Examining the Different Learning Strategies Between Extroverts and Introverts Among Flight Students at Embry-Riddle Aeronautical University

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EXAMINING THE DIFFERENT LEARNING STRATEGIES BETWEEN EXTROVERTS AND INTROVERTS AMONG FLIGHT STUDENTS AT EMBRY-RIDDLE AERONAUTICAL UNIVERSITY

by

John R. Brooks

A Graduate Capstone Project Submitted to the College of Aviation, Department of Graduate Studies, in Partial Fulfillment of the Requirements for the Degree of Master of Science in Aeronautics

Embry-Riddle Aeronautical University
Daytona Beach, Florida
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EXAMINING THE DIFFERENT LEARNING STRATEGIES BETWEEN EXTROVERTS AND INTROVERTS AMONG FLIGHT STUDENTS AT EMBRY-RIDDLE AERONAUTICAL UNIVERSITY

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This Graduate Capstone Project was prepared under the direction of the candidate’s Graduate Capstone Project Chair, Dr. Kim Chambers, Professor, 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 Master of Science in Aeronautics

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Abstract

Scholar: John R. Brooks

Title: EXAMINING THE DIFFERENT LEARNING STRATEGIES BETWEEN EXTROVERTS AND INTROVERTS AMONG FLIGHT STUDENTS AT EMBRY-RIDDLE AERONAUTICAL UNIVERSITY

Institution: Embry-Riddle Aeronautical University

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Extroverts and introverts have unique approaches to new materials that make learning more efficient. In aviation where quick learning and responses are required, students may struggle because preferred comprehension strategies are not utilized. The research question is whether introverts/extroverts learn better when given the option to approach materials using strategies that match their personality type. 16 participants are placed into one of two different groups (either extrovert/introvert). The Eysenck Personality Questionnaire – Revised (EPQ-R) determines personality trait. Participants are then subdivided into one of four random groups. All participants are given instructions on how to complete two different flight maneuvers (DME Arc and Direct entry to a hold). A two-way mixed design has participants experience both maneuvers with a different treatment for each. Despite which medium is being presented, all instructions are the same. The independent variable is introversion/extroversion personality trait and type of instruction. The dependent variable is flight performance measured by altitude, bank angle and course. The hypothesis is that participant performance will be increased when the presentation is associated to specific personality type, such as extroverts performing better when receiving oral instructions. The results show a pattern of introverts being more proficient at reading-based instructions. Extroverts do well with all instruction methods and showed higher proficiency with ‘Hold’ maneuvers. The research re-enforces learning method as a tool for reaching all students.
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Chapter I

Introduction

Throughout the course of an individual’s educational experiences, specific idiosyncratic learning strategies may be identified by them which enable them to learn better (e.g. in groups, one-on-one, reading then re-reading, etc.). One determining factor of how people prefer to learn is the type of personality they have. The two broad personality traits are introvert and extrovert and they both have unique styles of preferred learning. Introverts tend to be more individualistic in their learning, preferring to read on their own or silently listen to others lecture. Extroverts are more group–oriented and like active discussions to flesh out the ideas and concepts of new topics. Personality type undoubtedly plays a role in the classroom due to its connection with communication between other people as well as ideas and concepts (Jalili & Mall-Amiri, 2015). The importance of learning and communication is epitomized in flight training where comprehension of lessons and teamwork is essential. Personality type usually also dictates the classroom size that is most beneficial to an individual with introverts tending to enjoy smaller class numbers and extroverts’ larger numbers (Jalili & Mall-Amiri, 2015). The Federal Aviation Administration (FAA) oversees two main types of flight schools: FAR Part 61 & FAR Part 141. Part 61 flight schools are usually smaller, less regimented flight programs that may be one-on-one while Part 141 are often larger, more regimented programs that are found at professional flight academies (FAA, 2016). Depending on personality type, either one of these programs may have positives or negatives for a given student, but additional layers of tailoring may lead to greater success.

The existing research on the subject of the cognitive processing and learning techniques between extroverts and introverts is conclusive in that different unique strategies exist for both
personality types. Using this knowledge, this study will attempt to apply that theory to flight education. The research question posed for this study is whether introverts and extroverts learn better when given the option to approach material in a method suited to their personality type. The answer to this question will hopefully be beneficial in tailoring flight training courses to better serve the individual students and, therefore, create a safer and more knowledgeable generation of pilots.

**Significance of the Study**

The conclusions drawn from this study will be beneficial in the further education of the future generation of pilots. This research is not meant to provide an answer on how to build a new way to train pilots, but rather to serve all in the aviation and larger educational community on the overall theories of how students learn best. Organizations that will best utilize this research include; the FAA, Part 61 & 141 flight schools, all Certified Flight instructors (CFIs) and flight students, and all other educational institutions interested in learning more about personality type based educational strategies.

The FAA is the organization responsible for dictating the specific requirements for pilot education at all levels and creates the framework which all flight schools must adhere to. This research could serve as a guide in future promulgations of rule revisions on how student pilots receive their education. In addition to the FAA, all Part 141 and Part 61 flight programs can utilize this research to modify their existing flight education methods. CFI’s working in any flight program can use the knowledge inferred from this study to better understand how to approach their students with new educational material. For example, if a student is struggling with a certain concept, the CFI could present material in way that is better suited to the student’s personality traits.
Companies hiring pilots such as airlines or charter companies also may have a vested
interest in the results of this study as well. Many large airlines have their own certified flight
schools and could use this research to improve their teaching methods which would facilitate
greater retention among students, thereby alleviating the pilot shortage. While this research is
clearly beneficial to several facets of the aviation industry, educational institutions from pre-
schools to universities may use this research to better understand how to approach preferred
cognitive learning techniques.

**Statement of the Problem**

Personality plays a large part in an individual’s success or failure in aviation
(Hokeness, 2012). The relevant research concerning the different learning styles of extroverts
and introverts supports the justification to examine how these methods may be applied to flight
training. According to the FAA (2010), flight students have an 80% attrition rate. There are
several reasons for a student to not complete flight training; financial reasons, family obligations,
etc., but differences in learning styles may also play a role in a student dropping out of flight
school (Hokeness, 2012). Several studies conducted have concluded that the pilot populations of
many flight schools are nearly a 50% split between extroverts and introverts, with extroverts
usually being slightly more prevalent (Robertson & Putnam, 2008).

**Purpose Statement**

The purpose of this research was to examine the extent that different forms of preparation
material (written or oral) contributed to the overall effectiveness and proficiency of completing a
flight maneuver between extroverted and introverted flight students. Examining the data will
lead to conclusions on how to better approach lesson plans so that both personality types
(extrovert or introvert) can equally grasp and comprehend new material. This will ensure that
the material being studied is both more fundamentally understood and committed to memory and retained by the student which will enhance overall pilot proficiency.

Hypothesis

The research question for this study is whether introverts and extroverts learn more efficiently when given the option to approach educational materials using learning strategies that match their personality type. The null hypothesis for this study is that the type of instruction being given (written or orally) when the student familiarizes themselves with the operation or maneuver will have no effect on proficiency in the simulator for either the extrovert or introvert groups. The following hypothesis were tested during this study;

H1: Participants receiving the briefing material in the medium that agreed with their personality types (oral with extroverts & written with introverts) would perform better than those receiving the briefing material opposite their personality types.

H2: Participants receiving the briefing material opposite their personality types would see no significant performance increase during the maneuvers or a significantly poorer performance during the maneuvers

Delimitations

The scope of research for this study was deliberately restricted due three main constraints; time to complete the project, access to resources and limited funding. The research restrictions included the exclusion of further gender-based analysis of participant results, solely using the PI-138 flight simulator in lieu of using real aircraft, and the amount of participant flight training hours that were allowed in order to participate in this study.

Gender is deliberately not included as an area of further research among participant performance. The reason for this is, although it could give more in depth insight to the study, it
would add an extra layer of complexity to analyze and interpret which the time constraints for completing the study did not allow for. Lack of using real aircraft was also a time constraint-based delimitation as well as being due to limited funding. Using an actual aircraft would have created a natural setting while the PI-138 can never be more than a contrived setting to conduct the study. Despite this limitation, the PI-138 is a very powerful system that will easily give high experimental and mundane realism to increase the external validity of the study. Due to the relatively easy flight maneuvers used to examine the DV of this study, participants could not have accumulated more than 20 flight hours to participate in this study. Access to more funding and a longer time frame could address these delimitations.

**Limitations and Assumptions**

Limiting factors beyond control of the research team included the lack of a more in-depth indicator of personality type, an unpredictable participant personality type ratio that would be in the study, the amount of instruction given to participants and the overall number of participants available to this study.

Due to the cost and time commitment associated with longer, more in-depth personality tests, a shorter format was needed in order to more quickly determine participant personality types. While longer, more complex tests usually provide higher accuracy of true personality type, funding for each individual participant was unavailable to pay for the associated expenses. Since personality type was determined after a participant volunteered for the study, an unknown ratio of extroverts and introverts would be in the study. The accuracy of this study required more than self-identification of participant personality type, so an even number of extroverts and introverts could not be guaranteed, only hoped for. The number of volunteers for the study could
not be assured due in part to the lack of any compensation for participation and the specific eligibility requirements of the participants.

**Definitions of Terms**

**Elite Flight Simulator PI-135:** Three monitor advanced flight simulator located in the CERTS lab within the MSA building.

**Emotional Intelligence:** The capability of individuals to recognize their own emotions and those of others, discern between different feelings and label them appropriately (Fitzgibbon, Schutte & Davis, 2004).

**Extrovert:** State of obtaining gratification from outside oneself. Extroverts tend to enjoy human interactions and to be enthusiastic, talkative, assertive and gregarious. They are energized by and thrive being around other people.

**Goldberg’s Five Factor Model:** Personality test which breaks down 16 areas into five general groups

**Introvert:** Personality trait characterized by a focus on internal feelings rather than on external sources of simulation.

**Eysenck Personality Questionnaire-Revised:** 36 question scaled variable assessment that determines personality type using two dimensions; extroversion-introversion and neuroticism-stability

**Part 61/ Part 141 Flight Schools:** Part 61 flight schools can go at the student’s own pace and do not need to follow a certain structure. Part 141 schools do follow a more rigid and set paced structure to complete the required FAA curriculum (FAA, 2006).
### List of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ATC</td>
<td>Air Traffic Control</td>
</tr>
<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
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<tr>
<td>CERTS</td>
<td>Cognitive Engineering Research Transportation Sciences</td>
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<tr>
<td>CFI</td>
<td>Certified Flight Instructor</td>
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<tr>
<td>DAB</td>
<td>Daytona Beach International Airport</td>
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<tr>
<td>DME</td>
<td>Distance Measuring Equipment</td>
</tr>
<tr>
<td>DV</td>
<td>Dependent Variable</td>
</tr>
<tr>
<td>EI</td>
<td>Emotional Intelligence</td>
</tr>
<tr>
<td>EPQ-R</td>
<td>Eysenck Personality Questionnaire-Revised</td>
</tr>
<tr>
<td>FAA</td>
<td>Federal Aviation Agency</td>
</tr>
<tr>
<td>FFM</td>
<td>Five-Factor Model</td>
</tr>
<tr>
<td>IFR</td>
<td>Instrument Flight Rules</td>
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<tr>
<td>IV</td>
<td>Independent Variable</td>
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<tr>
<td>MBTI</td>
<td>Myers Briggs Type Indicator</td>
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<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
</tr>
<tr>
<td>ORM</td>
<td>Ormond Beach Airport</td>
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<tr>
<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
</tr>
<tr>
<td>VHF</td>
<td>Very High Frequency</td>
</tr>
<tr>
<td>VOR</td>
<td>VHF Omnidirectional Radio range</td>
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Chapter II

Review of the Relevant Literature

Variations of Extroversion/Introversion Theory

A comprehensive study focusing on extroversion/introversion traits requires an understanding of the core foundations of its theories. Like many scientific constructs, the theory of extroversion/introversion has evolved throughout its existence spawning several different versions. In order to better grasp how the concept is applied to this study, an explanation of the definition of extroversion/introversion theory as conceptualized by its founder, Carl Jung, along with a juxtaposition of the modern definition will provide a clear understanding of its practice in this research.

The father of extroversion/introversion theory, Carl Jung, defined the theory in his *Psychological Types* publication. Jung’s theory claims that humans exist on a continuum or spectrum with split determined behavioral characteristics or emotional intelligence. To Jung, decision making in humans utilizes a trait known as the ‘thinking-feeling’ (T-F) trait (Pearman, 2002). According to the T-F trait, both introverts and extroverts make reactions to their environment by either using logic (thinking) or using emotion (feeling). Jung believed where people fell on the introversion extroversions continuum is categorized by where individuals focused their emotional energy (Pearman, 2002). The lack of a middle ground between the two personality *types* is important to highlight as it is the epitome of how extroversion/introversion theory has changed from its early conceptualizations to its modern definition and practice (Stepp, 2011).

Considering extroversion and introversion as personality *types* or personality *traits* are the main way that the theory of the concepts has changed in modern psychoanalytical thought.
Since this is a categorical measure and not a scaled measure, individuals are considered to portray all of the associated behaviors with each personality (Furnam, Forde & Cotter, 1998). Recent research has revealed that human personality indeed does exist upon spectrums which in turn allows individuals personality descriptions to be more individualistic rather than being lumped into a broad category (Furnam, Forde & Cotter, 1998).

**Emotional Intelligence**

Emotional Intelligence has grown as a theory alongside personality trait theory and has different interpretations depending on which theory is used. Carl Jung’s theory on an individual’s decision making is that it seems to be a product of the thinking-feeling trait which an individual possesses (Pearman, 2002). To Jung, E/I reflects the emotional reaction and logical and steady approach to decision making (Pearman, 2002).

Hans Jurgen Eysenck theorized that human personality falls not into two separate categories but exists upon a continuum such as bell-shaped curve (Eysenck, 1967). Like most bell-shaped curves, the majority of individuals would fall somewhere within one standard deviation away from the mean (Eysenck, 1967). This meant that most people had a mix of both extroversion and introversion traits rather than just one or the other. Eysenck’s explain s human decision-making preferences as the result of obtaining certain behavioral characteristics. Eysenck’s behavioral spectrum uses neuroticism and extroversion as scales that all humans fall on (Eysenck, 1967).

**Personality Identification Scales**

The personality identification scale used in this study, the Eysenck Personality Questionnaire-Revised (EPQ-R), is a product of personality trait theory. A close runner up considered for the study was Lewis Goldberg’s Five Factor Model (FFM). Both scales are
derivatives of personality trait theory, though differ on their methods of scoring. Goldberg’s FFM is a product of his five-factor structure of personality theory (Goldberg, 1993). The five-factor structure of personality which the FFM uses rates participants across five dimensions: Openness, Conscientiousness, Extroversion, Agreeableness and Neuroticism (OCEAN). Scores are measured on a continuum which allow for a more individual approach to personality determination ((Mathews, Deary, & Whitman 2003).

Eysenck and his EPQ-R rate participants on just two dimensions, extroversion-introversion and neuroticism-stability, which provide a more focused view of where a participant falls on the extroversion/introversion continuum (Kerry, 2007).

**Flight-Simulator Based Training**

The introduction to high tech flight simulators into aviation-based training programs has added a new dynamic to traditional pilot instruction (FAA, 2006). Simulator based flight training on high tech-realistic flight simulators provides a near lifelike virtual creation of any given flight scenario with none of the inherent risks associated with it (FAA, 2006). Flight-simulator based training is the corner stone of new pilot training to get rated on any aircraft that modern airlines operate (JetBlue, 2008). At the JetBlue Academy, pilots wishing to get type rated on a CRJ-900 or A320 may log as many as 150 hours in the nearly $40,000,000 simulators before operating the actual aircraft (JetBlue, 2008).

A study found that flight students who learned landings on a flight simulator before graduating to an actual aircraft performed better than peers who had practiced the same number of landings, but had not started on the simulator, going immediately to actual flight instead (Robertson & Putnam, 2008). The reasons for this is that, unlike in actual flight, a flight-simulator can be paused mid-flight, record the entire flight, and manipulate conditions such as
wind, weather and terrain. The ability for this extra analysis leads to an increased understanding of flight performance as it is happening which carries over into real world flying leading to improved performance (Robertson & Putnam, 2008).

Having all flight students train on a simulator before an actual aircraft may also level the playing field between extroverts and introverts given their preferred learning styles. Given the fact that introverts prefer to digest and take time to consider new learning material, a simulator which can be paused and recorded provides an excellent tool with which to practice. Extroverts may still move at their desired pace but also have the same simulator benefits as introverts. The result of this is a more even distribution of performance with any studies associated with the two groups (Robertson & Putnam, 2008).

**Introverted Learning**

Although a definitive percentage is difficult to ascertain, introverts make up between 30% to 50% of the U.S. population (Goudreau, 2012). The percentage of introverts in any flight student population, even internationally, appears to adhere to the standard ratio of extroverts and introverts being very close. A sampling of Australian flight students showed a 40% introverted population. Despite the average introvert percentages in a given flight student population being slightly lower than extroverts, it is still a very significant portion. (Gao & Kong, 2016).

The difference in processing information between extroverts and introverts indicates a unique use of the brain and neurotransmitters for each personality type (Isaacs, 2009). The introverted thinker will recall thoughts from their long-term memory in order to build more complex associations between concepts (Isaacs, 2009). This means that introverts usually need more time to develop and express ideas to formulate responses to given information. Recalling Jung’s E/I theory, introverts feel most comfortable with time to study and apply logic to new
information before acting on it. Because of this preferred method of longer individualistic contemplation, introverts have a stereotypical quietness that may be associated with shyness or even a lack of enthusiasm within a classroom setting (Isaacs, 2009). A study which exemplifies the learning preferences of introvert learners explored the difference in success of distance learning between both personality traits. Both groups (extroverts & introverts) were placed in a room and asked to complete tasks by the researcher communicating via video conference. The success of introverts was higher due to their preference to work alone and be able to individually work on an assignment rather than in person or in groups (Offir, Bezalel & Barth, 2007).

Learning traits such as these may explain the comparative lack of success that introverted flight students have when compared to their extroverted peers. A study of pilot characteristics correlated to performance conducted at Embry-Riddle Aeronautical University demonstrated that pilots who had higher levels of both self-assuredness and group-oriented thinking were more proficient pilots than those lacking in the same areas (Farmer, 1995). According to the Myers-Briggs Type Indicator (MBTI), character traits similar to these can be found in both personality types, but are slightly less prevalent in introverts (Micaela, 2013).

**Extroverted Learning**

As previously stated, the proportion of extroverts in society is very nearly half of the population. Among flight students however, the ratio is slightly higher with extroverts making up a larger portion of the population. In addition to the study conducted by Gao & Kong (2016) which showed a 60% extroverted flight student population in an Australian flight schools, other studies have concluded the shown the number of extroverts to be higher. A study of pilot personality types at the University of Southern Illinois, Carbondale found an even higher majority of flight students possessed extrovert personality types (Robertson & Putnam, 2008).
Extroverts draw upon smaller amounts of information from their short-term memory in order to draw associations when formulating a response to a given task. This gives them their stereotypical nature of jumping into work relatively quickly after comprehending instructions, as opposed to the introvert who usually take longer (Isaacs, 2009). Due to this quick association cognitive preference, extroverts tend to enjoy social interaction as a way to intake and process information. This is why extroverts tend to thrive in lively classroom settings based around group discussion (Isaacs, 2009). These characteristics appear nearly synonymous with the typical traits associated with pilots. NASA described the basic pilot personality profile being emotionally stable and having low levels of anxiety, vulnerability, hostility, impulsiveness and depression (Fitzgibbons, Schutte & Davis, 2004).

Flying requires excellent teamwork and communication skills for success. Whether communicating with Air Traffic Control (ATC), other aircraft, or crew members, keeping constant communication and quick information processing are both required for safe flight operations. It is logical therefore to assume that extroverts would be at an advantage because of their pre-disposition to excel in group oriented, teamwork-based tasks that utilize fast communication. Again, considering Farmer’s (1995) study on pilot personality types among Embry-Riddle Aeronautical University flight students, the most successful students displayed the afore mentioned traits which are most often characteristics of extrovert personalities.

**Instructor Personality Types**

Not only is the personality type of a student determinant on how learning is best accomplished, but also the instructor’s personality type. The style in which teachers communicate their lessons also has to do with their own personality, which may or may not be beneficial for their students (Jalili & Mall-Amiri, 2015). It could be possible that the method of
teaching and learning which one seeks for a highly technical field such as flying is different than one seeks for a less technical, classroom-based topic. With the many factors and demands that go into learning to fly, thinking about the ideal learning strategy for each individual student may be an afterthought.

The personality type of instructors also plays a role in the educational experience which they provide to their students. Not only do the communication abilities of personality types differ, but the management style of classroom environments differs between introverts and extroverts, affecting the success of their students. To help prove this theory, a study was conducted that explored the effectiveness of classroom management between extroverted and introverted teachers. The experiment juxtaposed two groups of extroverted and introverted teachers with the results showing that extroverted teachers had students with a significantly higher success rate than introverted teachers (Jalili & Mall-Amiri, 2015).

Communication and personality type are also associated with emotional intelligence (EI). An individual’s EI is defined as the ability to regulate impulses, empathize with others, persist and be resilient in the face of obstacles (Pearman, 2002). Flight students who have CFIs with high EI tend to be more successful (Hokeness, 2012). Having high EI also tends to correlate with higher levels of an extrovert type personality, which as previously stated, is the type a large proportion of pilots fall under (Robertson & Putman, 2008). Possessing higher levels of EI translates into more proficient teaching and learning abilities in the cockpit (Hokeness, 2012). In a learning environment, such as a cockpit or classroom, the EI of an instructor can lead to the success or failure of a student (Chen & Chen, 2010).

In order to create a more efficient CFI-flight student pairing based on personality, the theory is that pairing similar personalities is the best strategy. This method was observed within
the South Korean Air Force (SKAF) pilot trainees and their flight instructors. Of the participants observed, paired groups who were similar extrovert types performed the best of the total observed population (Sohn & Jo, 2010). This finding is significant because the personality characteristics of the most successful groups included things like self-assertiveness, creativity, realism, etc. which are all traits of extroverted individuals.

**Tailored Flight Lessons**

If research can be done to tailor flight learning to better suit individual students, the potential for a new generation of safer, more proficient pilots in greater numbers is a possible outcome. Research on the ability to accomplish motor related tasks between extroverts and introverts does highlight an interesting finding. The study revealed that both introverts and extroverts achieved similar levels of success when given a choice on how to accomplish a task (Kaefer, Chiviacowski, Meira & Tani, 2014). This could mean that the differences in learning between extroverts and introverts may be in cognition and not in physical operations. This is significant due to the technical aspect of physically flying an aircraft.

The existing research on the subject of the cognitive processing and learning techniques between extroverts and introverts is conclusive that different unique strategies exist for both personality types. Using this knowledge, this experiment will attempt to apply that theory in flight education. The posed research question for this study is whether introverts and extroverts learn better when given the option to approach material in a method suited to their personality type. The answer to this question will hopefully be beneficial to tailoring flight lessons in order to better serve the individual student and, therefore, create a safer and more knowledgeable generation of pilots.
Summary

Extroversion/introversion theory has gone through several evolutions throughout its uses by different psychologists. Trait theory was developed which measured extroversion/introversion on a continuum rather than discrete categories. From his research, Eysenck developed the EQP-R, a personality identification scale which measures personality on a continuum using two dimensions: extroversion-introversion and neuroticism-stability.

Flight-simulator based training provides a level playing field when comparing extrovert-introvert learning. A flight simulator is a lower cost, safe method of training which can be paused, recorded and manipulated to increase student learning. Extroverts can go at their own pace when learning on them and introverts have the added ability of pausing to digest information and further analytical ability of their flights due to the features of the flight simulator.

In the general population as well as in flight schools, the ratio between introverted and extroverted individuals is very close to half and half. Their preferred style of learning however appears to be very opposite resulting in a comparatively lower number of introverted pilots succeeding when compared with their extroverted counterparts. The lack of success may be attributed to introverts needing more time to process learned information than extroverts. Extroverts tend to utilize their short-term memory when engaging with new material which may explain their ability to readily take on new tasks without much background knowledge.

The personality of an instructor is also crucial to introverted/extroverted learning. It appears the extroverted teachers generally produce higher scoring pupils of both extroverted and introverted personalities. In aviation specific studies, extroverted CFIs also appeared the most
successful. Reasons for this higher success could be partially due to extroverts having more EI and the associated positive personality traits that are associated with them.

Due to the high margin of safety required for flight, being proficient with all the knowledge required for flight is vital. It is easy however for some material to be forgotten or not mastered due to several factors. Studies have proven that extroverts and introverts both achieve similar levels of success when given their choice of instruction method. Tailoring flight courses to fit the individual needs of different kinds of learners based on personality could create future generations of safer pilots.
Chapter III

Methodology

Research approach

The three main designs - approach, descriptive and exploratory – are used to varying degrees in this study. The apparatus and materials used for the study are found within the CERTS lab where the research was conducted.

**Design and procedures.** The design which this study focuses most on is *causality* as a means to obtain data. The focal point of this study is the cause and effect relationship between personality trait (IV) and flight performance (DV), with the hypothesis being: Flight students will perform better when given instruction matching their personality trait is the focal point of this study.

This study also uses the *descriptive* design to assess participants’ personality traits, as well as to provide a post assessment about the study. Participants complete both a ‘pre-test’ questionnaire (EPQ-R) to determine their personality trait (introvert/extrovert) and a ‘post-test’ survey about their experience during the study.

This study will use the *exploratory* design to ascertain qualitative data from the EPQ-R and the post-test questionnaire given to participants. The data taken from these assessments will yield specific details for the study. The EPQ-R will initially sort participants by personality trait, and the post-test questionnaire will further analyze conclusions taken from the actual flights.

Every participant that volunteers for this study will experience the procedures in the same order with the exception of the two flight treatments. Participants who volunteer for this study will contact the researcher and the researcher will send them a copy of the EPQ-R to complete.
Once the participant has completed the EPQ-R, they will email their results back to the researcher and a time to come to the lab will be scheduled.

The researcher will give the participant a number and place them into one of four groups. The participants will never meet others in their group and each participants session in the lab will be an individual experience, the groups are purely for comparison and balancing purposes after the data has been collected. Each group will have three extroverts and three introverts within it, if an uneven number of the two personalities exists, participants will be grouped using median split. Each group represents a different treatment (instructions presented through oral or individual reading) and a different order with which the two maneuvers are encountered (two groups will get the DME Arc instructions before Holds and vice-versa). Once grouping has been completed, there will be one group that receives DME Arc oral before Holding oral, one group that receives Holding oral before DME oral, one group that receives DME Arc reading before Holding reading and one group that receives Holding reading before DME Arc reading.

When participants arrive at the lab at their scheduled time, they will be greeted by the researcher who will present them with a consent form and ask them to read and sign it. After signing it, the researcher will verbally acknowledge to the participant that this is a voluntary study and that they may choose to discontinue it at any time, for any reason without consequences. The researcher will also ensure that the participant’s credentials remain confidential and will never be used or published with the study. The researcher will then explain that the participant will be hearing two set of instructions for two different IFR maneuvers and will follow each instruction session with a flight trial of the maneuver taught. Depending on the group, the participant will either hear two sets of oral instructions or two sets of reading instructions. For the oral instruction groups, the participant will receive a paper and pencil and
the researcher will read a set script of flight instructions aloud. The participant may ask questions and write notes during the portion read aloud. The instruction portion for all oral groups will take a maximum of 15 minutes before the participants will be asked to fly the respective maneuvers. For the reading instruction groups, participants will be given a script to read quietly (the same exact scripts as the researcher reads aloud for oral groups) and may write down notes with their paper and pencil. No more than 10 minutes will be allowed for each reading group; however, they will then have a 5-minute period following their reading time to ask questions before flying the maneuver. Reading groups will also be timed to see how long participants prefer to read quietly before feeling ready to fly. Before the first maneuver is flown, each participant may practice on the PI-138 for two minutes to get a feel for the controls. Each maneuver will then be flown by the participants. Each flight will take a maximum of 10 minutes.

After both of the maneuvers have been flown, a posttest survey will be given to participants to fill out. The questions ask about the participant’s experience in the study and serves as a medium for further analysis of the results from the flight simulator. Participants will then be thanked for their time and compensated with $10 from the researcher before leaving.

**Apparatus and materials.** The apparatus and material to be used in this study will all be contained within the ERAU CERTS lab. The main apparatus used in this study is the PI-138 Elite Pro Flight Simulator. This will be the platform on which participants will fly the two maneuvers in the study. In addition to the PI-138, the Elite Pro firewall will be attached to flight simulator. The Elite Pro firewall provides nearly identical control scheme as a Cessna-172 which is the plane being simulated which gives high realistic validity to the study. To determine the personality trait of each participant, the EPQ-R will be administered before the maneuvers
are performed. The EPQ-R is a 36-question test with scaled answers that can be finished in as little as 10 minutes.

There are several materials used in this study which include a posttest survey, instructions for each maneuver and basic items for the participant. The post-test survey is given to participants after the initial portion of the study is completed. The aim of this is to help further analyze the results from the main part of the study. Additional materials used in this study are physical copies of the instructions of both the DME arc maneuver and the direct entry to a hold which will either be read aloud to the participant or given to them to personally read. Participants will receive a paper and pencil for the opportunity to take notes during the instruction portion of the study. The participants will be seated at a chair and desk within the CERTS lab during the instruction portion of each maneuver.

Population/Sample

Participants in this study were chosen from the general ERAU flight department population. The sample size is 16 participants with eight extroverts and eight introverts. To be eligible for this study participants must be over 18 years of age, have at least 5 hours of flight training and to have not sought any IFR flight training towards an IFR certification. The entire aviation industry may benefit from the results of this study. Within the aviation industry, flight schools and aviation training centers (such as commercial airlines/military) will benefit the most from this research.

Sources of Data

The main sources of data in this study comes from the flight recordings on the PI-138 Simulator. The flight data numbers (airspeed, altitude, VSI, bank angle.) for each flight will be recorded 10 times per second in both maneuvers. These specific numbers will provide a
statistical mean for how far off from a perfect maneuver each participant flies. In addition to the raw data from the simulator, the EPQ-R provides qualitative data for this study. The EPQ-R gives the specific personality trait that this study analyzes, and the posttest survey provides further analysis of the conclusions from this study’s results.

The appropriateness of these sources of data is due to the type of hypothesis and nature of the study. The data set taken from the Elite Pro sim provides the best source of data as it specifically analyzes each participant equally despite their personality trait. The EPQ-R provides a brief indicator of personality on only two dimensions, as opposed to the 5 and 16 dimensions on MBTI/Goldberg.

In terms of properties of the instruments in this study, the Elite Pro sim records all aircraft movement in a 3-D environment numerically (airspeed, VSI, altitude, bank angle) and logs them for later retrieval. The EQP-R rates participants using a 36-question series with each question having five answer choices. Personality is shown on a 4-axis quadrant measuring between the scales of neuroticism - stability and introversion - extroversion.

Each source of data for this study has different scoring techniques. The EPQ-R gives participants either an extroversion or introversion identification, a percentage of extroversion will be denoted at its conclusion. A score of over 50% identifies an extroverted participant and below 50% identifies higher introversion.

**Data Collection Device**

The two instruments used to collect data in this study are the PI-138 Flight Simulator and the EPQ-R personality test. Both have adequate reliability and validity to extract the required data in this study.
**Instrument reliability.** The reliability of the EPQ-R as an instrument has been proven in studies conducted that compare the EPQ-R’s scores against other longer versions of the test using the same participants. The results of the study showed that 249 participants scored the same personality trait on EPQ-R and the longer EPQ-R (S. Foresst, C.A. Lewis & M. Shevlin, 2000). This study proved high internal consistency, test/retest reliability and concurrent validity of the EPQ-R.

The PI-138 Flight Simulator can be considered to be a reliable instrument through many of its own design merits. Its geography, weather, and engine physics are capable of recreating 3D environments nearly identical to what a pilot would experience nearly anywhere in the real world under a variety of meteorological conditions. The simulator can also take 10 real-time captures of the airplanes position in space a second providing a much more complex window into all aspects of the pilot’s performance.

**Instrument validity.** The EPQ-R has been widely used since the mid 1980’s in a wide range of psychological studies. Because of its heavy utilization in behavioral science based research, the EPQ-R can be assumed to be a valid instrument in the collecting of personality trait data for this study.

The PI-138 can be considered a valid instrument due to the accuracy of the software and The experience of its developers. *Elite Simulator Solutions* is the program designer of the PI-138 and have been creating top of the line flight simulators since the early 1990’s. Additionally, *X-Plane*, which is the actual flight program that the simulator uses was created by a team of former U.S. NAVY pilots. Thus, the realism of aircraft performance within the simulation enhances the accuracy of the experience.
Treatment of Data

Descriptive statistics. In order to assess participant performance while flying the two maneuvers on the PI-138 flight simulator, specific data from the flight will be recorded. The collected data will represent aircraft altitude, heading, VSI, ground speed and bank angle. The measures of central tendency (mean, median and mode) will be looked at for each of the aforementioned data sources and analyzed to find if there is a significant different in either group (extrovert/introvert) in how they completed the maneuver and how accurate or inaccurate that performance was to the instructions given.

Reliability testing. For this study, internal consistency in flight performance is maintained by all participants doing the same maneuvers and procedures in the same order within their specific groups. A correlation will be sought between the determined personality of participants, pilot performance on the simulation and the posttest survey after the conclusion of the data collection on the simulator. An alpha level of .05 was also set for this study.

Hypothesis testing. The null hypothesis for this study is that there is no significant correlation between pilot performance on the simulator and whether or not they learned the maneuver based on their personality type. The statistical tests that determine if the null hypothesis is rejected or retained are the measures of central tendency calculated from the raw flight performance numbers followed by a within-subjects ANOVA.

Qualitative data. The qualitative data in this study originate from two sources, the EPQ-R pre-test and the posttest survey following the main flight data collection phase. The pre-test EPQ-R determines the personality type of participants and places them into groups accordingly. This test is integral to analyzing if there was a significant difference between flight performance and how each personality trait received flight maneuver instructions. The posttest survey is
taken immediately following a participant’s completion of each of the two flight maneuvers in the study. The posttest allows for further analysis of the quantitative results ascertained from the flight data. The survey will illuminate why the null hypothesis was either rejected or retained.
Chapter IV

Results

The main results observed in this study are comprised of measures of central tendency and other statistics which are drawn from the flight data each participant created. Each of the two maneuvers flown by participants has a target distance of 5.5 miles away from the originating fix. The mean distances which participants maintained are compared to 5.5 miles to test for significant performance differences between groups. The mean altitude participants maintained is also compared against the cardinal altitude of 3000 feet, which is what participants were instructed to use for every maneuver. The different mean total times extroverts and introverts took to examine the material in the ‘reading’ teaching medium is also observed. The results of a qualitative post-test survey which participants answer upon completion of the entire session provides analysis of the participant’s perspective during the study.

Descriptive Statistics

The mean distances participants maintained the aircraft in both maneuvers as well the mean altitude held are ranked from worst to best by group. The maneuver with the lowest proficiency in the introverted group is the Hold-oral maneuver with a and SD of .26 and a mean of 4.8 miles. The second lowest is DME-oral with SD of .55 and a mean of 4.9 miles. The second best is DME-read with a SD of .12 and mean of 5.43 miles. The best is the hold-read with a SD of .15 and a mean of 5.47. The ranked altitudes from worst to best among the introverted participants are: Hold-oral (2890.8 feet), DME-oral (2921 feet), DME-read (3030.2 feet) and hold-read (3016 feet). The ranked average distance and average altitudes are a match for all introverted groups. Extroverts use an average of 47 seconds out of the total 120 seconds
allotted to look over new information before a flight. Introverted participants on average take 119 seconds.

The maneuver with the lowest proficiency in the extroverted group is the DME-read with a SD of .337 and a mean of 5.25. The second lowest is the DME-oral with a SD of .05 and a mean of 5.42 miles. The second best is the hold-read with a SD of .15 and a mean of 5.52 miles. The best is the hold-oral with a SD of .047 and a mean of 5.53 miles. The ranked altitudes from worst to best among the introverted participants are: DME-read (3044.3 feet), Hold-read (2966.7 feet) and Hold-oral (3015.7) and DME-oral (3014.9).

Table 1

Performance Data

<table>
<thead>
<tr>
<th>Maneuver</th>
<th>Sig(2-tailed)</th>
<th>Standard Deviation Extro</th>
<th>Standard Deviation Intro</th>
<th>Extrovert Mean</th>
<th>Introvert Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hold-oral Dis</td>
<td>.003</td>
<td>.047</td>
<td>.263</td>
<td>5.53</td>
<td>4.87</td>
</tr>
<tr>
<td>Hold-Oral Alt</td>
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<td>44.09</td>
<td>221.6</td>
<td>3015.77</td>
<td>2890.8</td>
</tr>
<tr>
<td>DME-oral Dis</td>
<td>.158</td>
<td>.05</td>
<td>.55</td>
<td>5.42</td>
<td>4.97</td>
</tr>
<tr>
<td>DME-oral Alt</td>
<td>.625</td>
<td>45.1</td>
<td>360.5</td>
<td>3015.95</td>
<td>2921.4</td>
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<tr>
<td>Hold-read Dis</td>
<td>.654</td>
<td>.15</td>
<td>.15</td>
<td>5.52</td>
<td>5.47</td>
</tr>
<tr>
<td>Hold-read Alt</td>
<td>.410</td>
<td>96.8</td>
<td>56.3</td>
<td>2966.72</td>
<td>3016.35</td>
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<tr>
<td>DME-read Dis</td>
<td>.343</td>
<td>.337</td>
<td>.125</td>
<td>5.25</td>
<td>5.43</td>
</tr>
<tr>
<td>DME-read Alt</td>
<td>.930</td>
<td>300.9</td>
<td>58.8</td>
<td>3044.30</td>
<td>3030.22</td>
</tr>
</tbody>
</table>

Note. Adapted from SPSS by Brook, J.
*p < .05.
Significance of Results

A two-tailed between subjects t-test at an alpha level of $a = .05$ is used to ascertain the significance of the results from this study. The only truly significant group comparison between extroverts and introverts is .003 in the Hold-oral treatment group. The next most significant result is .158 in the DME-oral group. All of the altitude significance levels observed in this study are not significantly different between extrovert and introvert populations. Since they are so close between all participants regardless of personality type or treatment, they are considered statistically similar.

Reliability Testing

The accuracy of the data the PI-138 Flight Simulator produces can be considered valid, accurate and reliable. The computer engine which produces its geography, weather, physics and aircraft dynamics is a constantly self-updating platform designed by actual pilots. A participant flying the simulator to the same fixed point as another participant experiences the exact same weather conditions, geographical layout and start/ending points. All distances, assigned altitudes and maneuver instructions are identical whether given orally or as written. Due to these constants, reliability of data from the instrument and the study overall are high.

Hypothesis Testing

Of the two null hypothesis that the research question of this study creates, both were rejected. The first null hypotheses which states that participants receiving the briefing material in the medium that agreed with their personality types (oral with extroverts & written with introverts) would experience no significant difference in performance than those receiving the briefing material opposite their personality types is rejected. The second null hypothesis, which states that participants receiving the briefing material opposite their personality types would see
no significant difference in performance than participants receiving the same material which agreed with their personality type is also rejected.

**Qualitative Data**

All participants complete a 9-question post-test survey immediately following the end of their lab session. The questions of the survey are comprised of inquiries about how the participants felt about the personality type with which they were identified, the clarity the maneuver instructions and which maneuver they found to be easier and more difficult. All 16 participants in this study said they had agreed with the personality that the EPQ-R identified them as prior to their lab session. 15 out of 16 participants said that both sets of instructions were clear and easy to understand with the exception of one saying the written hold instructions were unclear. The last question asks if participants found the first or second flight easier. All introverted participants indicate the easier flight is whatever flight the ‘read’ teaching medium was regardless of whether it was first or second. All extroverted participants indicate that the second flight was easier than the first flight.
Chapter V

Discussion, Conclusion, Recommendations, and Lessons Learned

The findings extracted from this study when distilled show definite patterns of results between participant groups. While not all statistically significant, these patterns are discerned as idiosyncratic trends when juxtaposing results of the introvert and extrovert participant samples.

Discussion

The results of this study show that extroverts and introverts both generally do better at a task when learning that task through the preferred teaching medium of their personality type. Not all cross comparisons between groups are statistically significant but do show a definite pattern. In addition, extroverted participants tend to be better with oral learning than reading. Introverted participants tend to do better with reading learning than oral. Extroverted participants scored higher in all groups despite teaching medium than introverts.

Extroverts and ‘oral’ learning. Extrovert’s experience very high proficiency with the ‘oral’ teaching medium. Despite the discrepancy of a 0.1 difference making the Hold-read slightly more proficient than the DME-oral, a clear trend of extroverts excelling with the ‘oral’ learning technique is apparent. Extroverts experiencing higher proficiency in maneuvers learned orally sides with existing research indicating oral learning is more preferred among that personality type.

Introverts and ‘read’ learning. Introverts experience higher proficiency with the ‘read’ teaching medium than the ‘oral’ teaching medium. No matter the order of learning techniques that an introverted participant experiences in the study, the introverted participants do better with whichever maneuver uses the ‘read’ teaching medium. Type of teaching medium appears far
more important to introvert participant proficiency than the order in which each maneuver is encountered, or type of maneuver being performed.

**Extrovert’s overall proficiency.** Extrovert’s performance is significantly better in every group despite teaching method than introverts. The target distance for every maneuver is 5.5 miles and all extrovert groups had an average distance very close to this target. The lowest proficiency for extroverts is 5.25 miles on the DME-read maneuver compared to the lowest performance of introverts at 4.8 miles on the Hold-oral maneuver. Extroverts in the study also use 50% less time to read the instructions during ‘read’ maneuver sessions. Extroverts use an average of 47 seconds out of the total 120 seconds allotted to look over new information before a flight. Introverted participants on average take 119 seconds. This result agrees with research that claiming extroverted personality types tend to do better at active tasks such as flying and are able to take in more information after just one learning session.

**Maneuver order vs. type of learning style performance.** All participants filled out a post-test survey following their lab session. The questions asking about which maneuver (first or second) that participants felt they performed better on points to two different observations for both the extroverts and introverts. Nearly all extroverted participants claim that the second maneuver is easier than the first during their lab session. This is logical due to participants being able to practice on the first maneuver and being more prepared for the second. Type of learning method does not matter as much, especially since they tended to have high proficiency in all groups. Introverts identified whichever maneuver used the ‘read’ medium as the one they most prefer. The answers of the post-test survey indicate that extroverts preferred the second maneuver regardless of learning method because they had already had some practice on the simulator during their first maneuver. All introverted participants prefer whichever flight uses
the ‘read’ teaching medium regardless of order. This indicates that style of teaching is more important than maneuver type or order.

Conclusions

The observations and interpretations of the outcomes from this study create two main conclusions about the learning preferences of both introverts and extroverts. Extroverted personality types in this study generally did better overall than introverted personality types and did not feel partial to a particular learning strategy according to self-report measures. Introverts unanimously favor the ‘read’ teaching medium to ‘oral’ in this study and do more proficiently with reading. This finding concludes that a correlation between reading and introvert proficiency exists.

**Extroverted success.** Extroverted personality types will likely perform best in an environment where learning is done through engaging discussions followed by a question and answer period. Their stereotypical nature of jumping into new material negates the need for long sessions of solitary study an instead may move into active learning far quicker than their introverted counterparts. Extroverts will still do well when learning through more individualistic methods but do best with active learning where they can engage with the material.

**Introverted success.** Introverts will do best when given time to study new material individually and with extra time to do so. Introverts that have time to study new material and take notes on that material will see higher success than those who do not. Introverts should also be encouraged to take personally written instructions into the activity to refer back to.
Recommendations

The conclusions drawn from this study apply both to the aviation industry and the broader educational community as whole. Educational institutions, whether aviation focused or not, should recognize the outcomes of this study as a tool for increasing learning proficiency among their students.

**Aviation education.** Understanding the different learning strategies that work best between introverts and extroverts and applying them to aviation education will lead to a more proficient generation of pilots. The strategies demonstrated in this study may be applied to any Part 61 or Part 141 flight schools to better aid students in flight mastery. As earlier research suggests, most populations of flight students will be a near even mixture of introverts and extroverts learning best through different methods. Application of the conclusions drawn from this study into real world practice will be beneficial for flight programs not leaving any of their students academically behind.

**Broader educational application.** The lessons learned about education and personality are not restricted to aviation as they are in this study. The learning differences between extroverts and introverts can apply to any given educational focus and should be recognized as such. Educational institutions should utilize this knowledge to ensure that their pupils are all getting a fair chance to grasp new material. The same strategies as applied to the aviation industry work for any other educational foundations and should be an integral concept for teachers to understand about their students.

Lessons Learned

A hypothetical replication this study or further extension of it would improve the results and conclusions based on the recognition of various needed improvements. Utilizing the lessons
learned from the conclusion of the original study and testing again could yield both more accurate data and expanded results.

**Higher statistical precision.** The alpha level for this study is set at $\alpha = .05$ for a two-tailed $t$-test. The statistical precision of .05 is too large for SPSS to discern between a one-digit difference among participant performance. In the simulator a one-digit difference represents an entire mile. The one-digit difference presented to SPSS is not great enough to recognize significant comparisons between groups when they indeed exist. In a replication of this study, the alpha level should be set at $\alpha = .01$ to provide higher precision.

**Differentiate altitudes between groups.** For each maneuver for every participant, the instructed altitude to maintain is 3000 feet. Participants of both personality types were able to maintain an average altitude in each group very close to the target of 3000 feet regardless of teaching medium. There are no significant differences seen between any of the altitudes across all groups. To obtain a more accurate result of statistical significance, differentiating the assigned altitude between groups would ensure that participants would not experience carry over effects from one maneuver to another.

**Repetitive lessons.** Testing participants after one lesson is a good indicator of how much a participant can retain in a short amount of time. To achieve more external validity however, participants should be tested two or three times to test retention.
References


Appendix A

Permission to Conduct Research

IRB Approval
Emory-Riddle Aeronautical University
Application for IRB Approval
Exempt Determination

Principal Investigator: John Brooks
Other Investigators: Robert Bauer
Role: Student  Campus: Daytona Beach  College: Aviation/Aeronautics
Project Title: Examining the Differences in New Flight Material Learning Between Extroverted and Introverted Flight Students at Embry-Riddle

Review Board Use Only

Initial Reviewer: Teri Gabriel  Date: 02/23/2018  Approval #: 18-101
Exempt: Yes

Dr. Michael Wiggins  Date: 03/01/2018
Michael E. Wiggins, Ed.D.
IRB Chair Signature

Brief Description:
The purpose of this study is to gain knowledge of the preferred types of learning and the resulting proficiency between extroverted and introverted flight students. The goal is to determine if certain personality types prefer learning new material based on their own personality type. The EPQ-R will be used, followed by two new flight maneuvers and then a posttest questionnaire.

This research falls under the exempt category as per 45 CFR 46.101(b) under:

☐ (1) Research, conducted in established or commonly accepted educational settings, that specifically involves normal educational practices that are not likely to adversely impact students’ opportunity to learn required educational content or the assessment of educators who provide instruction. This includes most research on regular and special education instructional strategies, and research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

☑ (2) Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met:
   (i) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects;
   (ii) Any disclosure of the human subjects’ responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the
subjects’ financial standing, employability, educational advancement, or reputation.

(3) (i) Research involving benign behavioral interventions in conjunction with the collection of information from an adult subject through verbal or written responses (including data entry) or audiovisual recording if the subject prospectively agrees to the intervention and information collection and at least one of the following criteria is met:
   (A) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects;
   (B) Any disclosure of the human subjects’ responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects’ financial standing, employability, educational advancement, or reputation.

(4) Secondary research for which consent is not required: Secondary research uses of identifiable private information or identifiable biospecimens, if at least one of the following criteria is met:
   (i) The identifiable private information or identifiable biospecimens are publicly available;
   (ii) Information, which may include information about biospecimens, is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained directly or through identifiers linked to the subjects, the investigator does not contact the subjects, and the investigator will not re-identify subjects.

(6) Taste and food quality evaluation and consumer acceptance studies:
   (i) If wholesome foods without additives are consumed, or
   (ii) If a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture.

An exempt research project does not require ongoing review by the IRB, unless the project is amended in such a way that it no longer meets the exemption criteria.
Appendix B

Data Collection Device

Eysenck Personality Questionnaire - Revised
Answering these questions accurately requires honest reflection on how you really think, feel, and act in general and maybe taking the test on more than one occasion. Some of the questions on this test measure personality traits differently than you might guess so trying to answer the test in a way you think would be ideal is just going to screw up your results, so just focus on being honest if you want the most accurate results.

PLEASE NOTE: SELECTING THE MIDDLE ANSWER MEANS A STATEMENT IS AROUND 50% ACCURATE

1) I am at ease around others.
   \[\text{Very Inaccurate} \quad | \quad \text{Very Accurate}\]

2) I enjoy social gatherings.
   \[\text{Very Inaccurate} \quad | \quad \text{Very Accurate}\]

3) I am very tense.
   \[\text{Very Inaccurate} \quad | \quad \text{Very Accurate}\]

4) I have no trouble approaching people.
   \[\text{Very Inaccurate} \quad | \quad \text{Very Accurate}\]

5) I can be egocentric.
   \[\text{Very Inaccurate} \quad | \quad \text{Very Accurate}\]

6) I try not to be rude to people.
   \[\text{Very Inaccurate} \quad | \quad \text{Very Accurate}\]

7) I tend to be nervous.
   \[\text{Very Inaccurate} \quad | \quad \text{Very Accurate}\]

8) I enjoy being part of a group.
   \[\text{Very Inaccurate} \quad | \quad \text{Very Accurate}\]

9) I am very moody.
   \[\text{Very Inaccurate} \quad | \quad \text{Very Accurate}\]

10) I tend to be more comfortable with the known than the unknown.
    \[\text{Very Inaccurate} \quad | \quad \text{Very Accurate}\]
<table>
<thead>
<tr>
<th></th>
<th>11) I sometimes feel extremely sad for no reason.</th>
<th>Very Inaccurate</th>
<th>Very Accurate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12) I respect authority.</td>
<td>Very Inaccurate</td>
<td>Very Accurate</td>
</tr>
<tr>
<td></td>
<td>13) Being in debt would not worry me.</td>
<td>Very Inaccurate</td>
<td>Very Accurate</td>
</tr>
<tr>
<td></td>
<td>14) I suffer from anxiety.</td>
<td>Very Inaccurate</td>
<td>Very Accurate</td>
</tr>
<tr>
<td></td>
<td>15) I am quiet around others.</td>
<td>Very Inaccurate</td>
<td>Very Accurate</td>
</tr>
<tr>
<td></td>
<td>16) I frequently feel guilty.</td>
<td>Very Inaccurate</td>
<td>Very Accurate</td>
</tr>
<tr>
<td></td>
<td>17) I would rather play by the rules.</td>
<td>Very Inaccurate</td>
<td>Very Accurate</td>
</tr>
<tr>
<td></td>
<td>18) I know how to get people to have fun.</td>
<td>Very Inaccurate</td>
<td>Very Accurate</td>
</tr>
<tr>
<td></td>
<td>19) I fear for the worst.</td>
<td>Very Inaccurate</td>
<td>Very Accurate</td>
</tr>
<tr>
<td></td>
<td>20) I can be unsympathetic.</td>
<td>Very Inaccurate</td>
<td>Very Accurate</td>
</tr>
<tr>
<td></td>
<td>21) I frequently feel frustrated.</td>
<td>Very Inaccurate</td>
<td>Very Accurate</td>
</tr>
<tr>
<td></td>
<td>22) I frequently worry.</td>
<td>Very Inaccurate</td>
<td>Very Accurate</td>
</tr>
</tbody>
</table>
23) I like to be intimidating.
   Very Inaccurate | Very Accurate

24) I prefer to go my own way than live by the rules.
   Very Inaccurate | Very Accurate

25) I am hypersensitive.
   Very Inaccurate | Very Accurate

26) I tend to brood on past mistakes.
   Very Inaccurate | Very Accurate

27) I often feel lonely.
   Very Inaccurate | Very Accurate

28) I am very energetic.
   Very Inaccurate | Very Accurate

29) I think people are overly cautious.
   Very Inaccurate | Very Accurate

30) I make friends easily.
   Very Inaccurate | Very Accurate

31) I behave properly.
   Very Inaccurate | Very Accurate

32) I am outgoing.
   Very Inaccurate | Very Accurate

33) I like being in high energy environments.
   Very Inaccurate | Very Accurate

34) I enjoy meeting new people.
   Very Inaccurate | Very Accurate
35) I am very talkative.

| Very Inaccurate | Very Accurate |

36) I would like other people to be afraid of me.

| Very Inaccurate | Very Accurate |
Post – Test Survey

Examining the Differences In New Flight Material Learning Between Extroverted and Introverted Flight Students at Embry-Riddle

Please take a few minutes to fill out this survey on concerning the information you learned the and the simulator flight you took today.

General Participant Information
Did you identify as an extrovert or introvert on the EPQ-R?

☐ Extrovert ☐ Introvert

Did you feel that you were this certain personality type prior to taking this test?

☐ Yes ☐ No

Did you agree with the personality type the test determined you as?

☐ Yes ☐ No ☐ Still Not Sure

Flight Instruction Portion (Pre-Flight)
Was the written instruction method clear and articulately?

☐ Yes ☐ No

Was the oral instruction method clear and articulately said?

☐ Yes ☐ No

How helpful and clear on instructions was the CFI in both sessions?

Very clear □ □ □ □ □ □ □ □ □ Not clear at all

Which method of instruction did you feel most comfortable with?

☐ Written | ☐ Oral

Flight Portion
Have you ever flown on a flight simulator such as the PI-138?

☐ Yes ☐ No

What session of flight (1 or 2) did you feel most comfortable/proficient with?

☐ Session 1 ☐ Session 2
**DME ARC – Written Instructions**

This maneuver simulates the Distance Measuring Equipment (DME) Arc that is used to vector aircraft onto approach paths for specific landing at airports.

The goal of this maneuver is to enter the arc and maintain to as near a constant distance away from a specific point while remaining in an even arc turn as possible.

1. Fly the 270-degree heading until 5.0 DME away from ORM.
2. Turn 90 degrees to the left to a 180-degree heading and maintain 5.5 DME from ORM.
3. Continue to fly a complete quarter circle maintain a constant distance from ORM (5.5 miles).
4. Every 20 seconds, do a standard rate 5 degree turn to the left in order to achieve this.
5. After the 5 degrees has been turned, remain at straight and level flight for another 20 seconds before turning again.
6. Maintain as close to a constant altitude of 3000’ and correct heading as possible and distance of 5.5 DME.
7. Fly until the examiner instructs you to stop.
DIRECT ENTRY HOLD – Written Instructions

The purpose of this maneuver is to *hold* the aircraft in an oval pattern originating from a designated focal point.

This maneuver simulated aircraft waiting to be vectored for landing while ATC is busy with other aircraft.

1. Fly to ORM
2. Once over ORM, turn right standard rate (3 degree a second) to a heading of 180
3. Fly 180 degree heading for 1 minute
4. Turn right standard rate (3 degree a second) back to a 360-degree heading
5. Fly 1 minute back to ORM on 360-degree heading
6. Continue until the examiner instructs you to stop.
7. Maintain 3000’ altitude, and proper heading throughout
Appendix C

Tables

Table 1

Performance Data

<table>
<thead>
<tr>
<th>Maneuver</th>
<th>Sig(2-tailed)</th>
<th>Standard Deviation Extro</th>
<th>Standard Deviation Intro</th>
<th>Extrovert Mean</th>
<th>Introvert Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hold-oral Dis</td>
<td>.003</td>
<td>.047</td>
<td>.263</td>
<td>5.53</td>
<td>4.87</td>
</tr>
<tr>
<td>Hold-Oral Alt</td>
<td>.311</td>
<td>44.09</td>
<td>221.6</td>
<td>3015.77</td>
<td>2890.8</td>
</tr>
<tr>
<td>DME-oral Dis</td>
<td>.158</td>
<td>.05</td>
<td>.55</td>
<td>5.42</td>
<td>4.97</td>
</tr>
</tbody>
</table>

| DME-oral Alt  | .625          | 45.1                     | 360.5                    | 3015.95        | 2921.4         |
| Hold-read Dis | .654          | .15                      | .15                      | 5.52           | 5.47           |

| Hold-read Alt | .410          | 96.8                     | 56.3                     | 2966.72        | 3016.35        |
| DME-read Dis  | .343          | .337                     | .125                     | 5.25           | 5.43           |

| DME-read Alt  | .930          | 300.9                    | 58.8                     | 3044.30        | 3030.22        |

*Note.* Adapted from SPSS by Brook, J.

*p < .05.*