experience. Abstract conceptualization (AC) is the next stage, in which reflection leads to new ideas or the modification of an abstract concept. Last, the learner participates in active experimentation (AE) by applying the experience and reflection to the surrounding world and observing the results. The model is depicted in Figure 1.
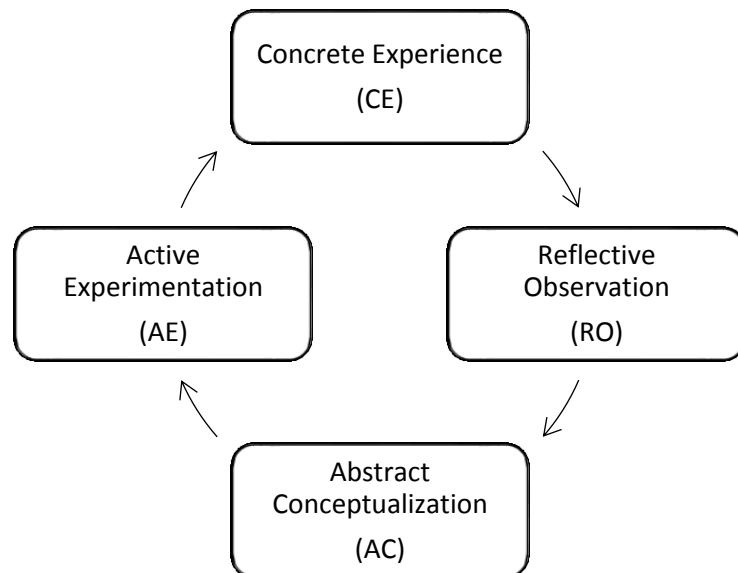

Figure 1. The learning cycle.

Each stage also describes how an individual orients to a situation using their preferred learning method. Individuals with an orientation toward concrete experience prefer situations where feelings are emphasized over merely thinking and intuition is valued over systematic approach. Those who orient toward reflective observation prefer to carefully observe situations and decipher the meanings of ideas. A learner who prefers abstract conceptualization utilizes logic, thinking over feeling, and systematic planning. An individual who orients to active experimentation prefers "to do" instead of observe and use practical application as opposed to reflection.

The Kolb model has four learning styles, or preferences, which are based on the stages of learning: converger, diverger, assimilator, and accommodator. The learning styles represent the patterns and consistencies within an individual's preferred learning process. Kolb (1984) emphasizes that learning styles and abilities are developed over time and to various degrees. How the learning preferences manifest are based on genetic predisposition, prior experience, and the present environment. Figure 2 illustrates how each learning style falls into the stages of learning.
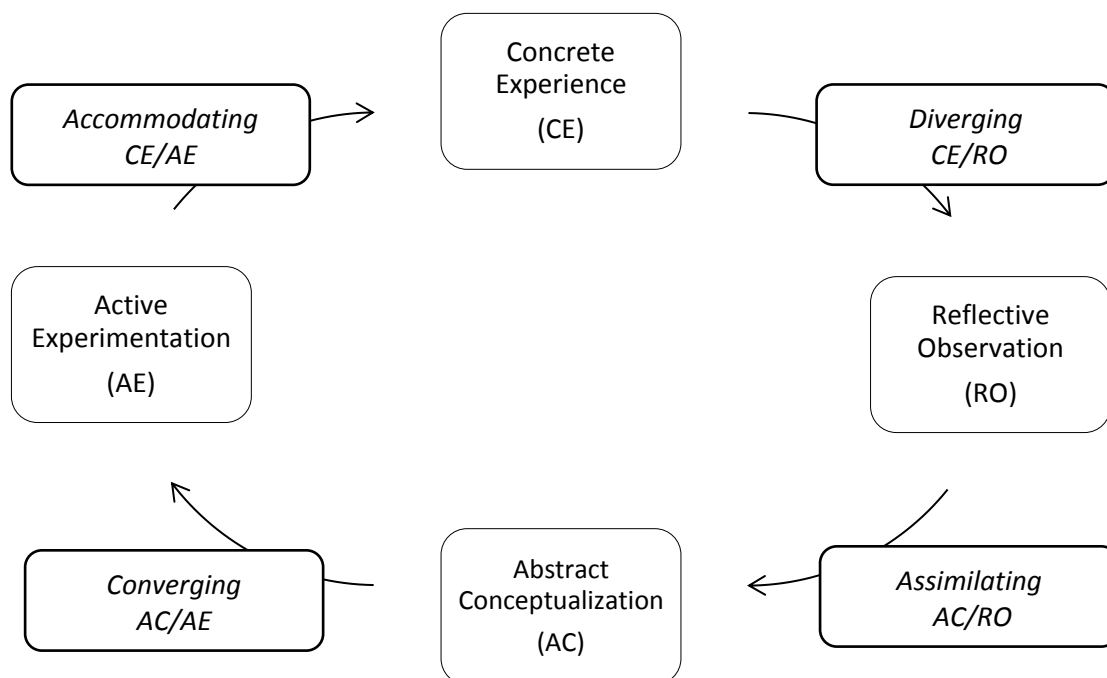
Figure 2. Kolb's learning styles within the learning cycle.

Converger. The converger learning style is dominant in those who favor abstract conceptualization and active experimentation. Knowledge is organized for deductive reasoning and focused on tasks. The learner prefers to take a practical approach to problem solving and decision making.

Diverger. The diverger learning style is the opposite of the convergent learning style. Favoring concrete experience and reflective observation, this learner prefers to seek alternative solutions and perspectives before organizing information. Observation and adaptation to situations are preferred to action.

Assimilator. This learning style utilizes abstract conceptualization and reflective observation. Inductive reasoning and theoretical models are used to integrate

observations. The learner is more concerned with the sound and logical theory of ideas and abstract concepts than with practical value of the theory.

Accommodator. The accommodator is the opposite of the assimilator and emphasizes concrete experience and active experimentation. The learner is skilled in adapting and orienting to changing environments and may be seen as a risk taker. They will solve problems using intuition and a process of trial and error.

The KLSI has also gone through several iterations; each time, the new iteration is compared to past iterations and tested on its own for reliability and validity (Kolb & Kolb, 2013). In a work assessing the theoretical limitations of the KLSI, Garner (2000) argues that the flexibility or adaptability of experiential learning detracts from the validity of the inventory.

Learning Styles Studies

Individuals utilize their preferences to process information and may gravitate to the methods that they have strengthened over time: those who conceptualize visually will use charts while those who prefer verbal language will listen to a lecture (Felder & Spurlin, 2005). Understanding learning style may allow a student to better process information, stay motivated, and create a learning environment conducive for effective learning (Dunn, Beaudry, & Klavas, 1989).

Researchers trying to understand learners may study hemisphericity, or the domination of either the left or right side of the brain that results in the behavior, characteristics, and thought patterns of a person (Devlin & Singh, 2010). Those who are "left-brained" are analytical and logical, whereas those who are "right-brained" are creative and holistic. Although both sides of the brain are utilized in learning, the

dominant side dictates learning preferences. Dunn et al. (1989) studied the correlation of hemisphericity and learning style of students in grades five through 12 and found that those with left brain dominance preferred conventional classroom learning. The students with right brain dominance preferred less structure, but were motivated by their peers.

Many educators and researchers recognize that understanding the learning preferences of students is important, whether they conduct studies or have amassed years of working with different styles in the classroom. Haar, Hall, Schoepp, and Smith (2002) note that although knowledge is reflected in the classroom, educators have a wide range of understanding of the theories of learning that may include their own experiences.

Although research has been done on teaching to students' preferred learning styles, a literature review by Pashler, McDaniel, Rohrer, and Bjork (2008) found little empirical evidence to support the argument that learning is increased when the preferred learning style is used. Nevertheless, others (Sergiovanni & Starrett, 1988) argue that more effective teaching results in more effective learning, and that educators may need to adjust teaching strategies at times. Barrett (1991) concludes that an educator's direct control of the learning environment, and therefore learning, warrants an understanding of student learning preferences. According to Reiff (1992), learning style is affected by how students learn individually and interact with other students, as well as how the instructor teaches and engages with the class.

Felder and Brent (2005) state that the amount a student learns is attributed not only to the student's ability and preparation but to the compatibility of the student's learning style to that of the instructor's teaching style. Understanding of learning styles is also beneficial for students to increase their learning (Felder & Spurlin, 2005). A

student aware of their learning preference may improve the skills not associated with their learning style, may seek out help to achieve learning objectives, and may leverage their strengths in the classroom.

Learning style studies related to aviation. Given that the personality types of aviation students differ from the personality types of the general student population, it is possible that their learning style also differ. Brady, Stolzer, Muller, and Schaum (2001) researched the traditional pedagogical model, often used in college classrooms, and the alternative model of andragogy. In a pedagogical teaching model, the instructor is the focus of attention and the needs and interests or students may or may not be accounted for; this model has been called teaching for *children*. Andragogy is teaching for *adults* and encourages a more active learning and teaching style. The two models may be combined for an effective approach to both teaching and learning. Brady et al. (2001) examined the characteristics of freshman students within a university aviation program to determine preference for pedagogy or andragogy. The study indicated that aviation students behaved as "adult learners" and aligned closely to the andragogy model. Aviation students were self-directing with set goals and motivations, brought relevant experiences to the learning environment, had internal motivations for learning (the "aviation bug"), and relate learning to practical problem solving in the real world.

Kolb's Learning Style Inventory was used in a longitudinal study focused on aviation students (Kanske, Brewster, & Fanjoy, 2003). The study found an overall significant deviation from population norms with a tendency toward abstract conceptualization. Although the freshman results matched the general student population, by sophomore and junior year the aviation students were mostly assimilators

and convergers. Gao, Au, Kwon, and Leong (2013) examined the learning styles of students enrolled in a university aviation program and found the majority to be convergers or assimilators. Most students preferred to learn using abstract conceptualization over concrete experience.

The KLSI has been used in the military by Kanske (2001). The study found the convergent learning style to dominate USAF pilots. These learners prefer to understand the mechanics of how something works; they also prefer to learn by doing an activity as opposed to being shown how to do the activity. The assimilative learning style was also common among the pilots. These learners have the ability to create complex mental models using theory, concepts, and abstract ideas. Both learning styles use abstract conceptualization over concrete experience, but it is the difference between active experimentation and reflective observation as a learning preference that differentiates the converger and the assimilator.

The Intersection of Personality Type and Learning Style

The relationship of personality type and learning style has been analyzed (Gilchriest, 2005; Komarraju, Karau, Schmeck & Avdic, 2011; Smilovitz, DiDona, Sonsky, & Butt, 2011). Although personality may shift and develop through maturity, many personality characteristics remain the same— an introverted person does not suddenly become extroverted, nor does an anxious person generally cease being anxious on their own. Similarly, learning preferences are innate and may be honed in the learning environment by developing coping strategies: a visual learner may need to pay extra attention and take notes during a lecture, and request graphical information when they do not understand.

Type theory and learning styles may be effectively incorporated into all aspects of life, and especially education. Jensen (2003) asserted that the MBTI can be used to understand how a student approaches learning; because type is static and will not fluctuate like behavior or performance (depending on the learning experience), it may be relied upon. The experiential learning model assumes that learning builds upon the individual's accumulated experiences. The learner discovers the learning style and orientation that they prefer; when the preferred way to process information is not adequate, adaptation must occur to ensure learning.

Kolb (1984) asserted that his model and that of Jung (1921) are identical— the styles (or types) of learning are a form of personal adaptation that may be developed through life. Kolb drew similarities between reflective observation (RO) preference and the introverted (I) personality and compared the active experimentation (AE) preference to the extraverted (E) personality. Kolb (1984) also related abstract conceptualization (AC) to intuitive (N) perception. Going deeper, Kolb related his four styles to the MBTI dichotomies of extroversion and introversion paired with perceiving or judging preferences, drawing parallels in the characteristics associated with the two models. Table 4 lists these parallels.

Table 4

Parallels between the MBTI and KLSI types

MBTI Paired Dichotomy	KLSI Type
Introverted – Feeling	Diverger
Extroverted – Thinking	Converger
Introverted – Intuitive	Assimilator
Extroverted – Sensing	Accommodator

Summary

Although studies show that aviation students have similar personality types, there are not enough studies to generalize about aviation students as a whole— most studies stressed that the findings may be limited to the study population. The research on personality type and learning style leaves much to be desired, although it is evident that it plays an important role in student learning. Studies show aviation students to be emotionally stable, logical, organized, competitive, and attuned to dynamic environments.

Aviation students have been identified by MBTI type as preferring the perceiving attitude, which indicates that they are open and attuned to changing information, adaptable, and able to change goals as new details emerge (Kutz, Carmichael et al., 2004). Using the KSLI, researchers have determined that aviation students are usually convergers or assimilators, with a preference for abstract conceptualization. A learner with a preference for abstract conceptualization uses theory and systematic planning when solving problems. In the aviation classroom, this can be translated to theory instruction, such as aerodynamics, and pre-flight planning to reinforce learning objectives (Gao et al., 2013).

Use of learning style and individualized teaching could improve learner satisfaction and achievement (Cronbach & Snow, 1969). Understanding the general learning preferences of students allows an instructor to adapt lesson plans to student strengths. Using the MBTI to assess the personality type of the modern aviation student would provide information on focusing attention, information processing, decision-making, and orientation to the environment. Effective utilization of type theory allows an

educator to improve instruction techniques. Additionally, teaching to multiple learning

styles challenges the student to learn in multiple ways and prepares them for a

professional world that will not always cater to their needs (Felder & Brent, 2005). The

goal, then, is adopting a balanced approach that allows the instructor to accommodate the

needs of the students while ensuring course objectives are met.

Chapter III

Methodology

Research Approach

This study replicated the *Wiggins Study* using a survey design. The study assessed the personality types and learning styles of students enrolled in the aeronautical science baccalaureate degree program at Embry-Riddle Aeronautical University using the MBTI and the KLSI, respectively.

Design and procedures. The participants self-selected to participate in the research study. Participants were contacted via email and provided a consent form, electronic access to the MBTI Form M, a URL to Survey Monkey to take the Kolb LSI Version 3.1, written instructions for both instruments, and a unique identifier code. The unique identifier code was assigned at random to protect the confidentiality of the students. Participants were directed to take the MBTI first and given a website URL and login information to complete the MBTI Form M. The MBTI Form M was administered on the CPP, Inc. ("CPP") delivery website and included select demographic questions. The MBTI was completed and submitted online. The participant was emailed a link to a Survey Monkey website to complete the KLSI Version 3.1 with select demographic questions. The Survey Monkey included an item asking if the participant read and agreed to the consent form; the participant could not proceed if they did not choose "Agree."

Apparatus and materials. The MBTI Form M assessed participant personality type. Form M has 93 items, each of which has forced-choice responses of two options for determining personality type. The participants took the MBTI on CPP's delivery website.

The KLSI Version 3.1 examined participant learning style and was administered via Survey Monkey. The KSLI features 12 questions with rank ordered answers that correspond to the four learning stages (CE, RO, AC, AE). Each question has four forced-choice response items.

Demographic data collected included age, gender, class standing, if the participant had soloed in their flight training (yes/no), number of solo flight hours, number of pilot in command flight hours, number of total flight hours, and current level of flight training (e.g., private pilot, instrument rating).

A copy of the consent form may be found in Appendix A. A copy of the instructions emailed to students may be found in Appendix B.

Population/Sample

The sample for the study was aviation students enrolled in the aeronautical science degree program at the Daytona Beach, Florida campus of ERAU in the spring of 2017. There are approximately 1,170 undergraduate students enrolled in this degree program. To be eligible to participate, students must have completed their first solo flight. Stratifying participants according to class standing allowed comparison among type distribution. The final sample size was 41 students.

The application for Institutional Review Board (IRB) was approved. The researcher requested approval to contact course instructors to enter classrooms for recruitment purposes. Classes taken by aeronautical science students within the aeronautical science program were identified by analyzing the courses available in the spring 2017 semester, accessible through the ERAU online course catalogue. Course instructors for these classes were contacted via email to request permission for the

privilege of initial recruiting announcement. These announcements were made just before the start of class. The researcher introduced the study, requested volunteers, and collected email information from the students interested in participating in the study. This list was kept confidential and will be destroyed upon completion of the study. It was made clear to students that participation in the study was voluntary and would have no impact on their academic involvement with the University or any course grade. If the instructor offered extra credit for participation in the study, the researcher would have no control over how points are distributed, but reminded the instructor that an alternative of equal difficulty and weight should be provided for students who do not wish to partake in the study. Flyers were hung in the College of Aviation to recruit students, with contact information for the researcher. An announcement was also sent to aviation students via the online messaging service accessed when students checked in for flight training. Participants were told that their names and identifying information not be connected to the data.

Sources of the Data

The study collected data on the personality types and learning styles of aviation students. Each assessment contains a set number of questions with forced-answer options, which participants were instructed to complete for the study.

Participants took the MBTI Form M on the CPP delivery website. The MBTI Form M was scored by CPP, Inc. and results were sent to the researcher. Results were delineated by participant and included continuous scores for each dichotomy, preference clarity index scores for each dichotomy, resulting MBTI type, and demographic

information. The results were analyzed using manuals provided by CPP, Inc. and the

MBTI Manual (Myers & McCaulley, 1985).

The KLSI learning styles was analyzed through an assessment on Survey

Monkey. All data was transferred to Excel by the researcher to analyze descriptive

statistics. The data was also analyzed by the researcher using the Kolb Cycle of Learning

(Version 3.1) graph and the Learning-Style Type Grin (Version 3.1) (Korn Ferry Hay

Group, Inc., 2005). The Korn Ferry Hay Group, Inc. (2005) manuals were utilized to

interpret the results.

Both sets of data were compared to population norms, published by the MBTI

(CPP, Inc.) and the KLSI (Korn Ferry Hay Group, Inc.).

Data Collection Device

Instrument reliability and validity. The MBTI Form M is published by CPP,

Inc. The KLSI is published by Korn Ferry Hay Group, Inc. The instruments have shown

good reliability and validity (Coffield, Moseley, Hall, & Ecclestone, 2004; Harker,

Reynierse, & Komisin, 1998; Myers & McCaulley, 1985; Kolb, 1984) for studies in

diverse fields (e.g., medicine, law, engineering, psychology, education, and

management).

Treatment of the Data

The delivery website of the MBTI, operated by CPP, scored the MBTI Form M

and sent the results to the researcher as continuous data. The KLSI was scored by the

researcher; the data was presented as continuous data and in graphical form by

participant. This data was used to compare the sample data to college norms using Chi-

square goodness-of-fit tests, one-sample t-tests, and Selection Ratio Type Tables (SRTTs), created by the Center for Applications of Psychological Type ("CAPT").

The continuous scores of the MBTI dichotomies, preference clarity indices, and the frequency of each MBTI personality type were entered into Statistical Package for the Social Sciences (SPSS). The researcher sent the data from the current study, data from the *Wiggins Study*, and data of college majors to CAPT for the creation of SRTTs. The SRTTs are used to compare distributions of study samples to the distribution of a baseline sample. The results include the MBTI type, the number of the type represented, the percentage represented in the sample, the index of attraction, and significant difference. The baseline samples for comparison were *Wiggins Study* of aviation students and the college majors sample (Schaubhut & Thompson, 2011). The researcher compared the self-selection indexes generated by CAPT; this figure compares the percentage of a type for a college major within a study to the baseline sample for significance. An index of 1.0 and greater in the study sample means a higher percentage of type for a college major than in the baseline sample. The researcher compared the percentages of the personality types of the class standings using the Pearson Chi-square test for independence in SPSS to determine if any there were any significant difference between the stratified groups.

The KLSI was administered through Survey Monkey and results were transferred to SPSS. The KLSI was scored by the researcher using the LSI profiling graphs provided by Korn Ferry Hay Group, Inc. (2005), distributor of the KSLI. The forced-rank answers for the KSLI provide a raw score for the four learning types (i.e., AC, CE, AE and RO). The scores were transferred to an axis, which measures scores on dichotomies of AE-RO and AC-CE. Korn Ferry Hay Group, Inc. (2005) provided the

scoring grids to the researcher. The means of the learning stages (e.g., AC, CE) from the sample of aviation students was compared to the sample data of university undergraduate students collected by Kolb and Kolb (2013) using one-sample t-tests to determine if there are any significant differences between the sample means. In a normally distributed population, the four learning styles (e.g., accommodating, assimilating, converging, diverging) will be equal. The distribution of the learning styles from the sample of aviation students was analyzed using the Chi-square goodness-of-fit test to determine if the study sample was equally distributed. The percentages of the learning styles of the class standings were compared using Pearson Chi-square test for independence in SPSS to determine if any there were any significant difference between the stratified groups.

The data from the dichotomous scores of the MBTI and KLSI learning styles were correlated using ANOVAs to determine if personality type can predict learning style. The MBTI type preference and the Kolb learning processes were assessed using the Pearson Chi-square test for independence.

Descriptive statistics. Frequencies, means, and standard deviations were the descriptive statistics computed for the demographic data, where appropriate. To protect participant confidentiality, data was summarized and reported in aggregate.

Hypothesis testing. To test the MBTI distribution hypotheses (i.e., H1 and H2), SRTTs were used. To test the KLSI distribution hypothesis (i.e., H4), one-sample t-tests and Chi-square goodness-of-fit tests were computed in SPSS. To examine the distribution of MBTI type and learning style preference between class standing (i.e., H3 and H), and therefore assess attrition rate, Pearson Chi-square tests for independence were computed in SPSS. To answer the research question, ANOVAs and Pearson Chi-

square tests for independence were used to compare participants' data of learning style to

the continuous scores for each personality preference type.

Chapter IV

Results

This chapter discusses the results of the hypotheses testing. Significant results and the relationship between learning styles and personality styles were noted.

Descriptive Statistics

To qualify for the study, participants must have completed their first solo flight; the level of experience ranged from student pilot to airline transport pilot. Of the 55 students who self-selected to participate in the study and completed the MBTI, only 52 students completed the KLSI; others completed the KLSI but failed to finish the MBTI. Four participants responded that they had not completed a solo flight and did not move forward with the study. The final sample for the study included 41 aviation students enrolled in the spring 2017 aeronautical science degree program. The sample included nine freshman (22.0%), 13 sophomores (31.7%), eight juniors (19.5%), and 11 seniors (26.8%). There were nine females (22%) and 31 males (75.6%) in the students; one student did not respond to the gender question. The students ranged in age from 18 to 26 ($M = 20.59$). Data was gathered for solo flight hours ($M = 19.05$, $SD = 15.76$), pilot in command hours ($M = 81.93$, $SD = 106.48$), and total flight hours ($M = 161.67$, $SD = 9.96$).

Myers-Briggs Type Indicator Data

Data were analyzed for the MBTI Form M using the four preference dichotomies— attitude (EI), perception (SN), judgment (TF), and orientation (JP). The aviation students were primarily *I*ntroverted ($n = 30$, 73.2%), *Se*nsing ($n = 35$, 85.4%), *T*hinking ($n = 30$, 73.2%), and *J*udging ($n = 24$, 58.5%). The prevailing MBTI type

combined the aforementioned preferences for the type of ISTJ. This type categorized 15 of the aviation students (36.59%). The second most represented type, ISTP, differed only in the orientation preference of *P*erceiving ($n = 7$, 17.07%).

The data were compared to college norms in selection ratio type table (SRTT) format, created by the Center for Applications of Psychological Type (CAPT) — these can be found in Appendix C. When compared to the norms of college students, the MBTI type of ISTJ was overrepresented in the aviation students. The normal college sample has a representation of 8.4% students (Schaubhut & Thompson, 2011), whereas the current study has 36.59% ($n = 15$) students; the self-selection index of $I = 4.36$ was found to be statistically significant, $p < .001$. The distribution of the MBTI type of ISTP was also significantly higher than the college norm of 4.4%; the sample data has 17.07% ($n = 7$) students classified as ISTP, with a self-selection index $I = 3.88$, $p < .001$.

The dichotomous preferences were analyzed by self-selection ratio. Introverts were significantly overrepresented, $n = 30$, 73.17%, $I = 1.80$, $p < .001$. The preference for the sensing perception was significantly overrepresented, $n = 35$, 85.37%, $I = 1.53$, $p < .001$. The judgment preference of thinking was significantly overrepresented in the sample data, $n = 30$, 73.17%, $I = 1.66$, $p < .001$. The preference for orientation, either for judging or perceiving, was not significantly different from the college major sample.

The distribution of the aviation students was also compared to the data collected in the *Wiggins Study* using an SRTT. His study at ERAU also revealed an overrepresentation of ISTJ types ($n = 55$, 15.85%). The comparison between the current study and *Wiggins Study* results showed a significant difference between the number of students identified as ISTJs, $I = 1.96$, $p < .01$. Comparing the dichotomous preferences

between the two studies, significant differences were found in the self-selection index of introverts and students who perceive by sensing. Table 5 outlines the significant differences between the sample data and the *Wiggins Study*.

Table 5

Significant Differences between the Current Study and Wiggins Study

	Current Study n	Percent of Sample	Wiggins' Study n	Percent of Sample	Self-selection Index	Significance Level
Introvert	30	73.17%	186	53.60%	1.31	$p < .05$
Sensing	35	85.37%	241	69.45%	1.41	$p < .01$
ISTJ-types	15	36.59%	55	15.85%	1.96	$p < .01$

The male students with the type of ISTJ ($n = 11$, 27.5%) was analyzed using a Chi-square goodness-of-fit test. Male students with the ISTJ type comprise 12.5% within the traditional college sample ($n = 108,699$) (Schaubhut & Thompson, 2011). The proportion within the current study was significantly higher, $\chi^2 (1) = 19.22$, $p < .001$.

To test attrition rate among the personality type by class standing (i.e., freshman, sophomore, junior, senior), the researcher ran a Pearson Chi-square test for independence in SPSS. The test showed no significant difference in type at the .05 level between the class standings, $\chi^2 (39) = 37.31$, $p = .55$.

Kolb Learning Style Inventory

Using the Kolb Learning Style Inventory Version 3.1 (KLSI), each student was characterized by one of four learning styles — diverger ($n = 17$, 41.46%), assimilator

(n = 10, 24.39%), converger (n = 7, 17.07%), and accommodator (n = 6, 14.63%). One student was characterized as balanced (n = 1, 2.44%); due to the frequency of 1, the student was omitted from the statistical testing. In a normally distributed population, each learning style will be found in equal proportion (Kolb, 1984). Using a Chi-square goodness-of-fit test, the researcher analyzed the aviation student learning style distribution and found an overrepresentation of divergers, χ^2 (3) = 7.40, p = .002.

The data were analyzed stratified by the four learning stages characterized by the KSLI— concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE). Using a one-sample t-test with significance set at .05, each learning stage was compared to published normative sample for traditional college students (N = 10,423) (Kolb & Kolb, 2013). The average CE score for aviation students (M = 27.63, SD = 9.96) was significantly different from the traditional college student (μ = 19.84, SD = 6.47), t = 5.01, p < .001; Cohen's d was computed to be 1.20, considered to be a large effect size. A significant difference was found when comparing the average RO score for aviation students (M = 30.41, SD = 6.83) to the traditional college student (μ = 26.22, SD = 7.02), t = 3.93, p < .001; Cohen's d was computed to be 0.60, considered to be a medium effect size. The average AC score for aviation students (M = 30.63, SD = 6.21) was significantly different from the traditional college student (μ = 28.99, SD = 6.66), t = 5.01, p = .01; Cohen's d was computed to be 0.25, considered to be a medium effect size. No significant difference was found when between the average AE scores in the sample data (M = 31.32, SD = 9.21) and the traditional college students (μ = 31.84, SD = 5.93), t = -0.36, p = .72.

The combined scores measuring preference for abstractness over concreteness (AC-CE) and action over reflection (AE-RO) were also compared to the population norms of traditional college students (Kolb & Kolb, 2013) using a one-sample t-test with significance set at 0.05. A significant difference was found for the average AE-RO score for aviation students ($M = 0.90$, $SD = 12.96$) from the traditional college student ($\mu = 5.62$, $SD = 10.92$), $t = -4.08$, $p < .001$; Cohen's d was computed to be 0.50, considered to be a medium effect size. The average AC-CE score from the sample data ($M = 3.00$, $SD = 13.44$) was not significantly different from the traditional college student ($\mu = 9.16$, $SD = 10.86$), $t = -1.25$, $p = .22$.

To test attrition rate among the learning styles by class standing (i.e., freshman, sophomore, junior, senior), the researcher ran a Pearson Chi-square test for independence in SPSS. The test showed no significant difference in learning style at the 0.05 level between the class standings, $\chi^2 (9) = 4.12$, $p = .90$.

Personality Type and Learning Style Intersection

To determine if MBTI preference was correlated to learning style, between-subjects ANOVAs were run using the continuous scores between each MBTI dichotomy (i.e., EI, SN, TF, JP) and the Kolb learning styles (i.e., accommodating, assimilating, converging, diverging). The alpha level was set at .05 for all tests. The result for the EI preference ANOVA was $F(3,37) = 1.42$, $p = .25$. The SN preference test was $F(3,37) =.32$, $p = .87$. The result for the TF test was $F(3,37) = 1.34$, $p = .26$. The JP ANOVA result was $F(3,37) = .89$, $p = .48$. No significant relationship was found to indicate that personality preference and learning style are related.

Using the Pearson Chi-square test for independence analyses were run between the scores for each MBTI dichotomy and the scores of the four modes of the Kolb learning process (i.e., CE, RO, AC, AE). No significant relationship was found to indicate that personality preference predicted learning style. Table 6 displays the results of the analyses by MBTI preference dichotomy (row) and Kolb learning process (column).

Table 6

Chi-Square Results of MBTI and KLSI

	RO		CE		AC		AE	
	χ^2	p	χ^2	p	χ^2	p	χ^2	p
EI Preference	.08	.63	-.08	.60	.10	.51	-.04	.81
SN Preference	-.14	.38	-.16	.31	.10	.52	.21	.19
TF Preference	.21	.19	.13	.44	-.19	.23	-.16	.32
JP Preference	-.12	.45	.07	.65	-.22	.16	.16	.32

Hypothesis Testing

The first hypothesis compared the distribution of MBTI types of students enrolled in a professional pilot program to that of the traditional college population (Schaubhut & Thompson, 2011). To test for significance, SRTTs were used to compare indices of attraction (i.e., compare the percentage of a sample distribution to a baseline sample for significance). Two MBTI types, ISTJ ($n = 15$, $I = 4.36$, $p < .001$) and ISTP ($n = 7$, $I = 3.88$, $p < .001$), had distribution proportions significantly different from the college major baseline. The null hypothesis was rejected.

The distribution of MBTI types of aviation students were compared to the distribution of the *Wiggins Study*. To test for significance, SRTTs were used to compare

indices of attraction. The type of ISTJ was found to be significantly different ($I = 1.96$, p <.01), and the null hypothesis was rejected.

The third hypothesis examined the difference of MBTI types between the class standings. A Pearson Chi-square test for independence was used to test for any significant differences in type distribution between. No significant difference was found between the class standings, thus retaining the null hypothesis.

The fourth hypothesis compared the distribution of KLSI types of students enrolled in a professional pilot program to that of the traditional college population (Kolb & Kolb, 2013). The researcher tested the hypothesis in two ways. The first compared the distribution of learning styles (e.g., diverging) using a Chi-square goodness-of-fit test; the proportions were found to be unequally distributed compared to the population with an overrepresentation of divergent learners, χ^2 (3) = 7.40, p = .002. Using a one-sample t-test, the scores for each learning stage for the aviation study was compared to that of traditional college students. Significant differences were found for the scores of CE (t = 5.01, p < .001), RO (t = 3.93, p < .001), and AC (t = 5.01, p = .01). The null hypotheses were rejected.

The fifth hypothesis examined the difference of KLSI types between the class standings; the null hypothesis was that there would be no significant difference between them. To test the hypothesis, the researcher ran a Pearson Chi-square test for independence and found no significant difference between the class standings, thus retaining the null hypothesis.

The research question examined if personality type is a predictive factor of aviation student learning preference. To determine if MBTI preference correlated to

learning style, the researcher completed an ANOVA using the continuous data of each MBTI dichotomy and Kolb learning style; no significant relationship was found. To determine if MBTI preference correlated to the Kolb learning process, a Pearson Chi-square test for independence was utilized and found no significant relationship. As neither test revealed significance, the researcher found no evidence to support a relationship between personality type and learning style in the sample of aviation students.

Chapter V

Discussion, Conclusions, and Recommendations

The purpose of the study was to examine the personality types and learning styles

of students enrolled in an aeronautical science baccalaureate degree program. There are

few studies analyzing the intersection of these traits in aviation students. As a result,

educators may not be teaching aviation students to their maximum potential.

The Personality Type Results

The prevailing MBTI type of the sample had preferences of introverted, sensing,

thinking, and judging, or ISTJ ($n = 15$). People with this personality type are

characterized as practical and systematic with a strong sense of responsibility— they use

logic and trust known, standard procedures to accomplish tasks (Myers & McCauley,

1985). Additionally, the type is dependable, realistic, and work toward their goals

actively. These characteristics align to the definition of pilots by Fitzgibbons et al.

(2000). Aviation students with the ISTJ personality can capitalize on their preference for

sensing to gather information for future use and can utilize the thinking preference to

make objective and logical choices (Myers & McCaulley, 1985). They may be more

prone to trust the known processes and procedures they have used in training. The

prevalence of ISTJ as dominant type align to the findings of Devlin and Singh (2010),

who assessed USAF officers and enlisted personnel ($n = 7$, 20.0%). The results conflict

with the study of Kutz, Carmichael et al. (2004), who found aviation students to align

with the perceiving attitude.

The second most prevalent type of MBTI personality found among the aviation

students was ISTP, a difference in the orientation dichotomy for perceiving. These

people are characterized as observant and analytical of their surroundings, adaptable, and able to find the root of an issue using logic and order. Efficient problem solving is favored by ISTPs, and they enjoy finding new ways to address challenges. The thinking preference is utilized to make rational and objective decisions, while the sensing preference makes the type practical, pragmatic, and focused on facts as opposed to theories. Aviation students with this type may be adept at observing and assessing a situation in dynamic environment.

The Learning Style Results

The KLSI measures the degree to which different learning styles are used by the individual. The assessment utilizes rank-ordered statements corresponding to the learning stages of concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE) (Kolb & Kolb, 2005). Although effective learning involves moving through all modes in a cycle, a learner can begin at any stage (Hay Group, 2005).

The data revealed that the CE scores of 19 aviation students were in the 80th percentile or higher when compared to population norms. Those who begin the learning cycle at the CE stage prefer to learn by being involved in an experience and working with feelings as opposed to theories; the instinctual approach is often used for these learners, and they adapt well to situations that are unstructured (Kolb, 1984). An aviation student with an orientation for CE may thrive when the curricula is less focused on theory in lecture-based instruction, and instead is more practical and hands-on. The ability to adapt to changing environments and draw from both intuition and experience is a strength for these students. Training on procedures, talking through situations with others in a

classroom for different perspectives, and hands-on learning will allow this student to excel as a pilot.

The scores of 16 aviation students were in the 80th percentile or higher of the RO stage. These learners prefer to observe a situation, reflect on the meaning and implication thereof, and consider the perspective of others as well as their own judgment before moving forward (Kolb, 1984). This learning style is more favored by introverts (Kolb, 1984). Aviation students who orient toward reflective orientation may benefit from more scenario-based training, observing and then talking through situations with a Certified Flight Instructor, and having the opportunity to discuss challenges with others to learn best practices.

The distribution of the four learning styles in the sample of aviation students at ERAU did not conform to other studies. The literature (Gao et al., 2013; Kanske, 2001; Kanske, Brewster, & Fanjoy, 2003) suggested that pilots and aviation students would be convergers and assimilators, with an orientation toward abstract conceptualization. The students in the sample were mainly divergers (41.46%) and assimilators (24.39%) with an orientation toward concrete experience and reflective orientation.

The significantly high proportion of CE and RO orientation within the study aligns to the diverging learning style. These learners analyze concrete situations from many perspectives and generally work well with the people around them. Additionally, they observe their environment and assess possible outcomes rather than simply reacting in a given situation; this suggests that they rely on a balance of intuition, experience, and rote knowledge (e.g., emergency procedures in a flight). This is especially important for an aviation student who must perform well in the cockpit: a dynamic environment a

student must quickly observe, assess the situation, analyze the implications of several actions, and choose an appropriate course of action. Instruction for divergent students should include the discussion of situations, alternative solutions, and ensuring procedures become second nature so they may be relied upon in a dynamic environment. Scenario-based training is also important for these learners to have a pool of experience to draw upon.

Personality Type and Learning Style Intersection

Although the dominant personality types and learning styles do not overlap in all participants, they do make up a majority in both cases. Statistical testing revealed no relationship between personality type and learning style; however, there are obvious similarities between the prevailing personality types and learning styles.

The researcher examined the characteristics of the personality types, learning styles, and preferred learning stages listed above to create a profile of the aviation students represented in the current study. These students are observant of their surroundings and are able to adapt as situations change. They trust known procedures they have learned, especially when they have successfully used them or seen them in use. Aviation students prefer to use logical and objective methods to reach a solution as opposed to theories. To make decisions, the aviation students rely on their observations, their experience, and objective analysis to create a whole picture. There is a preference for hands-on learning and an appreciation of input from other people, both of which the student may draw from. These students are practical and analytical, preferring facts and the concrete over the theoretical. Finally, they work well with others, especially appreciating different perspectives to solve problems and achieve goals.

Conclusions and Recommendations

Approximately 400 students were contacted directly before class periods and via the pilot messaging system. The study sample size was small and although some of the results were significant, the researcher recommends further study on the relationship between personality type and learning style with a larger sample size. Although two MBTI types showed significant difference from the traditional student population, the distribution of the current study may not be representative of the aviation students at ERAU. In addition, there were too few students in the sample to determine if any personality type or learning style suffered from attrition through the four years of the program. The small sample size may have been due to the study occurring toward the end of the semester or due to the lack of incentive provided to the students.

The aviation students in the current study did not conform to other studies in terms of learning style characteristics. Due to the sample size, the researcher is unsure if this is due to sampling error or if the majority of aviation students at ERAU align to the diverging learning style. A study on learning style, with a larger sample size, may answer this question.

The data revealed that there was no relationship between personality type and learning style. The small sample size may have been a contributing factor to the lack of relationship, or there may simply be no way to predict learning style in aviation students. A larger sample may answer the question more definitely.

Although the ISTJ type was significant and aligned with other studies, the majority of the students within the type were male: only three females were classified as ISTJ, or 33.33% of the females in the sample. The proportion of males was found to be

significantly higher in the aviation students. A study with a higher percentage of females to examine any difference between genders would be necessary to determine if the type of ISTJ is overrepresented in aviation students as a whole, or only for male students.

Although both studies took place at ERAU and assessed the personality types of aviation students, the results of this study differed from that of the *Wiggins Study*. According to the data, there are significantly more introverts currently enrolled in the aeronautical science program. The *Wiggins Study* had an almost even split of introverts (55.79%) and extroverts (44.21%), whereas the sample data was much more differentiated (73.17% introverts, 26.83% extroverts). The simplest explanation – that there may be a greater proportion of introverts in the general population now as opposed to 20 years ago – seems unlikely. The greater proportion may be due to a larger percentage of introverts enrolling in the program or universities. A different consideration is the amount of extroverts in two samples— since 1998, there may have been an exodus of extroverted students from science related fields into other academic studies. An introverted person may be more likely to choose a science, technology, engineering, or math degree as opposed to a liberal arts degree.

The students in the sample are also significantly more likely to favor sensing to perceive their environment. A higher proportion among aviation students aligns with the accepted characteristics of pilots (i.e., focused on the immediate experience, attuned to their surroundings, both student and commercial. The preference for thinking judgment, which emphasizes logical connections and objectivity, was significantly higher in the sample. This may provide understanding of how aviation students make decisions, especially in a dynamic environment such as the cockpit. A study with a larger sample

may confirm that aviation students are more likely to prefer the sensing perception and the thinking judgment.

Wiggins (1998) found six personality types to be overrepresented in his sample, including ISTJ and ISTP. The study was larger and represented a greater proportion of students enrolled in the aeronautical science program at the time ($n = 380$, 22.35%), and may provide more insight into the distribution within the program. Sample size notwithstanding, the prevalence of introverted, sensing students in significantly higher proportion in both samples supports other studies that found an overrepresentation of similar types. It seems possible that people with this type are more likely to prefer aviation-related studies or other science fields. Further studies are warranted to determine if these types are more likely to choose an aviation or other science major, and if they more likely to succeed in their chosen major and field. Although the topic was not explored in this study, longitudinal research with a larger sample size, also focused on attrition and compared to the data collected by Wiggins, may provide evidence of self-selection and success within a certain major.

A question the researcher seeks to answer is if the aviation students are receiving the most effective method of education based on personality type and learning style. The aeronautical science baccalaureate degree program is structured with a balance of lecture and activity in the classroom followed by application and one-on-one instruction with Certified Flight Instructors. There is an emphasis of working with the learning style best appropriate for the aviation student. Flight training is a mixture of scenario-based instruction on the ground, rote-knowledge of procedures, and in-air experience with instruction. Within the confines of the study, the researcher believes that the structure of

the program, with the balance of activity, lecture, and scenario-based training with

Certified Flight Instructors, may be effective for the aviation students. Follow on

research to assess educator and Certified Flight Instructor teaching style and personality

type may reveal interesting information for structuring the program to maximize learning

and teaching efficiency.

References

Barrett, L. (1991). Impact of teacher personality on classroom environment. *Journal of Psychological Type*, *18*, 50-56.

Brady, T., Stolzer, A., Muller, B., & Schaum, D. (2001). A comparison of the learning styles of aviation and non-aviation college students. *Journal of Aviation/Aerospace Education & Research*, *11*.

Brame, C., (2016). Active learning. Vanderbilt University Center for Teaching. Retrieved from https://cft.vanderbilt.edu/active-learning/

Callister, J. (1999). Revised NEO personality inventory profiles of male and female U.S. Air Force pilots. *Military Medicine*, *164*(12), 885-890.

Campbell, J. S., Castaneda, M., & Pulos, S. (2009): Meta-analysis of personality assessments as predictors of military aviation training success. *The International Journal of Aviation Psychology*, *20*(1), 92-109. doi: http://dx.doi.org/10.1080/10508410903415872

Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004). Learning styles and pedagogy in post-16 learning: A systematic and critical review. Retrieved from Learning & Skills Research Centre, London: http://lerenleren.nu/bronnen/Learning%20styles%20by%20Coffield%20e.a..pdf.

CPP, Inc. (2012) Comparing the MBTI Form G & Form M. Retrieved from https://www.cpp.com/ Pdfs/FormM_vs_FormG.pdf

Cronbach, L. J., & Snow, R. E. (1969). *Individual differences in learning ability as a function of instructional variables* (Report No. Contract OEC 4-6-061269-1217). Retrieved from http://eric.ed.gov/?id=ED029001

DiRienzo, C., Das, J., Synn, W., Kitts, J., & McGrath, K. (2010). The relationship between MBTI and academic performance: a study across academic disciplines. *Journal of Psychological Type*, *70*(5), 53-67.

Devlin, M. S., & Singh, A. (2010). MBTI personality and hemisphericity of a U.S. Air Force group. *Leadership and Management in Engineering, 10*(3), 108-120. doi: 10.1061/(ASCE)LM.1943-5630.0000063

Dunn, R., Beaudry, J. S., & Klavas, A. (1989). Survey of research on learning styles. *California Journal Science of Education*.

Dunn, R., DeBello, T., Brennan, P., Krimsky, J., Murrain, P. (1981). Learning style researchers define differences differently. *Educational Leadership, Journal of the Association for Supervision and Curriculum Development*, *38*, 372–375.

Felder, R. M., & Brent, R. (2005). Understanding student differences. *Journal of Engineering Education, 94*(1). doi:10.1002/j.2168-9830.2005.tb00829.x

Felder, R. M., & Spurlin, J. (2005). Applications, reliability and validity of the index of learning styles. *International Journal of Engineering Education*, *21*(1), 103-112.

Fitzgibbons, A., Davis, D., & Schutte, P. C. (2000). Pilot personality profile using the NEO-PI-R (Report No. ODURF-182271). Retrieved from https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20000105204.pdf

Ford, M. (2013, August 5). A history of personality psychology: Part 1. Retrieved from http://blog.motivemetrics.com/A-History-of-Personality-Psychology-Part-1

Fretwell, C. E., Lewis, C. C., & Hannay, M. (2013). Myers-Briggs type indicator, A/B personality types, and locus of control: Where do they intersect? *American Journal of Management*, *13*(3), 57.

Gao, Y., Au, K. T. S., Kwon, H. J., & Leong, E. W. (2013). Learning styles of Australian aviation students: An assessment of the impact of culture. *Collegiate Aviation Review, 31*(1), 17-26. Retrieved from http://search.proquest.com.ezproxy.libproxy.db.erau.edu/docview/1502610576?accountid=27203

Gao, Y., & Kong, S. (2016). Personality types of pilot students: A study of an Australian collegiate aviation program. *International Journal of Aviation, Aeronautics, and Aerospace 3*(3)*.* doi:10.15394/ijaaa.2016.1130

Garner, I. (2000). Problems and inconsistencies with Kolb's learning styles. *Educational Psychology, 20*(3), 341-348.

Gilchriest, N. C. (2005). Personality and learning style connections. *Academic Exchange Quarterly*, *9*(2), 220-225.

Haar, J., Hall, G., Schoepp, P., & Smith, D. H. (2002). How teachers teach to students with different learning styles. *The Clearing House*, *75*(3), 142-145.

Harker, J. B., Reynierse, J. H., & Komisin, L. (1998). Independent observer ratings and the correlates of MBTI preferences with their behavioral descriptors. *Journal of Psychological Type, 45*.

Hay Group, Inc. (2005). *Kolb learning style inventory on-line (Version 3.1): Interpretive report*. Boston, MA: Hay Resources Direct.

Heffner, C. (2014, August 21). Trait theory. In Personality synopsis. Retrieved from https://allpsych.com/personalitysynopsis/

Illeris, K. (2004). *Three dimensions of learning: Contemporary learning theory in the tension field between the cognitive, the emotional and the social*. Malabar, Florida: Krieger.

Jensen, G. H. (2003). Learning styles. In J. A. Provost & S. Anchors (Eds.), *Using the MBTI instrument in colleges and universities*. Gainesville, FL: Center for Applications of Psychological Type.

Jung, C. G. (1921). *Psychology of the unconscious: A study of the transformations and symbolisms of the libido; A contribution to the history of the evolution of thought*. Moffat, Yard.

Kanske, C. A. (2001). Learning styles of pilots currently qualified in United States Air Force aircraft. *Journal of Air Transportation World Wide, 6*(2), 33-46.

Kanske, C. A., & Brewster, L. T. (2001). The learning styles of college aviation students. *Collegiate Aviation Review, 19*(1), 62.

Kanske, C. A., Brewster, L. T., & Fanjoy, R. O. (2003). A longitudinal study of the learning styles of college aviation students. *International Journal of Applied Aviation Sciences*, *3*(1), 79-89.

Keefe, J. W. (1979). "Learning style: An overview," in *Student learning styles: Diagnosing and prescribing programs*, Reston, Va.: National Association of Secondary School Principals, 1979.

Keirsey, D. (1998). *Please understand me II: Temperament, character, intelligence* (1st ed). Del Mar, CA: Prometheus Nemesis.

Kolb, A. Y., & Kolb, D. A. (2005). The Kolb learning style inventory—Version 3.1 2005 technical specifications.

Kolb, D. A. (1984). *Experiential learning*. Englewood Cliffs, New Jersey: Prentice Hall, Inc.

Kolb, D.A., & Kolb, A. Y. (2013). *The Kolb learning style inventory 4.0: A comprehensive guide to the theory, psychometrics, research on validity and educational applications*. Boston: Hay Resources Direct.

Komarraju, M., Karau, S. J., Schmeck, R. R., & Avdic, A. (2011). The big five personality traits, learning styles, and academic achievement. *Personality and individual differences*, *51*(4), 472-477.

Korn Ferry Hay Group, Inc. (2005). The cycle of learning (version 3.1) and learning-style type grid (version 3.1). Boston, MA: Resources Direct.

Kutz, M. N, Brown, D. M., Carmichael, D. B., & Shandiz, M. (2004). Preliminary implications for academic professionals of aviation student Myers-Briggs type indicator (MBTI) preferences. *International Journal of Applied Aviation Sciences*, *4*(2), 221-228.

Kutz, M. N., Carmichael, D. B., Shandiz, M., & Brown, D. M. (2004). A comparative study of collegiate aviation students and business students related to Myers-Briggs type indicator preferences. *Journal of Aviation/Aerospace Education & Research*, *14*(1), 43-49. Retrieved from http://commons.erau.edu/jaaer/vol14/iss1/1

Myers, I. B., & McCaulley, M. H. (1985). *A guide to the development and use of the Myers-Briggs type indicator.* Palo Alto, CA: Consulting Psychologists Press.

Neal, G., & Neal, J. (2009). Assessment of Keirsey temperament traits among aerospace electronics students. *International Journal of Professional Aviation Training and Testing Research, 3*(1), 1-10. Retrieved from http://ojs.library.okstate.edu/osu/index.php/IJPATTR/article/view/18/10

Pashler, H., McDaniel, M., Rohrer, D., & Bjork, R. (2008). Learning styles concepts and evidence. *Psychological Science in the Public Interest*, *9*(3), 105-119.

Personality and Careers. (n.d.). Retrieved May 30, 2017, from http://www.myersbriggs.org/type-use-for-everyday-life/personality-and-careers/home.htm?bhcp=1

Pittenger, D. J. (1993). Measuring the MBTI… and coming up short. *Journal of Career Planning and Employment*, *54*(1), 48-52.

Reiff, J. C. (1992). Learning styles. What research says to the teacher series. Washington, D.C.: National Education Association. Retrieved from http://files.eric.ed.gov/fulltext/ED340506.pdf

Riaz, M. N., Riaz, M. A., & Batool, N. (2012). Personality types as predictors of decision making styles. *Journal of Behavioural Sciences*, *22*(2), 99.

Robertson, M. F., & Putnam, A. R. (2008). Personality types of student pilots admitted to the aviation flight program at Southern Illinois University Carbondale. *Collegiate Aviation Review, 26*(1), 111-124.

Robins, R. W., Fraley, R. C., Roberts, B. W., & Trzesniewski, K. H. (2001). A longitudinal study of personality change in young adulthood. *Journal of Personality*, *69*(4), 617-640.

Ryckman, R. (2013). *Theories of Personality* (10th ed.). San Francisco: Cengage Advantage Books.

Schaubhut, N. A., & Thompson, R. C. (2011). *MBTI type tables for college majors*. Mountain View, CA: CPP, Inc.

Scott, S. G., & Bruce, R. A. (1995). Decision-making style: The development and assessment of a new measure. *Educational and Psychological Measurement, 55,* 818–831.

Sergiovanni, T., & Starrett, R. (1988). *Supervision human perspectives* (4th ed.). New York: McGraw Hill.

Smilovitz, S., DiDona, T., Sonsky, K., & Butt, A. (2011). Everyone has a choice: Personality types and learning preferences. *International Journal of Arts & Sciences, 4*(21), 11-19.

Tieger, P. D. & Barron-Tieger, B. (2001). *Do what you are*. Boston: Little, Brown & Co.

The VARK Modalities. (n.d.). Retrieved May 30, 2017, from http://vark-learn.com/introduction-to-vark/the-vark-modalities/

Watson, W. E., Minzenmayer, T., & Bowler, M. (2006). Type A personality characteristics and the effect on individual and team academic performance. *Journal of Applied Social Psychology, 36*(5), 1110-1128.

Wiggins, M. E. (1998). *Distribution of psychological types among students in a professional pilot baccalaureate degree program and associated attitudes towards teaching* (Doctoral dissertation). Available from ProQuest Dissertations & Theses Global. (Order No. 9930177).

Workman, G. R. (2012). *Learning styles: Fact or fiction, a literature review of learning styles*. Retrieved from http://www.westpoint.edu/cfe/Literature/Workman_12.pdf

Appendix A

ERAU Informed Consent

AGREEMENT TO PARTICIPATE IN

Aviation Student Personality Type and Learning Style Survey

STUDY LEADERSHIP.   I am asking you to take part in a research project that is led by Stephanie Gill Fussell, Embry-Riddle Aeronautical University, Daytona Beach campus.

PURPOSE.   The purpose of this study is to determine if the personality types of aviation students can predict learning style.

ELIGIBILITY.   To be in this study, you must be 18 years or older, be enrolled in the aeronautical science degree program at Embry-Riddle Aeronautical University, Daytona Beach campus, and have completed your first solo flight in your flight training.

PARTICIPATION.   During the study, you will be asked to complete a brief personality survey and a brief learning style survey. Both surveys will be taken online and include 2-5 demographic questions. The two surveys will take approximately 30-40 minutes to complete.

RISKS OF PARTICIPATION.   The risks of participating in this study are minimal, no more than everyday life.

BENEFITS OF PARTICIPATION.   I do not expect the study to benefit you personally, however, the data learned from this study will allow me to analyze how ERAU aviation students differ from other students. Understanding the relationship between student personality and learning style can lead to more efficient and effective curricula design for aviation education programs and flight training schools.

VOLUNTARY PARTICIPATION.   Your participation in this study is completely voluntary.   You may stop or withdraw from the study at any time or refuse to answer any particular question without it being held against you.   Your decision whether or not to participate will have no effect on your current or future connection with anyone at ERAU. If you opt out at any time during the study, your survey results will be disregarded.

RESPONDENT PRIVACY.   Your individual information will be protected in all data resulting from this study.   Your responses to this survey will be confidential. In order to protect the confidentiality of your responses, I will provide each participant with a unique identifier code for the surveys. Emails between myself and you, the participant, will be deleted when the research is complete. No personal data will be collected by myself, and any information collected by the publisher will not be used by the researcher. The online

survey websites will not collect IP address or other identifying data. In order to keep your responses confidential, I will keep all data on a pass word protected website; when it is transferred to a password protected computer, the data will be deleted from the survey website. No one other than the researcher will have access to any of the responses.

FURTHER INFORMATION.   If you have any questions or would like additional information about this study, please contact Stephanie Fussell at gill974@my.erau.edu, or Dr. Andrew Dattel, dattela@erau.edu.

The ERAU Institutional Review Board (IRB) has approved this project. You may contact the ERAU IRB with any questions or issues at (386) 226-7179 or teri.gabriel@erau.edu. ERAU's IRB is registered with the Department of Health & Human Services – Number – IORG0004370.

CONSENT. Your agreement on the Survey Monkey survey (question 2) means that you understand the information on this form, that someone has answered any and all questions you may have about this study, and you voluntarily agree to participate in it. Please print a copy of this form for your records. A copy of this form can also be requested from Stephanie Fussell at gill974@my.erau.edu.

0 Agree
0 Disagree

Appendix B

Verbiage for Instruction Email

Thank you for agreeing to participate in this study to determine if personality types of aviation students can predict learning style. Your participation is voluntary, and will have no impact on course grade.

This study requires participation in two surveys to assess your personality type and learning style, and will take 30-40 minutes. Each survey has more complete instructions at the website. Please follow these directions to complete the study:

1. Please read the attached Consent Form. If you have any questions or concerns regarding the study, please contact the researcher, Stephanie Fussell, at gill974@my.erau.edu. Your agreement on the Survey Monkey survey (question 2) means that you understand the information on this form, that someone has answered any and all questions you may have about this study, and you voluntarily agree to participate in it. Please print a copy of this form for your records. A copy of this form can also be requested from Stephanie Fussell at gill974@my.erau.edu.
2. Proceed to the Myers-Briggs Type Indicator (MBTI) Form M to take the personality assessment, < https://online.cpp.com >. The login is **ERAUstudent2017** and the password is **GoEagles1**; there is no "UserID". Your "Personal ID" is <**XXXX**>. Please note that although the MBTI requires your name to complete the survey, this information will not be used by the researcher and is used for internal purposes only. Please read each question carefully and choose the option that best describes how you prefer to look at things or make decisions. At the end of the assessment, choose "Done" to submit your answers.
3. Proceed to Survey Monkey to take the Kolb Learning Styles Inventory (KLSI) Version 3.1, < https://www.surveymonkey.com/r/HFKZ25K >. Your Personal ID is the same as above. To complete the study, please choose "Agree" for Question 2. To opt out of the study, you may choose "Disagree" and your results will not be used. This survey uses rank-order answers to describe how you learn. At the end of the assessment, choose "Done" to submit your answers.

Again, thank you for your participation. Your participation will provide valuable data for this study.

Kind Regards,
Stephanie Fussell

Appendix C

Figures

C1   Sample Data Selection Ratio Type Table

C2   Sample Data Compared to College Baseline Selection Ratio Type Table

C3   Sample Data Compared to Wiggins Baseline Selection Ratio Type Table

Class Sample

The Sixteen Complete Types

ISTJ	ISFJ	INFJ	INTJ
N = 15	N = 1	N = 1	N = 1
% = 36.59	% = 2.44	% = 2.44	% = 2.44

ISTP	ISFP	INFP	INTP
N = 7	N = 3	N = 1	N = 1
% = 17.07	% = 7.32	% = 2.44	% = 2.44

ESTP	ESFP	ENFP	ENTP
N = 2	N = 2	N = 0	N = 1
% = 4.88	% = 4.88	% = 0.00	% = 2.44

ESTJ	ESFJ	ENFJ	ENTJ
N = 3	N = 2	N = 1	N = 0
% = 7.32	% = 4.88	% = 2.44	% = 0.00

Note: ■ = 1 percent

Dichotomous Preferences

	N	%
E	11	26.83
I	30	73.17
S	35	85.37
N	6	14.63
T	30	73.17
F	11	26.83
J	24	58.54
P	17	41.46

Pairs and Temperaments

	N	%
IJ	18	43.90
IP	12	29.27
EP	5	12.20
EJ	6	14.63
ST	27	65.85
SF	8	19.51
NF	3	7.32
NT	3	7.32
SJ	21	51.22
SP	14	34.15
NP	3	7.32
NJ	3	7.32
TJ	19	46.34
TP	11	26.83
FP	6	14.63
FJ	5	12.20
IN	4	9.76
EN	2	4.88
IS	26	63.41
ES	9	21.95
ET	6	14.63
EF	5	12.20
IF	6	14.63
IT	24	58.54

Jungian Types (E)

	N	%
E-TJ	3	7.32
E-FJ	3	7.32
ES-P	4	9.76
EN-P	1	2.44

Jungian Types (I)

	N	%
I-TP	8	19.51
I-FP	4	9.76
IS-J	16	39.02
IN-J	2	4.88
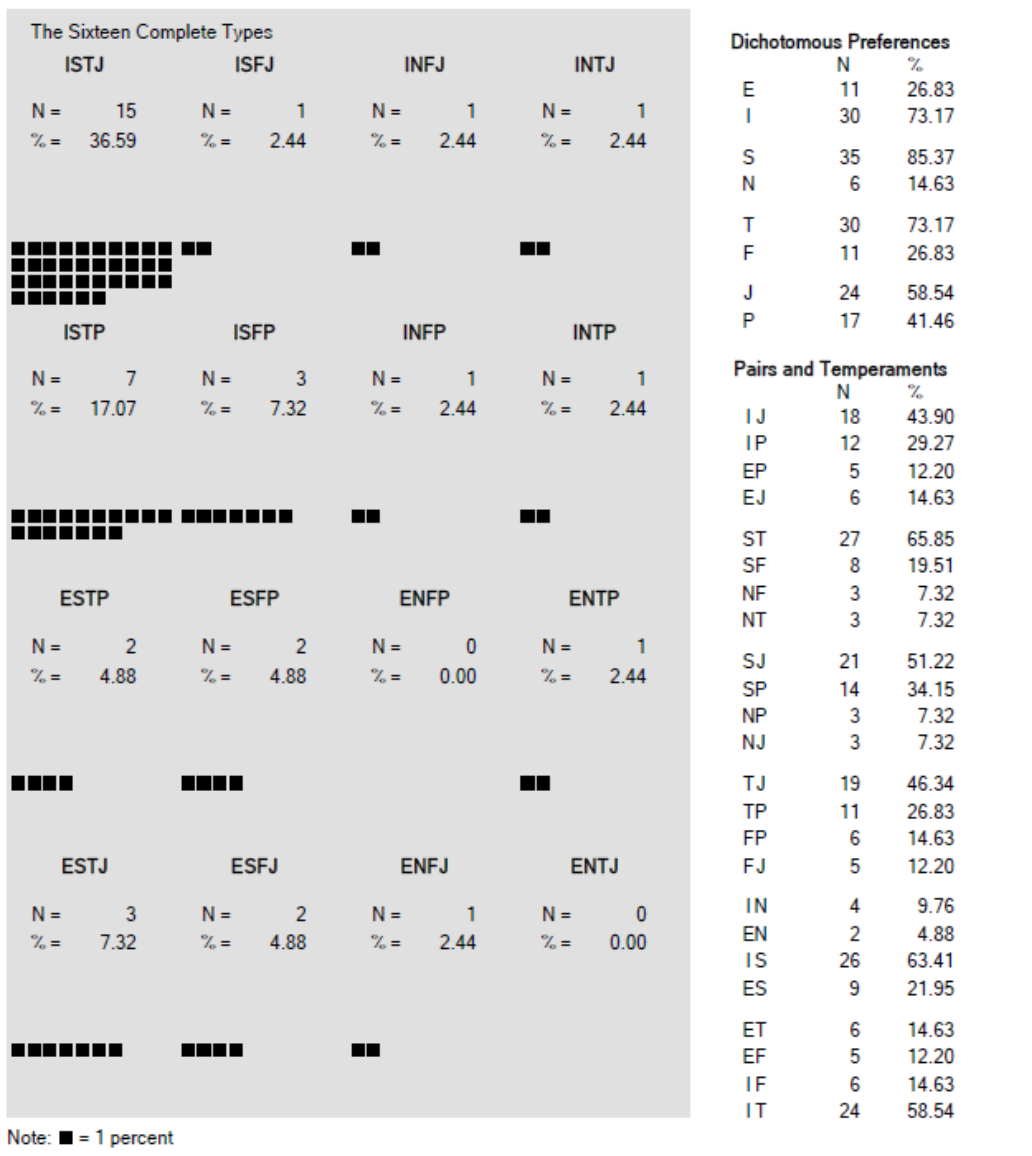
Dominant Types

	N	%
Dt. T	11	26.83
Dt. F	7	17.07
Dt. S	20	48.78
Dt. N	3	7.32

Figure C1. Sample data selection ratio type table.

Class Sample
Compared to
College Major Sample

The Sixteen Complete Types

ISTJ	ISFJ	INFJ	INTJ
N = 15	N = 1	N = 1	N = 1
% = 36.59	% = 2.44	% = 2.44	% = 2.44
I = 4.36***	I = 0.35	I = 0.74	I = 0.90

ISTP	ISFP	INFP	INTP
N = 7	N = 3	N = 1	N = 1
% = 17.07	% = 7.32	% = 2.44	% = 2.44
I = 3.88***	I = 1.59	I = 0.39	I = 0.59

ESTP	ESFP	ENFP	ENTP
N = 2	N = 2	N = 0	N = 1
% = 4.88	% = 4.88	% = 0.00	% = 2.44
I = 0.77	I = 0.64	I = 0.00	I = 0.40

ESTJ	ESFJ	ENFJ	ENTJ
N = 3	N = 2	N = 1	N = 0
% = 7.32	% = 4.88	% = 2.44	% = 0.00
I = 0.84	I = 0.55	I = 0.47	I = 0.00

Dichotomous Preferences

	N	%	I
E	11	26.83	0.45***
I	30	73.17	1.80***
S	35	85.37	1.53***
N	6	14.63	0.33***
T	30	73.17	1.66***
F	11	26.83	0.48***
J	24	58.54	1.24
P	17	41.46	0.79

Pairs and Temperaments

	N	%	I
IJ	18	43.90	2.06***
IP	12	29.27	1.52
EP	5	12.20	0.37
EJ	6	14.63	0.56
ST	27	65.85	2.37***
SF	8	19.51	0.70
NF	3	7.32	0.26
NT	3	7.32	0.45
SJ	21	51.22	1.56*
SP	14	34.15	1.49
NP	3	7.32	0.25
NJ	3	7.32	0.50
TJ	19	46.34	2.01***
TP	11	26.83	1.28
FP	6	14.63	0.46*
FJ	5	12.20	0.50
IN	4	9.76	0.60
EN	2	4.88	0.17
IS	26	63.41	2.61***
ES	9	21.95	0.70
ET	6	14.63	0.60
EF	5	12.20	0.35
IF	6	14.63	0.70
IT	24	58.54	2.99***

Note: ■ = 1 percent, I = self selection index, * = p < .05, ** = p < .01, *** = p < .001
Base N = 1000, Sample and Base are Independent.

Jungian Types (E)			Jungian Types (I)			Dominant Types		
	N	%	I		N	%	I		N	%	I
E-TJ	3	7.32	0.61	I-TP	8	19.51	2.30*	Dt. T	11	26.83	1.31
E-FJ	3	7.32	0.52	I-FP	4	9.76	0.90	Dt. F	7	17.07	0.69
ES-P	4	9.76	0.70	IS-J	16	39.02	2.55***	Dt. S	20	48.78	1.67**
EN-P	1	2.44	0.13	IN-J	2	4.88	0.81	Dt. N	3	7.32	0.29

Table C2. Sample data compared to college baseline selection ratio type table.

Class Sample Compared to Wiggins Sample

The Sixteen Complete Types

ISTJ	ISFJ	INFJ	INTJ
N = 15	N = 1	N = 1	N = 1
% = 36.59	% = 2.44	% = 2.44	% = 2.44
I = 1.96 **	I = 0.66	I = 2.32	I = 0.37

ISTP	ISFP	INFP	INTP
N = 7	N = 3	N = 1	N = 1
% = 17.07	% = 7.32	% = 2.44	% = 2.44
I = 1.85	I = 2.53	I = 0.42	I = 0.31

ESTP	ESFP	ENFP	ENTP
N = 2	N = 2	N = 0	N = 1
% = 4.88	% = 4.88	% = 0.00	% = 2.44
I = 0.64	I = 1.32	I = 0.00	I = 0.26

ESTJ	ESFJ	ENFJ	ENTJ
N = 3	N = 2	N = 1	N = 0
% = 7.32	% = 4.88	% = 2.44	% = 0.00
I = 0.65	I = 1.43	I = 1.85	I = 0.00

Note: ■ = 1 percent, I = self selection index, * = p < .05, ** = p < .01, *** = p < .001
Base N = 380, Sample and Base are Independent.

Dichotomous Preferences

	N	%	I
E	11	26.83	0.61*
I	30	73.17	1.31*
S	35	85.37	1.41**
N	6	14.63	0.37**
T	30	73.17	1.00
F	11	26.83	1.00
J	24	58.54	1.20
P	17	41.46	0.81

Pairs and Temperaments

	N	%	I
IJ	18	43.90	1.46
IP	12	29.27	1.13
EP	5	12.20	0.48
EJ	6	14.63	0.78
ST	27	65.85	1.41*
SF	8	19.51	1.43
NF	3	7.32	0.56
NT	3	7.32	0.28
SJ	21	51.22	1.38
SP	14	34.15	1.46
NP	3	7.32	0.26
NJ	3	7.32	0.63
TJ	19	46.34	1.18
TP	11	26.83	0.79
FP	6	14.63	0.84
FJ	5	12.20	1.29
IN	4	9.76	0.46
EN	2	4.88	0.27
IS	26	63.41	1.84***
ES	9	21.95	0.84
ET	6	14.63	0.48*
EF	5	12.20	0.91
IF	6	14.63	1.09
IT	24	58.54	1.38*

Jungian Types (E)				Jungian Types (I)				Dominant Types			
	N	%	I		N	%	I		N	%	I
E-TJ	3	7.32	0.52	I-TP	8	19.51	1.14	Dt. T	11	26.83	0.86
E-FJ	3	7.32	1.54	I-FP	4	9.76	1.12	Dt. F	7	17.07	1.27
ES-P	4	9.76	0.86	IS-J	16	39.02	1.74*	Dt. S	20	48.78	1.45
EN-P	1	2.44	0.17	IN-J	2	4.88	0.64	Dt. N	3	7.32	0.33

Table C3. Sample data compared to Wiggins baseline selection ratio type table.